

# THE CANADIAN ARMY TROPHY

*Achieving Excellence in Tank Gunnery*



*Robert S. Cameron, Ph.D.*

## **About the Cover**

The cover shows the special logo developed for the Canadian Army Trophy, indicating the competition range and year. The six national flags represent the participating nations. The inner circle includes the insignia for HQ AFCENT flanked by CENTAG on the left and NORTHAG on the right, all superimposed over a maple leaf symbolizing the competition's Canadian origins. (Ron Mihalko)

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## Foreword

The Canadian Army Trophy (CAT) constituted the premier tank gunnery competition of the 20<sup>th</sup> century. It originated during the Cold War years when the Soviet Union and its Warsaw Pact allies posed an existential threat to Central Europe. The presence of massed armored and mechanized assets poised to invade necessitated a NATO alliance with credible military deterrence rooted in armored mobility, shock, and firepower.

Rapid, precision gunnery offered a means of offsetting the materiel and numerical advantage possessed by the Soviet threat. CAT placed a spotlight upon tank lethality, thereby promoting related developments in armored training, doctrine, and materiel development. It also facilitated constructive interaction among the participants, who became familiar with one another's tanks and tactics. The competition regularly featured teams from Canada, Belgium, the Netherlands, the Federal Republic of Germany, the United Kingdom, and the United States. These nations bore collective responsibility for the defense of Central Europe, and CAT spotlighted their growing armored prowess.

The competition's steady evolution reflected this capability growth. CAT changed from single tanks shooting at stationary targets to platoon battle runs that challenged teams and platforms. The achievement of a strong performance required a commitment of time and resources, transforming competition preparation into a gunnery laboratory in which tankers pushed human and materiel capabilities to their limits. In the process they spurred developments in ammunition, fire control systems, training methods, and platforms that proved beneficial to their national armored forces. This linkage between the competition and training, doctrine, and materiel development represents a central theme throughout this book.

Today NATO once again faces a threat from the East, and alliance members have begun to revitalize their armored capabilities in response. Skills that atrophied during sustained counterinsurgency campaigns are being relearned. In this context, the following pages are instructive and timely. They describe the challenges associated with tank gunnery and the paths once taken to achieve mastery of the related skills. The ability to engage targets rapidly and accurately under diverse circumstances remains just as important for Armor in 2018 as it did when the guns of CAT fell silent after the last target engagement on Grafenwoehr's Range 301 in 1991.



David A. Lesperance  
Brigadier General, USA  
Chief of Armor



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## Introduction

Several years ago I received a recommendation to write a short overview of the Canadian Army Trophy (CAT) competition to provide some historical context for the then newly established Sullivan Cup. The idea possessed considerable merit, but a shortage of time and manpower prevented immediate action. Nevertheless, my interest in the project remained. In 2016 I began to plan how a CAT manuscript might be generated and what the final product might look like. I finally began the requisite research and writing in 2017.

Once this manuscript began to develop, it took on a life of its own. The original, simple notion of summarizing the competition's nature, identifying the winners and losers over the years, and including some tank pictures for eye candy gave way to a more serious work focused upon developments in armor training, doctrine, and materiel. Moreover, since CAT constituted a NATO event, this analysis required placement in an international context.

The nature of CAT changed considerably during its 30-year span. From a collection of individual tanks shooting at stationary targets from fixed positions, the competition's focus shifted to platoon battle runs. As the complexity and challenge of the competition rose, it forced participants to devote more time and resources to team preparation. In the 1970s the CAT emphasis upon precision gunnery coincided with a NATO-wide effort to boost combat readiness, particularly among its armored assets, to offset the numerical threat posed by the Warsaw Pact.

The profile of CAT increased, finally triggering U.S. Army participation. Poor showings in the late 1970s, however, raised questions about the state of American armor in general and the nature of tank gunnery training in particular. This concern coincided with the Army's training revolution, which emphasized immediate combat readiness. Armor benefited from rising training standards, new doctrine, and the fielding of the Abrams tank. The impact of these changes became manifest in a steadily improving CAT performance in the 1980s and an American win in 1987. The path to victory marked an evolution in tank gunnery in which science replaced art, technical knowledge eclipsed rote procedures, and training standards became an enemy to be defeated. Annual training programs that culminated in crew qualification expanded to include mandatory platoon battle runs and the emergence of tactical tables that merged gunnery with tactical maneuver.

This renaissance in gunnery resulted in American CAT teams immersed in the technical aspects of placing steel on target. Winning CAT necessitated the sustained commitment of resources and time to build a team. This requirement generated a byproduct in the form of a gunnery laboratory in which highly skilled, stabilized crews pushed the envelope of the possible in their desire to increase live fire accuracy. Their achievements offered potential improvements for the entire armored force. Determining just what CAT techniques had merit beyond the competition range generated constructive discussion and analysis, further immersing armored personnel in the science of gunnery. In the U.S. Army these efforts drove related, force-wide discussion and actions concerning ammunition performance, boresighting, zeroing, and the correct use of the muzzle reference system.

On the international stage CAT became a showcase for technological advances in fire control systems, ammunition, optics, stabilization, and overall reliability. What constituted a winning

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engagement time under competition conditions shortened over the years. By the 1980s a clear distinction emerged between older platforms like the Leopard 1 and Chieftain and the next generation of combat vehicles represented by the Leopard 2 and the Abrams tank. Accuracy measured by the number of targets hit experienced a similar trend. Moreover, a solid performance encouraged foreign interest, exemplified by the Leopard 1 and 2 that found service in many nations worldwide. Mediocre or poor performance tended to discourage international interest. Hence, the Chieftain found few foreign buyers and the Challenger none.

Yet despite the growing importance of technological factors in the competition, human factors remained critical. Highly trained and cohesive platoons with a solid mastery of gunnery fundamentals remained significant players whether or not they possessed the latest platform. The comparatively limited resources of the Belgian and Canadian teams did not prevent them from remaining tough competitors throughout the history of CAT. Moreover, the conscript nature of the German and Netherlands armies necessitated training measures appropriate to short service terms. Overemphasis upon technical considerations proved no guarantee of victory — a lesson learned the hard way by U.S. teams in 1989.

Heightened visibility attracted media coverage. Competition placement and final scores soon became associated with national readiness. Military efforts to distinguish between the artificial environment of CAT and actual combat conditions failed to break this linkage in the public eye. A poor competition placement resulted in criticism and questions regarding the efficacy of armored training, gunnery, and materiel. Indeed, sustained negative coverage could and did generate political repercussions. The Canadian Armoured Corps, for example, faced the divestiture of its entire tank fleet in the early 1970s, while the early 1980s inability of the United States to place first in CAT intensified media attacks upon the Abrams tank. In the United Kingdom, the outpouring of public criticism after Challenger's poor showing in 1987 resulted in withdrawal from the competition.

Conversely, a top score at CAT tended to stifle criticism, thereby building a public relations imperative to achieve victory. Participants assumed a more active role in the negotiation of the governing rules, seeking competition conditions most favorable to their national teams, while eroding the perceived advantages of other competitors. Crafting the rules for each competition thus became an exercise in NATO diplomacy.

Training a CAT team also became more expensive over time. Consequently, it became a driver for the increased use of computer-based simulations to hone gunnery skills. In 1987 the Americans adapted Simulations Networking (SIMNET) to help train its CAT teams in the execution of competition battle runs. The Unit Conduct of Fire Trainer (UCOFT) became a critical crew training asset due to its more accurate depiction of gunnery and its ability to collect detailed data on each engagement. It became a central feature of CAT preparation and gunnery training across the force. UCOFT helped to build skills and sustain them after live fire events and qualification. Its value as a training tool spurred the development of a purpose-built platoon gunnery trainer by the early 1990s. The other CAT participants came to rely upon similar gunnery trainers, which provided the means for the armored forces of Belgium and the Netherlands to remain competitive despite their relative paucity of resources in comparison with the United States and Germany.

Criticism of CAT often focused upon its artificiality. Often depicted as unrealistic and divorced from the harsh realities of combat, naysayers believed it encouraged gamesmanship rather than tactical skill. Yet CAT never aspired to be combat reality. The competition deliberately focused upon precision gunnery, but it underwent significant change over time. By the late 1980s competition battle runs necessitated firing on the move, conducting closed-hatch engagements, employing more than one weapon system, and night fire. Target arrays became more challenging, with scenario designers skillfully integrating them into the surrounding terrain. Multiple targets appeared at once, often in such a manner that firing platoons had to rely upon section drills or crossfire techniques.

Certainly the targets did not fire back, but the platoon and crew skill sets necessary to dominate the CAT range had equal applicability to combat, particularly the competition's consistent emphasis upon rapid target engagement, accuracy, and ammunition conservation. Indeed, many of the skills required for the platoon battle run found reflection in the national gunnery training programs of the participants. In the case of the United Kingdom and the United States, combat operations in the First Gulf War provided a convincing demonstration of the linkage between competition skills and battlefield success.

Between 1963 and 1991 CAT remained unchanged in its intent to improve the overall standard of tank gunnery and enable the participating teams to meet in a spirit of fraternity. The following pages illustrate how the competition contributed to tank gunnery developments, but the resultant interaction among NATO tankers proved an equally significant development, albeit more difficult to assess. The competition was a unifying event that promoted interoperability and mutual understanding among allies who might one day have to fight together against a common foe. These collective contributions were not fleeting. Every major tank gunnery competition established after 1991 included similar goals — a clear testimony to the enduring value of the Canadian Army Trophy and the relevancy of its original objectives.

Readers will have to determine for themselves whether this work achieves a similar stature. This book reflects a deliberate effort to place CAT in the context of international developments and emerging technology. The competition did not happen in a vacuum. It was shaped by NATO readiness needs, Warsaw Pact capabilities, and ultimately the end of the Cold War. Similarly, the specific performances of each participating team reflected national armored developments that are generally identified.

The depiction of events found in the main text reflect the source material available. For American readers, CAT appears as a vehicle through which to understand developments in U.S. Armor training, materiel, and doctrine related to tank gunnery that culminated with Operation DESERT STORM. This orientation reflects the general accessibility of source material with one critical exception. Many of the original after action reports compiled by American units that provided CAT teams between 1977 and 1991 defied efforts to locate them with the time and resources available. In their absence, a variety of secondary sources provided the details included in these pages. Analysis of the British, Canadian, Belgian, German, and Dutch CAT experience reflects the author's access to pertinent materials. There is a clear bias in coverage toward the British, Canadian, and to a lesser extent German, activities compared to the Dutch and Belgians because of the deliberate use of either English language sources or items readily translated via digital tools. Some materials provided background information to the Belgian and Dutch armies, but details regarding training and the influence of CAT upon their armored components proved scant.

In the absence of the specific rules and conditions for the early years of CAT, it proved impossible to offer more than generalized conclusions about national performance. As the competition profile rose over time, so too did the amount of military reporting and press coverage. Hence, readers will note a significant difference in the chapter sizes that reflects the amount of related source material on hand.

In the completion of this work, several individuals and organizations provided invaluable assistance. I am indebted to Colonel Scott D. King, who first broached the idea of a CAT manuscript to me and thereby planted the seed that grew into this product. Many thanks to the U.S. Army Armor School, particularly Chief of Armor Brigadier General David A. Lesperance and Deputy Commandant Colonel David S. Davidson for their leadership and support in the completion of this work. The staff of *ARMOR*, not only made an excellent branch journal accessible, but through the good services of Gary A. Jones also completed the formatting and layout of this book for printing. Retired Colonel Glenn Snodgrass graciously answered my questions related to his role as the chief

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judge of CAT 1991 and provided videos of that year's competition battle runs. Special thanks to retired General Crosbie E. Saint for also addressing questions about CAT 1989 and 1991. Retired First Sergeant Ron Mihalko made imagery available from his website, which includes a wealth of information related to the competition.

It would not have been possible to provide the depth of coverage on the British experience, including Challenger development, without the support of The Tank Museum and its Archive and Library Manager Stuart Wheeler. Photocopied materiel made its way across the Atlantic courtesy of British army Major John Edward M. Carey-Hughes, who personally delivered what he described as "a small rain forest" to my office. The Tank Museum's John Holt also took care of my imagery requests.

For information on the Canadian Forces CAT experience, Major Glenn G. Sylvester, the Canadian Liaison Officer to the Maneuver Center of Excellence, helped to facilitate contacts north of the border. Retired Major Mike McNorgan, who served in the Royal Canadian Dragoons and is currently the historian for the Royal Canadian Armoured Corps Association, provided details on CAT. He pointed me in the direction of the older issues of *Armour Bulletin*, which includes information related to Canadian armored developments. Another retired Canadian Forces officer, Alan Bolster, provided information related to the Canadian-American Cup. Lieutenant Commander Brian Owens and the Canadian Forces Combat Camera helped satisfy my needs for photos of Canadian tanks.

I would also like to express my thanks to the many other individuals who provided feedback on the draft, particularly the master gunners in Steve Krivitsky's Weapons and Gunnery Branch in the Maneuver Center of Excellence's Directorate of Training and Doctrine. They answered my many technical questions and otherwise put up with my excitement about a competition that ended nearly 30 years ago. However, the responsibility for any errors or misinterpretation lies entirely with me.

Forge the Thunderbolt!



# Chapter 1

## The Early Years of the Canadian Army Trophy, 1963-1968

The Canadian Army Trophy (CAT) originated amid a shift in NATO policy from a dependence upon nuclear weapons to a more realistic acceptance of the need for both nuclear and conventional forces. This reorientation encouraged an increase in the combat capability of NATO ground forces, particularly armored organizations expected to play a central role in any potential war with the Warsaw Pact. Actions intended to increase the effectiveness of such units generally received a favorable reception, and CAT proved no exception. It provided a competitive vehicle through which new standards of gunnery might be encouraged, while fostering bonds between the NATO tankers who might one day be fighting together in Central Europe.

### Evolving U.S. and NATO Policy

The onset of the Cold War in the late 1940s drove the United States to adopt a policy of containment, seeking to deter Soviet aggression wherever and however it might appear. From this broad aim arose the Truman Doctrine, which committed the United States to the support of free peoples against communist movements seeking to supplant their existing governments with totalitarian regimes. In the early years of the Cold War, these communist movements were considered tools of the Kremlin and directly responsive to Soviet efforts to expand its global influence.

Consequently, the United States supported nations endangered by communist agitation. In 1947 military and economic aid packages supported the Greek government in its civil war against communist rebels and Turkey's resistance to Soviet pressure for increased access to the Turkish Straits. Similarly, the Marshall Plan served to help rebuild Western Europe, transforming it into an anti-Soviet bulwark, while the Berlin airlift of 1948 provided evidence of American and European willingness to challenge Soviet actions directly. In Southeast Asia, the United States committed itself to the sustainment of an independent Republic of South Korea — a commitment honored when the North Korean People's Republic invaded in 1950, triggering the Korean War and a lasting partition of the Korean peninsula along the 38<sup>th</sup> Parallel.

In the wake of the Korean War, the Eisenhower Administration worked to contain and deter further communist aggression through reliance upon nuclear weapons and the intent to use them. Massive retaliation from a nuclear arsenal constituted the principal means of deterrence, supplemented with military alliances, including the North Atlantic Treaty Organization (NATO) and the Southeast Asia Treaty Organization (SEATO). Military and economic aid packages together with covert activities provided additional venues for blocking Soviet ambitions.

In the United States, however, the emphasis given to nuclear weapons in the 1950s came at the expense of conventional ground forces. Corresponding reductions to military manpower and funding followed, and the Army became a junior partner to Strategic Air Command and nuclear missile development. Between 1953 and 1961, the Army shrank from 20 to 14 combat divisions, its budget fell from \$16 to \$9.3 million, and the acquisition of new weapons and materiel slowed. Combat readiness consequently dropped. (1)

Reliance upon nuclear deterrence at the expense of ground combat power, however, created new dilemmas. When should nuclear weapons actually be used, particularly against an adversary with its

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own arsenal of atomic weapons? Moreover, no evidence existed that demonstrated the ability of an atomic arsenal to deter wars of national liberation, internecine conflict, or hostile military actions short of an outright invasion of an allied nation. The 1956 Hungarian revolt and its bloody suppression by the Soviet Union, the 1961 Berlin crisis, Fidel Castro's seizure of power in 1959, and unrest throughout Latin America all exemplified unwelcome developments that could not be addressed through reliance upon nuclear deterrence alone.

In the early 1960s American defense policy shifted from Massive Retaliation toward a balance of nuclear and conventional force capabilities. The Kennedy Administration implemented this transition through its adoption of Flexible Response. Reliance upon nuclear and conventional forces offered a better range of options with which to deal with an array of threats, including small wars, national liberation movements, and the subversion of friendly governments by communist forces. Flexible Response also reflected the Kennedy Administration's belief that a small scale conflict or a guerrilla action posed a more likely threat than a nuclear war with its prospect of mutual destruction for little gain. Conflicts in Africa and Indochina exemplified this new reality, providing the justification for a buildup of American conventional forces. Nevertheless, the Cuban Missile Crisis of 1962 underscored the continued need for a nuclear capability. (2)

America's Flexible Response strategy necessarily impacted NATO. The United States encouraged its NATO partners to adopt a similar strategy. The initial response, however, hardly proved encouraging. The ensuing debate among NATO members strained the alliance in 1961 and 1962. The next several years witnessed efforts to establish a policy consensus despite France's withdrawal from NATO military command in 1966. In the United States, the assassination of President John F. Kennedy did not alter the nation's commitment to Flexible Response. His successor, Lyndon B. Johnson, continued this policy. Indeed, his commitment to containing communist influences became manifest in the Republic of South Vietnam where the American role shifted from advisor to combatant, accompanied by a large influx of U.S. combat forces. In Europe, the military suppression of reformist efforts in Czechoslovakia by Warsaw Pact forces further underscored the need for a non-nuclear response capability. (3)

The need to increase conventional forces triggered joint acquisition programs by member nations seeking to maximize the benefits of new weapons, while sharing the related cost and research effort. The Franco-German-Italian common tank program and the U.S.-German MBT 70 program exemplify this trend. In both cases, however, the joint program collapsed and the participating nations pursued their own independent programs. The common tank project devolved into the French AMX 30 and the German Leopard 1. Similarly, the end of the MBT 70 program encouraged separate American and German development efforts that resulted in the M1 Abrams and the Leopard 2 tank designs.



*The Canadian Army Trophy. (Royal Canadian Armoured Corps School)*



*A prototype MBT 70, product of the U.S.-German program to build a common tank. (U.S. Army Armor School archives)*

### **Competition Origins**

In the Warsaw Pact, NATO faced a numerically superior, highly mechanized threat whose capabilities continuously evolved. NATO forces would have to fight outnumbered and win, relying upon better training, technology, mobility, and firepower. German World War II experiences on the Eastern Front offered examples of armored formations using firepower, protection, and mobility to offset numerical shortfalls and outmaneuver an otherwise superior enemy. NATO expected to do the same.

The potential for armored battles on a scale not seen in Europe since World War II underscored the importance of accurate, lethal firepower. Outmaneuvering the enemy offered few advantages if he could not then be destroyed. Although airpower and artillery might perform this role, their continuous availability could not be assured in the face of a Soviet invasion of Central Europe, particularly since NATO aircraft, airfields, headquarters, and artillery positions would be priority targets in the opening phases. Armored units therefore needed to rely upon their own firepower to destroy hostile forces. The ability to engage rapidly and destroy hostile machines offered the best hope of defeating the Warsaw Pact, sometimes characterized as a mechanized horde.

The combination of NATO's shift in policy toward a renewed emphasis upon conventional forces and the importance attached to armored forces in particular created an environment that encouraged the establishment of a tank gunnery competition. In 1962 the Canadian army offered through its Defense Liaison Staff in London a trophy for which teams drawn from NATO's Central Region would compete on an annual basis. (4) The competition sought to achieve two objectives: improve the overall standard of tank gunnery and permit participating teams to meet in a spirit of comradeship and fraternity. (5) It also served to stimulate constructive interaction among allies who might one day fight alongside each other in battle.

The Canadian offer marked the beginning of the Canadian Army Trophy competition. Headquarters Allied Forces Central Europe (HQ AFCENT) agreed to sponsor the event. (6) It provided a general officer to chair a Committee of Control responsible for supervising the competition. This committee also included representatives from each participating nation, each of NATO's army groups

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(NORTHAG and CENTAG), and the Canadian Ministry of Defense. Subject to the approval of the Canadian Ministry of Defense, the Committee of Control established the rules and conditions for the event, including targetry, engagement ranges, team selection criteria, and scoring. (7)

Competition participation focused upon those nations with forces subordinated to AFCENT. Specifically, it was open to the armored units of Belgium, Canada, France, the Federal Republic of Germany, the Netherlands, the United Kingdom, and the United States. France, however, never participated in CAT. In March 1966 France announced the withdrawal of its forces from NATO's military command and ordered the removal of all NATO assets from French soil. The United States also abstained from CAT participation in its early years. (8)

The nature of the early CAT competitions reflected simplicity of intent. Each participating nation nominated a representative regiment two months before the competition. Two weeks prior to the event, five competing crews were selected by ballot from a nominating list of nine. The host nation then provided each team a week's practice before the crews and their tanks competed for the trophy. (9) Other than these guidelines, few training constraints existed. Each nation could devote time, money, and ammunition to optimizing its CAT team. Hence, "... tank crews were selected and trained like gladiators of old." (10)

For the actual competition the national teams arrived at the designated range and positioned their tanks along a line of concrete firing points. Here they engaged a series of stationary, tank-type targets at varied ranges, generally not exceeding 2,000 meters. Each tank fired either target practice discarding sabot (TPDS) or high explosive squash head (HESH). They received a point score based upon the speed of engagement and accuracy reflected in the number of targets hit. Penalty points deducted from this score, generally given for slow engagement or missed targets. National team scores derived from adding the points garnered by each individual tank crew. The highest scoring national team received the Canadian Army Trophy, a silver scale model of a Centurion tank similar to that which equipped Canadian forces at the time. (11)

All CAT competitions prior to 1981 occurred at Bergen-Hohne Training Area in the Federal Republic of Germany. Initially established in 1935 to support German training, this facility with its heaths, woodlands, ridges, and marshes grew to include 12 ranges by 1944, including eight tank ranges. The remainder supported the use of infantry, artillery, and antiaircraft weapons. In the closing weeks of World War II, British forces secured the training area, initially using it as a camp to assist survivors of the Bergen-Belsen concentration camp and for the establishment of a Royal Armoured Corps training center. After the war, the British expanded the training area until it became one of the largest such facilities in Europe with its own permanent staff. In 1957, Germany's newly established army began training at Bergen-Hohne and the next year assumed responsibility for the site from the British. However, it remained a principal NATO training facility, and many of the CAT participants routinely trained there. (12)

The first CAT competition occurred in 1963. For this debut there was no host nation and no single, central event. Instead, each team conducted its competition firing during the annual live fire gunnery scheduled for its parent unit at Bergen-Hohne. Hence the timeline for the first CAT stretched from August to December, reflecting the different training schedules for the participating nations. Each team conducted its competition firing under the supervision of an international panel of judges. National scores were then tabulated and compared to determine the winner. (13)

The results of the first CAT proved difficult to assess, given the wide point spread. The Belgians achieved the highest score, outperforming the second place German team nearly twofold. In their effort to become reigning champions, the Canadians got off to a slow start, finishing with the smallest positive number. The United Kingdom achieved the only negative score in the history of CAT, presumably for penalty points accrued. Misunderstanding the scoring or other aspects of the rules may account for the poor result.

**CAT 1963 Team Scores (14)**

<i>Nation</i>	<i>Unit</i>	<i>Score</i>
1 Belgium	4 <sup>th</sup> Lancers	11,473
2 Federal Republic of Germany	Panzer Battalion 83	6,203
3 Netherlands	41 <sup>st</sup> Tank Battalion	1,221
4 Canada	Fort Garry Horse	180
5 United Kingdom	5 <sup>th</sup> Royal Tank Regiment	(1,851)

Overall, however, dissatisfaction with a scoring system considered unrealistic contributed to changes in the conduct of the competition. Instead of a collection of separate firing times, CAT became a single, week-long event at Bergen-Hohne in which all the competing teams participated. This change simplified the work of the supervisory judges' panel, and it encouraged interaction among the competitors in the spirit of the original CAT proposal. Each year a different participating nation assumed the responsibility for hosting the event, and the competition's actual dates corresponded to the host nation's scheduled time to conduct gunnery training at Bergen-Hohne. The single-event forum encouraged spectators and media attention, but in these early years the competition lacked the visibility and public scrutiny it would later attract. (15)

**CAT in the 1960s**

Following its debut in 1963, the Canadian Army Trophy became an annual competition through 1968. Few changes occurred to its basic structure, which continued to reward rapid engagement times and accuracy. After 1964, however, the scoring system changed to allow more points to be earned. Consequently, team scores for 1965-1968 proved significantly higher than in the first two years of the competition. In 1965 the size of the CAT teams fell to just four tanks, but this reduction did not continue. The standard five-tank configuration returned in 1966. The tendency to rely upon the experience of gunnery instructors, or their inclusion in vehicle crews to gain an advantage, remained a more longstanding trend. (16) The use of skilled individuals to enhance team performance encouraged persistent perceptions of CAT as unrealistic and divorced from the real military threat facing NATO combat forces stationed in Central Europe. Throughout its history, the competition would repeatedly be subjected to criticism as unrepresentative of actual combat conditions. Like similar competitions held by air, ground, and naval services, CAT was sometimes considered a curiosity that, while entertaining, diverted resources and training time better spent on combat readiness.

Criticism of CAT was not unfounded, but nor was the competition without merit or value to combat forces. Even in its early years, when the event proved little more than stationary tanks shooting at motionless targets, the importance attached to accuracy possessed direct relevancy to armored combat. On November 3, 1964, a small skirmish occurred on Israel's far northern border in which an Israeli tank platoon equipped with Centurions engaged two Syrian tanks. A lengthy gunnery duel ensued in which — like CAT — the Israeli tankers fired at stationary hostile targets. Despite firing nearly 60 main gun rounds, they failed to score a single hit. This poor showing resulted in major training changes in the Israeli Armored Corps focused upon weapons operation and maintenance. In particular, tank gunners were required to boresight and zero their weapons in accordance with the specific factory instructions issued with their equipment rather than personal whim. In subsequent encounters with Syrian tanks, the Israelis fared much better. (17)

The table below summarizes the CAT competition results from 1964 through 1968. Analysis of these scores show few clear trends. The final placement of each participating team generally changed each year. Nor did the type of tank provide clear advantages, particularly since the Dutch, Canadian, and British all used Centurions. The Belgians relied upon the aging M47, yet often outperformed the

other teams. In the absence of clear trends, CAT performance instead reflected the strengths, weaknesses, and continuous ebb and flow of military activity typical of all combat organizations.

<b>CAT Results 1964-1968 (18)</b>		
<b>1964</b>		
<b>Canada hosts October 5-9</b>		
1 Belgium	4 <sup>th</sup> Lancers	8,425
2 Federal Republic of Germany	Panzer Battalion 83	8,005
3 United Kingdom	11 <sup>th</sup> Hussars	7,163
4 Netherlands	43 <sup>rd</sup> Tank Battalion	2,830
5 Canada	Fort Garry Horse	1,024
<b>1965</b>		
<b>Belgium hosts September 27-October 1</b>		
1 United Kingdom	Royal Scots Greys	22,970
2 Belgium	4 <sup>th</sup> Lancers	20,860
3 Canada	Fort Garry Horse	18,930
4 Netherlands	11 <sup>th</sup> Tank Battalion	17,000
5 Federal Republic of Germany	Panzer Battalion 83	16,240
<b>1966</b>		
<b>Federal Republic of German hosts September 5-9</b>		
1 United Kingdom	13/18 Royal Hussars	27,070
2 Belgium	4 <sup>th</sup> Lancers	26,310
3 Federal Republic of Germany	Panzer Battalion 324	23,920
4 Canada	Lord Strathcona's Horse	23,810
5 Netherlands	101 <sup>st</sup> Tank Battalion	10,820
<b>1967</b>		
<b>United Kingdom hosts July 24-28</b>		
1 Canada	Lord Strathcona's Horse	28,200
2 United Kingdom	15/19 King's Royal Hussars	24,570
3 Belgium	4 <sup>th</sup> Lancers	24,290
4 Federal Republic of Germany	Panzer Battalion 83	22,930
5 Netherlands	41 <sup>st</sup> Tank Battalion	21,370
<b>1968</b>		
<b>The Netherlands hosts October 4-9</b>		
1 Belgium	1 <sup>st</sup> Lancers	21,290
2 Federal Republic of Germany	Panzer Battalion 33	20,430
3 United Kingdom	Royal Scots Greys	16,990
4 Netherlands	43 <sup>rd</sup> Tank Battalion	14,670
5 Canada	Lord Strathcona's Horse	14,620
<b>NOTE:</b> CAT 1965 featured a revised scoring system and was the only year depicted here in which teams included just four tanks instead of the usual five.		

### Belgium's American Cast-off

Belgium provided the strongest showing during the 1960s CAT competitions. Its team won three times and earned second place on two occasions. Its worst showing occurred in the 1967 competition, when it only achieved third place. Compared to the other national teams, this was a superior performance. Belgium's experience offered the best case for drawing the CAT team from the same unit each year. From 1963 through 1967, the 4<sup>th</sup> Lancers represented Belgium in the Canadian Army Trophy. Presumably, this consistency enabled the creation of a pool of experts with specific experience related to CAT, who could be utilized to build and train each year's team. The 4<sup>th</sup> Lancers, however, were relative newcomers to tank gunnery, having converted from a light reconnaissance to a tank unit in 1961. (19)

Like other NATO members, Belgium relied upon American materiel. American-built M47s equipped the 4<sup>th</sup> Lancers. The design of this vehicle occurred as part of the U.S. effort to upgrade its World War II-era tank fleet in response to the outbreak of the Korean War and the perceived superiority of Soviet tank performance. The M47 mated a new turret layout with an M46 medium tank

chassis. To expedite production and fielding, the Army compressed testing and development, ordering the tank into production in July 1950. Within two years, the M47 entered service with American combat units. It possessed sloped armor and an elongated turret that gave it a distinctive look. The tank weighed 48.5 tons and managed speeds over 30 miles per hour, but it possessed an operational range just short of 80 miles. It also proved one of the last American tank designs to mount a bow machine gun and carry a five-man crew. (20)

The M47's most innovative features lay in its turret. The high velocity 90-mm main gun with a variety of ammunition types offered improved lethality, and an automatic compensator restored the aim of the weapon after each round to permit a higher rate of fire. The hydraulic turret traverse proved exceptionally fast, but it required more maintenance. The main gun could be fired by either the tank commander or the gunner, reflecting an American belief that such redundancy increased responsiveness to sudden contact situations and multi-target engagements. (21) The commander also possessed supplementary periscopes to facilitate aim and the ability to override the gunner's control of the weapon and turret to rapidly target a new or more dangerous threat. (22)

In World War II range determination proved critical to successful target engagement. American tank commanders, however, relied largely upon their own skills rather than technical devices. After the war, American tank design continued to embrace the importance of highly accurate range calculation and provided the necessary tools. The M47 became the first combat vehicle equipped with an optical rangefinder integrated with the fire control system. (23)

To engage a target, the tank commander or gunner used the stereoscopic rangefinder mounted in the turret roof. The ranging reticle appeared as a three dimensional "V" pattern with the point furthest away and the middle and top portions of the reticle appearing progressively closer. Adjusting the view moved the reticle (sometimes known as "flying the geese" because of the "V" pattern). The correct range was found when the bottom of the ranging reticle appeared to be at the same distance as the target. The gun tube automatically raised to provide the correct amount of superelevation, the angle above the line of sight to which the gun tube must be elevated to hit a target at a given range



*The American M47 during training. Large numbers of this tank were sold to allied nations, including the Belgians. (National Armor and Cavalry Museum)*

with the selected ammunition type. The gunner then made final adjustments and fired the weapon. In the event either of the rangefinder end boxes became damaged, the sight could still be used as an off-set telescope to determine range. The stereoscopic rangefinder marked a significant improvement in accuracy over wartime ranging methods, but not all soldiers could properly employ it. (24)

Despite its rangefinder, numerous mechanical faults plagued the M47. The abbreviated testing and development process coupled with rapid production ensured significant teething troubles. Users experienced firsthand the related maintenance burden, and the Army came to view it as a stopgap measure. Indeed, the Army accepted its first M47 deliveries in April 1952, the same month its successor, the M48, began to roll off the production lines. When production of the M47 ceased at the end of 1953, many of the nearly 9,000 vehicles built were exported. (25) On June 28, 1952, Belgium became the first European nation to receive the M47. Ten were delivered during a special ceremony in Antwerp. (26)

Sixteen years later the Belgians were still using America's one-time cast-off to compete aggressively for the Canadian Army Trophy. In 1965, however, the Belgian government began testing newer tanks from NATO members. An American team trained two Belgian crews on the M60A1, after which they conducted live fire gunnery at Grafenwoehr. The Belgian crews performed well under the tutelage of American NCOs, demonstrating an appreciation for the tank and transitioning easily from the M47. A team of American subject matter experts also briefed senior Belgian officials on the merits of the M60A1. Despite this marketing effort the Belgian army opted instead to upgrade its tank fleet with the German Leopard 1. (27)

### **The German Armored Force Comes of Age**

In 1955 the German parliament approved the rebuilding of the nation's armed forces. The following year marked the establishment of a school to train armor soldiers. In 1958, similarities in training programs and common principles of employment among armor, armored infantry, and armored reconnaissance units resulted in the consolidation of their separate training programs under the Kampftruppenschule II. This school provided instruction for section leaders and each command echelon through brigade. The school also included its own research and development staff and school units for demonstration of tactical principles and the testing of new materiel. Located near Bergen-Hohne, Kampftruppenschule II possessed easy access to gunnery ranges and training areas. (28)

German armor officer training proved immersive and progressive. Officer candidates first completed basic training and learned vehicle crew tasks. Once mastered, the candidates then served as an NCO tank commander for five months in an armored unit. Success in this role enabled individuals to attend advanced officer candidate schooling; failure resulted in the soldier's removal from officer training. Advanced officer candidate schooling included 22 months of instruction focused upon tactical operations and general education. Upon successful completion, the candidate received a commission as a lieutenant and received a duty assignment as a platoon leader, which he held for three years. Further schooling and assignments prepared the officer for company command, a posting that required seven years of prior commissioned service and a minimum age of 27. Subsequent staff assignments and schooling groomed the officer for higher service. Compared to American officer development at the time, the German system resulted in more experienced platoon and company commanders, who possessed firsthand knowledge of duties and responsibilities of their subordinate NCOs and enlisted personnel. (29)

German unit training also proved comprehensive. For example, in 1967 a company of Panzer-grenadier Battalion 51 supplemented its classroom gunnery instruction with two specially crafted miniature ranges. Each range included varied terrain, infantry, artillery, and moving tanks. One range served to provide training in target acquisition, tracking, and fire adjustment. The other supported sub-caliber firing. In both cases, tank crews trained on their tank, using the gun controls and sights with fire commands. For sub-caliber firing on the second range, a .22 caliber rifle was mounted next



to the tank's main gun. The rifle fired special tracer ammunition to facilitate observation of each round fired. The range was scaled to represent what each target and terrain feature would look like through the gunner's sight at 1,200 meters. The ranges were constructed by unit personnel when off duty and reflected a high level of interest and detail. Moreover, the ranges enabled on board training in cantonment areas or when direct access to a gunnery range was not possible. (30)

American units stationed in Germany took interest in the training devices of their host nation. In a 1967 training exchange program between the 3<sup>rd</sup> Squadron, 14<sup>th</sup> Cavalry Regiment and Panzergrenadier Battalion 51, the American soldiers were introduced to a German training device known as the Dreiben Übungsschiessgerät. Dubbed by the Americans the Rotenburg Gunner's Device, it included a seat on a tripod, elevating and traversing controls, and mounts for a .22-caliber rifle and gunner's sight. Essentially an over endowed stationary bicycle, this device served as a gunnery trainer. The .22-caliber rifle could be replaced with a projector that showed crosshairs on a terrain board or landscape-painted wall. In this configuration, a soldier practiced his ability to track and engage targets. With the rifle mounted, the device enabled the trainee to engage targets in an indoor small arms range. In addition to the gunner, another soldier serving as the tank commander issued fire commands and observed the fire effects. An instructor oversaw and evaluated the gunner's training progress. Loaned to the cavalry squadron, this device underwent modification to accommodate an American sight and an infrared capability. Thus modified, the device was used to train day and night firing, permitting repetitive hands-on training to supplement classroom gunnery instruction. It directly contributed to the squadron's high performance during subsequent gunnery qualification. (31)

In its early years the new German army lacked the materiel necessary to equip its new armored force. Therefore it looked to its allies to overcome this deficiency. The United States provided tanks, armored personnel carriers, and self-propelled artillery, together with translated technical manuals. Other NATO members also provided materiel, making the early German armor units a microcosm of the alliance in terms of the varied collection of vehicles and equipment. This lack of uniformity,



*The special patch worn by CAT team members from Panzer Battalion 33 in the 1968 competition. (Ron Mihalko)*

however, posed training, maintenance, and logistical problems. It also encouraged the German military to develop its own family of vehicles to satisfy doctrinal and equipment needs. In particular, the German army sought an infantry fighting vehicle, a tank destroyer, and a tank. German armor doctrine embraced the importance of massing tanks. It relieved them of the responsibility to provide infantry support and protect dismounted elements from hostile armor. Germany pursued development of a tank destroyer to satisfy these roles, equipped either with a 90-mm gun or SS-11 antitank missile. Armored reconnaissance units were intended to include the new German main battle tank. (32)

Initially, M47s equipped many German tank units until gradually replaced by M48s. In the 1960s, only German teams with the M48 competed for the Canadian Army Trophy. This vehicle originated during the Korean War to redress the imbalance between the U.S. and Soviet tank fleets. Intended as a replacement for the M47, the M48 also experienced rushed development and operational testing that occurred simultaneous with production. Special teams of military personnel and industrial representatives strove to provide early warning of defects and provide remedies. (33) Consequently, the M48 first entered service with the 2d Armored Division in 1953, less than three years after design work began. Numerous problems quickly emerged, including excessive oil consumption, engine failures after only 1,000 miles, and a host of transmission, track and suspension issues that kept operational readiness rates for the new vehicle low. The fire control system was also considered overly complex, and its operational radius of just 75 miles posed a challenge for the fast-paced, far ranging mobile operations considered likely to characterize the opening phases of a war in Europe. (34)

Nevertheless, the M48 offered several improvements over previous tank designs. Its dome-shaped, one piece cast turret gave this vehicle a distinctive look and improved ballistic protection over turret designs that narrowed at their base. It directly reflected the influence of the Soviet JS III, considered an American tank nemesis in the 1950s. The M48 dispensed with the bow machine gun, reducing its crew to four men, and it utilized the same engine intended for the M103 heavy tank to ensure it possessed sufficient power and mobility. (35)



*American M48s on a firing range in Germany in 1959. The M48 equipped many German tank units until gradually replaced by the Leopard 1. (National Armor and Cavalry Museum)*

The M48's most significant feature lay in its fire control system, which offered a major improvement to gunnery accuracy at longer ranges — a critical consideration for an army expecting to fight outnumbered. The fire control system included a stereoscopic rangefinder, ballistic computer, ballistic drive, and gunner's periscope. Both the gunner and the tank commander could traverse the turret and fire the main armament. The rangefinder, however, was operated by the commander. He initiated an engagement by moving the turret toward the target and indicating the ammunition to be loaded. While the round was physically loaded, the gunner set the ballistic computer to the correct ammunition type. The commander then determined the range to target. The ballistic computer calculated the correct superelevation based upon the ammunition type and range and automatically transmitted this data to the ballistic drive. These actions depressed the line of sight of the gunner's periscope. The

gunner then returned the line of sight back to the aiming point, and the gun was ready to fire. The entire process required an estimated 15 seconds and offered a 50-percent hit probability out to 1,500 meters, but the vehicle had to stop to fire. The entire process could be bypassed for short range engagements in which the distance was estimated or the coaxial machine gun used to range the target. Vehicles might also use a predetermined range setting with a preloaded ammunition type. This technique, known as battlesight gunnery, proved useful for sudden, close range engagements. A coaxially mounted telescope served as a backup sighting system should the main fire control system become damaged or inoperable. (36)

Neither the M48 nor its M47 predecessor possessed a stabilization system. The single axis stabilization provided to American tanks in World War II in the form of the gyrostabilizer did not result in the postwar development of a true fire on the move capability. Instead, American design emphasis shifted to the optical rangefinder first found on the M47, followed by the more sophisticated fire control system of the M48. Despite the improved accuracy, the M48 needed to fire from a stationary position to realize the full benefits of its more precise fire control system. (37)

The mechanical deficiencies that plagued the M48 in its early days became the target of a series of product improvement programs. These changes addressed engine, transmission, and suspension problems. The attachment of external fuel tanks proved a simple solution to boost range, but it decreased the vehicle's survivability. Consequently, the rear compartment was redesigned to accommodate larger fuel tanks and a new engine to increase range without compromising protection. Collectively these improvements constituted the M48A2, the most numerous version of the M48-series produced. Operator related problems with the stereoscopic rangefinder resulted in its replacement with a coincidence rangefinder, denoted by the M48A2C designation. It was this version with which the German teams competed for the Canadian Army Trophy through 1966. (38)

In 1967 the Leopard 1 made its CAT debut. This vehicle was the first German-built tank since World War II, and it reflected the German army's need for a modern platform optimized for the Central European operational environment. The initial requirements emerged in 1956, and the following year France and the Federal Republic of Germany agreed to develop the vehicle as a joint program. The resultant tank would equip the armored forces of both nations. In 1958, the program expanded further with the inclusion of Italy. Two German and one French industrial group began prototype construction, after which demonstrations and trials began in 1961. Development, testing, and evaluations continued into 1965. By then, however, the program had lost its multinational character. Changes in French defense policy and its pending withdrawal from NATO military command led to its departure from the program. The French design, developed as a candidate for the joint program, instead became the AMX 30. The Italians opted to purchase the American M60A1. (39)

Krauss-Maffei AG delivered the first production model of the Leopard in September 1965. Large-scale fielding followed with priority going to those units equipped with M47s. Other NATO members took notice, and Leopards were soon being evaluated by the British, Dutch, Belgians, and Norwegians. The British undertook comparative assessments with their own new Chieftain tank. Within a few years, many nations had negotiated purchase contracts for the Leopard 1. (40)

The new German battle tank weighed 44.25 tons, carried a crew of 4 four, and mounted the British-built L7 105-mm gun as its main armament. It also carried coaxial and anti-aircraft machine guns. Although the final production model proved heavier than original design intent, the Leopard retained an agility and mobility that matched its firepower, with a maximum road speed of 40 miles per hour and the ability to climb 60-percent gradients. Its 10-cylinder Mercedes-Benz diesel engine delivered 830 horsepower and a range of 375 miles. Overall, the design reflected the German emphasis given to firepower and mobility. It was not among the most heavily protected tanks of the day, but its main gun was among the most effective available. Moreover, it could fire a variety of ammunition. (41)

The Leopard incorporated German tank design experience from World War II, particularly with the Panther and Tiger platforms. Indeed, the name continued the wartime tendency to name German tanks after noted felines. The Leopard was organic to panzer and panzergrenadier brigades. It mounted a 105-mm gun similar to that used by the American M60A1 but with recoil and breech mechanisms designed by Germany. In the Leopard, the gunner performed the ranging function via a combined rangefinder and sight. The rangefinder operated in both stereoscopic and coincidence modes to garner the best qualities of each type. Unlike the American practice in which a high level of interaction between gunner and tank commander was necessary to engage a target, in the Leopard, the gunner bore responsibility for ranging and firing upon targets identified by the commander. Consequently, the commander had little involvement in the engagement process, instead focusing his attention upon his vehicle's overall operation. He possessed a 360-degree rotatable sight to facilitate situational awareness, and it also served as a secondary rangefinder. (42)



*An early model of the Leopard 1, the first German tank produced after World War II.  
(U.S. Army Armor School Archives)*

In the CAT competitions of the 1960s, the Germans used both the M48 and Leopard 1. Like the Belgians, they tended to rely upon the same unit to provide their CAT teams. In four out of six competitions, Panzer Battalion 83 performed this role. This unit formed in 1958, initially equipped with the M47. The next year it upgraded its vehicle set to the M48A2 and again in 1961 to the M48A2C. When the Leopard 1 became available, the battalion exchanged its M48s for the new vehicle in 1966. (43)

Nevertheless, despite relying upon a single unit and the use of the most modern platforms among the participants, the Germans failed to win CAT in the 1960s. The placement of Panzer Battalion 83 varied considerably, despite its experience with the competition. It achieved second place in 1963 and 1964, but a last place finish the next year marred this solid performance. The battalion did not compete in 1966, presumably because it was being re-equipped with the Leopard 1. When it returned to CAT in 1967 with the most modern tank among the competitors, it garnered only fourth place — behind the older M47s of Belgium and the aging Centurions of Canada and the United Kingdom. Clearly, novelty was not a guarantee for success. Two other tank battalions represented the Federal Republic of Germany, one equipped with the M48A2C in 1966 and a Leopard 1 unit in 1968. The latter finished second and the former third.

## **British Centurions**

Throughout the 1960s British CAT teams competed with the Centurion. This tank constituted one of the United Kingdom's most successful and storied combat vehicles. It possessed a global popularity reflected in its use by many nations, including fellow NATO members Holland and Canada, also participants in the CAT competition. This popularity stemmed from its proven battlefield effectiveness. The Centurion entered combat with British forces in the Korean War and the 1956 Suez intervention. The Indian army employed it during its wars with Pakistan in 1965 and 1971, the Australian army in Vietnam, and the Israeli Defense Force during the Six Day and Yom Kippur Wars. The Centurion restored Britain's reputation for quality tank design following a succession of program failures in World War II.

Centurion development began in 1943. Although it entered service too late to see combat in World War II, it incorporated lessons learned from the battlefields of Europe and North Africa. It possessed better survivability and lethality than most wartime British designs combined with adequate mobility. Its dual purpose main armament enabled it to engage both soft and armored targets — a critical improvement over early war models that only fired armor piercing ammunition, placing them at a disadvantage when engaged by antitank guns. In addition to thicker armor, the Centurion benefited from side armor skirts that provided additional protection against hand-held shaped charge weapons — a direct reaction to the German Panzerfaust and Panzerschreck. The gunner's sight was mounted in the turret roof rather than the gun mantlet to prevent any degradation in the latter's armor protection. Main gun ammunition was also stored below the turret ring to minimize the risk of an ammunition fire should the turret be penetrated. (44)

The British army received its first prototypes in 1945. They were promptly sent to continental Europe for extended service tests. They arrived too late to see combat, but these early platforms were subjected to extensive road marches, comparative evaluations with Sherman and Cromwell tanks, and presented to British armor personnel who had fought their way into Germany. The feedback from these activities identified issues that drove design improvements. Production began in November 1945 and the British army accepted the Centurion for service in December 1946. The 5<sup>th</sup> Royal Tank Regiment became the first unit equipped with the new tank. (45)

The early production models weighed 48 tons and possessed a maximum speed of 21 miles per hour. They suffered numerous teething problems, including poor automotive reliability, limited engine life, and oil leakage into the brakes. Aging communications equipment impaired command and control, but an operational range of just 60 miles constituted the most significant drawback. Corrective measures included the use of external fuel tanks, later superseded by a 200-gallon fuel trailer towed by the tank. The trailer boosted the vehicle's range, but complicated driving and created new hazards. Fuel spillage on surfaced roads could be ignited by sparks from the tank's steel tracks, necessitating remaining in place until the fuel evaporated — hardly a desirable state in which to conduct mobile operations. A less disruptive solution emerged in the form of a 100-gallon fuel tank bolted to the back of the tank. Later models dispensed with these improvised measures entirely by incorporating a 95-gallon fuel tank under armor inside an elongated hull. (46)

The Centurion became Britain's principal battle tank in the 1950s, and it benefited from continuous improvements. In addition to resolution of the additional fuel storage problem, the tank gained a more powerful engine with a more robust exhaust system. Suspension improvements, increased automotive reliability that boosted the distance between engine overhauls to 3,100 miles, and a new electrical system improved its overall capability. Indeed, its ability to climb 35-degree gradients resulted in its characterization as an "Alpine tank." (47)

Similar enhancements increased the tank's lethality. The original Besa coax machine gun was replaced by the more reliable NATO standard Browning machine gun. A quick firing 20-pounder

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replaced the original 17-pounder main armament. The 20-pounder was considered the bane of any contemporary tank when it fired armor piercing discarding sabot ammunition. Nevertheless, development of the more powerful L7 105-mm rifled gun began in 1956, the year of the Hungarian uprising and its brutal suppression by Soviet forces. The fighting provided an unexpected intelligence boon when a T54 was driven onto the British embassy compound in Hungary. Data regarding the capabilities of the Soviet tank soon became a shaping influence on development of the new British tank gun. However, this data provided an inflated sense of the T54's ballistic protection. Consequently, the L7 105-mm gun possessed the ability to penetrate armor considerably stronger than what the T54 actually carried. Production of Centurions carrying the new armament began in 1959. The subsequent addition of a bore evacuator and thermal sleeve further enhanced the weapon's excellent performance. The thermal sleeve prevented the gun tube's warping due to sun exposure, wind, rain, and rapid temperature changes. (48)

In 1965 the Centurion received infrared driving and night fighting equipment. The following year the Centurion began to feature a ranging machine gun. This weapon was a modified M2 .50 caliber machine gun mounted coaxially in the gun mantlet. It fired three-round bursts of incendiary-tipped tracer that ignited on impact with a hard surface. The weapon was fired at known ranges and its tracers observed by the tank commander and/or gunner. Once the target was hit, an accurate range reading was then available for the main gun. The ranging machine gun was not a new invention, and it hardly constituted a high tech device. Instead, it provided a simple and effective means of range determination without the potential technical malfunctions and user errors associated with the more sophisticated rangefinders of the time. Moreover, the ranging gun automatically provided an indication of crosswind and cant, although it tended to lose its accuracy at longer ranges. (49)



*One of the most successful British tank designs — the Centurion. (The Tank Museum)*

The Centurion did not possess a fire control system or optical rangefinder. However, it bore the honor of being the first postwar tank to possess a stabilized weapon system. (50) The Metrovick stabilization system provided both elevation and azimuth stabilization to keep the main gun on its original heading as it traversed terrain. It did not lock the gun on the target irrespective of hull movements as later main battle tanks would, but it did enable target acquisition on the move. By keeping his sight on the general target area with the tank in motion, the gunner could rapidly engage the target when the tank stopped. Upon completion of the engagement — a matter of seconds — the tank could move on to seek the next target, thereby spending more time in motion and complicating enemy acquisition efforts. The stabilization system automatically engaged when the vehicle's speed exceeded 1.5 miles per hour. It made firing on the move less erratic and problematic, but the best anti-armor results derived from stationary firing of armor piercing discarding sabot ammunition. The stabilization system did facilitate firing high explosive rounds and the coaxial machine gun, particularly when used to suppress targets or areas. Both the gunner and commander could control the variable speed electrical turret traverse with an override capability provided for the commander. The latter also possessed a rotating cupola to facilitate target acquisition while the vehicle maneuvered. (51)

In the 1960s British CAT teams utilized the most up-to-date version of the Centurion. They proved consistently high performers — at least after the dismal score achieved in the 1963 competition. Ironically, it was the 5<sup>th</sup> Royal Tank Regiment — the first unit to receive the Centurion — that received the only negative score in the history of the Canadian Army Trophy. The British won twice, placed second once, and secured third place on two separate occasions. The CAT team also varied from year to year. Between 1963 and 1968 only the Royal Scots Greys participated in more than one competition. Overall, the United Kingdom experience reflected an effort to draw upon a pool of armored units rather than rely upon a single organization with a concentration of CAT talent.

### **The Canadian Experience**

In contrast to the United Kingdom and German armed forces, the Canadians had only a single unit from which to draw its CAT team. Canadian Forces maintained only a single armored regiment in Europe. In the first years of CAT, The Fort Garry Horse represented Canada. The unit activated in 1958 as the fourth armored regiment of the Canadian regular army. It received its first Centurion tanks in November of the same year. Training accelerated over the next three years, until its departure for the Federal Republic of Germany was announced late in 1961. The unit arrived at its new station in December 1962, where it provided the armor component of the 4<sup>th</sup> Canadian Infantry Brigade. The regiment's 60 Centurions began training on the Bergen-Hohne ranges and established contacts with German, Belgian, and British units. In July 1963, the Canadian Centurions received an armament upgrade that exchanged their 20-pounders for the L7 105-mm rifled gun. The next month the CAT competition began. The Fort Garry Horse placed only fourth, despite national pressure to win an event sponsored by Canada. It finished last in 1964 and third in 1965. The CAT competitions, however, marked only a portion of the regiment's military activities that included major NATO exercises. During Exercise Treble Chance conducted in the fall of 1964 The Fort Garry Horse served as the opposing force. Its success in rapidly defeating defending forces expected to hold for an extended period triggered a reevaluation of NATO defensive strategy. No doubt, however, training for this event overshadowed CAT preparations, possibly explaining the low score of the Canadian team in 1964, which garnered only 1,024 points compared to the winning 8,425 score achieved by the Belgians. Following its participation in the 1965 CAT, The Fort Garry Horse completed its rotation in the Federal Republic of Germany and returned to Canada. (52)

The role of providing an armor component to the 4<sup>th</sup> Canadian Infantry Brigade fell to Lord Strathcona's Horse (Royal Canadians). This regiment, whose history dated back to the Boer War, remained in Germany from 1965 until its return to Canada in 1970. It provided the Canadian CAT teams for the competitions held in 1966-1970. On Lord Strathcona's watch, Canada won its first Canadian Army Trophy in 1967 when a team from B Squadron achieved the highest score, beating the

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second-place British team by a large margin of nearly 4,000 points. The unit received the award personally from Major General F.F. Worthington, considered the father of the Royal Canadian Armoured Corps. (53)



*A Canadian Centurion in the field. (Royal Canadian Armoured Corps School)*

### **The Netherlands**

The Netherlands also employed the Centurion in the 1960s CAT competitions. In this timeframe the Dutch drew their CAT teams from four different units. The 41<sup>st</sup> Tank Battalion, for example, represented the Netherlands in the 1963 and 1967 competitions. Established in 1953, the unit initially was equipped with Sherman tanks until replaced by Centurions the following year. As one unit history noted, “The Centurion was a special tank with some typical English characteristics. Anyone who has worked with this tank will recognize them. The time-consuming maintenance, countless antifreeze leaks, always problems with the auxiliary motor.” The same author also noted several crew comforts associated with the Centurion, including the onboard electric tea kettle. (54)

Between 1961 and 1963, the 41<sup>st</sup> Tank Battalion rotated between the Netherlands and the Federal Republic of Germany as part of a broader Dutch response to increased tension with the Warsaw Pact in the wake of the 1961 Berlin Crisis. In 1963 the battalion assumed a permanent station in Germany at Bergen-Hohne. (55) There is no indication, however, that this new home near the ranges on which the Canadian Army Trophy was held helped either this unit or other Dutch CAT teams. In 1963, the 41<sup>st</sup> Tank Battalion placed third, while finishing last in 1967. Indeed, throughout the 1960s, the





*The patch worn by the Dutch 41st Tank Battalion team for CAT 1967. (Ron Mihalko)*

Dutch teams placed fourth on three occasions and finished in last place twice. The highest placement of a Dutch team in during this period was the third place achieved by the 41<sup>st</sup> Tank Battalion. Dutch scores overall also proved significantly lower than that achieved by other participants. Introduction of a ranging machine gun for the Centurion does not seem to have resulted in a marked performance improvement, despite the Dutch developing a much better mounting for the machine gun that provided for better accuracy. (56)

### **Whither the Americans?**

Noticeably absent from these early CAT competitions was the United States. Despite its influential role in NATO affairs, the large-scale presence of its military in Europe, and its leadership in blocking Soviet and Warsaw Pact aggression, the U.S. Army abstained from participation in the Canadian Army Trophy. Training for possible war with the Warsaw Pact no doubt partially lay behind this decision, but all NATO members shared a similar responsibility. The growing involvement of the U.S. Army in Vietnam looms as a more logical reason, particularly after the large-scale buildup of forces in the Republic of South Vietnam that began in 1965. As America's commitment to the war in Southeast Asia increased, so too did manpower requirements. Units stationed in Germany often bore the brunt of this need, providing a steady stream of replacements as well as soldiers seeking transfers into an active combat theater. The impact upon organizations remaining in Germany to deter the Soviet threat proved extreme in some cases. As one junior officer serving in the 1<sup>st</sup> Squadron, 14<sup>th</sup> Armored Cavalry Regiment recalled:

I filled the last officer position in the squadron in October 1965. There was only one vacancy, and I was fortunate that it was a cavalry platoon. I was platoon leader for six months. At that time the Army began its drawdown of forces in Europe to support the buildup in Vietnam. Many officers were pulled out in the spring of 1966. However, I remained in Germany, since I was detailed from the Chemical Corps and not a Regular Army combat arms officer. I became the troop's executive officer after the other three lieutenants left for Vietnam. The troop commander left in the summer of 1966. As the only officer left in the entire troop, I became the troop commander. I was still a second lieutenant. Fortunately, the majority of the

senior NCOs remained in the organization, but the officer complement for the regiment and squadron almost entirely disappeared by the summer of 1966. (57)

Despite this commitment of American manpower and resources, no other NATO member supported the war. Indeed, the British maintained their embassy in Hanoi and their merchant ships continued to ply their trade with North Vietnam. (58) For the United States, the absence of NATO support coupled with the real strain on military resources made participation in a competition anything but a priority event.

**Tank Gunnery Tables 1964 (59)**

<b>Tank Table</b>	<b>Description</b>	<b>Crew Evaluated</b>
Preliminary Gunnery Examination	Prerequisite for sub-caliber firing	All
I	Zeroing and initial lay exercises	All
II	Adjustment of fire exercises	All
III	Moving target exercises	All
IV A	Service firing—stationary target exercises (day)	Tank commander, gunner, and one other crew member
IV B	Service firing—stationary target exercises (night)	Tank commander and gunner
V A	Service firing—moving target exercises (day)	Tank commander, gunner, and one other crew member
V B	Service firing—moving target exercises (night)	Tank commander and gunner
VI A	Crew machine gun exercises (day)	All
VI B	Crew machine gun exercises (night)	All
VII A	Crew field firing exercise (day)	All
VII B	Crew field firing exercise (night)	All
VIII A	Crew proficiency exercises (day)	All
VIII B	Crew proficiency exercises (night)	All

In the 1960s, American tank gunnery training focused largely upon the tank crew. Individual crew members received specific skill instruction, followed by crew training that emphasized target recognition and acquisition. Range determination remained a critical skill and received considerable attention, including the use of both stereoscopic and coincidence rangefinders. As training progressed from the individual to the crew, the latter ultimately conducted a tank gunnery qualification firing. The progression was reflected in tank tables used to evaluate gunnery and the related skill sets. The culminating event lay in crew proficiency exercises that included live firing exercises during the day and night. The results were scored, records kept, and the crew rated as expert, sharpshooter, marksman, or unqualified.

Training devices were used routinely, particularly before soldiers participated in live fire events, including sub-caliber ranges. In the 1960s, common training devices included a laser gun for practicing boresight and zeroing procedures for use on the sub-caliber tank tables. By 1968 improved laser simulators were undergoing testing for potential Army use. These devices were intended for use on sub-caliber ranges, replacing the machine gun normally used to replicate main gun fire. (60) A conduct of fire device helped practice laying of the gun, determination of lead, and fire adjustments. Essentially a reticle that could be moved on a screen, it enabled the tank commander, gunner, and loader to interact in the firing and adjustment process. For target identification, the use of a projector screen, lamp, and vehicle models provided a simple means of showing a vehicle silhouette for crew members to identify. (61)

In the 2d Armored Division, the 2d Battalion, 66<sup>th</sup> Armor Regiment (2-66 Armor), pursued a different approach to gunnery training aids. This unit generated its own design for an effective, robust, and inexpensive sub-caliber weapon to support training on Tables I-III for both the 105-mm and 90-mm gun, thereby supporting training for M48 and M60 tanks. The division adopted the device, and it was locally manufactured by the Fort Hood Director of Maintenance. Following the completion of gunnery training, the device was found to be superior to the coaxial machine gun normally used for sub-caliber firing. Indeed, the accuracy of the new design encouraged units to adopt somewhat unconventional targetry, including balloons and clay pigeons at greater than normal ranges. Further applications included the potential development of a sub-caliber Table VIII and more frequent firing of Tables I-III. (62)

The Armor Center at Fort Knox introduced a laser simulator to assist gunnery training for new Armor crewman. This device was mounted on the tank in place of the coaxial machine gun. Operation of the laser simulator used the same controls as the machine gun, and it could be operated on a sub-caliber range, training complex, or open area. Feedback on the device proved positive, and it provided a realistic and accurate hit indicator. It had the added training benefits of being cheaper than live firing and could be used in areas with restricted training and range space, although the hazards of laser beams had to be factored into training plans. The device also required soldiers to use proper engagement techniques with the tanks' weapon controls, adding another layer of realism. (63)

For Army National Guard tank units, however, less sophisticated measures had often to be adopted. In the New York 1<sup>st</sup> Battalion, 205<sup>th</sup> Armor Regiment (1-205 Armor), tank gunnery training entailed the use of a stationary tank, 35-mm slides, the gunner's periscope, a flashlight, and a screen. Slide images of different target types appeared on a screen. As they did so, the gunner received a fire command and had to lay the gun on target. The boresighted flashlight was then turned on by an instructor to indicate where the round went. Fire adjustment as necessary followed. (64)

Tank gunnery training, however, fell short in its coverage of platoon gunnery and the related planning and fire control measures. Platoon fire distribution and control received coverage in the principal tank gunnery manual, which provided the proper principles to be applied and effective techniques. However, platoon fire was not part of the qualification process. No tank table addressed platoon firing, despite its clear importance in combat against a numerically superior enemy. The guidance was provided, but without a clear link to qualification, it remained for units to decide how or if to incorporate this training into their annual training plans. (65)

Indeed, tank platoon training overall was considered too subjective, thereby undermining efforts to determine accurately unit readiness and specific areas of weakness. In the 1960s the U.S. Army Armor Human Research Unit at Fort Knox proposed a means to objectively assess individual Soldiers, crews, and platoons. The resultant Tank Platoon Combat Readiness Check entailed a progressive series of evaluations, starting with individual crew member duties, then entire crews, and culminating in a platoon evaluation. The criterion used derived from doctrinal responsibilities, and the corresponding evaluation sought to prevent subjective assessments. Instead a numerical rating system provided evaluators and commanders a simple and accessible means of determining skills requiring additional training at the individual, crew, or platoon level. This readiness test was intended to precede company training, and it paralleled a similar Armored Cavalry Platoon Combat Readiness Check undergoing evaluation in 1966. (66)

Battle drills constituted another means of instilling realism into training and enhancing unit reactions to combat situations. Similar in nature to football plays, in which team members automatically respond in a coordinated manner to a play call, the concept of battle drills was not a new one, and it had been employed to some extent in armored training in World War II. In the 1950s, General Hamilton H. Howze devised updated battle drills for the armored units of the day that became part of doctrine and training. By the 1960s, though, battle drill training had become problematic. It re-emerged in doctrine, but its execution remained haphazard throughout the force. (67)

## Changing CAT

By 1968 the regular participants in the Canadian Army Trophy competition were seeking ways to reduce the cost associated with the event and improve its realism. In addition, the annual nature of CAT increased its impact upon routine training of the participating nations. CAT teams had to be selected and trained amid routine gunnery schedules, NATO and national field maneuvers, and deployments. The related time commitment also impacted the senior leaders overseeing the competition.

Therefore following the 1968 competition, the Commander-in-Chief Allied Forces Central Europe (CINCENT) was asked to undertake a review of the rules governing CAT. CINCENT appointed a special committee to conduct this study, and its recommendations resulted in significant changes that reflected the concerns of the participating nations. The most important change lay in a shift from an annual to a biennial event, immediately reducing the costs and time commitment related to preparing a CAT team. In addition, the nature of the competition focused upon a two-tank section battle run that included movement and firing at varied targets. The basis of selection of CAT teams also widened to ensure that the benefits from the competition became more widely spread. (68)

These changes served to improve the potential tactical value of CAT, although it still remained an artificial event not entirely reflective of combat conditions. Nevertheless, it marked a significant improvement, and the reduction in frequency provided additional training time for teams that now had to operate as sections and move through a range course as a unit rather than simply independently shoot at stationary targets from a firing point. The revised CAT underwent a trial run in 1969 before its formal implementation in the 1970 competition. (69)



*An American M60A1 on a training exercise in Germany.  
(National Armor and Cavalry Museum)*

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## Chapter 2

### Improving the Canadian Army Trophy, 1970-1979

In the 1970s the Canadian Army Trophy evolved from the single platform, stationary engagements of the previous decade into multi-tank battle runs. Platoon rather than crew skills determined victory, while actual scoring continued to reflect the importance of rapid, accurate firing that conserved ammunition. The competition remained an artificial event, but it rewarded the demonstration of competencies considered vital in combat. Indeed, CAT came to reflect a NATO emphasis upon increased combat readiness and interoperability among its partners. For the United States, its poor showing in the competition underscored the need for fundamental changes in tank gunnery training.

#### NATO Developments

The 1962 Cuban Missile Crisis heightened the risk of a nuclear conflict, averted only through direct negotiations between the United States and the Soviet Union. In the wake of this event, NATO members sought some form of détente with Russia to reduce the risk of nuclear war. Arms control talks ensued, and by the 1970s member states proved willing to consider troop reductions in Europe. They incorrectly sensed a recession of the threat posed by the Warsaw Pact that would permit a smaller military footprint without compromising regional security. (1)

The interest shown by European nations in troop reductions and détente, however, generated friction in the NATO alliance. The cost of the Vietnam War, coupled with the onset of “stagflation,” encouraged America to seek an increase in the commitment of other NATO states to Europe’s security. Under President Richard M. Nixon’s administration, the United States also pursued détente directly with the Soviet Union, resulting in the signing of the first Strategic Arms Limitation Talks (SALT) agreement in 1972. While this act coincided with European interests in reducing Cold War tensions, America’s support for Israel during the 1973 Arab-Israeli War did not. Dependent upon Middle East oil from Arab nations, European nations proved reluctant to follow the American lead. Indeed, throughout the 1970s the European allies often found their shared common interests at odds with American policy. (2)

This discord did not seriously threaten the NATO alliance, but it did complicate efforts to pursue a unified strategy. In the 1960s NATO members accepted Flexible Response with its reliance upon a mix of nuclear and conventional force capabilities. NATO could now offer an appropriate, tailored response to Soviet aggression however manifested. Flexible Response made sense, but conventional force reductions by member states forced a continued reliance upon nuclear weapons well into the 1970s. NATO’s commitment to prevent the loss of German territory reinforced this dependence. Lacking sufficient conventional forces to defend forward, nuclear weapons became a necessary bulwark against defeat. (3)

NATO’s internecine friction and the pursuit of détente by individual member states did not alter the persistent need to plan for the defense of Central Europe. Since the 1960s, the Soviet Union had continued to upgrade its ability to wage war. While the United States remained focused upon Vietnam, Russia effectively stole a march on NATO, upgrading its doctrine and fielding multiple new systems. The steady evolution of Soviet main battle tanks paralleled similar improvements in armored personnel carriers, artillery, and aircraft. These systems increased the military threat posed to Central Europe even as the Soviet Union continued to support national liberation movements

throughout the world. Earlier Soviet interventions in Hungary and Czechoslovakia also demonstrated a willingness to employ military force in the pursuit of state objectives. The 1979 invasion of Afghanistan highlighted the continued central role of military action in Soviet policy, notwithstanding détente and discussions of strategic arms limitation.

Throughout the Warsaw Pact, NATO noted a steady increase in capability and readiness. The quality disparity that traditionally existed between Soviet and non-Soviet formations diminished through the latter's acquisition of improved materiel and training. NATO expected to fight outnumbered, but it relied upon the superior quality and technology of its troops to avoid defeat. In the 1970s these twin pillars of survival had been significantly eroded, thereby encouraging a continued reliance upon nuclear weapons. (4)



*Soviet tank crews mount up. (U.S. Army Armor School Archives)*

Nevertheless, NATO planners had still to determine how best to employ the conventional forces at their disposal. Armored formations constituted both the backbone of NATO's ground defense and the spearhead of any Warsaw Pact invasion. By the end of the 1970s the Warsaw Pact possessed an estimated 16,480 tanks, giving it a 2.5:1 superiority over NATO. These numbers did not reflect the qualitative impact of Soviet modernization. In the early 1960s, the T62 entered service with a night fighting capability. It was succeeded by the T64 and T72. Both vehicles carried more advanced armor, mounted a stabilized 125-mm main gun, and utilized an autoloader. Comparative assessment of the M60A1 with the T72 found the latter superior in terms of lethality, survivability, and mobility. Indeed, most NATO tanks continued to carry a 105-mm gun, despite growing numbers of Soviet platforms with heavier armament. Anticipated Soviet tactics included the saturation of the battlefield with tanks supported by artillery to overwhelm forward positions and reach deep into NATO rear areas. The American XM1 then in development offered improved prospects for engagements with T72s, but it was considered only an even match for the T80, which entered Soviet service in 1976. The same study that provided these sobering assessments concluded:

To sum, whether one uses informed U.S. or Soviet calculations, the conclusion is that NATO can expect, through 1984, no advantage over the Soviets in quality of armor or anti-armor weapons, and only a modest redressing of its present quantitative disadvantage. (5)

In addition to being outnumbered by Soviet platforms of steadily improving quality, NATO tankers faced additional concerns. The 1973 Arab-Israeli War showcased the increased lethality of dismounted forces equipped with the latest man portable antitank systems, particularly the RPG-7 and the Sagger antitank guided missile (ATGM). Such weapons proved a much cheaper means of destroying hostile armor than a tank. The high losses incurred by Israeli armored units in the first days of the war exemplified their effectiveness. In Europe, such weapons might readily disrupt NATO plans to rely upon mobile, armored operations to defeat Warsaw Pact columns. Conversely, analysts considered the ability of American ATGMs to defeat T64s and T72s only problematic. (6)

The Middle East conflict also highlighted several disturbing tendencies of modern war. The first lay in the exceptionally high loss of materiel in a relatively short period. The combatants lost through battle more armored platforms and artillery systems than the U.S. Army in Europe's (USAREUR) entire inventory of similar weapons. Coupled with an extremely high expenditure of all types of munitions, the war forced NATO planners to rethink their expectations of a new conflict in Europe, particularly the sufficiency of pre-positioned stocks of materiel and ammunition. (7)

In addition to equipment considerations, the Arab-Israeli War began with little notice. The Arab attack achieved maximum surprise, disrupted Israeli mobilization plans, and forced the latter to enter combat with forces immediately on hand. Against a Warsaw Pact invasion of Central Europe, such a no-notice attack had immediate repercussions for defense plans that envisioned sufficient time to mobilize additional forces and shift from a peacetime to wartime footing. Notwithstanding NATO rapid response exercises, the possibility of a sudden Warsaw Pact invasion posed a difficult challenge to counter. Only by sustaining higher training and readiness standards would NATO forces survive initial contact. (8)

The shift in the balance of military power in favor of the Warsaw Pact triggered several NATO initiatives. In 1969 the United States conducted the first of several annual Return of Forces to Germany (REFORGER) exercises to test the ability to deploy rapidly troops from North America to Europe to reinforce NATO defenses. These exercises included an actual deployment and culminated in a series of NATO field maneuvers. To further facilitate the rapid reinforcement of Central Europe, the United States established prepositioned equipment stockpiles for three divisions, later increased to six. (9)

In 1974 American General Alexander Haig became the Supreme Allied Commander, Europe (SACEUR). He implemented a series of new initiatives to improve NATO capabilities and readiness, including Readiness, Reinforcement, and Rationalization. This effort sought to improve NATO's ability to transition quickly from a peacetime to a wartime orientation in direct reaction to the danger of a sudden Warsaw Pact invasion. It included a rigorous and standardized readiness evaluation process for each NATO formation. The same initiative included measures to increase NATO's ability for rapid reinforcement and to improve mutual support among the armies of the alliance members. Separate multinational exercises became part of a single, linked series of training events every autumn, and the number of U.S. forces available to support Europe and participate in REFORGER expanded. (10)

A competition focused upon improving combat skills amid an atmosphere of camaraderie clearly supported these efforts to improve NATO effectiveness and interoperability. Hence, the Canadian Army Trophy retained its relevancy in the 1970s. Moreover, its focus upon tank gunnery and the related training standards became even more important given the tank's prominent role in the defense of Central Europe. CAT served to spotlight a critical skill set required at the tactical level to defeat an ever more capable foe. Rising concerns about the imbalance of NATO and Warsaw Pact military power underscored the importance of the tanker's ability to engage targets in a rapid and accurate manner.

## Updating CAT

The 1970 Canadian Army Trophy competition reflected the first major changes to the event since its inception. Throughout the decade it continued to be held at Bergen-Hohne, but it became a biennial event, and its focus shifted from individual platforms and crews to a two-tank section. Each section conducted a battle run, moving to three different firing points (or bounds) from which they worked as a team to engage targets. The targets appeared singly or in pairs at ranges out to a maximum of 2,000 meters. They represented a total of 16 tank turrets and two trucks for machine gun engagements. The targets themselves were black canvas screens that flipped upward for tanks to identify, acquire, and engage. Prior to beginning their battle run, tank commanders only knew the total number of targets to be engaged. They did not know the array or how many might appear at each firing point. Each tank carried a total of 16 anti-armor main gun rounds and 100 rounds of coaxial machine gun ammunition. Platforms equipped with ranging machine guns received an additional allotment for the ranging weapon. (11)

Technical issues encountered by the Leopard 1 drove changes in competition targetry and ammunition selection. The vehicle's initial inability to fire either the training version of armor piercing discarding sabot, often referred to as DS/T, or high explosive squash head (HESH), spurred German concerns about its ability to compete with the British Chieftain. Therefore, instead of targets representing a mix of fully exposed armored vehicles and those in hull defilade with only their turrets visible, the competition used only turret silhouettes. Each national team was permitted to use any type of armor defeating ammunition. The German team selected high explosive antitank (HEAT), while the United Kingdom and Canadian teams opted for DS/T. (12)

Scoring rewarded rapid and accurate target engagements, with bonus points awarded for ammunition conservation and time savings. Targets appeared for just 30 seconds. Within this timeframe they had to be identified and hit. Each main gun target hit earned 500 points. Hits achieved in a shorter time received a bonus of 10 points per second for each second under 30 for a maximum of 300 points if hit in 0 seconds. (13) Teams that hit every target also received 50 points for each round they did not fire. For machine gun engagements, 5 points were received for each round put through a target in 30 seconds. In all cases, the targets were physically inspected to determine whether they had been hit. The score for each national team was calculated by adding the points received by each of its tank sections, and an international panel of judges determined the final results. (14)



*The patch worn by Panzer Battalion 33 CAT team members in 1970. (Ron Mihalko)*

The team selection process also changed. Six weeks before the competition, each competing nation nominated two regiments (or battalions in the case of the United States, Germany, and the Netherlands) as potential competitors, except Canada, which maintained only one armor regiment in Germany. Five weeks out, the CINCENT randomly selected the national representative for each nation from the unit candidates provided. Just ten days before the competition began, each selected regiment met with the chief judge of the Canadian Army Trophy and presented him with a list of twenty crews. From this list, eight were selected by ballot. Six crews would conduct the actual competition; the other two constituted reserve, or “spare,” crews. The regimental commander determined from this final set which crews would comprise each two-tank section. (15)

Once a regiment or battalion became identified to provide the CAT team, training efforts focused upon the competition and related skills, thereby ensuring a pool of qualified crews. This orientation necessarily impacted the unit’s other routine duty assignments and training activities. However, the change in the selection process required each nation to provide a sufficiently large number of potential crews to discourage the creation of a special CAT organization. The competition was intended to reflect gunnery capabilities across a national force rather than a select set of experts groomed specifically for the event.

CAT teams did not receive additional time or special access to Bergen-Hohne to prepare for the competition. Therefore, each team conducted their live gunnery practice during the annual training window normally allotted to their nation for range use. Consequently, the CAT team of a nation whose gunnery training ended just before the competition began gained an advantage. Its crews would be at peak readiness in comparison with those whose national firing time occurred considerably earlier or even after the event. (16)

### **Rule Britannia in 1970**

Canada hosted the 1970 competition from May 20-22. Unlike previous years, only three nations participated: Canada, the Federal Republic of Germany, and the United Kingdom. Belgium and the Netherlands abstained due to issues related to the re-equipping of their forces. Despite the smaller size of the competition, the range on which the battle runs occurred sported a new control tower and the flags of every NATO nation. Crowded bleachers and an obvious senior leader presence all contributed to a heightened stress level for crews, unrelieved by knowledge that a public address system would amplify and broadcast to the spectators all radio transmissions made during battle runs. (17)

Nevertheless, the United Kingdom’s 16/5 Queen’s Royal Lancers won the competition by a significant margin with a team score of 29,250 points. Section scores proved generally consistent. The Federal Republic of Germany’s Panzer Battalion 33/34 secured second place, trailing the British by more than 4,000 points. However, the performance of the German sections varied considerably. Two trailed the British, but one secured the highest section score of the competition. A British observer noted, however, that this German section was the last of its national team to fire. It benefited from monitoring the broadcasts of the previous battle runs and exploited the ability of one tank to spot for another. These factors combined with effective use of the Leopard 1’s stereoscopic rangefinder mode ensured the speed and accuracy necessary to beat the top British section by 35 points. The Canadians in their aging Centurions fared relatively poorly, trailing the United Kingdom national score by nearly 12,000 points and garnering the lowest section score. (18)

<b>CAT 1970 Results (19)</b>	
<b>1 United Kingdom</b>	
16/5 Queen's Royal Lancers	10,240
16/5 Queen's Royal Lancers	9,615
16/5 Queen's Royal Lancers	9,395
<b>National team score</b>	<b>29,250</b>
<b>2 Federal Republic of Germany</b>	
Panzer Battalion 33/34	10,275
Panzer Battalion 33/34	7,960
Panzer Battalion 33/34	6,660
<b>National team score</b>	<b>24,895</b>
<b>3 Canada</b>	
Lord Strathcona's Horse	6,585
Lord Strathcona's Horse	6,045
Lord Strathcona's Horse	4,880
<b>National team score</b>	<b>17,510</b>

In preparation for CAT, the United Kingdom nominated the 16/5 Queen's Royal Lancers and the 2d Royal Tank Regiment as potential candidates for the competition in March 1970. These two regiments constituted around 20 percent of the British Army of the Rhine's (BAOR) armored strength. Pending notification of which regiment had been selected for CAT, both units began to prepare 20 crews as potential competitors. This training intensified for the Queen's Royal Lancers following its selection for CAT. Within the regiment squadron commanders worked to assess the performance of crews and vehicle commanders, particularly under pressure. Each squadron then nominated four crews (20 total for the regiment) as potential members of the CAT team. These selectees entered a two-week training regimen focused upon section operations, including target sensing skills, radio communications, action drills, and fire coordination. The regimental commander then selected eight of the 20 crews by ballot to provide the final CAT team of six tanks with their crews and a reserve of two tanks and crews should the need arise for a replacement in the starting lineup. The regiment as a whole provided administrative, logistical, and maintenance support to the CAT team, whose requirements tended to be a priority for the regiment. (20) In reference to the seemingly magical manner in which routine difficulties encountered in securing parts disappeared, one officer noted that "... even the supply of "non-available" spares improved. "CAT" on an indent is better than a red star!" (21)

Preparation of the CAT team occurred amid normal annual training events. In April the Queen's Royal Lancers conducted field training prior to the execution of gunnery training in May. This schedule probably helped the CAT team, since it completed its gunnery training just prior to the start of the competition, ensuring a high level of readiness. In contrast, Canadian gunnery occurred during the CAT, thereby limiting its value in terms of competition preparation and may have been a factor in that nation's poor performance. Nevertheless, the British focused upon the ability to fire fast and accurately. Section drills had to be developed and practiced to ensure effective inter-tank cooperation and communication. Overall, however, the British did not develop competition-specific techniques, instead relying upon an intensification of those practices routinely trained. (22)

Normal troop tactics seemed suitable for the CAT competition. During the execution of the actual battle runs, conventional ranging procedures were applied, utilizing the tank's ranging machine gun. Throughout the competition, the British did not zero any of their tank main guns. Instead, they relied upon a daily boresight of each weapon. Hence the victory seemed to validate British training methods. Nevertheless, among British tankers, membership in the CAT team became a mark of distinction. (23)

The 1970 competition marked the CAT debut of the Chieftain. The design of this platform began in the 1950s as a replacement for the Centurion. It continued the British postwar emphasis upon firepower and protection to prevent a recurrence of the World War II experience in which tankers found themselves outclassed in these areas by German combat platforms. Hence the Chieftain possessed significantly better armor than the Centurion. Design specifications required the front glacis and turret to protect against penetration by a Soviet 100-mm gun at 700 yards. Therefore, the turret did not include a conventional mantlet, and it featured cast armor on its front and rolled homogenous armor on its sides and rear. The resultant spherical look reflected the influence of Soviet tank designs. Armored skirts provided protection against hand-held antitank weapons, and a height reduction was achieved by permitting the driver to function in a supine rather than upright position. (24)

The original lethality requirement focused upon the destruction of the T54 at 2,000 meters. Analysis of potential weapons resulted in the selection of the L11 120-mm rifled gun for the main armament. This gun's destructive power made it one of the most powerful tank guns in NATO's inventory. During gunnery demonstrations in 1962, it achieved an 81 percent chance of a first round hit with APDS ammunition while firing at known ranges no greater than 2,000 meters. Chieftain, however, relied upon a .50 caliber ranging machine gun rather than a rangefinder. First introduced on the Centurion, the ranging weapon was aligned with the main gun and fired long burning tracer ammunition in three-round bursts. Observation of the target when hit indicated which main gun reticle mark should be used — in effect determining an accurate opening range. (25)



*The lethal Chieftain with its 120-mm gun and heavy armor protection for its day. (U.S. Army Armor School Archives)*

This simple system had the benefit of automatically accounting for crosswind and vehicle cant. It proved effective and accurate at ranges below 2,000 meters. At longer ranges or in poor visibility conditions, it became difficult to observe the tracers. A 1967 test in which the L11 fired at targets located between 2,000 and 3,000 meters showed a sharp drop in accuracy. The results indicated a 48 percent probability of a first round hit at 2,000 meters with APDS ammunition, falling to just 22 percent at 3,000 meters. Against turret targets, representing an enemy tank in hull defilade, these figures dropped to 16 and 6 percent. (26)

Yet the L11 could achieve destructive results at much greater distances than could be determined by the ranging machine gun. Indeed, the early adoption of a thermal sleeve helped to facilitate accuracy at longer distances by minimizing the impact of barrel droop or warping. By the mid-1970s laser rangefinders began to replace the ranging machine guns in the Chieftain fleet, thereby facilitating accurate engagements at much greater distances than previously possible. In the early 1980s the addition of a muzzle reference system (MRS) increased long range accuracy still further. The MRS included a mirror mounted on the end of the gun tube. A light source on the turret roof projected a circular red dot at the mirror. The reflection of this dot appeared on the gunner's sight, which also included a boresight marking. The gunner could thus see when the gun tube began to drift from the boresight after a period of firing and make a realignment within seconds to retain the weapon's accuracy. (27)

The combination of a 120-mm gun and limited turret space encouraged the adoption of two piece ammunition. The bag charge containing the propellant and the projectile had to be loaded separately. However, each component required less stowage space and was lighter than fixed ammunition in which the projectile was permanently attached to a case containing the propellant. When fired, separated ammunition ejected no metal casing to be collected and discarded. In the Chieftain, the propellant was stored below the turret ring to minimize the risk of a catastrophic explosion should the turret be penetrated. Each charge was further encased in a jacket that if penetrated, doused the propellant with a chemical-water mix to prevent its sudden explosion. (28)

Several other features increased the Chieftain's lethality and survivability. It possessed an electric gun control stabilization with a battery backup that constituted an evolution of the system fitted to the Centurion. In addition to APDS, the standard ammunition mix included HESH and smoke, while infrared devices enabled nighttime engagements. An auxiliary generator to start the engine without draining the vehicle's batteries also provided sufficient electrical power to operate the gun control equipment with the engine shut off in a silent watch. Smoke grenade dischargers provided a means of screening a withdrawal, and crew survivability benefited from an automatic fire detection system. (29)

Initially intended to weigh less than 45 tons, continuous modifications and additions to the original design resulted in a vehicle that weighed nearly 55 tons. The steady increase in weight resulted in a maximum road speed of just 30 miles per hour, but the Chieftain could negotiate 60 percent gradients. It possessed a robust suspension and, unlike Centurion, rubber track pads to minimize damage to Germany's roads. Early versions also included a navigation system that provided the commander a multi-digit grid coordinate showing the vehicle's location in addition to indicators of heading and bearing. Its four-man crew also benefited from the boiling vessel found on most British tanks for heating water. (30)

The engine constituted Chieftain's most significant drawback. In the 1950s, NATO encouraged the use of multi-fuel tank engines to offset the impact of any scarcity of diesel fuel in the event of hostilities. However, while other nations largely ignored this requirement, the British retained a multi-fuel engine for Chieftain. The resultant L60 engine proved prone to breakdown and emitted large clouds of white smoke that heralded Chieftain's presence. Worse, it did not provide sufficient



power for the tank's weight and bulk. The steady accretion of modifications and additional capabilities resulted in a vehicle significantly heavier than the original design for which the engine was matched. Engine reliability issues limited early performance tests to road travel, thereby preventing identification of gearbox and transmission problems that only became evident during more strenuous cross country evaluations late in the vehicle's development. (31)

The Chieftain entered service with the British army in 1966. It provided a welcome addition in firepower and survivability to the British Army of the Rhine. However, crews found it to be a cold tank, since it lacked a heater. It burned through oil at a high rate, and it proved noisy and dirty. The fuel gauge did not work, thereby encouraging crews to refuel at every opportunity. For unit commanders, running out of fuel was a sacking offense. Dipsticks allowed the fuel in each tank to be measured more precisely, but the process required time and could not match the efficiency of a properly functioning gauge. (32)

The mean time between engine failures was supposed to be 2,500 miles, corresponding to the mileage covered by an armor unit in the British Army of the Rhine over a three-year period. In 1976, the estimated time between engine failures was only 1,000 miles. Data gathered during a training exercise the same year revealed that for every 100 miles a tank unit traveled, Chieftains suffered a 10 percent breakdown rate with repairs requiring more than 48 hours to complete. During an earlier 1969 training event a single Chieftain unit lost 40 of its 43 tanks within 10 days due to breakdowns. For combat units preparing to fight a war that would likely be characterized by continuous mobile operations at least in its early phases, such data was worrisome indeed. (33)

Over time the L60 engine improved through a series of upgrades and modifications. Its horsepower increased, reliability improved, and the telltale white smoke diminished. Tank units developed a series of regular maintenance checks throughout each day of operations. Crews developed a special bond with their tank based on a thorough knowledge of its peculiarities and problems. While this close relation elevated maintenance awareness to a very high level, it also discouraged transferring crewmen from one tank to another, lest they be left disoriented by an unfamiliar vehicle. The engine constituted a never-ending source of concern for Chieftain units, and it detracted from the vehicle's ability to attract foreign sales. In CAT 1970, however, teams were not being evaluated for mobility and maintenance. The focus upon lethality played to Chieftain's strengths. (34)

### **The Doldrums of 1973 and 1975**

The first half of the 1970s marked a decline in CAT participation. After the 1970 competition, the next events did not occur until 1973 and 1975. Only three nations participated in each one. The United Kingdom and the Federal Republic of Germany remained staunch supporters and consistently provided a team. The Netherlands competed only in 1973, while the Belgians finally returned in 1975. The Americans continued to abstain.

After its poor performance in CAT 1970, Canada did not return to the competition for several years. Budget cuts and government policy drove a reduction in its military footprint. In 1970, in a move that shocked its NATO allies, Canada reduced its military forces in Europe by half. The remainder consolidated at Canadian Forces Base Lahr, effectively making them a NATO reserve. Canada's only armored asset in Europe, the 4<sup>th</sup> Mechanized Brigade Group, began to arrive at its new home in Lahr in June 1971. The unit had originally been the 4th Infantry Brigade Group until renamed in 1968. By then the group included three mechanized infantry battalions and Canada's sole armored regiment in Germany. Undermanned, the group's combat effectiveness depended upon substantial reinforcement from Canada. The downsizing and reorganization of Canadian Forces in Germany precluded participation in CAT. (35)



*A Canadian Centurion is serviced in the field. By the mid-1970s Centurions were reaching the end of their service life, and a replacement was needed. (Royal Canadian Armoured Corps School)*

Canada's armored force faced a more existential problem. The massive budget cuts and sharp reduction in NATO commitment made its modernization plans problematic and its future uncertain. The Canadian army recognized the need to replace its tank fleet of over 300 Centurions. Purchased after the Korean War, these vehicles served the nation well, but the Centurion had become slow and unreliable in comparison with newer tank designs. Only about two dozen Centurions remained with Canadian Forces in Europe. Largely hangar queens and maintenance nightmares, they were not considered serviceable beyond 1976. Hence, the army sought their replacement. Instead, the Canadian government opted to jettison its tank force altogether and replace it with light, air transportable vehicles. (36)

The Canadian army's decision to retain the Centurion through 1976 followed by the government's determination to eliminate its tank force negatively impacted armored training. The Armour Department bore responsibility for generating armor soldiers. In the early 1970s it anticipated the Centurion's replacement and began to reduce related training activities and discarded training aids. The army's decision to retain the Centurion into 1976 then forced the Armour Department to revitalize Centurion training and expand its tank gunnery instruction. These changes coincided with the creation of the Advanced Armoured Gunner Course designed to train select personnel as vehicle gunnery experts. (37)

Further disruption followed the Canadian government's decision to eliminate tanks from its force structure. The Armoured Department leadership considered the retention of an understanding of armor operations vital, since Canadian forces would have to both work with allied tank teams and defend against enemy ones. The challenge lay in achieving this training goal and retaining skill sets associated with armored operations without a tank force. According to the commander of the Armoured Department, "The loss of the tank has affected all the combat arms units, but most of all it has deeply wounded our Corps." Nevertheless, the school began to plan how best to represent armor in army training activities without any actual tanks. (38)



Canadian Centurions on a field exercise. (Royal Canadian Armoured Corps School)

Despite the turmoil affecting the Canadian military, the tank gunnery competition it had created continued, albeit with reduced participation. In 1973 the Federal Republic of Germany hosted the competition from September 24-27. In addition to the host, only the United Kingdom and the Netherlands participated. Each national team included six tanks with two in reserve, all commanded by a team captain. The Dutch and German teams used Leopard 1 tanks against the British Chieftains. The German Panzer Battalion 83, a veteran of several prior CAT competitions, won with the highest national team score.

The British Queen's Royal Irish Hussars won the first and second place section scores, performing exceptionally well at the second bound and gaining significant ammunition conservation bonuses. The other British section, however, encountered difficulty at bound 2, scoring just 860 points compared to the 4,995 and 5,450 scores of the other United Kingdom sections. Failing to secure an ammunition bonus, its overall score of 6,425 ensured a last place finish and likely prevented a win by the British national team. (39)

<b>CAT 1973 Results (40)</b>	
<b>1 Federal Republic of Germany</b>	
Panzer Battalion 83	11,835
Panzer Battalion 83	10,570
Panzer Battalion 83	9,060
<b>National team score</b>	<b>31,465</b>
<b>2 United Kingdom</b>	
Queen's Royal Irish Hussars	11,905
Queen's Royal Irish Hussars	11,860
Queen's Royal Irish Hussars	6,425
<b>National team score</b>	<b>30,190</b>
<b>3 The Netherlands</b>	
11 <sup>th</sup> Tank Battalion	8,590
11 <sup>th</sup> Tank Battalion	6,825
11 <sup>th</sup> Tank Battalion	6,470
<b>National team score</b>	<b>21,885</b>

Belgium hosted the 1975 competition in August. Once again only three nations participated: Belgium, the United Kingdom, and the Federal Republic of Germany. The German Panzer Battalion 84 won this competition, achieving the highest section and national team score. However, all teams shot well, reflected in the high scores for all teams. Indeed, the German and British teams outperformed the 1973 winner, and the Belgian 2d Lancers came very close to the winning score of that earlier competition. At the section level, the Germans won the first and second place positions. Their highest score of 12,200 approached the maximum 14,600 points possible. In addition to hitting fast and accurately, two German sections received bonuses for conserving ammunition. No Belgian or British sections received such a bonus.

In this competition, even the reserve sections conducted battle runs that were scored. The total of the three highest section scores determined the national team score and overall standing in the competition. The British Royal Hussars (Prince of Wales' Own) came in second place, but all of their sections fired consistently with a maximum point spread between their highest and lowest scoring section of just 500 points. In contrast, over 4,000 points separated similar German sections. (41)

<b>CAT 1975 Results (42)</b>	
<b>1 Federal Republic of Germany</b>	
Panzer Battalion 84	12,200
Panzer Battalion 84	12,085
Panzer Battalion 84	9,240
Panzer Battalion 84	7,880
<b>National team score</b>	<b>33,525</b>
<b>2 United Kingdom</b>	
Royal Hussars (Prince of Wales' Own)	11,070
Royal Hussars (Prince of Wales' Own)	10,945
Royal Hussars (Prince of Wales' Own)	10,635
Royal Hussars (Prince of Wales' Own)	10,560
<b>National team score</b>	<b>32,650</b>
<b>3 Belgium</b>	
2d Lancers	11,195
2d Lancers	10,265
2d Lancers	10,145
2d Lancers	8,530
<b>National team score</b>	<b>31,605</b>

## **Upping the Ante**

In the wake of the 1975 competition, American General Haig undertook a campaign to promote the event. As Supreme Allied Commander, Europe (SACEUR) from 1974 until 1979, Haig strove to improve NATO readiness and capabilities to prepare member states to resist an increasingly capable Warsaw Pact. The Canadian Army Trophy emphasis upon tank gunnery skills and interaction among participating teams directly reinforced these efforts. Haig's support for the event and its association with NATO readiness reinvigorated the competition and attracted renewed attention. Indeed, for the first time in its history, Belgium, the Netherlands, Canada, the United Kingdom, the Federal Republic of Germany, and the United States all sent teams to the 1977 competition. (43)

The revitalization of CAT triggered another major rules change. The two-tank section battle run gave way to a three-tank battle run. This modification effectively shifted the competition from a section to a platoon event, since armor platoons in many NATO armies included only three vehicles. (44) The American five-tank platoon represented an anomaly within NATO. The change to a platoon transformed CAT into a unit-oriented event. Success remained dependent upon rapid and accurate gunnery, but it now required individual crew competency and unit skills. The three tanks had to operate together, utilizing unit fire discipline and control to engage multiple targets in a movement to contact situation. In short, the adoption of the three-tank battle run made the Canadian Army Trophy better reflect combat conditions in which units — rather than collections of individuals — maneuver and fight. (45)

Each participating nation provided a team that included 12 tanks and crews organized into four, three-tank platoons. Three platoons competed for a score, while the fourth constituted a reserve. Team selection occurred one month before the competition with limitations placed upon practice ammunition to prevent unrealistic and excessive, competition specific training. Each battle run included movement to three bounds, or firing points, where a variety of moving and stationary targets would appear. The target array included single, double, triple, or pairs of targets presented at ranges out to 2,000 meters. Each main gun target measured 1.9 meters wide by one meter high. A total of 15 main gun targets appeared during the course of a battle run in addition to six sets of machine gun targets to be engaged between bounds. Each tank received 10 target practice discarding sabot (TPDS) rounds and 100 rounds for the coaxial machine gun. The TPDS ammunition resembled normal APDS service ammunition, and it possessed a similar ballistic performance out to 2,000 meters. The principal difference lay in the training round's lack of similar penetrating power. The overall objective for each platoon lay in the rapid and successful engagement of all targets with the least ammunition expenditure. Given the ammunition limits for each tank, success necessarily entailed a coordinated and interactive effort by the entire unit. (46)

## **O Canada in 1977**

The year 1975 opened with the Canadian Armoured Branch facing the permanent loss of its remaining tank fleet and an uncertain future. However, the Canadian government's decision to transform its heavy armor units into light organizations met with opposition from other NATO members. Facing a Warsaw Pact growing in capability, NATO needed every asset, particularly mechanized ones, to cope with the rising threat from the East. Canada found itself under significant pressure to rethink its decision. In November 1975 the government announced its determination to retain a tank force. Although good news for the alliance, Canada's aging Centurions were not expected to be serviceable beyond 1976, necessitating a quick replacement action. (47)

The Canadian military considered two potential courses of action: upgrade its existing Centurions or purchase the Leopard 1. Serious concerns were expressed regarding the ability of even a modernized Centurion to cope with a threat equipped with the latest main battle tanks. Newer platforms such as the American M1 Abrams, the British Challenger, and the German Leopard 2 remained in development. They were not expected to become available to Canada until the 1980s. Hence, the

## Chapter 2

Leopard 1 offered a reasonably up to date weapon and an improvement over the current Centurion fleet. The Leopard 1 had been fielded in 1965 and was already in service with six other NATO members. (48)

Actual acquisition of Leopard tanks posed a different problem. German production lines for the vehicle were not projected to be able to meet Canada's requirement until 1979, three years after the cutoff point for Centurion serviceability. Therefore Canada undertook to borrow tanks from Germany in the interim. In October 1976, it contracted with the German firm Krauss-Maffei and the German Ministry of Defense for the loan of 35 Leopard 1s until Canada's order for 128 tanks could be met through new production. Krauss-Maffei also agreed to purchase the entire Canadian Centurion fleet, in turn selling the turrets to Austria for border defense use. The Germans secured the requisite number of loan vehicles by scrounging their inventories and reclaiming several Leopards stationed in the United Kingdom to support gunnery training there. Deliveries of the loaner vehicles to Canadian Forces began in December 1976 and completed by April 1977. The following year Canada began to take delivery of its new production tanks, designated Leopard 1 C1. (49)



*Canadian Leopard 1 crossing an obstacle courtesy of an armored bridgelayer. (Canadian Forces Combat Camera)*

Canada's receipt of the Leopard 1 coincided with its purchase of a six-wheeled armored vehicle for reconnaissance training. Known as the armored vehicle general purpose (AVGP), the reconnaissance version was better known as the Cougar. Although intended only for training in Canada, this vehicle was considered as a training expedient for tankers. It provided a low-cost alternative to actual tanks, but the Armoured Department questioned the wisdom of this plan. As a light, wheeled platform, the Cougar lacked the capabilities of the Leopard 1 and would likely impart the wrong lessons to tankers. The Armoured Department preferred to train Cougar crews to employ the vehicle in a reconnaissance role and assume the platform would be deployed overseas. In fact, Cougars supported several Canadian deployments as part of United Nations missions. (50)

In Germany, the Royal Canadian Dragoons received the interim Leopards, often referred to as "rental tanks." This regiment replaced Lord Strathcona's Horse as the armored component of the 4th Canadian Mechanized Brigade Group in 1970. It continued this affiliation for the next 17 years and

provided Canada's CAT teams throughout this period. In 1977, however, the recent changes in Canada's armored force made its participation in that year's competition problematic. However, Colonel Merritt "Bomber" Bateman, a World War II veteran who commanded the Royal Canadian Dragoons, urged participation. (51)

The Canadians received Leopard training and technical manuals written in German. Their value could not be leveraged until translated. The Royal Canadians sought assistance from Canada only to be informed that completed translation would take two years. The regiment instead sent a team of soldiers, including at least one officer with German language skills, to the German armored school in October 1976 to become familiar with the tank. These individuals then generated new training materials for Canadian crews, complete with translated diagrams and illustrations from German materials. The team also designed driving, maintenance, gunnery, communications, and crew commander courses for new tank crews. These courses began to run in January 1977, and although rushed, provided a necessary level of familiarization with the Leopard 1 and its operation. (52)

Canadian tank crews found the Leopard a faster, more agile, and reliable platform than their Centurions. Indeed, one tank driver received a speeding ticket while driving on Canadian Forces Base Lahr. Designed for use by a conscript army, the Leopard proved easy to maintain with its critical components readily accessible. Changing the engine on the Leopard required less than an hour compared to the 48 hours for the Centurion. Spark plug replacement offered a similar contrast. The Centurion's spark plugs were located on the bottom of the engine, a placement that reflected the power plant's initial intended use in aircraft. They could be readily accessed by a flight mechanic. However, such placement complicated maintenance in the tank, where engine access occurred from the top down. No such accessibility challenge confronted Leopard 1 mechanics. (53)

Despite the Leopard 1's relative ease of use, it required time for the Canadian crews to acquire intimate knowledge of their new steed. Simply painting over the German crosses and replacing them with black maple leaves did not ensure this knowledge base. It more appropriately symbolized the hurried nature surrounding Canadian CAT preparation. The decision to participate in the Canadian Army Trophy ensured that learning the new vehicle would occur simultaneously with preparing for an international competition that, thanks to General Haig, would be a more high profile and better attended event than in past years. Worse, the 1977 CAT was scheduled for April, further constraining the training time available to the Canadians. Every other CAT competition occurred later in the year, often in June.



*Canadian Leopard 1 conducting a CAT battle run. (Royal Canadian Armoured Corps School)*

The Royal Canadian Dragoons completed their annual gunnery training in March, providing an opportunity for each squadron to conduct eight days of live fire. Upon completion, CAT crews were selected from each squadron and placed under Captain Tom Burnie, the team leader. Three weeks of competition preparation followed in which the team crews conducted exercises, live fire drills with machine guns, and conducted dry fire battle runs. Training began on Lahr before shifting to the Bergen-Hohne ranges. Throughout this short but intense preparation, the CAT team benefited from the continuous support provided by other regimental assets formed into the Canadian Army Trophy Teams' Administrative Support Squadron, better known as the CATS ASS. This support helped the team to focus upon training. (54)

Nevertheless, the Canadian CAT team faced long odds to win the competition. The Royal Canadian Dragoons received their first Leopard tanks just four months before the event. In a short period, the CAT team had to master a new tank and hone its gunnery skills to a high level after years of confusion in the Canadian armored community and training base. The Leopard 1's design emphasis upon firepower and mobility differed from the protection and lethality qualities built into the Centurion and to which Canadian crews had become accustomed. Although the Royal Canadian Dragoons benefited from the completion of training and gunnery on the eve of the CAT competition, it remained to be seen whether the crews had fully mastered Leopard 1, whether they had developed the requisite man-machine interface, and whether they could function as a team. (55)

When the Federal Republic of Germany hosted the 1977 Canadian Army Trophy on Bergen-Hohne from April 25-29, the Royal Canadian Dragoons were not odds on favorites to win. In addition to the stiff competition posed by the British, Germans, and Belgians, the United States with all the potential resources of a major military power represented a new challenge. Nevertheless, the Canadian CAT team achieved the highest aggregate score of any nation on each day of the competition and won the event. Each participating troop to conduct a scored battle run performed well. Indeed, one of the Canadian troops achieved the highest score at bound one of any competing element. For the Canadians, consistent high scores at every bound and during the machine gun engagements in between bounds proved a winning combination. One Canadian troop in succession hit a pair of head-on moving targets within nine seconds, a single static target in nine seconds, and a pair of static targets within eight seconds. This type of rapid, accurate gunnery was sustained by the Canadians throughout the competition. Even the reserve troop placed second in a separate, unofficial competition held among the CAT team reserve elements. For their accomplishment and victory the Canadian CAT team received the trophy (ironically a model of the Centurion tank they had just discarded) and a case of champagne presented by the commander of Canadian Forces in Europe. (56)

Platoons from other nations did outperform the maple leaf team at one particular bound or another, but they generally proved unable to maintain this performance throughout a battle run. The top score for a platoon went to the Netherlands 11th Tank Battalion (8,290 points out of a maximum of



*The Canadian Leopard 1 (Canadian Forces Combat Camera)*



10,000) and the British 17th/21st Lancers earned second place. However, the other platoons on these CAT teams did not match these performances. Dutch machine gun engagement scores proved low overall, and two of their platoons experienced difficulty on at least one bound that lowered their battle run score. Similarly, one British troop performed poorly on two bounds and finished with the lowest platoon score of the competition, bringing down the national standing. The British overall finished fourth with the Netherlands fifth. The Germans and Belgians placed second and third, respectively. (57)

The Canadian win proved a classic underdog success story, and it contrasted sharply with America's inauspicious debut at the Canadian Army Trophy. The 2d Battalion, 81st Armor Regiment represented the U.S. Army. It ranked last in the national scores, trailing the Canadian and German teams by a significant margin, and its platoons finished in 8th, 15th, and 16th places. The highest scoring platoon garnered 6,610 points out of a total of 10,000, behind platoons from every other participating nation. While no American platoon experienced disaster at any bound during a battle run, neither did their performance excel. (58)

<b>CAT 1977 Results (59)</b>	
<b>1 Canada</b>	
Royal Canadian Dragoons	7,830
Royal Canadian Dragoons	7,370
Royal Canadian Dragoons	5,820
<b>National team score</b>	<b>21,020</b>
<b>2 Federal Republic of Germany</b>	
Panzer Battalion 144	7,690
Panzer Battalion 144	6,760
Panzer Battalion 144	6,270
<b>National team score</b>	<b>20,720</b>
<b>3 Belgium</b>	
1 <sup>st</sup> Lancers	7,090
1 <sup>st</sup> Lancers	6,210
1 <sup>st</sup> Lancers	5,930
<b>National team score</b>	<b>19,230</b>
<b>4 United Kingdom</b>	
17/21 <sup>st</sup> Lancers	8,250
17/21 <sup>st</sup> Lancers	6,170
17/21 <sup>st</sup> Lancers	3,010
<b>National team score</b>	<b>17,430</b>
<b>5 The Netherlands</b>	
11 <sup>th</sup> Tank Battalion	8,290
11 <sup>th</sup> Tank Battalion	5,300
11 <sup>th</sup> Tank Battalion	3,770
<b>National team score</b>	<b>17,360</b>
<b>6 United States</b>	
2-81 Armor	6,610
2-81 Armor	5,220
2-81 Armor	4,270
<b>National team score</b>	<b>16,100</b>

The size of the U.S. Army footprint in the Federal Republic of Germany, its dominant role in NATO, and its key defense responsibilities in the event of a Warsaw Pact invasion all suggested a strong performance in a tank gunnery competition. However, the U.S. Army in the 1970s faced significant internal challenges. Withdrawal from Vietnam generated a sense of defeat and demoralization that compounded the readiness erosion caused by years of using the entire force structure as a rotation base for units serving in Southeast Asia. The Army suffered from increased drug abuse, discipline issues, and a poor public perception. Many career officers and NCOs left for civilian life, depriving the force of experienced leadership at a critical time. Budget cuts and downsizing in the wake of Vietnam further undermined the Army's readiness. Of the frontline defenders stationed in the Federal Republic of Germany, one senior leader noted: "Soldiers and units deployed to USAREUR saw themselves as minor speed bumps for Soviet forces en route to the Rhine River and beyond; they did not believe they could defend successfully, let alone win." (60)

The year 1973 became a pivotal one for the U.S. Army. In that year the Army abandoned the draft to become an all-volunteer force. This basic shift in the military's manning coincided with the first stage of gender integration in which many non-combat arms duty positions opened to women. The dissolution of the Continental Army Command (CONARC) and its replacement by the Training and Doctrine Command (TRADOC) and Forces Command (FORSCOM) in July marked a significant organizational change intended to facilitate training and readiness improvements. In October the sudden outbreak of another Arab-Israeli war underscored the importance of combat readiness and the growing lethality of the battlefield. The U.S. Army, already struggling with readiness issues, now faced the prospect that the next war might begin without warning or time to shift to a wartime footing and mobilize reserves. Combat formations, especially in Europe, needed to be ready for combat on short notice lest they suffer early defeats from which they could not recover.

This confluence of developments in 1973 triggered TRADOC-led efforts to overhaul Army training programs and develop new doctrine. TRADOC sought to redesign how the Army trained for war and evaluated its readiness. The training focus for battalion and smaller units lay in building tactical competency. New training manuals for these command echelons served as "operator manuals." In the wake of the Arab-Israeli conflict, emphasis on individual training shifted away from its education orientation and toward a balance of education and training in specific skill sets, reinforced by new evaluation standards. Unit training shifted toward mastery of essential tasks, conducted and assessed according to Army Training and Evaluation Programs (ARTEP) and Mission Training Plans (MTP). Improvements in leader development included a revision of the NCO education system (NCOES) and the establishment of the Combined Arms Services and Staff School. Armor enlisted personnel benefited from the creation of one station unit training at Fort Knox that combined basic combat training with advanced individual training oriented toward the generation of skilled Armor crewmen. (61)

The resultant training revolution continued for over a decade accompanied by parallel changes in doctrine. In 1976, the Army published FM 100-5: *Operations*. This manual focused upon concentrating combat power upon the enemy at a decisive point to win the first battle. It also embraced offsetting the Warsaw Pact's superior numbers through reliance upon mobility and firepower in a defense in depth to deplete the enemy forces and set the stage for a decisive counterattack. In this context, the tank constituted a primary weapon system to be used in close conjunction with mechanized infantry and antitank helicopters. These basic ideas became the essence of Active Defense, and they were supported through a series of comparative assessments of NATO and Warsaw Pact systems and force ratios, a mathematical approach often referred to as battle calculus. (62)

Critics of Active Defense considered it too defense-oriented. Its reliance upon mobility and firepower reflected lessons learned from World War II, but in the Federal Republic of Germany an outnumbered defender could not trade space for time without abandoning key urban centers. Soviet doctrine advocated the use of multiple, simultaneous attacks to disrupt NATO defenses. Follow-on

echelons of combat forces then exploited the opportunities thus created. Critics of Active Defense argued that without defeating these follow-on forces, NATO might win the first battle only to lose the war. (63)

Further analysis and study led to the steady revision of Active Defense and the final emergence of AirLand Battle doctrine in the 1980s. In the interim, however, overarching doctrine remained a work in progress with direct ramifications for materiel development and training. A host of new programs, including the XM1 tank, remained under development in the 1970s, and the Army could look forward to a significant modernization once fielding began. Until then organizational flux and training challenges resulted from the anticipation of new equipment pending but not yet available.

For American armor units stationed in the Federal Republic of German, the ongoing changes simply meant a continued reliance upon the M60-series tank. The M60 first entered service in Europe in December 1960. Outwardly similar to the M48, it carried a 105-mm main gun. It was intended as an interim solution pending development and fielding of the MBT70, a joint US-German effort that ended in early 1970. Each nation began pursuing separate programs. The German program ultimately resulted in the Leopard 2, while the American program continued as the XM803. In 1971 the growing cost and complexity of the latter resulted in its cancellation. Work on a new tank began in 1972 with the creation of the Main Battle Tank Task Force, but the fruits of its work would not become evident until the next decade.

In lieu of a new tank, the Army upgraded the M60. Improvements initially included a redesigned turret, better suspension, a new commander's cupola, and better armor. Lethality enhancements centered upon the easier to use coincidence (rather than stereoscopic) rangefinder and an electrical computer for more accurate ballistic solutions. These changes resulted in the M60A1 that entered production in 1962 and constituted the principal American battle tank in Europe into the 1970s. It proved popular and relatively free of the major teething problems that plagued earlier U.S. tank designs. (64)



*The competing steeds of CAT 77. From left to right they are an American M60A1, a Belgian Leopard 1, a Canadian Leopard 1, a Dutch Leopard 1, a German Leopard 1, and Britain's Chieftain. (Ron Mihalko)*

However, by the end of the 1960s, the M60A1 was considered less than ideal for offensive action or sustained off-road operations. Physically one of the largest tanks in the world, it lacked sufficient protection against the latest Soviet hypervelocity kinetic energy rounds. While its electronic computer facilitated accurate gunnery, the absence of a stabilization system meant that such accuracy only occurred when stationary. Failure rates for the fire control system overall proved worrisome for tankers charged with fighting outnumbered, and they were not offset by the vehicle's poor night-fighting capability. During the 1973 Arab-Israeli War, Israeli tank crews equipped with the M60 found that the hydraulic fluid burned the crew if the system was ruptured in combat, while the stowage of main gun rounds in the turret posed a catastrophic threat in the event of a turret penetration. (65)

To address these issues, a Senior Officers Materiel Review Board recommended several corrective measures implemented between 1971 and 1975. These improvements focused upon reliability, mobility, night operations, and firing on the move. In 1971 the tank received a top loading air cleaner that increased engine life by reducing dirt intake. An add-on gunnery stabilization system made firing on the move at least viable in 1972. In a test environment, the new system increased the probability of hitting a target while moving from 0 to 50 percent. New tracks with replaceable pads became available in 1974, and the next year witnessed the fielding of the Reliability Improved Selected Equipment (RISE) engine. Together with improved electrical components, these modifications resulted in an engine averaging 5,000 miles before requiring replacement. A deep water fording kit improved its ability to cross rivers. By 1977 the M60A1 also sported night vision devices to intensify ambient light. A searchlight provided a degree of visibility on moonless nights. By 1978 the M60A1 further benefited from the addition of smoke grenade launchers and the much more reliable M240 coaxial machine gun. Other improvements included additional chin armor for the turret and a new hydraulic fluid to reduce the danger of fire. Collectively, however, these upgrades increased vehicle weight to 58 tons. (66)

These modifications to the M60A1 resulted in a more effective combat platform at least comparable to other main battle tanks used by NATO and a viable opponent for many of the Warsaw Pact's ground combat vehicles. In terms of the Canadian Army Trophy, the upgraded M60A1 possessed the technological capabilities to make it a strong competitor in the hands of an experienced crew.

### CAT 1979

CAT 1979 varied from prior years in its team selection process. Once the regiments from each participating nation had been determined, each one organized a CAT team with five, three-tank platoons. Four of these platoons were selected by random draw to fire in the competition. The remaining one served as the CAT team's reserve. (67)



*Contenders for the Canadian Army Trophy in 1979. (Ron Mihalko)*

The Federal Republic of Germany hosted the competition at Bergen-Hohne between May 28 and June 1. The schedule included two days (May 23 and 25) set aside for the teams to zero their tank weapons. Saturday, May 26, included a reception for the national teams, judges, and senior officials. The actual competition occurred the following week, with firing times scheduled between 0800 and 1800 on Range 9. On Friday, June 1, competition firing ended by noon, followed by an awards ceremony and farewell reception. The winning team received the Canadian Army Trophy from CINCENT and a replica of the trophy from the senior Canadian officer present. The senior general present for each participating nation presented their team with scale tank models and certificates. The NORTHAG commander also recognized the highest scoring tank crew with a special award. (68)

CAT 1979 retained the battle run concept first implemented in 1970, but it also introduced small modifications to enhance complexity, while the special instructions governing spectators suggested an event gaining visibility and interest beyond those individuals directly associated with the management or execution of the competition. Each team conducted a battle run that included movement to three bounds from which they engaged static and moving targets. In addition, the teams were presented with machine gun targets and were expected to also engage targets while moving. During the course of each battle run, teams were presented with 18 main gun targets. Stationary targets had to be engaged at ranges out to 2,000 meters, while moving targets appeared at a maximum range of 1,000 meters. Machine gun engagements necessitated hitting six groups of 10 falling plates at ranges no further than 1,000 meters. When targets appeared, they were indicated by a smoke puff. Tank crews then had to identify and hit each one as quickly as possible. Each tank carried 10 main gun rounds and 250 rounds of coaxial machine gun ammunition, necessitating as in previous years a coordination of platoon effort. Points were received for speed and accuracy, with bonuses provided for hitting every target and ammunition conservation. Penalty points punished slow arrival at a bound and the unauthorized use of reserve ammunition that normally had to be cleared by the judges. Each national score was derived by adding the three highest platoon scores. (69)

<b>CAT 1979 Scoring (70)</b>		
<b><i>Points earned</i></b>		
Hit scoring (main gun)	Successful engagement	500 points
Time scoring (main gun)	Sliding scale with maximum points for engaging target within 1 second and no points for engaging target at 40 or more seconds	500 points (1 second) 0 points (40+ seconds)
Ammunition bonus (main gun)	Each round remaining at the end of a battle run in which all targets hit	100 points
Hit bonus (main gun)	All targets hit	500 points
Machine gun engagement	Each falling plate	25 points
<b><i>Penalty points</i></b>		
	Failure to arrive at bound in the specified time	-600 points
	Unauthorized use of reserve ammunition	-1000 points

Reminiscent of the 1960s competitions, the Germans and Belgians earned the top scores. The German Panzer Battalion 284 won the event with 39,749 points, followed by the Belgian 2d Lancers with 36,778 points. Although both teams used the Leopard 1, differences existed between the models of each nation. The German Leopard 1A4 included several upgrades over the original production model, including a Cadillac-Gage gun stabilization system to enable firing on the move, side skirts to improve ballistic protection, a new thermal sleeve for the gun barrel, image-enhancing night sights, improved turret armor, and a new and distinctive wedge-shaped gun mantlet. The A4 introduced a computerized fire control system and improved sights. Overall, these modifications marked a significant improvement, particularly in the tank's ability to engage targets accurately and while moving. By contrast, the principal improvement of the Belgian Leopards was the addition of a stabilization system starting in 1975. (71)

German platoons secured first, third, fourth, and tenth places. None of the German platoons experienced significant difficulty on their battle runs. The 10th place platoon simply did not achieve the high scores of the other three. The top scoring German platoon earned over 5,000 points on the first bound, the only platoon throughout the competition to do so. Similarly, the third place platoon scored 4,525 points on the same bound, beating its closest rival, a United Kingdom troop by five points. The fourth place German platoon scored 4,222 points on bound three, a score surpassed only by one United Kingdom and one Belgian platoon. (72)

Among the other CAT teams, the Belgians trailed the Germans by nearly 3,000 points. Their overall placement suffered from problems experienced at the first bound by each of their two platoons. One barely earned 2,000 points, while the other one scored below this level. The Belgians lost still more points when a platoon garnered a machine gun score of just 825 points, the lowest such score among all the competitors, which generally ranged from 1,000 to 1,375. Despite these mishaps, the Belgians still achieved a national placement of second, leading the United Kingdom's 4th/7th Royal Dragoon Guards by over 2,000 points. British performance, however, if not stellar was solid. While one platoon scored 12,270 to finish fifth behind the Germans and Belgians, the other two platoons each managed less than 2,000 points on separate bounds, lowering the overall British score. The Royal Canadian Dragoon's last place finish reflected the relatively poor showing of one its platoons whose low scores at each bound (660 points at bound 1, 1,675 at bound 2, and 1,368 at bound 3) dragged down the national standing. Canada also became the only team to incur penalty points for a platoon that did not arrive at a bound in sufficient time. This platoon's score, however, was not counted toward the national total. (73)

The American 2d Armored Cavalry Regiment team turned in a mediocre performance, despite the general reputation of American cavalry as being among the best units due to their forward deployed status on the East German border. While the American CAT team experienced no major failures or exceptionally low scores, neither did it earn any outstanding point totals at any bound or in the machine gun engagements. A unique trend of the American team was the tendency of every platoon that contributed to the national standing to achieve its highest score on the first bound, perform less effectively at the second bound, and rebound somewhat on the last one. No platoons of any nation earned bonuses for ammunition conservation or for hitting every main gun target. (74)

The Netherlands did not participate in CAT 1979 due to "contractual issues with their military union." (75) This curious comment reflects the unique nature of the Dutch army in comparison with those of its NATO allies. It retained a military draft at a time when other nations, including the United States, shifted to a volunteer force. In Holland, the draft remained popular. Conscription did not reflect a military need, since no manning shortfalls were anticipated should the nation abandon the draft. Instead, retention of the draft reflected a Dutch belief that a volunteer army would result in an army of the economically disadvantaged that no longer represented society as a whole. The conscript army remained, but unions emerged to protect draftee rights and ensure they were spared from abuse. These military unions were legalized in 1973 and represented both officers and enlisted personnel,

often becoming involved in discussions over wages, uniforms, and a host of military activities generally considered routine in other armies. In the 1970s, long hair and headbands proved commonplace in addition to the practice of soldiers not saluting their officers. The Dutch soldier was as much an employee as a protector of the state. Hence influences unknown to other Western armies could impact Dutch army activities — including the Canadian Army Trophy of 1979. (76)

<b>CAT 1979 Results (77)</b>	
<b>1 Federal Republic of Germany</b>	
Panzer Battalion 284	14,250
Panzer Battalion 284	12,792
Panzer Battalion 284	12,707
Panzer Battalion 284	44,174
<b>National team score</b>	<b>39,749</b>
<b>2 Belgium</b>	
2d Lancers	13,174
2d Lancers	12,420
2d Lancers	11,184
2d Lancers	7,169
<b>National team score</b>	<b>36,778</b>
<b>3 United Kingdom</b>	
4/7 Royal Dragoon Guards	12,270
4/7 Royal Dragoon Guards	11,622
4/7 Royal Dragoon Guards	10,795
4/7 Royal Dragoon Guards	9,063
<b>National team score</b>	<b>34,687</b>
<b>4 United States</b>	
2d Armored Cavalry Regiment	11,707
2d Armored Cavalry Regiment	10,617
2d Armored Cavalry Regiment	10,165
2d Armored Cavalry Regiment	7,380
<b>National team score</b>	<b>32,589</b>
<b>5 Canada</b>	
Royal Canadian Dragoons	10,372
Royal Canadian Dragoons	10,297
Royal Canadian Dragoons	10,012
Royal Canadian Dragoons	8,026
<b>National team score</b>	<b>30,681</b>

## The American Thunderbolt in Disarray

In the United States the TRADOC-led effort to transform how the Army prepared for war ultimately generated sound training practices and an effective fighting force. In the 1970s, however, these results lay in the future. Training reform constituted a work in progress, and the deficiencies it sought to remedy remained visible in every branch throughout the decade. Armor proved no exception. The branch seemed to be in the doldrums. General Donn A. Starry, who commanded in succession the Armor Center, the V Corps in Germany, and TRADOC, observed: “No longer are we sought out as the leading purveyor of new ideas. We’ve become bureaucratic, soft. We lack innovation. We don’t suffer well those who do take the initiative. We have a ho-hum attitude.” (78)

Tank gunnery training offered ample evidence of this dismal assessment. The platoon constituted the smallest maneuver element and hence the backbone of any armored unit. In combat it would rely upon firepower and maneuver to offset the numerical advantage of the Warsaw Pact. Therefore in the 1950s USAREUR conducted tank platoon battle runs that integrated gunnery and tactical movement at Bergen-Hohne and Hohenfels. One exercise conducted on Range 8 at Bergen-Hohne simulated a tank platoon attack over a course about three miles in depth using service ammunition. The unit conducted fire and maneuver to take an objective that then had to be defended against a counterattack. The range officer “retained sufficient flexibility in the target system so as to allow him to actually employ his targets in a way that would best challenge the scheme of maneuver of the attacking platoon. The targets were set with explosive charges.” By the 1960s Bergen-Hohne ceased to be a principal American training site, and access to Hohenfels diminished. Grafenwohr remained as the primary location for U.S. tank training. Construction began upon a special tank platoon range to permit combined gunnery and maneuver, but in 1963 — the first year of the Canadian Army Trophy — safety and space issues caused the project’s cancellation. (79) Platoon battle runs and combined fire and maneuver training ceased as a consequence. No formal requirement existed to train or test tank sections, let alone entire platoons. The 1972 version of FM 17-12: *Tank Gunnery* included coverage of unit fire distribution and control, vital to the unit’s effective operation, but the manual required no evaluation of these skills at the section, platoon, or company level. Such units seldom if ever practiced or underwent an assessment of their collective live fire and maneuver capability except at the behest of a particularly imaginative commander. (80)

Consequently, annual crew qualification constituted the culminating event for tank gunnery training. It followed the successful completion of Tank Tables I through VII, necessitating mastery of weapons preparation and their use during day and night operations. Tank Table VIII constituted the final and formal assessment of crew ability. In a series of live fire engagements, crews shot at targets depicting armor, personnel, and antitank weapons. They received points for engaging targets within a given timeframe, using appropriate fire commands, and accuracy. The final score determined whether they qualified and the level of their expertise. The parent unit maintained records of all crew qualification scores, which could then be used to determine areas for future training emphasis. (81)

This process was not without merit. Its progressive and sequential nature focused crew attention upon the basic skills necessary to employ their weapons. However, the execution of crew qualification became the subject of critical scrutiny in the wake of the 1973 Arab-Israeli War. In that conflict, effective tank gunnery proved a decisive battlefield influence. For American armored forces facing a large mechanized threat that might attack with little notice, the ability to fight outnumbered and survive — let alone win — would depend in part upon crew gunnery skills. Yet the training and assessment of those skills proved somewhat haphazard and less than adequate. For example, after completing annual gunnery, one tank battalion reported its crew qualification status as 100 percent. Subsequent inspection found several crews unable to boresight a tank main gun. Similarly, dead lined infrared equipment precluded its use. The qualification tables, however, clearly required demonstration of the ability to boresight and to conduct night engagements with infrared devices. (82)





*The U.S. M60A1 became a mainstay of American armor in Europe in the 1960s and 1970s. (National Armor and Cavalry Museum)*

Nonstandard and subjective evaluation of tank crew qualification undermined the Army's ability to gauge accurately its combat readiness. It proved difficult to implement an objective scoring system when units evaluated themselves. Writing in 1979, General Starry observed:

... we have no real standardized gunnery practices that are insisted on to a high level of proficiency by every unit in the Army. This reflects our misguided notions of decentralization — everyone does his own thing; no one is to insist on high standards and centralized direction of evaluation — the results might endanger someone's career. (83)

The Armor School provided little assistance, noting that its mission focused upon the training of individuals. Crew and unit training constituted unit responsibilities. (84) These problems triggered an unflattering assessment of American tank gunnery training:

As it is practiced now, tank gunnery is a farce — an unreal, artificial, misleading indicator of a crew's ability to survive a tank-versus-tank battle. It's barely the beginning of true tank gunnery training. As currently performed, it is possibly marksmanship, but not gunnery. (85)

The Canadian Army Trophy often received criticism for not being a true reflection of combat conditions. Yet by the end of the 1970s, its emphasis upon fire and movement during platoon battle runs made it a much better reflection of the skills necessary for combat operations than found in American tank gunnery training. The ability of platoon leaders to control and distribute fires against multiple targets and from moving tanks generated success. Yet, the U.S. focused upon crews with few opportunities for section and platoon training. Nor did gunnery training promote the precision firing skills critical in battle and required for victory in the Canadian Army Trophy. (86)

Not surprisingly, and not entirely without cause, field commanders attributed training problems to onerous administrative requirements that consumed training time and limited access to gunnery ranges. Funding shortfalls plagued the entire force, while other issues reflected the specific circumstances of individual units, including the state of range construction and the constraint posed by

outdated or vague post regulations. Urban encroachment further undermined training activities at the home stations of some units. As one officer stationed at Fort Carson summarized:

... we continually train our tankers under crash programs; block out six weeks for Tables IV through VIII, and IX if time permits; utilize only the warm weather for gunnery so as not to hassle the troops; and above all, condense everything so as to ensure that they can still pull their fair share of the "ash and trash" details." (87)

Limitations upon the ammunition available for training led most tank battalion commanders to conclude their crews had only one annual opportunity to fire all eight tank tables. A few enterprising leaders found that through careful management of their annual allotment and through the appropriation of unused ammunition allocations, they could qualify crews twice a year, but their actions proved exceptional. (88)

When a unit did arrive on a range, the ensuing training suffered from several problems. Gunnery ranges included a set of firing points connected by a lane that each tank followed. Range personnel routinely dampened these road surfaces to prevent dust obscuration of targets and meticulously cleared them of all debris. Such pristine care did not reflect combat conditions. Similarly, tanks did not move into hull defilade at each firing point. Instead, they completed engagements in fully exposed positions. Large six-foot square white panels unlike any potential threat vehicle constituted the targets in contrast to the smaller, dark shapes used in the Canadian Army Trophy. Some improvement occurred when the Seventh Army Training Center began to mandate the use of olive drab silhouettes of known vehicles. Nevertheless, the use of unchanging target arrays that always appeared in the same location allowed crews to anticipate the time and place of each engagement. Such practices encouraged sloppy gunnery techniques that might satisfy qualification, but they did not sharpen combat skills. They also reinforced the perception of crew qualification as the rote completion of a checklist of activities rather than combat preparation. (89)

German tanks entered gunnery ranges with the main gun loaded and ready to fire at a predetermined range. This practice enabled them to react quickly to sudden, unexpected engagements. American crews were not permitted or encouraged to practice similar battlesight gunnery techniques or fire multiple rounds into a target to ensure its destruction. While these current, combat proven practices were discouraged, gunnery manuals dictated continued reliance on an outmoded method of fire adjustment. When a tank fired, the gunner observed through his sight to determine where the round went in relation to the target. In the event of a miss, he noted the point where the shot passed the target. By adjusting his sight to lay this point upon the target, he could immediately re-engage with a high probability of a hit. Known as burst on target, this method became common practice during World War II. Its success depended upon the gunner's ability to sense the round, but the very high velocity of newer armor piercing ammunition made sensing much more difficult if not impossible, particularly if battlefield visibility proved less than ideal. (90)

American crews, however, had little experience with armor piercing discarding sabot ammunition or its training derivative. Unlike their counterparts in other NATO armies, they received few opportunities to fire the round or become familiar with its characteristics. Nor did crew qualification require it to be fired, even though this ammunition constituted the principal means of engaging hostile armor. (91)

Personnel problems only intensified the impact of deficient training. Most tank battalions experienced a 30-40 percent turnover in soldiers every quarter. These rates directly undermined efforts to build combat readiness. They resulted from a personnel management system unsympathetic to unit needs, the tendency of higher command echelons to siphon soldiers from maneuver battalions, and the corresponding efforts of battalion commanders to reorganize their remaining personnel. The Army's centralized individual replacement system provided no guaranteed tour lengths for soldiers with



*The distinctive patch worn by the American 2nd Armored Cavalry Regiment team for CAT 79. (Ron Mihalko)*

a particular unit. Instead, individuals came and went based upon the requirements of personnel policies rather than field commander requirements. General Starry noted:

It is increasingly clear in crew, team, section, squad, or platoon that unit cohesion is the single distinguishing feature that characterizes good units over poor, winners over losers. Unit cohesion comes in large part from personnel stability. (92)

Tank battalions struggled to build cohesion amid the constant movement of soldiers into and out of the organization. Unit commanders fought to keep crews together long enough to complete annual gunnery training and crew qualification. Afterward they could anticipate up to half of those same crews losing at least one crew member. A survey of tank battalions stationed at Fort Hood in 1975 found that only 17 percent of crews had remained together longer than six months. Such personnel turbulence directly impacted unit readiness and the sustainment of crew level skills. (93)

The disruptive influence caused by continuous turnovers in personnel reflected the Armor Branch's lack of control over duty assignments. No means existed to identify skills desirable for Armor or to select individuals with those skills for branch service. Similarly, no mechanism existed to select and retain skilled Armor soldiers or remove ineffective ones. In short, armor units had little recourse but to work with whatever human capital was on hand at any given moment without the ability to shape their own human terrain. Moreover, armor units often experienced shortfalls in personnel due to manning standards that allowed no overstrength. Hence, loss from illness, emergency leave, school attendance, or other routine causes ensured that a unit would experience significant personnel shortages upon mobilization or deployment, further aggravating crew level issues. (94)

Some improvement occurred following studies by TRADOC and the Department of Army focused upon issues impacting the combat effectiveness of armored units. Following a recommendation of the Tank Forces Management Group, a special body established by the Army Chief of Staff in 1976, a new 19-series career management field became effective in 1978. It included two principal categories devoted to cavalry scouts and armor crewmen, with subcategories

providing more specialized groupings. The new career management field constituted a constructive step, but it could not and did not resolve Armor Branch's personnel management problem. (95)

NCOs constituted the backbone of the Army, ensuring effective training of junior enlisted personnel and support for officers in command slots. In addition to these basic responsibilities, NCOs constituted the majority of tank commanders in the Armor Branch. In the 1970s, the NCO corps emerged from the Vietnam War in a broken state, and many experienced NCOs either left the military or transferred into more attractive duty assignments that rarely included armored units. Tank battalions experienced a shortage of NCOs, resulting in the transfer and reclassification of personnel from other branches. In 1976 an estimated 14 percent of Armor sergeants and staff sergeants fell into this category. Most such personnel received no familiarization training to prepare them for tank command in an armored unit, leaving them to learn on the job despite the increasingly technical and platform oriented nature of their assignment. (96)

Tests designed to evaluate a soldier's mastery of skills within their MOS did not reflect the special skills required of Armor NCOs and enlisted personnel. Described as "a farce, or worse," these tests did little to help ensure Armor soldiers possessed the requisite technical and tactical competencies. In General Starry's view, "current tests reflect neglect, ignorance, and dogmatic pursuit of stupid rules." Part of this scathing denouncement of the MOS tests stemmed from their written nature. They were not performance based. MOS evaluation scores did not reflect crew leadership skills, gunnery qualification, or tank crew training — all basic responsibilities of a tank commander. (97)

The continued improvement in weapon and vehicle capabilities required tank commanders intimately familiar with their platforms to ensure their optimal employment and oversee crew training. This level of knowledge proved rare. No tank commander's course existed to prepare NCOs for their role as platform commander. The Basic NCO Course addressed vehicle command, but only the non-technical responsibilities. Hence, tank commanders learned much of their craft via on the job training or through ad hoc training programs created by their unit. Given the NCO's training and platform command roles, the lack of standardized instruction for tank commanders ensured a similar unevenness across the force. According to a 1977 assessment, "Current tank crew training worldwide is not standardized, degrading crew proficiency and compounding the effects of normal rotational turbulence." (98)

The assignment of sergeants major and first sergeants from other branches to armored organizations aggravated these issues. Since 1973, an estimated 20 percent of first sergeants in tank units did not belong to the Armor Crewman Military Occupational Specialty (MOS). Nearly one third of all command sergeants major in all armor units similarly were assigned from other branches. Such assignments filled a slot and helped to offset the shortage of qualified Armor NCOs, but regardless of their individual abilities, they were not Armor experts and they lacked the experience and knowledge derived from a career spent in the branch. Despite their seniority among enlisted ranks, they were ill-equipped to supervise tanker training, mentor tank platoon and company leaders, or assist armor battalion commanders. (99)

Officer training did not provide new leaders with the skills necessary to offset NCO issues. General William E. DePuy, TRADOC's first commander, noted that "the training of the tank lieutenants, the armor lieutenants, was awful." Part of the problem lay in the emphasis given by the Armor School to preparing new lieutenants for company command rather than their first duty assignment as tank platoon leaders. (100) In 1977, for example, analysis of crew qualification results in the 4th Infantry Division revealed that more than 50 percent of crews commanded by platoon leaders failed to qualify on their first attempt, underscoring the need for more tank gunnery instruction in the Armor School's Armor Officer Basic Course. (101)



*The M60A1 with its associated tools and cables. (National Armor and Cavalry Museum)*

The Army school system in general remained oriented upon a mass mobilization in which regular Army officers would be expected to assume higher duty responsibilities. Hence, lieutenants prepared for company command and captains focused upon brigade and battalion operations. This emphasis reflected a tradition that dated back to the Civil War in which relatively junior officers assumed higher command upon the outbreak of war and the start of mobilization. Unfortunately, this trend resulted in officers attending schools too general in their curricula and unable to generate technically qualified platoon leaders. General DePuy summarized the problem with the question “Why should we go to war with untrained platoon leaders, untrained company commanders, and untrained battalion commanders, when they have to win the first battle?” (102)

### **Reforging the Thunderbolt**

Recognition of Armor training problems resulted in a host of corrective measures and recommended actions across the force. Spurred by analysis of the 1973 Arab-Israeli War, common suggestions included expanded use of training aids, sub-caliber devices, and simulators as an inexpensive means to enhance training and better prepare crews for live fire gunnery. The Telfare device, essentially a .50-caliber machine gun strapped to the main gun, provided a simple means of simulating main gun fire on a scaled range before progressing to further training in gunnery techniques with a laser. Both devices facilitated skill development at home station. (103)

The TRADOC Combat Arms Test Activity undertook a detailed study to determine appropriate measures of effectiveness with which to assess tank crew competencies. The study focused upon the expectations of company commanders and platoon leaders for their crews. Maintenance, movement, shooting, communications, situational awareness on the battlefield, and survival all constituted key functions. Proficiency derived from the combination of individual skills and the ability of the crew to cooperate as a team. The result of this study lay in the development of a new tank crew proficiency test that focused upon individual skill assessment, preparation of the tank for combat operations, negotiation of an obstacle course, target acquisition and recognition, road marches, qualification firing, demonstration of tactical skills in a field training exercise, and the execution of a section battle run. The emerging test concept paralleled a similar action applied to the scout platoon, and it reflected TRADOC’s intent to improve armor training at its most basic level. (104)

TRADOC also published soldier manuals that identified competencies to be mastered at each skill level within a given MOS. Skill qualification tests (SQT) supplemented these manuals and provided corresponding evaluation standards. Together, these items helped to focus soldier training upon critical competencies and provided NCOs tools to oversee and supervise the development of enlisted soldiers. For Armor Branch, the soldier manuals and SQTs proved especially valuable, given the problems with crew qualification, the shortage of experienced personnel, and the central role of the NCO as a tank commander. (105)

In April 1974 the Army senior leadership approved the concept for a master gunner program. Analysis of the recently concluded Arab-Israeli conflict underscored the linkage between battlefield success and gunner proficiency, particularly among the outnumbered Israeli tankers. The master gunner program trained NCOs to become tank gunnery specialists to oversee unit training, supervise weapon operations and maintenance, and troubleshoot problems related to gunnery. The master gunner program included a highly technical resident course conducted at the Armor School. The resultant pool of tank gunnery specialists became one of the most important assets available to unit commanders seeking improvements in training and combat readiness. (106)

Lessons learned from the Arab-Israeli War also began to reach the field in the form of training circulars. This venue provided a faster method of disseminating new concepts before their incorporation into a published field manual. In 1975 the Armor School issued Training Circular (TC) 17-12-3: *Battlefield Gunnery Techniques for Tanks*. Short, well-illustrated, and easy to understand, this circular provided a soldier-friendly compendium of techniques proven on the battlefields in the Sinai Desert and on the Golan Heights. It emphasized the importance of rapid, precise gunnery and hitting the enemy first. Reminiscent of German practice, this publication encouraged tanks to move onto the battlefield with a preloaded round and the computer pre-indexed to the ammunition type and a preset range. When a target appeared, gunners were instructed to aim at its bottom center and fire without first ranging the target. This technique leveraged the flat trajectory and armor piercing capabilities of APDS and HEAT to achieve a first round kill without awaiting a precise range and ballistic solution. It proved especially effective at engagement ranges under 1,600 meters. (107)

A second training circular published the same year by the Armor School provided a comprehensive program to assist unit commanders in the training of individual tank crewmen, crews, and entire platoons. It incorporated the techniques presented in TC 17-12-3, and it partially superseded the 1974 tank gunnery manual. This second circular, TC 17-12-5: *Tank Gunnery Training*, emphasized dry and sub-caliber firing as a prelude to live fire with main gun ammunition. It modified the existing tank tables, but it retained the progressive development from individual skills to more comprehensive crew engagements. It clearly identified those crew competences requiring demonstrated mastery and the means of achieving this proficiency. For crew qualification, the circular raised the training standard and mandated more stringent evaluation. The most significant change to gunnery training, however, lay in the addition of two more tank tables. Tables IX and X included day and nighttime section and platoon battle runs. The circular provided suggestions regarding the design, layout, and scoring of these battle runs. Further guidance appeared in the form of charts showing an annual gunnery training calendar and the frequency with which specific tasks, including embedded maintenance, should be completed in preparation for the final, formal evaluation. (108)

Battle runs became a point of discussion in the Armor community following their re-introduction in TC 17-12-5. They offered desirable training challenges in terms of the controlled movement of sections and platoons, distribution of fires to engage effectively multiple targets, and communication. Battle runs were inherently more difficult to execute and therefore a more useful training tool than static target engagements. Implementation throughout the force occurred slowly. Units began to develop section and platoon battle runs focused upon offensive tasks, but their efforts were undermined by the lack of a training ammunition allotment designated for the battle runs now included in Tables IX and X — tables recommended but not required. (109)

Individual units, nevertheless, did begin to execute battle runs. The 3d Armored Cavalry Regiment began to incorporate them into their desert training program. The 4th Infantry Division soon followed suit, but the manner of execution varied. The incorporation of mortars and dismounted infantry into the battle run increased its complexity and the training challenge posed. Such expanded exercises proved exceptional, but they encouraged discussion of still further modification to include air cavalry and mechanized infantry. More fundamental issues concerned safety regulations, application to the Reserve Component, and increasing the annual allotment of training ammunition to include the battle runs. (110)

In Europe, the Seventh Army Training Center began to modify gunnery training. In January 1975, the 64th Armor Regiment became the first USAREUR unit to fire a revised Table VIII on Range 80 at the American training facility at Grafenwoehr. The new table included longer range targets, necessitating additional training in the related techniques on preceding tables. But the list of actions crews needed to successfully accomplish shrank to focus on those skills directly related to hitting the target. The unit continued to stress the import of standard methods of target engagement that were evaluated. Targets were designed to be more realistic, and tanks moved into defilade positions before exercising the option to fire one or two-round engagements. Observers noted a significant increase in overall training effectiveness, despite the short days, long nights, and early morning fog common at that time of year. Yet, they also recommended a balance between training and realism, noting that "... the Table VIII range, specifically Range 80, Grafenwoehr, should not be bastardized to the point where we are mixing gunnery with tactics so as not to fully accomplish either objective during the short time we are on the range." (111)

A new scoring system emphasized engagement speed and accuracy as the key for tank crew qualification. Crews effectively had to beat the clock in an engagement in accordance with earlier recommendations that crews should be scored on their ability to secure quick kills and save ammunition, receiving points on a sliding scale that rewarded rapid engagement. They also received bonus points for bringing ammunition back to the start line after achieving a single shot kill. Earning this bonus, however, proved difficult due to the difficulty of sensing a round through the muzzle blast and smoke. The standard for qualification rose, and what previously earned a distinguished rating now became the new baseline standard. Overall these changes sought to instill in crews a desire to get a rapid, first round kill. (112)



*M60 tank being towed by an M88 armored recovery vehicle during REFORGER 78. (National Archives and Records Administration)*

The 64th Armor Regiment became one of the first American tank units to conduct battlesight engagements with Target Practice Discarding Sabot — Tracer (TPDS-T) ammunition. While included in the unit's tactical standard operating procedure, battlesight gunnery had not been previously fired. Similarly, few gunners had any experience with sabot rounds. Unfamiliar with the round's characteristics, some gunners struggled to engage and hit moving targets. The high velocity of the round made sensing a problem. By the time the muzzle blast cleared, the round had long since disappeared, and it was not always clear whether it hit the target or not. This difficulty further encouraged the desirability of a definitive first round kill, necessitating gunners know exactly where on the target to sight. The front slope of a target just below the turret ring became the optimal aiming point. Through the combined use of sabot ammunition and battlesight gunnery techniques, the regiment attained a high number of hits during gunnery. Symptomatic of their growing competency, unit personnel determined 1,100 meters as a more effective battlesight range rather than the 1,600 meters advocated in TC 17-12-3. They further advocated the inclusion of sabot rounds in all future qualification firing. (113)

The gunnery experience of the 64th Armor Regiment also included a test of the gunnery ability of three-man crews. This condition assumed that tank units would be short personnel until sometime after mobilization occurred. Hence, in the opening days of a conflict they might have to fight without a full crew. One company from the regiment conducted gunnery with three-man crews in which the tank commander performed both his own duties and those of the gunner. The M60A1's ability to permit either the tank commander or gunner to lay and fire the gun facilitated this operation. The results proved encouraging, with the short crews scoring among the top 50 percent of the regiment and generally better than expected. Not surprisingly their ability to adjust fire after an initial miss, engage multiple targets, or simply acquire a target proved inferior to that of a full crew. (114)

In the 4th Infantry Division stationed at Fort Carson, Colorado, senior officers became involved in gunnery training. In 1975 the 1st Brigade commander spent the time and effort necessary to qualify on Table VIII as part of a tank crew. This act established a trend for other senior leaders in the formation to follow, including other brigade commanders and the assistant division commander for maneuver. The involvement of senior leaders in the particulars of tank gunnery training served to build awareness among them of the related issues and challenges. This finding mirrored similar conclusions by World War II era armored personnel regarding the importance of leader immersion in tank gunnery. Indeed, at the battalion level all crews were to conduct annual qualification, including those led by the battalion commander, executive officer, and company commanders. (115)

The 4th Infantry Division created a tank gunnery assistance team that included an armor captain and an NCO from each subordinate armored battalion. This team then worked directly with master gunners trained at the Armor School to prepare and supervise a division gunnery program. It assisted reclassified soldiers from other branches by providing a program of instruction to prepare them for their new roles as tank crewmen and platform commanders. The team also built a master gunner training program to enable every company in the division to have an NCO gunnery expert. These measures underscored the importance and raised the profile of gunnery throughout the division. They also resulted in a decision to allow crews to have more than one chance a year to qualify on Table VIII. The creation of a ranging, quick lay, and target acquisition range, and a new dry run crew course facilitated preparation for the increased qualification frequency. The division also encouraged extensive use of sub-caliber devices by crews prior to any tank main armament live fire. (116)

In an effort to determine an optimal gunnery program, each of the division's four tank battalions received varying amounts of time to build and execute their own training path. The overriding requirement for each unit was the training and Table VIII qualification in a short time. Use of sub-caliber devices, dry firing on ranges, and extensive pre-gunnery instruction collectively instilled in crews a basic understanding of gunnery principles, transcending simple instruction in the sequence of actions necessary to send a round down range. Overall, the battalions found it possible to use less



time and ammunition while qualifying at least 70 percent of all crews. Division leaders found such findings encouraging, given the cost of main gun ammunition, the competition for range time (and the related need to make the most of this time), and the importance of the platoon battle run. Savings in time and ammunition made possible the more frequent qualification sought by division. Consideration was also given to quarterly platoon battle runs, since platoon qualification represented a better measure of combat readiness than a single crew. (117)

Many of the changes indicated in the training circulars and beginning to permeate the force found incorporation in a new gunnery manual published in 1977. This manual increased the allotment of training ammunition to include battle run firing engagements. However, the tank table devoted to the section battle run disappeared. This event focused upon the section in isolation rather than in coordination with other sections. Hence, the authors preferred to emphasize the platoon over the section, introducing a number of command and control challenges into the corresponding battle run. (118)

By the end of the 1970s American armored units began to benefit from improvements in gunnery and training. This positive development proved part of a broader Army-wide trend that reflected the burgeoning impact of the training revolution begun by TRADOC. However, challenges remained. The Armor community had yet to see the full impact of the changes to gunnery training. In USAREUR tank units still possessed only limited access to ranges, undermining efforts to conduct more frequent live fire. In the Reserve Component, most armored units struggled with the fundamental issues of space, time, and funding. (119)

**Tank Gunnery Tables 1977 (120)**

<b>Tank Table</b>	<b>Activity</b>
<i>I (Sub-caliber)</i>	Zeroing/Manipulation/Range Card
<i>II (Sub-caliber)</i>	Adjustment of fire vs stationary targets
<i>III (Sub-caliber)</i>	Adjustment of fire vs moving targets
<i>IV (Sub-caliber)</i>	Stationary tank firing at stationary & moving targets
<i>V (Sub-caliber)</i>	Moving tank firing at stationary targets
<i>VP (Sub-caliber)</i>	Stationary tank platoon firing at stationary & moving targets
<i>VI</i>	Stationary tank firing at stationary & moving targets
<i>VII</i>	Tank combat course (practice)
<i>VIII</i>	Tank combat course (qualification)
<i>IX</i>	Platoon battle run

## *Chapter 2*

Constructive changes in tank gunnery did not alter the U.S. Army's lackluster performance in the Canadian Army Trophy. Indeed the low placement in both the 1977 and 1979 competitions served to reinforce the poor public perception of the Volunteer Army. Continued participation in a competition that exposed the Army to negative press for limited gain was not an attractive proposition for a force in the midst of fundamental training and doctrinal change. Therefore the Army considered withdrawing from CAT. (121)

Ironically, this consideration occurred amid a growing alignment between the nature of the competition and emerging trends in American gunnery. By the end of the 1970s, the U.S. Army had adopted the platoon battle run, embraced more realistic targetry, and raised the standard for crew qualification. Live fire evaluation rewarded rapid engagement, accuracy, and ammunition conservation — the same qualities underwriting CAT battle run scoring. Moreover the changes to the competition and the improvements to American gunnery training reflected the more general NATO effort to boost combat readiness.

Ultimately, the U.S. did not withdraw from CAT, instead remaining a regular participant throughout the next decade. It remained to be seen whether more effective training would result in an American win.

## Notes

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## Chapter 3

### The Canadian Army Trophy in the Spotlight, 1981-1985

The early 1980s marked a significant increase in the attention given to the Canadian Army Trophy. By mid-decade it began to be referenced as an Olympic caliber event or a tank Super Bowl. The higher profile reflected its continued association with NATO training and readiness, which increased in the same timeframe. CAT became another means of showcasing military capability as part of a broader message of deterrence aimed at the Warsaw Pact. The competition also served as a platform to demonstrate new combat vehicles and push the potential standards of gunnery achievements. In the process it also garnered media attention that tended to focus upon national performance at the expense of the competition's purpose in promoting NATO fraternity.

#### Cold War Background

In the 1980s the Cold War continued to dominate American and NATO policy. The threat posed by the Soviet Union remained high, evidenced by the growth in Warsaw Pact military capability and continued worldwide efforts to spread Soviet influence. The Soviet Union forged close ties with Vietnam, while escalating military operations in Afghanistan. In Africa, the use of aid packages to Angola, Ethiopia, Mozambique, Guinea, and Mali promoted Soviet influence, supplemented through academic scholarships that brought students from across the continent to study in Soviet universities.

In the Middle East war or the threat of war remained a constant state of affairs throughout the decade. The 1979 overthrow of the Shah of Iran removed a Western ally and replaced him with an Islamic republic openly opposed to the United States. The following year Iraq invaded Iran, triggering an eight-year-long conflict that created friction between Shia and Sunni Muslim communities. The conflict between these two oil-producing nations spilled onto the international scene in the form of attacks by both belligerents on Persian Gulf shipping. In the late 1980s, the United States began to provide naval escorts for reflagged Kuwaiti tankers, resulting in a number of shooting engagements with Iranian naval vessels. Iran sought to increase its regional influence by fostering ties with Syria and establishing a presence in Lebanon. In 1982, however, Lebanon became the focus of international attention when Israel invaded it to eliminate its long-time foe, the Palestinian Liberation Organization. This conflict also involved Syria, and it ended with the PLO's removal from Lebanon.

Unrest stemmed from the Kremlin. The death of three presidents between 1982 and 1985 generated a degree of instability in the Soviet superpower. This leadership turbulence created uncertainty within NATO regarding its impact upon Soviet policy. It also seemed to weaken Soviet ability to respond quickly and firmly to crises. Rebellion in Poland, for example, did not meet with the same military suppression that had crushed earlier dissent in Hungary and Czechoslovakia. Poland also received popular support from the United States, Western Europe, and the Pope.

Soviet hesitancy may also have stemmed from President Ronald W. Reagan's determination to both increase American military strength and demonstrate a will to employ it. Military intervention in Grenada, a military peacekeeping presence in Lebanon, air strikes against Libya in response to terrorist actions, and support for the mujahedeen against the Soviets in Afghanistan all supported specific national interests, while sending a clear signal of American resolve to the Soviet Union. Similarly, negotiations continued on strategic arms limitations simultaneous with the Strategic Defense Initiative to provide a defense against the Soviet ballistic missile threat.



*A T72 on parade in the Soviet Union. (U.S. Army Armor School Archives)*

The U.S. Army also benefited from increased military budgets. The fielding of the Big 5, including the Abrams tank and the Bradley Fighting Vehicle, and the creation of the Army of Excellence resulted in more robust combat formations with increased combat capabilities. The employment of these new systems and organizations reflected a steady evolution in doctrine. Criticism of Active Defense with its defensive orientation triggered changes that evolved into AirLand Battle. This new doctrine focused upon winning the first battle and defeating Soviet follow-on echelons. It embraced the operational level of war, particularly in its emphasis upon the planning and execution of campaigns. AirLand Battle integrated maneuver and the employment of a wide array of assets over a broad area. Seizure of the initiative, empowerment of subordinates, and a rapid pace of operations in a nonlinear battlespace all became characteristics of the new doctrine that distanced itself from the attrition-style battles and kill ratio assessments of the 1970s. (1)

The emergence of AirLand Battle coincided with a steady evolution in training. The transformation of training begun the previous decade continued into the 1980s. Mission Training Plans (MTP) supplemented the existing Army Training and Evaluation Programs (ARTEP) to replace subjective evaluation of training by unit commanders with an objective standard. Together, the ARTEP and MTP provided a training strategy to achieve unit proficiency for specific battle missions. Similar refinement occurred in individual soldier training, symbolized by the 1983 implementation of the Individual Training Evaluation Program (ITEP). ITEP combined the skills qualification test and common task test of basic skills, and it included a commander's evaluation to improve soldier training. Unit training benefited from the activation of the National Training Center in 1980. The facility became a premier training site that pitted rotating units against an Opposing Force organized to resemble the Warsaw Pact threat. The overall impact of the doctrine and training changes resulted in higher standards of readiness and evaluation for both the active and reserve components.

The resurgence of America military power had a beneficial impact upon NATO allies in Europe. The combination of U.S. leadership and resolve to confront Soviet aggression encouraged support, particularly from France, the Federal Republic of Germany, and the United Kingdom. The NATO allies presented a united front against an old enemy, bolstered by rising combat effectiveness achieved through training reform and new materiel. In a further sign of unity, NATO adopted AirLand Battle doctrine as its own, further encouraging interoperability between U.S. forces and the European states. (2)

### **Rules and Conditions**

The heightened visibility of CAT increased the complexity of its governance. The headquarters of the Allied Forces in Central Europe (AFCENT) served as Canada's executive agent in governing the competition, providing a general officer to chair the Committee of Control. This body included representatives from each competing nation, NORTHAG, CENTAG, and the Canadian Ministry of Defense. The committee established the rules for each competition, subject to the approval of the Canadian Minister of Defense. Under the supervision of AFCENT and on behalf of the Committee of Control, one of the participating nations served as the competition host. The host addressed the administrative arrangements and oversaw the execution of the competition. A project officer appointed by the host nation addressed all administrative needs of the CAT teams, including accommodations and support. Host responsibility rotated among the national participants. (3)

To ensure impartiality in the preparation and execution of the competition, all key personnel became subordinated to AFCENT, including the chief judge. He rendered the final ruling on all battle runs and resolved any related issues. The host nation provided the chief judge, but he remained directly accountable to AFCENT for the overall conduct of the competition. A panel of national judges that included two field grade officers from each participating nation assisted the chief judge. They helped to score the battle runs and heard any complaints or appeals from the competition teams.(4)

Collectively, the responsibilities of the host nation entailed considerable effort and commitment, but the most influential decisions lay with the Committee of Control. In the wake of CAT 1979, this body began to plan for CAT 1981, reflecting both the growth in the competition's administrative complexity and the need to resolve issues raised by the participating nations. Divisions of opinions arose between the smaller NATO states and their larger allies over the nomination pool, ammunition limits on training, range access, and personnel. The Committee of Control bore responsibility for resolving these debates and finalizing the rules and conditions, a process requiring months of negotiations.

Smaller nations feared their larger allies would invest more resources into their CAT preparations, thereby gaining an advantage. Therefore they proposed that participating nations nominate all of their eligible armored units as potential CAT teams. This action would level the playing field by forcing larger nations to distribute their greater resources among many different units. The United States and the Federal Republic of Germany rebutted this recommendation, noting the disruption to combat readiness likely to result if required to skew the training of all armored assets in Europe to CAT rather than a potential war with the Warsaw Pact. (5)

Similarly, smaller nations sought to limit range access and the amount of ammunition available for CAT training. In the absence of such restrictions, they feared their larger allies would provide large ammunition stockpiles for training and dominate firing ranges. The resultant range familiarization and live fire experience would generate better prepared teams more likely to win. (6) In the case of range access, however, the United States possessed no advantage, since its armored units competed among themselves and their NATO allies for range time. Indeed, lack of range access had been a complaint of unit commanders throughout the previous decade and a reason offered for America's poor showing in previous CAT competitions.



*Medal issued for CAT 1981. (Ron Mihalko)*

The Committee of Control resolved these issues through negotiated compromises — an exercise in diplomacy that symbolized the sometimes contentious relations within NATO. With finalization of the rules, all participating nations indicated their compliance in writing to the commander-in-chief of AFCENT. For CAT 1981, while most nations were required to nominate one armored unit for the competition, the United States and Germany provided two candidate units, reflecting the larger size of their armored forces. HQ AFCENT received these nominations in February 1981. In May, AFCENT randomly determined which unit would actually participate in the competition. All nations had the same total preparation time, but the Americans and Germans had to divide their effort between two units until just over a month before the actual competition. (7)

All CAT tank crews were restricted to a total of 210 main gun rounds for training. Machine gun ammunition was not restricted in the belief that it would facilitate training with less expensive ammunition. Sub-caliber ranges in particular offered opportunities to train crews and platoons in simulated battle runs. Range time for main gun firing was restricted as in previous years to normal annual training with no special, additional access given to CAT teams. A final condition required all nations to fix personnel assignments in their competing teams two months before the event to prevent the last minute attachment of CAT experts. Well intentioned, this requirement could not and did not prevent each team benefiting from prior CAT experiences. (8)

The Committee of Control also acted to resolve criticism of CAT 1979. In that competition, five different scenarios determined the sequence and nature of target appearance for 20 platoon battle runs. Each day of the competition featured the employment of all five scenarios. Scenario repetition enabled waiting platoons to see all potential target arrays and permit identification of the scenario in use after the first targets appeared. Platoons firing late in the competition therefore received an advantage through advance knowledge of the target sequence — hardly a realistic condition likely to occur in combat. For CAT 1981, the platoons were organized into nine groups identified by their scheduled battle run time. Each platoon in a particular group faced the same target scenario. Before the first platoon fired, all platoons in the same group were placed under quarantine with personnel movement and communication strictly controlled. In this manner, platoon members had little idea of what they would face until they began their own battle run. (9)

The actual battle runs necessitated the movement of each platoon tank along separate lanes from firing point (or bound) to firing point. Each platoon faced 18 main gun targets, including at least two movers at 1,200 meters. The remaining targets represented stationary vehicles at ranges between 900 and 2,500 meters. The targets appeared for 40 seconds in groups of two to five. In addition, the platoon had to engage two targets at 1,200 meters while moving. Machine gun targets appeared in six groups of ten individual plates at ranges between 800 and 1,000 meters. Main gun targets did not fall when hit, but the machine gun targets did. Each tank carried 10 main gun and 250 machine gun rounds, necessitating as in prior events a platoon effort to succeed. Upon the conclusion of each battle run, a team of three officers selected from other competing nations physically inspected each target to determine hits. Their findings supported the final scoring of the platoon's performance by a multinational panel of judges. (10)

### **National Preparations**

CAT 1981 marked the debut of United States as host nation and a shift in the event's location from Bergen-Hohne to Grafenwoehr. The latter served as the principal training center for USA-REUR, but its military usage long predated the 1980s. It officially opened as a training site in 1910. In World Wars I and II, Grafenwoehr underwent significant expansion to support the German war effort in both conflicts. After World War II, it became the primary live fire site for American forces stationed in the Federal Republic of Germany. Between 1947 and 1953 the firing ranges and facilities received upgrades to make them more suitable for tank training. In the 1950s an additional action began to build a fire and maneuver range similar to those found on Bergen-Hohne, but the inability to secure sufficient space resulted in its abandonment. This effort was revitalized in the 1970s together with the development of new billets, classrooms, and motor pools. Part of this development was spurred by the pending fielding of new equipment, including the Bradley Fighting Vehicle and the M1 Abrams tank. (11)

As CAT host, the United States oversaw the administrative arrangements for the competition. The Seventh Army Training Command, in particular, played a central role. It selected the actual range on Grafenwoehr to be used and accelerated previously scheduled improvements to the facility. It received personnel augmentation from USAREUR, and the command assigned the chief judge by December 1980. In February 1981 the command outlined the creation of a CAT support organization, defining its duties and actions to complete before the competition. Between March and June 1981, the CAT support organization grew through the assignment of personnel from USAREUR and the other competing nations. (12)

The 1<sup>st</sup> Armored Division assigned a tank battalion to help support CAT preparations separate from the American competition team. The 1st Battalion, 13th Armor (1-13 Armor) prepared and oriented personnel assigned to administrative and support responsibilities. The battalion formed three-tank platoons to conduct zeroing and battle runs under competition conditions. These actions helped to familiarize personnel with their duties during the actual competition. This battalion trained the NATO personnel responsible for overseeing the event and validated range operation and organization. All participants received invitations to observe these activities, and all sent representatives. The 1-13 Armor also conducted preliminary rehearsals before the competition to familiarize multinational personnel with American range operations and target arrays similar (but not the same) as those likely to be used during the event. Unit personnel assisted in scoring battle runs when the competition began. (13)

For CAT 1981 unit training generally began in late 1980. For the Americans and Germans, such preparation necessarily focused upon two tank battalions, since the actual unit that would provide the competing team would not be identified until May 1981. For the nominated units, the normal annual training calendar was condensed and restructured to emphasize gunnery, enabling the American units to conduct more training in a few months than normally accomplished during a full calendar year.

Dry fire exercises, sub-caliber range use, and live fire at different training areas helped to raise gunnery proficiency above the norm. Moreover, each national CAT team received two days of familiarization on the actual competition range, although the competition target arrays remained unknown. (14)

In May, HQ AFCENT selected the specific unit that would form the American and German CAT teams. The other participants already knew which unit would represent them, since they were required to nominate only one armored unit. Each nation then prepared a CAT team of five, three-tank platoons from its designated unit. Just prior to the competition, the chief judge randomly selected one platoon from each national team to constitute a reserve to provide replacement vehicles and crews should the need arise. While all five platoons would conduct battle runs, the score of the reserve platoons would not count toward the national total. The actual score of each CAT team derived from the highest three scores of the four, non-reserve platoons. (15)



*Patch worn by the 1-32 Armor CAT 1981 team. (Ron Mihalko)*

The 1st Battalion, 32nd Armor (1-32 Armor), commanded by Lieutenant Colonel Ross A. Johnson, was selected to represent the United States. Its five-platoon CAT team received direct support from its parent brigade and division in terms of funds, materiel support, personnel, and command focus. The brigade command and staff, in particular, undertook a host of coordination actions associated with the preparation for the competition. The resultant interaction with USAREUR and various NATO organizations, however, marked a significant deviation from its normal activities and placed a strain on the staff. At the battalion level, gunnery training received emphasis over maneuver activities. The battalion trained all personnel in order to identify and select the best crews for the competition, even though only 15 tanks would actually participate. Those crews not selected for the CAT team became its support assets. (16)

The increased visibility of CAT in the 1980s resulted in a higher stress level for competing teams. Each one sought to become the best throughout the NATO Central Region. The U.S. team in particular sought to offset the negative press attention given to American performance in prior CAT competitions. Too often the press associated the absence of a win with poor combat readiness and condemned the all-volunteer Army and its ongoing training revolution. Such press coverage encouraged a negative perception of the Army regardless of the actual improving state of affairs. (17)

A more tangible form of stress existed in the higher gunnery standards required for success in CAT. Competition targets proved smaller and appeared at longer ranges than those used in American gunnery training. CAT crews carried less ammunition with which to engage targets, while the targets themselves provided no feedback to the firing crews. Overall, they had to hit targets faster and more accurately in comparison with regular training programs. Competitive platoons needed to engage and hit targets within an average time of 17 seconds, driving training regimens oriented upon teamwork and honing the man-machine interface. In the case of 1-32 Armor, it also resulted in the use of an abbreviated fire command sequence to shorten engagement times. (18)



American ranges utilized targets that emitted smoke when they appeared to represent a tank firing. CAT targets tended to blend into the terrain and vegetation and did not provide any indication when they appeared or when they were hit, thereby complicating identification and sensing. The absence of target feedback, coupled with the difficulty of a firing tank sensing a TPDS/T round necessitated reliance upon a second tank to observe the effect of the shot. Through the development of drills and repetitive training, platoons became more effective at engaging multiple targets at once, but such training marked a deviation from most U.S. gunnery training programs. (19)

The Canadian Army Trophy necessitated platoon coordination, particularly in the engagement of multiple, simultaneous targets. Yet most American gunnery ranges included sets of lanes for individual tanks to follow and engage targets within a single, narrow sector. They were not designed to accommodate cross sector engagements, or the coordinated engagement of a target array by all platoon vehicles. These restrictions limited the platoon leader's ability to manage unit gunnery, but the Canadian Army Trophy required such interaction and management, particularly because of the stringent vehicle ammunition limits. A CAT battle run might also confront a vehicle with multiple targets at once, requiring assistance from the platoon. (20)

German CAT preparations benefited from a robust tank gunnery program. The German army considered tank units to be decisive weapons and the core of any antitank defense. Their primary focus lay in the destruction of hostile mechanized assets. Therefore commanders at all levels focused upon fire and maneuver. Tactical and training exercises integrated gunnery. However, all training reflected the army's conscript nature. The short term of service for a draftee (15 months) resulted in focused training that channeled new soldiers into specialized areas of service. (21)

Armor recruits were selected on the basis of physical and aptitude tests and assigned to training units. There they were re-evaluated and subsequent training and unit assignment determined. Loaders and gunners underwent a three-month training period that included 98 hours of tank gunnery, 95 hours devoted to weapons and equipment, and 10 hours of communication training. Upon completion, soldiers possessed a basic knowledge of gunnery, could operate tank weapons and equipment, and could perform preventive maintenance. Tank gunnery instruction followed in which soldiers received individual instruction in gunnery and ammunition. This training included 85 hours devoted to turret operation, target acquisition, gun laying, ranging, and use of the auxiliary sights. Use of the Leopard 1's optical rangefinder required another 60 hours. Training aids included actual tanks, turret trainers, sub-caliber devices, and the use of both full size and scaled ranges. Successful completion of this training resulted in the tentative identification as a gunner. Subsequent training immersed the aspiring gunner in progressive exercises leading to live fire. (22)

The culminating point in gunnery training lay in the execution of a scored battle run that included main gun and machine gun engagements and rewarded rapid engagement, accuracy, and conservation of ammunition. Bonus points were earned for unused ammunition if all main gun targets were hit. These battle runs had a strong parallel to the Canadian Army Trophy, and in fact, German gunnery training was influenced by analysis of CAT performances. The Germans conducted section, platoon, and combined arms battle runs. The section battle run focused upon single and joint engagements while maneuvering as part of a platoon with emphasis upon crew proficiency. Successful completion enabled progression to the platoon exercise. Again the emphasis lay upon independent target engagement by the platoon tanks under the general guidance of the platoon leader. The combined arms battle run mixed tanks with infantry fighting vehicles or armored reconnaissance platforms. Its purpose lay in providing experience in combined arms operations, command and control, maneuver and gunnery, but unlike the section and platoon battle runs, it was not part of a regular unit training regimen. (23)

German armor training also benefited from access to the German Army Training Establishment at Canadian Forces Base Shilo, located in Manitoba, Canada. This facility offered broad expanses of

land to support both maneuver and gunnery training. It became operational in 1974, enabling German armor and mechanized infantry units to conduct three-week training cycles annually between spring and fall. Gunnery training included battle runs at the section, platoon, and company levels. Each rotation culminated in a battle run by a reinforced battalion, sometimes augmented by Canadian artillery. The size and scope of these combined arms activities provided opportunities to practice fire and maneuver on a large scale without the range access and land usage constraints common to Central Europe. (24)



*The CAT 1981 team patch for Panzer Battalion 294. (Ron Mihalko)*

Platoon leaders and armor NCOs received their training from the German armor school. The Tank Commander's Course prepared NCOs for their role as tank commanders and tank crew instructors. Before attendance at this course student NCOs had to have already earned the tank gunner military occupational specialty. The platoon leader and advanced NCO courses included gunnery instructor training. The overall intent of this training lay in providing combat units with a tactical leadership immersed in maneuver and gunnery. Moreover, by ensuring that each tank platoon possessed at least one master gunner, units were able to achieve a high level of training sustainment and conduct instruction with the expertise on hand. Company and battalion commanders received similar exposure to the preparation and execution of gunnery training. (25)

Units in the field relied upon the German armor school's Tank Gunnery Advisory Group. Its personnel included experienced officer and NCO gunners who visited units conducting live fire training to provide support and advice. The Group also served as direct conduit between the school and the field, sharing information and policy updates as they became available. (26) In addition to this regular support, the German CAT team also included a special training cell, whose purpose lay in providing gunnery expertise to the CAT team. The cell included individuals associated with the German armor school who possessed knowledge of and experience with the Canadian Army Trophy. The cell leader was a lieutenant colonel, who served in prior competitions in the capacity of a national judge and a chief judge. He also directed the gunnery branch of the German armor school. The cell as a whole helped to facilitate training support from other army organizations. (27)

The British also used a training cell to prepare their CAT team. Major Charles Rogers led this cell and provided expertise based upon his own prior CAT experience. (28) This specialized focus supplemented the routine gunnery received by all British armored units and the intensified gunnery focus given to the CAT team. In addition to classroom instruction and sub-caliber devices, tank units annually conducted live fire at Bergen-Hohne for two weeks. They also spent several weeks performing brigade tactical exercises in the field. Once every other year, each tank unit conducted a month long rotation to the British Army Training Unit at Canadian Forces Base Suffield (BATUS) in Alberta, Canada. An agreement with the Canadian government permitted the British to maintain an equipment set for a combined arms battle group at Suffield. BATUS provided the British army a training area the size of Luxembourg in which to conduct virtually unrestricted training in a manner impossible in the United Kingdom or on the high usage facilities in Central Europe. (29)

The Belgians proved strong competitors in the Canadian Army Trophy. In addition to tactical ability Belgian tank gunnery relied upon careful personnel management. Through rigorous screening and performance evaluation, the Belgians sought to identify and retain the best qualified soldiers as their tank gunners. Before entrance into the tank gunnery program, each candidate had to be carefully screened and accepted. Subsequently, the soldier underwent regular and frequent performance evaluations. Gunnery training activities were scored and individual performance scores maintained. Tankers who failed to meet stringent standards, including the achievement of a first round hit, found their status as a gunner under review. (30)

The Belgians also used the Tank Level Aiming and Firing Trainer (TALAFIT) to hone gunnery skills. This device included an optical simulator unit attached to the turret roof and connected to the gunner's sight. Once activated, the gunner then viewed a computer-generated battlefield on which he had to lay the gun and follow fire commands. An instructor control box was connected to the optical unit, enabling the instructor to program the battlefield, target configuration, and movement status of the firing vehicle. Training progressed through a series of exercises that focused upon his ability to acquire targets, use the laser rangefinder, lay the gun, and achieve hits. The control box provided indication of the success or failure of these tasks, permitting each gunner's ability to be evaluated, tracked, and used to guide further training. The tank powered both TALAFIT components. (31)

The American team introduced the latest development of the M60-series to the Canadian Army Trophy. In 1978 the addition of a laser rangefinder and solid state computer with a limited self-diagnostic capability to the M60A1 (RISE Passive) resulted in the M60A3. Subsequent improvements included a thermal shroud to prevent gun tube droop and warping. In 1979 the platform received the Tank Thermal Sight (TTS), enabling target engagement on moonless nights, in smoke, and during inclement weather. This upgrade resulted in the designation M60A3 TTS. Coupled with main gun and coaxial machine gun stabilization, these modifications improved accuracy, especially during low visibility conditions. The computer determined a more precise ballistic solution based upon the type of ammunition being fired, wind (the vehicle possessed a wind sensor), range, atmospheric conditions, and the target tracking rate, and it calculated the corresponding gun elevation and azimuth. It took less than 15 seconds from the moment of target identification to firing, and much of this process proved automatic except for aiming and manual data inputs. (32)

### **CAT 1981**

The Canadian Army Trophy competition of 1981 occurred from June 12-19 on the American training facility at Grafenwoehr. Participants included four-platoon teams from the Federal Republic of Germany, Belgium, the United States, Canada, the United Kingdom, and the Netherlands. These teams competed on a new range built specifically for CAT.

The German Leopard 1-equipped Panzer Battalion 294 won the competition with a score of 41,770 points and a comfortable 5,000-point margin over the second place Belgian 2d Lancers. One German platoon alone garnered 15,761 points, making it the top scoring platoon of the competition.

### CAT 1981 Results

<b>1 Federal Republic of Germany</b>	
Panzer Battalion 294	15,761
Panzer Battalion 294	13,447
Panzer Battalion 294	12,562
Panzer Battalion 294	9,524
<b><i>National team score</i></b>	<b>41,770</b>
<b>2 Belgium</b>	
2d Lancers	13,781
2d Lancers	13,399
2d Lancers	9,397
2d Lancers	9,046
<b><i>National team score</i></b>	<b>36,577</b>
<b>3 United States</b>	
1st Battalion, 32nd Armor	12,288
1st Battalion, 32nd Armor	12,179
1st Battalion, 32nd Armor	10,720
1st Battalion, 32nd Armor	7,155
<b><i>National team score</i></b>	<b>35,187</b>
<b>4 Canada</b>	
Royal Canadian Dragoons	13,624
Royal Canadian Dragoons	11,046
Royal Canadian Dragoons	10,320
Royal Canadian Dragoons	9,462
<b><i>National team score</i></b>	<b>34,990</b>
<b>5 United Kingdom</b>	
Queen's Own Hussars	13,742
Queen's Own Hussars	11,764
Queen's Own Hussars	9,334
Queen's Own Hussars	5,914
<b><i>National team score</i></b>	<b>34,840</b>
<b>6 Netherlands</b>	
41st Tank Battalion	10,852
41st Tank Battalion	10,781
41st Tank Battalion	9,091
41st Tank Battalion	8,444
<b><i>National team score</i></b>	<b>30,724</b>

Moreover, the same platoon hit every target without expending all of its ammunition, thereby earning almost 700 bonus points. This platoon further earned one of the higher scores for machine gun target engagement and outperformed every other German platoon by a significant margin. Against this accomplishment, however, was a somewhat erratic performance by the national team as a whole. German platoons finished in first, fifth, seventh, and 16th place. A point spread of over 6,000 points separated the highest and lowest scoring platoons. The lowest scoring platoon made a poor showing on the first bound, earned fewer points than the other German platoons at bound 2, and experienced difficulty firing at targets while moving. Fortunately, only the top three platoon scores determined the national team total, but the Germans also proved one of only two teams to earn penalty points. (33)

The Belgian 2d Lancers, also equipped with the Leopard 1, placed second with a national score of 36,577. Platoons finished in second, sixth, 18th, and 21st place. Its two high scoring platoons achieved totals of 13,781 and 13,399, outperforming all but the highest German platoon. However, the remaining two Belgian platoons performed poorly during firing on the move and in machine gun engagements. A significant point spread also separated the highest and lowest scoring platoons (over 4,000 points), and the Belgians also incurred penalty points. (34)

The American team from 1-32 Armor earned third place with 35,187 points. Individual platoons secured eighth, ninth, 14th, and 23rd place. Overall, the team's performance marked an improvement over previous Canadian Army Trophy competitions. Less than 2,000 points separated the scores of the top three platoons, but this figure increased to over 5,000 with the inclusion of the lowest scoring platoon. More worrisome for ongoing efforts to improve American tank gunnery was the wide variance in performance among the platoons, illustrated in the table below. Ironically, the lowest scoring platoon performed poorly at the first and third bounds, but its score for engaging targets on the move proved the highest of any platoon in the competition. (35)

	Bound 1	Bound 2	Bound 3	Moving	MG	Total
Pltn 1	1,176	5,514	2,180	925	925	10,720
Pltn 2	4,126	4,354	1,958	900	950	12,288
Pltn 3	1,510	2,075	620	1,925	1,125	7,155
Pltn 4	2,930	4,505	1,964	1,655	1,125	12,179

American analysis of the CAT 1981 scores indicated the need for specialized training in target acquisition. Some crews failed to see and engage targets during the competition. This observance resulted in a recommendation to change gunnery training by not using a smoke designator to show a range target's appearance. This prompt represented a threat vehicle firing, but it accustomed crews to expect a target location indicator. Removing this prompt forced crews to search for the target, presumably engaging the target *before* it fired. Similarly, the shorter fire command sequence adopted by 1-32 Armor for the Canadian Army Trophy became the subject of discussion, particularly whether a similar abbreviation should be applied across the force. (37)

U.S. performance in CAT 1981 incurred press criticism that continued to link competition placement with overall Army readiness. Such criticism played into a consistent narrative begun in the 1970s and fueled by real problems associated with the transition to a volunteer Army and the end of involvement in Vietnam. Following CAT 1981 the *Washington Star* reported that "Tank ... crews from what are supposed to be some of the most combat-ready units in the U.S. military have been beaten in several recent military competitions by their NATO counterparts." The article further asserted the importance of training and personnel issues that seemed at odds with the fielding of multiple new weapon systems. (38)

In fact the Army had implemented sweeping changes to its training that were beginning to bear fruit in the early 1980s. The Army did not win CAT 81, but its efforts to prepare for it reflected a determination to do so. Indeed, training reform coupled with command emphasis on CAT offered a potentially winning combination. Moreover, greater attention to CAT preparation and performance was stimulating constructive discussion about gunnery techniques across the force.

The Army, however, proved reluctant to acknowledge the potential value of competitions like the Canadian Army Trophy and indeed questioned their utility. In 1982, USAREUR commander General Frederick J. Kroesen Jr. provided the following response to a question about international competitions during testimony before the Senate Appropriations Committee:

Our philosophy with respect to international competitions has always been that they disrupt normal training, are no measure of the true readiness of competence of the whole force, but that they are an excellent peacetime pursuit which contribute to high morale and esprit de corps among the soldiers and units which compete for the honor of representing the United States. In the past, we sent our competitors into matches as normal well-trained crews. The poor showing in past years was the result, and we had to learn to marshal resources, engage in special training, and assure close adherence to special competition practices and procedures. (39)

As the visibility of such competitions rose, so too did media attention and scrutiny. Such attention proved a two-edged sword, rewarding high performance while castigating those institutions behind a losing team. With its training transformation well underway, new systems being fielded, and a major threat still threatening Central Europe, the Army needed no more negative publicity. As the decade unfolded, the higher visibility of CAT encouraged a greater rather than lesser investment.



*The regal looking CAT 1981 patch for the British Queen's Own Hussars team. (Ron Mialko)*

For the Canadian Forces, CAT remained one of many activities undertaken by the nation's only armored unit in Europe. In the 1981 competition the Leopards of the Royal Canadian Dragoons finished fourth with 39,990 points. Platoons secured fourth, 11th, 15th, and 17th place, with a point spread of over 4,000. The highest scoring Canadian platoon also earned the highest point total for machine gun engagements. However, three of Canada's four platoons performed poorly while firing at targets on the move. The other platoon earned among the highest totals of the competition for this type of engagement, but it encountered difficulty on bound three, receiving few points, and eroding its overall placement. (40)

The performance of the Queen's Own Hussars proved lackluster. The United Kingdom team with its Chieftain tanks finished in fifth place with 34,840 points. Its highest scoring platoon secured third place, just 39 points behind the second-place Belgian team. However, the other British platoons finished in 10th, 19th, and last place. With a point spread of nearly 8,000 separating its highest and lowest scoring platoons, the British team showed the least consistency in its competition performance. Worse, two of its platoons failed to earn any points firing on the move, thereby raising questions about the Chieftain's fire control system. (41)

The Dutch 41st Tank Battalion finished last in the national team scores with just 30,724 points. Its platoons secured 12th, 13th, 20th, and 22nd place. All of the Dutch platoons fared poorly during engagements on the move, but overall the team proved much more consistent than other nations. Less than 2,500 points separated its highest and lowest scoring teams. This spread fell to less than 2,000 points among the top three platoons, whose scores determined national placement. Yet this outcome did not generate a national shock. Dutch participation in CAT reflected a more general consistency of support for NATO. Unlike the Germans, Americans, and British, the Dutch populace did not see the competition as a statement on martial prowess or a platform showcase to attract foreign sales. (42)

### **Preparing for CAT 1983**

Preparations for CAT 1983 began after the guns of CAT 1981 fell silent and the corresponding press commentary ceased. Once again the Committee of Control became the central venue for implementing modifications and addressing specific national issues. The American Seventh Army Training Command, for example, briefly considered making the company the basis of CAT nomination. It ultimately abandoned this idea, since company organizations lacked the necessary command and staff support. They would have to be augmented, thereby eliminating much of the potential benefit associated with a smaller unit in terms of personnel and resource allocation. (43)

The most significant change to emerge lay in the transition from a national to an army group competition. For CAT 1983, two principal teams, one from CENTAG and one from NORTHAG, would compete. NORTHAG included the British Army of the Rhine (BAOR) I Corps, the U.S. III Corps (Forward), the German I Corps, the Netherlands I Corps, and the Belgian I Corps. CENTAG included the German II and III Corps', the U.S. V and VII Corps', and the Canadian 4th Mechanized Brigade Group. The winning army group would receive the trophy rather than a national team. This shift also accompanied a transfer of host responsibilities from a single nation to one of the two army groups. (44)

These changes sought to realize the Canadian Army Trophy's intent to promote comradeship and fraternity among the competitors. The highest scoring platoon still retained the privilege of displaying its distinctive CAT colors and bumper markings, but the new award process focused upon the joint endeavors of each army group's multinational composition. The army group alignment largely eliminated concerns about the potentially greater resources available to the United States and Germany. The NORTHAG and CENTAG teams both included American and German units. For the United States, these changes increased American involvement in CAT, necessitating the commitment of more resources and training time for the competition. The expanded participation increased the

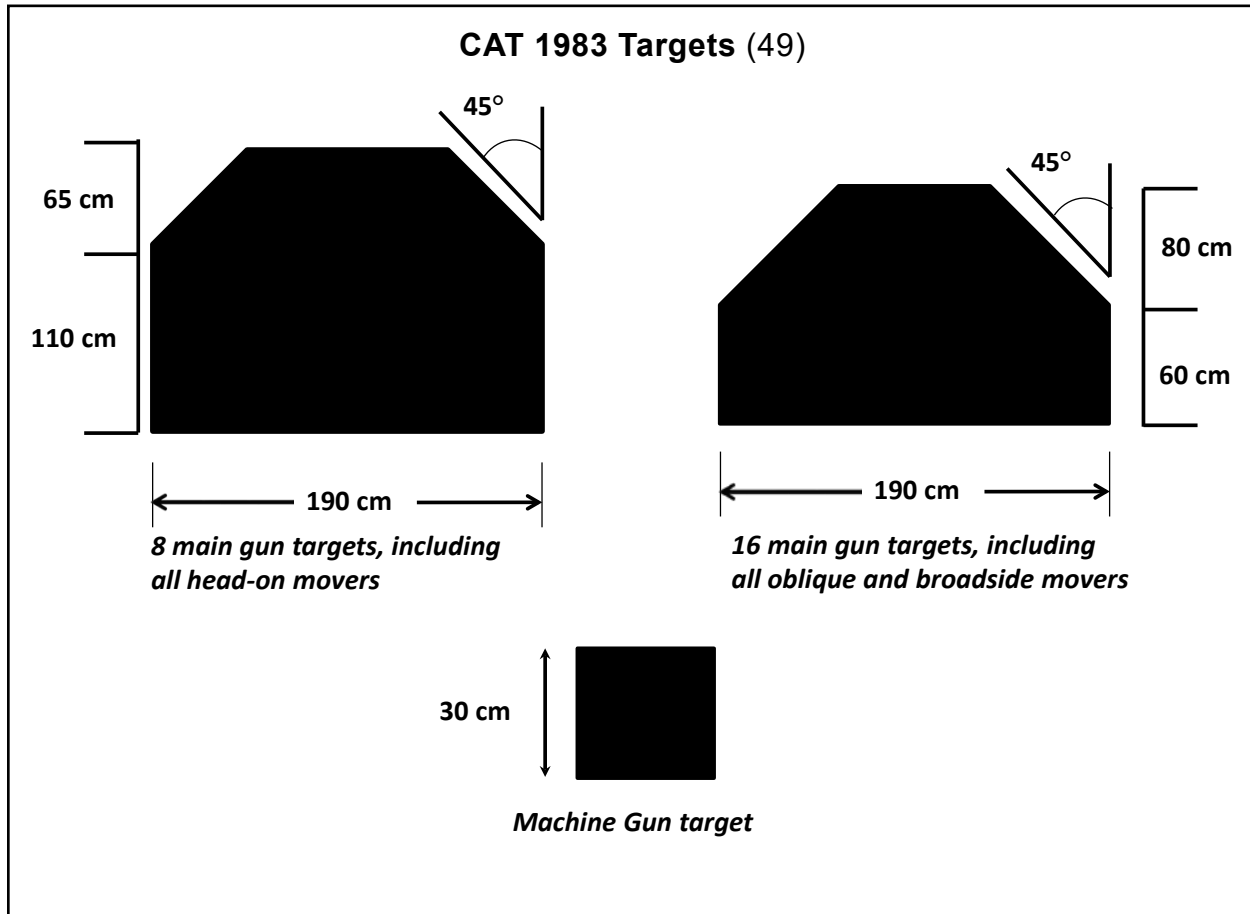
chances for success. Moreover, it broadened the pool of American units and soldiers familiar with CAT and its higher competition gunnery standards. It remained to be seen how such familiarity might influence armor training throughout the Army. (45)

Each army group provided 15 platoons to participate in CAT, three for each corps and the Canadian 4th Mechanized Brigade Group. Platoon size increased from three to four tanks. The three platoons selected by each formation were organized into a CAT company that became the subject of special training and support. During the actual competition, all platoons conducted scored battle runs. The judges determined which army group won based upon the collective performance of their subordinate platoons. It still remained possible to track and compare national performance by monitoring the achievements of each CAT company or each platoon from a particular nationality. The highest scoring platoon still received acknowledgement and an award, but determination of the CAT winner derived from army group rather than national totals. (46)

The scoring of each battle run continued to reward engagement speed and accuracy. As in prior years, each tank carried insufficient rounds to engage all targets alone. Platoons had to work as a team and the resultant score reflected individual crew prowess and platoon coordination and fire control. Ammunition conservation and hitting every target earned bonus points, while the speed of engagement continued to be scored on a sliding scale with more points earned for faster engagements. Targets appeared for 40 seconds during which they had to be hit; afterward they were lowered and could no longer be shot. The target arrays for each bound varied, and they included three targets that had to be hit while moving. Penalties accrued for not arriving at a bound on time or using reserve ammunition without authorization from a judge. These extra rounds were issued to offset range target malfunctions or other unforeseen developments. (47)

<b>CAT 1983 Scoring (48)</b>		
<b>Points earned</b>		
Hit scoring (main gun)	Successful engagement	500 points
Time scoring (main gun)	Sliding scale with maximum points for engaging target within 1 second and no points for engaging target at 40 or more seconds	500 points (1 second) 0 points (40+ seconds)
Ammunition bonus (main gun)	Each round remaining at the end of a battle run in which all targets hit	100 points
Hit bonus (main gun)	All 24 main gun targets hit	500 points
Machine gun engagement	Each falling plate	25 points
<b>Penalty points</b>		
	Failure to arrive at bound in the specified time	-600 points
	Unauthorized use of reserve ammunition	-1000 points
<b>Maximum Point Allocation for Platoon Battle Run</b>		
	Hit Score (24 targets x 500 points)	12,000 points
	Time Score (24 targets x 500 points)	12,000 points
	Hit Bonus (500 points)	500 points
	Ammunition Bonus (16 rounds x 100 points)	1,600 points
	Machine Gun Score (80 plates x 25 points)	2,000 points
	<b>Maximum Total Score for a Platoon</b>	<b>28,100 points</b>





### CAT 1983

NORTHAG hosted the 1983 Canadian Army Trophy at Bergen-Hohne from June 20-24. During the course of this week, the competing platoons from NORTHAG and CENTAG alternated in the execution of scored battle runs. Upon tabulation of the final results, CENTAG won the competition with 184,170 points against NORTHAG's 182,010. CENTAG tank platoons earned the first, second, and third highest scores. Still, the narrow margin of victory reflected well on all participants, but considerable variation occurred among the competing company teams and their subordinate platoons. Despite the emphasis given to army group affiliation, analysis of the competition still tended to focus upon national performance, encouraged by press coverage that sought a national identity for the winners and losers. (50)

### CAT 1983 Platoon Scores (51)

Army Group	Nationality	Unit	Score
CENTAG	Federal Republic of Germany	Panzer Battalion 293	21,153
CENTAG	United States	3-64 Armor	19,294
CENTAG	United States	3-64 Armor	18,068
NORTHAG	Federal Republic of Germany	Panzer Battalion 74	17,413
NORTHAG	United States	2-66 Armor	16,717
CENTAG	Federal Republic of Germany	Panzer Battalion 293	16,383
NORTHAG	Federal Republic of Germany	Panzer Battalion 74	16,248
NORTHAG	United States	2-66 Armor	16,190
CENTAG	United States	3-64 Armor	16,116
CENTAG	Canada	Royal Canadian Dragoons	16,040
NORTHAG	Belgium	4 <sup>th</sup> Lancers	15,738
CENTAG	United States	1-32 Armor	15,497
CENTAG	Canada	Royal Canadian Dragoons	15,241
NORTHAG	Netherlands	11 <sup>th</sup> Tank Battalion	15,177
NORTHAG	United States	2-66 Armor	15,151
NORTHAG	Belgium	4 <sup>th</sup> Lancers	14,830
NORTHAG	Belgium	4 <sup>th</sup> Lancers	14,556
NORTHAG	United Kingdom	Royal Scots Dragoon Guards	14,487
NORTHAG	Netherlands	11 <sup>th</sup> Tank Battalion	14,483
CENTAG	United States	1-32 Armor	14,378
CENTAG	Canada	Royal Canadian Dragoons	14,291
NORTHAG	United Kingdom	Royal Scots Dragoon Guards	14,134
NORTHAG	Federal Republic of Germany	Panzer Battalion 74	13,604
CENTAG	Federal Republic of Germany	Panzer Battalion 153	13,272
NORTHAG	Netherlands	11 <sup>th</sup> Tank Battalion	13,001
NORTHAG	United Kingdom	Royal Scots Dragoon Guards	12,942
CENTAG	Federal Republic of Germany	Panzer Battalion 293	12,816
CENTAG	Federal Republic of Germany	Panzer Battalion 153	12,751
CENTAG	United States	1-32 Armor	12,612
CENTAG	Federal Republic of Germany	Panzer Battalion 153	9,141

The highest scoring platoon belonged to the German Panzer Battalion 293, equipped with the Leopard 1A4. The platoon was the only one to earn bonuses for hitting every target and ammunition conservation. Another platoon from the same battalion earned the highest score for hitting targets while moving. However, a wide variance in scores existed among the three competition platoons from this battalion, ranging from a high of 21,153 to a low of 12,816 points — a wider spread than found in any other CAT company by a large margin. Some of this erratic performance stemmed from unit specific preparations for the battle runs. The platoons relied upon a single zeroing of their weapons, using the same ammunition intended for the competition and with meteorological input from a German field weather station. The Germans gambled on the weather conditions during the competition being the same or very similar to those existent during zeroing. In the case of the high scoring platoon, weather conditions were indeed identical. However, the other two platoons conducted battle runs when weather and atmospheric conditions differed considerably from the time of zeroing, and their scores suffered. Distrust of the more modern equipment resulted in all three platoons conducting battle runs using only their auxiliary optical rangefinders and sights in lieu of the laser rangefinder. The experience of this battalion highlighted the pros and cons of orienting preparation too much upon competition conditions. (52)

The other two German teams proved less erratic in their performance. In Panzer Battalion 74, equipped with the Leopard 1A1A2, its platoon scores ranged from 17,413 to 13,604. The lowest scoring platoon encountered difficulties during the machine gun engagements, garnering the lowest score of any platoon for this part of the battle run. The Leopard 1A2-equipped Panzer Battalion 153 earned scores from 13,272 down to 9,141. Its low scoring platoon earned the least points of any other competing platoon, trailing the next lowest score by 3,500 points. None of the battalion's platoons hit any targets while firing on the move, but the highest scoring platoon received the only penalty awarded during the competition for failing to arrive at a bound in the allotted time. (53)

The Belgian 4th Lancers, equipped with the Leopard 1A1, collectively performed at the median range. None of the three Belgian platoons placed in the top ten scores. One platoon received the second lowest score for its machine gun engagements, and another one garnered the worst score of any platoon on the first bound. The unit recovered during the rest of its battle run, but it still received the lowest Belgian platoon score. However, the Belgian team shot much more consistently than the other national participants with less than 1,200 points separating its highest and lowest scores. Overall, the Belgians provided a credible if not stellar performance, building on a legacy as a strong CAT performer. (54)



*The patch worn by the Dutch 11th Tank Battalion team for CAT 1983. Note strong similarity with the tank-eating cat of the American World War II-era tank destroyer force. (Ron Mihalko)*



*A German Leopard 1 emerging from a tree line during REFORGER 1983. (Aerospace Aviation Service)*

American personnel interacting with the Belgian tank crews found them to possess a high degree of technical knowledge. The Belgians believed that consistent high performance was not possible without crews thoroughly understanding their tank and its related principles of operation. Their armored personnel relied upon frequent boresighting to achieve accuracy, but suffered from the dearth of boresight devices. Many tank platoons possessed only one such device to be shared. However, a week before the competition, the Belgian team opted to utilize a tunable boresight device that improved their accuracy. Indeed, the highest scoring Belgian platoon hit 22 of 24 targets presented, paralleling in accuracy results attributed to American platoons equipped with the M1 Abrams. The Belgians received a lower score, because it took them longer to complete engagements. (55)

The Dutch 11th Tank Battalion ranked in the lower third of national platoon scores. The unit's Leopard 1A1A1 featured improved turret armor, sights to enable use of British APDS ammunition, and a thermal sleeve. An ongoing modernization program in progress added additional armor, fire control improvements, and thermal imaging. During the 1983 Canadian Army Trophy, Dutch platoons incurred no penalties, earned no bonuses, and completed battle runs without significant mishap. Like the Belgians, the Dutch performance overall demonstrated a degree of consistency with just 2,000 points separating its highest and lowest scoring platoons. The high-scoring platoon also utilized a tunable boresight device, and while it did not win CAT, it did win a separate Dutch gunnery competition. (56)

The Royal Canadian Dragoons represented Canada with their Leopard 1 tanks. Indeed, 1983 marked the unit's 100th anniversary, but it was unable to celebrate this event by achieving either the highest CAT team score or the highest platoon score. Nevertheless, the machine gun engagement scores for two of the platoons were among the highest for the competition. One platoon also scored in the upper ranks for hitting targets while moving. Less than 2,000 points separated the highest and lowest scoring Canadian platoons, a spread likely to have been even smaller had not one of the platoons experienced difficulty on its second bound and received a correspondingly small point award. While not outstanding, the Royal Canadian Dragoons' performance contributed to CENTAG's competition victory. (57)

<b>Company Team Placement for CAT 1983 (58)</b>	
<b>Parent Battalion</b>	<b>Nationality</b>
1—C Company, 3 <sup>rd</sup> Battalion, 64 <sup>th</sup> Armor	United States
2—2 <sup>nd</sup> Company, Panzer Battalion 293	Federal Republic of Germany
3—C Company, 2 <sup>nd</sup> Battalion, 66 <sup>th</sup> Armor	United States
4—4 <sup>th</sup> Company, Panzer Battalion 74	Federal Republic of Germany
5—A Squadron, Royal Canadian Dragoons	Canada
6—B Squadron, 4 <sup>th</sup> Lancers	Belgium
7—B Company, 1 <sup>st</sup> Battalion, 32 <sup>nd</sup> Armor	United States
8—B Squadron, 11 <sup>th</sup> Tank Battalion	Netherlands
9—C Squadron, Royal Scots Dragoon Guards	United Kingdom
10—3 <sup>rd</sup> Company, Panzer Battalion 153	Federal Republic of Germany

### **The U.S. Experience**

The United States fielded three CAT teams for the 1983 competition. The 2<sup>nd</sup> Battalion, 66th Armor Regiment (2-66 Armor) supported the NORTHAG team. The 3<sup>rd</sup> Battalion, 64th Armor Regiment (3-64 Armor), and the 1<sup>st</sup> Battalion, 32nd Armor Regiment (1-32 Armor), constituted the American CENTAG representatives. Reflective of the transitional state of American tank battalions in Europe, each battalion fielded a different tank.

2-66 Armor entered the competition with the M60A1 RISE. This tank proved one of the oldest to participate, but its platoons fired consistently with less than 1,600 points between their highest and lowest scores. Its high scoring platoon ranked fifth, while the CAT company team's overall performance earned it third place among the competing teams. These results proved remarkable, particularly given one platoon's battle run experience on June 22. Early morning haze made targets barely visible. The platoon failed to score any points while firing on the move, and it experienced difficulties at the second bound. Strong showings at the other bounds coupled with a solid machine gun engagement score prevented the battle run from becoming a disaster and dragging the team's overall standing down. (59)

The 2-66 Armor CAT team's aging platforms were greeted with derision and dubbed dinosaurs by other CAT participants sporting newer tanks. The 2-66 Armor team accepted the designation with pride. They possessed a confidence born of an effective training program. The unit focused upon immersing tank crew members in the basics of gunnery, building upon the required basic task proficiency, and instilling in them an understanding of how and why the turret and weapons controls performed as they did. In short, the unit sought crewmen both trained and educated in the operation of the platform in order to rapidly diagnose malfunctions and quickly recognize errors in firing solutions. This emphasis necessarily increased the involvement of crews in vehicle maintenance, especially those components related to firing. Commanders soon discovered that the more crews knew of their tank, the more dedicated they became to ensuring it remained in good working order. (60)

The understanding and maintenance-orientation of the CAT training resulted in crews that sought to identify, understand, and resolve problems related to gunnery accuracy. They did not simply re-zero the weapon, effectively erasing the problem without determining why it occurred. Indeed, the CAT crews did not zero during their training period. Instead the crews became immersed in boresight theory and principles, applying them regularly. (61) Offered the option of using either the M26 muzzle boresight device or a tunable one, the unit opted for the latter. They anticipated that the worn gun tubes of their aged tanks would require more precise alignment than possible with the M26, which they considered too fragile for field, combat, or competition conditions. Crews became sufficiently confident and proficient to complete boresighting correctly within four minutes. Indeed, during short halts, crew members often conducted a boresight while the driver checked the oil level. (62)



*The 2-66 Armor team patch for CAT 1983. (Ron Mihalko)*

Confidence in the value of frequent boresighting led crews to question whether or not to zero their weapons at all prior to the actual competition battle runs. The issue was resolved in favor of zeroing by the unseasonably sunny and warm temperatures that existed during the competition. The M60A1s of 2-66 Armor were the only platforms to compete that did not have thermal shrouds on their gun tubes, making them more susceptible to warping generated by the sun and temperature. Crews remained concerned lest weather and atmospheric conditions, including a crosswind, change between the time of zeroing and the execution of their battle run. In fact such changes adversely impacted the scores of two platoons of the German Panzer Battalion 293. The Dinosaurs addressed this concern by factoring a wind correction adjustment into their zero results. They also advised crews on what corrections to make should the wind die during their battle run. (63)

Building crew competency, however, constituted only part of 2-66 Armor's preparation for CAT. Ranging exercises helped tank commanders to rapidly and accurately determine the range to a target, while testing of the gunner's sight led to adjustments to ensure accuracy. Scaled ranges provided

opportunities to practice reacting to platoon fire commands and hone the individual skills necessary for target engagement. To make the most use of the limited range time available, crews not actually firing conducted dry fire exercises or pre-firing checks. Waiting tanks were kept on standby for sudden alert to engage targets, while their platoon leader might suddenly find control of a hot range passed to him. These actions served to keep personnel focused on the ongoing live fire and their own preparations rather than idling for hours until their turn to fire. Detailed after action analysis followed live fire training, assessing each engagement and the related actions of the platoon leadership, individual crew members, and the performance of the weapon system. All unit personnel actively participated in assessing engagements to determine the causes for missed targets and provide solutions. (64)

The CAT team also focused upon single shot engagements and battlesight gunnery techniques. Crew training focused upon the accurate delivery of the first round. Multi-shot engagements encouraged rapid snap shots in the hope of a lucky hit with the knowledge that a second or third shot would be available in the event of a miss. This approach encouraged sloppy techniques and undermined efforts to understand why a hit or miss occurred. Hence, 2-66 Armor focused upon achieving a first round hit, and analyzed carefully every round fired. In addition, every tank in a platoon adopted an initial battlesight range oriented upon the distance to a particular target rather than a common generic range. This approach increased the likelihood that the distance to an appearing target would correspond to at least one vehicle's preset battlesight range, thereby shortening engagement time. CAT team members rationalized this practice as commensurate with a platoon leader receiving orders to watch a sector and prepare for engagements at a particular range. In the event that appearing targets did not correspond to any preset battlesight ranges, normal precision engagement procedures were followed. (65)

Unlike the Dinosaurs, 1-32 Armor was among the first battalions in Europe to be equipped with the M60A3, and the unit had competed in CAT 1981. Its team was well trained, but it experienced several problems during preparation for the 1983 competition. It received 11 M26 muzzle boresight devices. These tools provided units a more precise method of boresighting in comparison with the more rudimentary method involving thread, tape, and binoculars. Despite their potential value the unit encountered difficulty calibrating the devices and lost confidence in them. One master gunner considered the M26 too fragile, forcing crews to continuously act to safeguard the device. The boresight problems were compounded by laser rangefinder issues that collectively degraded the effectiveness of gunnery training. These problems directly impacted accurate firing during the competition and ensured a mediocre performance. All three platoons did well in their machine gun engagements, but two platoons proved unable to hit targets on the move. Two also experienced difficulties at their first bound while firing from a stationary position. One platoon placed 29th out of 30. (66) In the opinion of one American technical advisor, "what happened to this team shouldn't happen to a dog." (67)

The United States also introduced an entirely new vehicle, the M1 Abrams. This platform originated from the aftermath of the failed U.S.-German MBT 70 program. When this joint endeavor failed and American efforts to sustain the program alone similarly collapsed, the Army undertook the design of a new tank. In 1972 the Main Battle Tank Task Force convened at Fort Knox to determine its basic characteristics. Development efforts adjusted to accommodate lessons learned from the 1973 Arab-Israeli War. Consequently, crew survivability and the need for increased protection strongly influenced the resultant design. Composite armor based upon British Chobham armor provided significantly improved ballistic protection, supplemented by an automatic fire detection and suppression system, and a spall liner. (68)

Earlier American tank designs, including the World War II-era M4 Medium and the M60-series, carried most of their main gun ammunition in the turret. In the event of a penetration, the ammunition ignited and destroyed the vehicle. To avoid a similar fate, ready rounds were stored behind an

armored bulkhead in the Abrams' turret. Should a round detonate behind this bulkhead, the force of the explosion was vented through blow-off panels in the turret roof. Further survivability enhancement occurred through a lowered silhouette, achieved by placing the driver in a supine position. The driver gained a degree of comfort, and the overall height of the vehicle dropped. Compartmentalization of the tank further reduced the risk of an outright catastrophic kill and raised the likelihood of crew survivability. (69)

The use of a gas turbine engine rather than the more common diesel engine reflected anticipation of reduced life cycle costs. The gas turbine also provided more power than the M60A3 powerplant and doubled the power to weight ratio. Combined with a robust, if conventional, suspension, the Abrams tank proved capable of rapid acceleration and high cross country speeds. On roads, the vehicle attained speeds over 40 miles per hour. The gas turbine permitted the use of varied fuel types, not unlike the Chieftain. In contrast with the British platform, the Abrams' engine proved much more reliable and easier to maintain. The principal drawback lay in its high fuel consumption, partially offset by a large onboard fuel capacity and careful planning. (70)

The original M1 design carried an American-built version of the proven British L7 105-mm rifled gun. The tank's fire control system resembled that of the M60A3, integrating the main gun with a ballistic computer, thermal sights, and a laser rangefinder. It also possessed a muzzle reference system. The computer generated a ballistic solution based upon the range, ammunition type, vehicle cant, gun tube data, and environmental inputs. The gunner selected the ammunition, tracked the target in his sight, and fired. The computer adjusted for target lead and directed the gun's movement to ensure proper elevation. With a stabilized gun and sights, the Abrams offered a high degree of accuracy when firing either stationary or on the move. Battalions within the 3rd Infantry Division were able to secure an average first round probability of 75 percent shortly after fielding the Abrams. In 1982, the M1 made its debut in NATO maneuvers. After being overrun by an Abrams unit, a Canadian soldier serving with the defeated opposing force referred to the tank as "Whispering Death" for its fire on the move capability and the relative quietness of its gas turbine engine. (71)



*An M1 tank crossing a stream on Fort Knox in 1983. (National Archives and Records Administration)*



The Abrams entered Army service in 1980. Its arrival marked an organizational change. The standard tank platoon fell from five tanks — a number consistent since the first days of the Tank Corps in World War I — to four. The change reflected both the improved capability of the new tank but also its cost. The reduction in platoon size necessitated changes in tactics oriented upon platoon and section actions in which the platoon leader had both to fight his tank and manage the unit. However, the smaller size now aligned American platoons with the standard CAT platoon configuration. No longer would American units preparing for the event have to adopt a competition-unique organization.

The 3rd Battalion, 64th Armor Regiment (3-64 Armor), 3rd Infantry Division, debuted the M1 Abrams tank at the 1983 Canadian Army Trophy. Among the first battalions in Europe to receive the new tank, 3-64 Armor's CAT team placed first among the competing companies. Its platoons placed second, third, and ninth. These results marked a significant accomplishment for the United States, particularly in the context of prior CAT competitions. They also reflected well upon the Abrams tank and American gunnery training. (72) One British article described the American CAT performance as "a tour de force." (73)

American observers were understandably impressed, exemplified by the comments of a technical advisor. He noted:

The M-1 was awesome. The first platoon of the 3rd of the 64th came on line with such style and grace that they made the rest of the competitors look like lumbering bulldozers. And then, they came off the line with such a rapid and accurate response to the first array of targets that they left the spectators gasping in amazement. (74)

The top scoring platoon of 3-64 Armor performed well in its machine gun and firing-on-the-move engagements, and it earned the highest point total for any platoon during its third bound engagements. The other two platoons earned high scores for machine gun engagements, one scoring the highest of any platoon, but one platoon attained only an average score for targets engaged while moving, and the other one encountered difficulties on its final bound. (75) The company's overall performance benefited from using new tanks with limited barrel wear. The M26 muzzle boresight device worked well with the new platforms, but at least one technical advisor worried about the effectiveness of the device to properly align the gun and sights as the barrel developed significant wear. In his view a tunable boresight was required lest alignment adjustments beyond the capability of the M26 were required. Citing an Armor Center report, he noted:

Essentially, the M26 is an obsolete design serving the most modern fire control. When given a choice, tank crews will opt for the tunable boresight to optimize the gun center alignment. The M-26 is not tunable because it uses a non-linear adjustment (Fort Knox Report), which would require every tank commander to become an optician." (76)

Despite concerns manifest by some CAT personnel concerning the M26, the crews of 3-64 Armor were well trained and confident in their abilities. Target malfunctions forced the official timing of engagements and target appearances to stop, while the problems were addressed. These disruptions benefited the crews, since they received more time to complete their battle runs and search for target locations. (77) Nevertheless, the competition results proved a good news story for the Abrams tank and the U.S. Army, helping to offset but not quite quash the negative media attention received in recent years.

### Britain's Challenge

The United Kingdom competed in CAT 1983 as part of NORTHAG. The Royal Scots Dragoon Guards provided the CAT team, and the subordinate platoons executed their battle runs with the Chieftain. This vehicle retained its unique status as the only competitor carrying a 120-mm rifled gun. Moreover, by CAT 1983 it also featured the Improved Fire Control System (IFCS), which utilized a computer to calculate more accurate firing solutions. The laser rangefinder determined the range, while data provided manually by the crew and automatically by sensors provided information related to the ammunition type, barrel wear, propellant temperature, vehicle speed, target motion, and trunnion tilt. When the gunner acquired a target, he used the laser rangefinder to determine range and then relied upon the computer to traverse and elevate the gun. The appearance and movement of an ellipse-shaped aiming point in his sight indicated the computer's progress. The target appeared centered inside the ellipse when the gun had been laid on target. The gunner then determined whether to accept the computer solution. If he did, he waited momentarily for the gun to settle and fired. If he did not, he laid the gun himself. This decision rested entirely upon the gunner (or tank commander's) judgment. No established standards existed to guide whether or not to accept the computer autolay. Overall, however, IFCS provided a more precise ballistic solution and improved weapon accuracy. (78)



*Britain's mighty Chieftain. (U.S. Army Armor School Archives)*

IFCS did require some additional maintenance tasks and regular testing during firing periods. However, during CAT 1983 the British CAT team benefited from the direct support of contractors and Royal Electrical and Mechanical Engineers (REME), particularly in maintaining the operability of the IFCS and laser sight. Although some vehicles suffered from mechanical wear, particularly in their elevation and traverse gearboxes, none experienced IFCS or laser rangefinder failures during battle runs. The CAT tanks proved reliable throughout the competition without experiencing any major faults or breakdowns — a significant achievement given the longstanding issues with the L-60 engine. Indeed, throughout their training for the competition, the Royal Scots Dragoon Guards achieved high gunnery scores. (79)

The combination of IFCS, functioning vehicles, and skilled crews made likely a strong British performance in CAT 1983. Instead, the British team placed ninth overall and last place among the NORTHAG teams. In terms of country placement, the United Kingdom placed last among the six participating nations. The British platoons finished 18<sup>th</sup>, 22<sup>nd</sup>, and 26<sup>th</sup> out of the 30 competitors. Compared to other nations, the British proved remarkably consistent in their performance with less than 2,000 points separating the highest and lowest scoring platoons. Bad luck plagued one of the platoons, when a target malfunction occurred during the moving fire engagement between bounds. The unit hit the main gun target in six seconds and hit 35 of 40 machine gun plates. However, the target failure forced the unit to rerun the moving engagement phase, resulting in a final score lower by 1,125 points. (80)

Royal Armoured Center Director Major General R.M. Jerram noted the contrast between expectations and results as he observed the Royal Scots Dragoon Guards at the competition:

One of the SCOTS DG's troops started its battle run full of confidence and acknowledging with waves from their turrets the vociferous support of their many well-wishers amongst the spectators. They returned black with despondency at having achieved "only 16 first round hits" (out of a possible 24). (81)

Consistently low scores did not encourage confidence in British tanks. Negative press coverage ensued. The headline of one article read, "US Smarter: UK Smarting." It contrasted the poor showing of the professional British CAT team with the higher scores achieved by conscripts among the competing nations. Moreover, "it could be assessed that Britain's fielded tank firepower fortunes have reached a nadir in relation to those of her allies." The article noted the absence of a fin-stabilized armor-piercing round considered necessary to destroy a T72. The author proved singularly unimpressed with IFCS, since the accuracy of other platforms seemed much better. As a result, "no crew can relish the thought that it might not succeed in hitting its target, nor that it might not kill it if it did." (82)

Analysis of the root causes of the poor performance at CAT focused upon Chieftain's limitations in a competition setting. The tank's 120-mm main armament possessed significant destructive potential, but it was considered less accurate than the more common 105-mm guns used in CAT due to its size and weight. The 120-mm rifled gun took longer to lay on target and settle, and its separated ammunition required more time to load than fixed rounds. The muzzle blast of the larger caliber weapon made sensing more difficult, particularly since Chieftain did not yet possess a thermal imaging system to see through the obscuration. Despite regular watering of the firing points, the dry June conditions increased the muzzle blast obscuration effect. These characteristics did not nullify Chieftain's combat potential, but they did increase engagement time thereby contributing to a lower CAT score. (83)

IFCS offered a more precise firing solution and better accuracy, but only if the gunner waited for autolay to complete and the gun to settle. If he did not, accuracy suffered. CAT, however, rewarded quick engagements rather than patience, and amid the stress and tension of a battle run some gunners

fired too soon. A missed target garnered no points, no matter how fast an engagement occurred. Gunners also struggled with an aiming ellipse designed for standard NATO targets rather than the smaller ones used in CAT. Hence, gunners experienced difficulty centering the ellipse on the target and making fine aiming adjustments. (84)

The gunner's work was probably not facilitated by the tank commander screaming out fire commands. Yet the loader had no alternative means of hearing the orders. His vehicle helmet linked to the vehicle intercom interfered with his loading duties, and only two headsets were issued to the vehicle. Thus the loader depended upon a verbal prompt communicated without benefit of a microphone. This problem was later resolved, but not in time for CAT 1983. (85) High volume verbal orders, however, had become something of a tradition that Royal Armoured Corps director Major General R.M. Jerram questioned. He wondered:

... whether the long-standing practice of yelling fire orders and acknowledgments is appropriate when dealing with computers, lasers, etc. It may have inculcated a sense of urgency when procedures were so manual but today it may cause people to 'flap' when handling sophisticated, precision instruments. As one goes round training wings anywhere people in Tactical, D&M [Driving and Maintenance] and Signal Wings talk in normal civilized tones, whereas in Gunnery Wings everybody is always bawling at everybody else which, with boom microphones, seems superfluous. I am finding out what our allies do in this respect (and it was noticeable at Hohne that their troop nets were all much quieter than ours)... (86)

The British also reviewed the reports on CAT performance provided by retired American Colonel John Frost, a retired armor officer serving as a technical advisor to the NORTHAG CAT teams. Frost criticized the British Pye-Watson muzzle boresight device and recommended use of an alternate tunable one. He also noted inaccuracies with the British laser rangefinders. (87) Frost was thought to be an agent of the company manufacturing the tunable boresight, but his views nevertheless received serious consideration. His comments regarding laser rangefinders proved disconcerting, because legal constraints restricted their use to specially designated ranges that complicated testing and adjustment. Development of the Field Optical Rangefinder Test Equipment (FORTE) offered the potential for safe and legal testing in varied settings. Fielding plans included distribution to tank crews. (88)

The British acknowledged competition shortcomings, but did not believe the CAT 1983 results accurately reflected their armored capability. Hence, an analysis completed in October concluded:

It was necessary to see CAT in the right perspective. The competition was false in many way and did not pretend to be a complete test of the system [Chieftain and IFCS]. Thus it was necessary to guard against over-reaction at the results of CAT 83 and the 'knocking' of the capability of the Chieftain and IFCS. No stone would be left unturned, however, to provide the wherewithal to compete successfully in the future. (89)

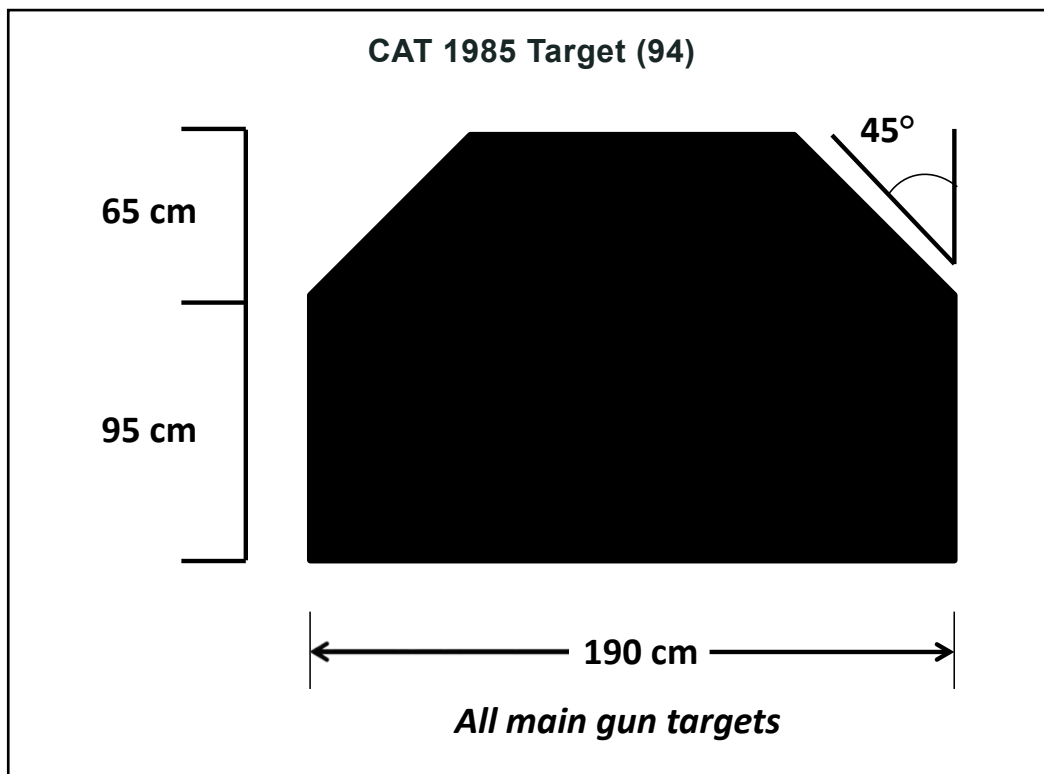
The army in fact considered withdrawing from further CAT participation. The competition did not reflect the combat conditions for which its tanks were designed, resulting in a poor showing and negative media coverage. Participation offered few advantages, but it risked the erosion of confidence in the United Kingdom's tank fleet at home and abroad. Nevertheless, the British did not wish to withdraw after a weak performance, preferring instead to improve their competition standing first. Nor did they want to insult the Canadians. (90)

Therefore, the British pursued modifications to IFCS to boost its accuracy. The principal improvement included a software improvement to provide a smaller aiming ellipse in the gunner's sight. Testing and further development soon indicated the operational value of the change, resulting in fielding plans for the entire tank fleet. The low cost associated with this modification in

comparison with hardware changes encouraged universal fielding. Moreover, broader distribution dispelled any perception of cheating through the creation of a “CAT special.” The early identification of the Royal Scots Dragoon Guards to once again represent Britain in CAT 1985 also resulted in that unit’s early receipt of the software to begin familiarization with the new aiming ellipse. By March 1985 development and fielding neared completion. (91)

Modification of the aiming ellipse benefited from a change in CAT target size. The 1983 competition utilized two different target sizes. In preparation for CAT 1985, the Committee of Control opted for a single target size intended to represent the turret of a T72. The British accordingly optimized their aiming ellipse to match. However, the small size of the target still posed a challenge to Chieftain gunners. Early live fire testing with the new ellipse generated hit rates of just 50 percent, a figure not likely to make a positive impact under competition conditions. Analysts cautioned against generating high expectations for CAT 1985. (92) Instead they suggested a more sobering course of action:

In view of the recriminations last year, we believe that it might be advantageous to calculate the theoretical hit rate well before we start the work up firings. It would not be our intention to release these on a wide distribution, but they could be used to dispel any tendency to blame SCOTS DG for failing to achieve 100% percent hit rate! (93)



The British also pursued a second modification to IFCS. Analysis of the 1983 competition results suggested that gunners fired before the completion of the computerized autolay process. Premature firing reduced accuracy, though it was likely prompted by the competition atmosphere. To avoid this problem, the British sought to provide tank gunners a clear, visible indication as to when autolay completed. Despite its potential value, it was abandoned when it became clear through testing that technical complications precluded a reliable indication of autolay completion without compromising weapon accuracy. (95)

The combination of negative publicity and sustained poor performance by the Chieftain in CAT 1981 and 1983 led the British to explore alternatives in preparation for CAT 1985. The Challenger tank quickly attracted attention. It entered service with the British army in 1983, featuring Chobham armor and a more reliable and powerful engine. Its speed and smooth ride contrasted sharply with the slow, shuddering movement of the Chieftain, creating a disparity in performance that discouraged plans for a mixed tank fleet. (96) Challenger also carried the L11 120-mm rifled gun that would be linked to a new fire control system known as the Improved Computer Sighting System (ICSS).



*The CAT 1985 patch for the Royal Scots Dragoon Guards, which includes a unit crest superimposed upon a NATO emblem. (Ron Mihalko)*

Challenger thus represented a significant capability improvement. However, the platform was not yet ready for the Canadian Army Trophy. Fielding advanced at a slow pace with only one regiment fully converted to Challenger by the end of 1984. Nominating this unit for CAT 1985 simply created another burden for tank crews already working through the teething and familiarization problems typical of new platforms in addition to annual training requirements. Nor did the few Challengers produced yet carry ICSS, which remained in development. Instead they relied upon IFCS. Rushing Challenger into CAT ran the risk of tarnishing the new tank's reputation without the potential to demonstrate superior performance. (97) British CAT strategy therefore planned to rely upon Chieftain in CAT 1985 while preparing Challenger with ICSS for the next competition anticipated in 1987 or 1988. (98) The next Canadian Army Trophy performance would likely be other than stellar. It would also attract attention. Therefore as early as July 1984, the commander of the I British

Armoured Corps recommended actions to lower the visibility and profile afforded to CAT 1985. He specifically suggested the curtailment of any major media campaign and urged not inviting the Chief of the General Staff to reduce further the attention paid to the event. (99) Early damage control seemed the wisest course of action.

In the meantime, the Royal Scots Dragoon Guards prepared for CAT 1985. Its early nomination enabled planning and preparations for the competition to begin nearly a year in advance. By August 1984 a support working group had been formed to address a broad array of logistical actions. Such an organization had convened to support the 1983 competition, and it received a singular mission: “to provide faultless tanks for CAT 1985.” This support group managed a detailed inspection program focused upon IFCS and part supplies to ensure the units received maintenance priority over all other regiments. The Royal Scots Dragoon Guards still performed routine training and active duty responsibilities, but its CAT designation ensured unusually high levels of support for training and vehicle maintenance. (100) Consequently, the unit experienced few materiel problems during its preparations, and those that arose were quickly resolved. (101)

**Royal Scots Dragoon Guards CAT 1983 Training Schedule (102)**

<b>Event</b>	<b>Date</b>
Selection of CAT MBT	By 2 NOV 1984
Form CAT (Eagle) Squadron	By 10 NOV 1984
GTS training and MBT preparation	12-16 NOV 1984
Final CAT regulations produced	By 19 NOV 1984
Preliminary firing at Bergen-Hohne	19-23 NOV 1984
Post firing maintenance, training, and vehicle preparation	26 NOV-21 DEC 1984
Training and vehicle preparation	21 JAN -22 FEB 1985
CAT ONE—GTS fire control, rules and troop training; preparation of all MBTs	25 FEB- 15 MAR 1985
CAT ONE—Firing at Bergen-Hohne	18 MAR-4 APR 1985
Shoot against another regiment if required	28 MAR 1985
Post firing maintenance	9-19 APR 1985
CAT TWO—GTS training, final MBT preparation	20 APR—17 MAY 1985
CAT TWO—firing at Bergen-Hohne	18-31 MAY 1985
Shoot against another regiment if required	23 May 1985
NORTHAG Shoot at Bergen-Hohne	3-7 JUN 1985
Team registration	7 JUN 1985
CAT 85 competition	10-14 JUN 1985

The training program proved less hectic and more measured than had characterized preparation for CAT 1983. It encompassed a steady progression of events centered upon live fire gunnery events conducted at Bergen-Hohne between November 1984 and May 1985. In the process the crews became familiar with the CAT environment and the rules that would govern the battle runs and related scoring. Particularly beneficial was the gunnery conducted in late May, less than a month before the competition began. Traditionally, the proximity of live fire gunnery shortly before CAT ensured a high state of readiness for the participating team. In 1985 the Royal Scots Dragoon Guards received a second boost to final readiness in the form of a NORTHAG team shoot conducted from June 3-7, one week before CAT began. This event served to prepare all NORTHAG teams for the competition and provide some exposure to the stress and atmosphere to be expected. (103)

The Royal Scots Dragoon Guards entered CAT 1985 with confidence. They had completed a robust training regimen focused upon tank gunnery in addition to the normal activities required of armored units serving in the British Army of the Rhine. Their Chieftain tanks had benefited from software upgrades to improve aiming and the high importance attached to overall vehicle maintenance. The regiment was also no stranger to CAT, having participated in three previous competitions. Trained, ready, and confident, the conditions seemed set for a credible British performance.

### **CAT 1985 Rules**

The rules for CAT 1985 reflected similar concerns and related negotiations among the participating nations as in prior years. Training for the competition restricted range access for gunnery training to the amount of time normally allocated for a unit without special consideration for CAT participation. Total main gun expenditure was similarly limited. Live main gun firing was prohibited after June 7, but all CAT teams received access to the competition range on Bergen Hohne (Range 9) from June 1-2 for a safety orientation. Afterward, no team personnel were allowed on the range. The tanks used in the competition had to reflect the national standard rather than ones optimized for CAT. The NORTHAG and CENTAG teams each included 10 four-tank platoons. All of the personnel for these units had to be finalized two weeks prior to the competition with the name and duty position of each crew member submitted to the chief judge. Personnel changes after that point were limited to those individuals designated as reserve. All of these conditions sought to prevent any team or nationality gaining an unfair advantage either in the acquisition of range information or in the allocation of resources — a particularly sensitive point for the smaller NATO participants. (104)

The essence of the competition remained unchanged. Each platoon conducted a battle run that included three bounds, or firing points. During the course of the battle run, the platoon would be faced with a total of 24 targets. Ten different target configurations were used in the competition to reduce the chance of a platoon obtaining advance knowledge of target location by simply observing earlier battle runs. All firing points were watered by range personnel before the start of each battle run to ensure that all platoons faced similar dust and obscuration conditions. This action also served to prevent those vehicles with thermal imaging from attaining a clear advantage over those platforms that did not, including the British Chieftains. (105)

At the start of the battle run, a competition judge directed each platoon to move to the first bound. The unit moved as prescribed with weapons unloaded. At the first bound, tanks were given two minutes to load weapons. Upon completion and an indication of readiness, the platoon was directed to watch its front. After a minimum of 30 seconds, between two and six targets would begin to appear. The main gun targets included a mix of moving and stationary panels presented at different angles to the firing unit and presented at ranges between 1,200 and 2,000 meters. There were no limitations on how each platoon engaged the targets. They could be engaged by all or part of the platoon. Eight groups of ten falling plate targets provided machine gun targets, distributed throughout the battle run. They represented deployed dismounted troops to be engaged at ranges out to 1,000 meters. Target appearance was indicated by a single puff of smoke regardless of the actual number of targets to be engaged. Platoons then had 40 seconds to spot and engage main gun targets before they disappeared. When all had been hit or the maximum time to engage elapsed, the platoon would be notified that their front was clear, and the unit began moving to the next bound. Enroute to the second and third bounds, they would engage main gun and machine gun targets while on the move. A vehicle that halted for any reason and then fired at the next bound caused the entire platoon to receive a score of zero for that bound. Engaging a machine gun target with a main gun also resulted in no points, regardless of whether the target was destroyed. The movement from bound to bound had to complete within a time limit established by the chief judge to avoid penalty points. (106)

Each tank carried 10 main gun (HEAT, HESH, or TPDS/T) and 250 machine gun rounds. Machine gun ammunition restricted tracer to one in four rounds. Reserve ammunition was also carried,



but it could only be accessed on a judge's authority. The limitations on ammunition necessitated platoons work as a team, since no single vehicle possessed sufficient rounds to engage all targets. Misfires were not sufficient reason for a battle run to be suspended. Time limitations remained in effect, and crews had to resolve the problem while continuing operations — much like a combat environment. There was no repeat of an engagement in which a misfire occurred, and the round did not count toward the ammunition conservation bonus. Similarly, no extra time was offered for mechanical failures. In such cases, the tank commander notified the range control tower, but the battle run continued. The impacted tank sought to fix the fault, and if successful, then sought permission to re-join his platoon's battle run. Safety concerns constituted the principal factor in determining whether to stop a battle run, but the authority to do so lay with the judges. (107)

The chief judge and the panel of assistant judges oversaw the entire competition. The chief judge came from the host army group, while each participating nation provided two additional judges separate from both the Committee of Control or any CAT team. The chief judge, however, held considerable authority over the competition. His rulings were considered final and not subject to appeal. Upon the completion of a battle run, the panel of judges completed score sheets, and then evaluated the performance in accordance with scoring standards. They conferred and physically confirmed all main gun target hits. The focus of scoring lay in rapid, accurate hitting within the 40 second window. Targets might be hit multiple times, but a successful hit did not include ricochets or splintering. In all cases of uncertainty, the chief judge issued a ruling. (108)

### CAT 1985 Scoring (109)

<b>Points earned</b>		
Hit scoring (main gun)	Successful engagement	500 points
Time scoring (main gun)	Sliding scale with maximum points for engaging target within 1 second and no points for engaging target at 40 or more seconds	500 points (1 second) 0 points (40+ seconds)
Ammunition bonus (main gun)	Each round remaining at the end of a battle run in which all targets hit	100 points
Hit bonus (main gun)	All 24 main gun targets hit	500 points
Machine gun engagement	Each falling plate	25 points
<b>Penalty points</b>		
	Failure to arrive at bound in the specified time	-600 points
	Unauthorized use of reserve ammunition	-1000 points
<b>Maximum Point Allocation for Platoon Battle Run</b>		
	Hit Score (24 targets x 500 points)	12,000 points
	Time Score (24 targets x 500 points)	12,000 points
	Hit Bonus (500 points)	500 points
	Ammunition Bonus (16 rounds x 100 points)	1,600 points
	Machine Gun Score (80 plates x 25 points)	2,000 points
	<b>Maximum Total Score for a Platoon</b>	<b>28,100 points</b>

### CAT 1985

In keeping with the shift from national to army group orientation, host responsibilities alternated between NORTHAG and CENTAG headquarters. In 1985 NORTHAG hosted the Canadian Army Trophy at Bergen-Hohne. The actual event occurred June 10-14 with battle runs conducted on Range

9, which featured a mix of 84 potential moving and stationary targets spread over the length of 1.2 miles. (110)

On each day of the competition, each team received time to conduct system checks, boresight, and zero weapons. Upon completion vehicles moved to the quarantine area where, as in the previous competition, they remained under tight communication and movement restrictions to prevent the acquisition of advance knowledge of the target array they would face. Umpires ensured the correct ammunition loads had been stowed. A wait of 45 minutes or more then ensued before a platoon moved to the competition range. There it received two minutes to make final checks. Upon notification from the judges, the battle run commenced. The platoon moved from bound to bound, engaging different types and configurations of targets. The distance between bounds varied from 600 to 900 meters. (111)

In preparation for the competition, the Americans and Germans designated three units to prepare CAT teams, reflecting the larger size of their armored force in Europe. The other participants nominated one unit. All CAT teams included three platoons, but only two actually conducted battle runs. The third served as a reserve element. All platoons utilized a four-tank organization. In total the NORTHAG and CENTAG teams each included ten platoons.

Amid periodic bouts of bad weather and heavy rainfall, the competition ended with the NORTHAG team beating CENTAG with a final score of 190,755 to 185,656 points. The army group scores reflected the cumulative totals of the subordinate platoon scores. Despite the shift in focus to army group, interest in national performance remained high and subject to intense scrutiny by the press and military establishments alike.

**CAT 1985 Platoon Scores (112)**

<b>Army Group</b>	<b>Nationality</b>	<b>Unit</b>	<b>Score</b>
<b>CENTAG</b>	Federal Republic of Germany	Panzer Battalion 244	22,037
<b>CENTAG</b>	United States	3-64 Armor	21,934
<b>NORTHAG</b>	Netherlands	43 <sup>rd</sup> Tank Battalion	21,364
<b>CENTAG</b>	United States	3-64 Armor	21,321
<b>CENTAG</b>	Federal Republic of Germany	Panzer Battalion 244	20,560
<b>NORTHAG</b>	United States	2-66 Armor	20,341
<b>NORTHAG</b>	United States	2-66 Armor	20,305
<b>NORTHAG</b>	Federal Republic of Germany	Panzer Battalion 24	20,011
<b>NORTHAG</b>	Netherlands	43 <sup>rd</sup> Tank Battalion	19,914
<b>CENTAG</b>	Federal Republic of Germany	Panzer Battalion 63	19,746
<b>NORTHAG</b>	Federal Republic of Germany	Panzer Battalion 24	19,611
<b>CENTAG</b>	Federal Republic of Germany	Panzer Battalion 63	18,957
<b>NORTHAG</b>	Belgium	2d Lancers	18,152
<b>NORTHAG</b>	United Kingdom	Royal Scots Dragoon Guards	17,829
<b>CENTAG</b>	United States	3-32 Armor	17,718
<b>NORTHAG</b>	Belgium	2d Lancers	17,664
<b>NORTHAG</b>	United Kingdom	Royal Scots Dragoon Guards	15,564
<b>CENTAG</b>	Canada	Royal Canadian Dragoons	15,175
<b>CENTAG</b>	United States	3-32 Armor	14,909
<b>CENTAG</b>	Canada	Royal Canadian Dragoons	13,299

Analysis of the final scores showed the domination of the competition by the United States, the Federal Republic of Germany, and the Netherlands. These nations filled the top 12 of 20 platoon scores, and the top six company placements. This clear trend did not reflect the larger size of the German and American armored forces or access to a greater resource pool. The Netherlands possessed a relatively small armored component, and it certainly trailed the other two nations in terms of available resources. Training played a role, but all participating nations, regardless of final placement, devoted considerable energy to ensuring their competition teams possessed a high degree of readiness and capability.

The principal difference separating the Americans, Germans, and Dutch from the other participating nations lay in the employment of newer and more capable tanks. The 3-64 Armor entered the competition with the M1 Abrams Improved Performance (IP). This platform differed from the M1 through the addition of extra armor and a more robust suspension. It retained the same 105-mm gun and fire control system as the M1 used in the competition by 2-66 Armor. The 3<sup>rd</sup> Battalion, 32<sup>nd</sup> Armor Regiment (3-32 Armor), however, still retained the M60A3, and ranked the lowest of the three American CAT teams. It placed 15th and 19th out of 20 at the platoon level and ninth place among the CAT company teams.

<b>CAT 1985 Company Team Placement (113)</b>	
<b>Parent Battalion</b>	<b>Nationality</b>
1—A Company, 3 <sup>rd</sup> Battalion, 64 <sup>th</sup> Armor	United States
2—2 <sup>nd</sup> Company, Panzer Battalion 244	Federal Republic of Germany
3—A Squadron, 43 <sup>rd</sup> Tank Battalion	Netherlands
4—C Company, 2 <sup>nd</sup> Battalion, 66 <sup>th</sup> Armor	United States
5—2 <sup>nd</sup> Company, Panzer Battalion 24	Federal Republic of Germany
6—3 <sup>rd</sup> Company, Panzer Battalion 63	Federal Republic of Germany
7—2 <sup>nd</sup> Lancers	Belgium
8—C Squadron, Royal Scots Dragoon Guards	United Kingdom
9—B Company, 3 <sup>rd</sup> Battalion, 32 <sup>nd</sup> Armor	United States
10—B Squadron, Royal Canadian Dragoons	Canada

The Germans and Dutch debuted the Leopard 2 at the 1985 Canadian Army Trophy competition. The origins of the Leopard 2 lay in the desire of the United States and the Federal Republic of Germany to field a common tank. An agreement between the two nations signed in 1963 triggered the start of design work on what became known as MBT 70. The first American prototype emerged in 1966 with a German model completing the following year. However, high program and expected life cycle costs, the complexity of the new technologies being pursued, and the inability to meet development deadlines resulted in the cancellation of the joint program in 1970. The United States tried to sustain the program on its own, resulting in the abortive XM 803. When this effort also failed, an entirely new program began that ultimately became the M1 Abrams. (114)

During the course of MBT 70 development, the Germans independently explored the modernization of key components of the Leopard 1. Following the cancellation of the MBT 70 program, the Germans faced a decision between expanding the Leopard 1 modernization effort into a complete tank program or pursuing a new start program that incorporated MBT 70 concepts, including a gun/missile launcher. By 1971, however, work on a missile-equipped tank halted. Between 1972 and 1974, the Germans built 16 different chassis and 17 turrets. The principal thrust of this development lay in providing a more powerful main armament with an integrated fire control system. Initially, the Germans favored a gun armament with a dual laser and optical rangefinder in a turret compatible with the Leopard 1 hull. Prototype development and testing continued between 1972 and 1974, including cold weather trials in Shilo, Canada. Hot weather testing occurred at Yuma, Arizona. In the

midst of this development and testing period, analysis of the 1973 Arab-Israeli War highlighted the importance of ballistic protection. The Germans therefore opted to increase armor, initially in the form of applique turret armor. (115)

The tests in American and Canada attracted U.S. attention. In 1974 Germany and the United States sought to standardize tank program components. One German prototype was sold to the U.S. for testing, but the Americans considered the armor protection insufficient, the fire control system too complex, and the overall vehicle too expensive. Nevertheless, interest emerged in the conduct of a comparative test between emerging German tank designs and the XM1. In preparation, Germany built another prototype to satisfy American cost and performance requirements. Designated the Leopard 2 Austere Version (AV), this vehicle included spaced armor for the hull and turret and a 105-mm gun similar to that intended for the XM1. Two prototypes of the Leopard 2 AV were built and delivered to the U.S. for comparative testing between September and December 1976. (116)

American analysis of the results favored the XM1 for its better ballistic protection, but found both designs comparable in firepower and mobility. The Americans, therefore, selected the XM1 for continued development. The Germans perceived the test as a means for the United States to study German technology and concepts in detail and incorporate them into their preferred, homegrown design. They noted that the Leopard 2 AV demonstrated a higher probability of hitting targets than the XM1, particularly when firing on the move. The Leopard proved more expensive than the American design, but possessed capabilities not present on the XM-1 used for testing, including NBC protection, deep fording, and a commander's independent sight. (117)

In the wake of the comparative tests, the Germans opted to use the Leopard 2 AV as the baseline for further development. They upgraded the armament to a Rheinmetall 120-mm smoothbore gun in the process. Following firing tests, the German government opted for series production in September 1977, ordering a production run of 1,800 vehicles. Additional testing continued through 1978 and 1979, prior to the acceptance of the first Leopard 2 by the German army in October 1979. Fielding priority went to the armored school and those panzer divisions still equipped with the Leopard 1 and stationed in areas most threatened by a possible Warsaw Pact attack. These Leopard 1s then replaced the M48A2 platforms still in service with panzer battalions assigned to panzergrenadier divisions. (118)

The Leopard 2 weighed over 60 tons combat loaded. It featured a four-man crew, spaced armor, armored skirts, and an automatic fire detection and suppression system. Ammunition stowage was split between the hull and turret, utilizing an armored bulkhead and roof blowoff panel to prevent the vehicle's catastrophic destruction in the event of a penetration of the turret ammunition compartment. Smoke mortars provided the means to screen movement. The diesel engine lay behind a fireproof bulkhead. It was designed for easy access and quick powerpack replacement. It generated 1,500 horsepower to move the tank over roads at more than 40 miles per hour. The tank possessed a maximum road travel range of over 300 miles. A fault detection system alerted the crew to engine problems and was later modified to provide similar fault indicators for the gun control system. (119)

The tank's weapons included a coaxial machine gun, a machine gun for the loader, and a 120-mm smoothbore gun. The Germans favored the larger caliber for its greater lethality. They also found the smoothbore more effective than the rifled guns generally in use by NATO forces. Compared to a rifled gun, the smoothbore generated higher gas pressure, providing greater muzzle velocity with less wear on the gun barrel. Traditionally, the rifled gun had been favored because the rifling imparted a spin to the round fired, enhancing its accuracy. However, the emergence of the fin stabilized sabot round meant that such spin was generated by the ammunition and no longer dependent upon rifling. Facing the mechanized threat posed by the Warsaw Pact, the Germans optimized their anti-armor capability through the use of fin-stabilized ammunition and a smoothbore main gun. (120)



The German Leopard 2. (U.S. Army Armor School Archives)

The gunner possessed a primary stabilized sight with 12-power magnification. Like other tanks of its generation, the Leopard 2 gunner moved the sight to keep his reticle on the target. The tank's computer calculated a precise ballistic solution and moved the gun accordingly. Moving the sight did not directly move the gun as it did on the British Chieftain. The computer relied upon range data from the laser rangefinder and other inputs provided automatically via vehicle sensors or manually by the crew. Collectively, this data included such information as atmospheric pressure, temperature, crosswind speed, ammunition type (inputted by the loader rather than the gunner), vehicle cant, speed, and target movement. Height corrections and lead angle were automatically determined. Keeping the reticle on the target provided a continuous data feed to the computer regarding the target. In the event of battle damage or a malfunction to the fire control system, the gunner utilized an emergency sight located right of the gun. This sight was considered to be not as good as the Leopard 1 sight, and it was slaved to the gun. (121)

Preproduction models included a muzzle reference system, which the Germans referred to as a field zeroing system. It enabled the gunner to check quickly gun and primary sight alignment and make appropriate adjustments. Like the MRS found on other NATO tanks, it relied upon a mirror mounted on the muzzle, but it was found to be too fragile and deleted from early production models. It would not emerge on production vehicles until the mid-1990s with the digitized Leopard 2A4. (122)

Similarly, the first Leopard 2 tanks fielded to the German army did not possess thermal imaging. Instead they relied upon an image intensifying camera mounted on the gun mantlet. The resultant image was seen by the gunner on a screen at his station. A thermal imaging system began to replace

image intensification in 1983, and new production vehicles carried thermal imaging beginning with the Leopard 2A1 in 1982. (123)

The tank commander's position featured six periscopes for external vision while buttoned up. The commander also had another fully stabilized, rotating sight with 2-power and 8-power magnification that enabled him to scan for targets independent of the gunner's action. He could also override the gunner's control of the turret and slew the gun onto a target he identified with this sight. Hence, the commander could locate a target, leave its engagement to the gunner, and begin searching for the next one. This capability increased the tank's lethality and the speed with which it acquired and engaged multiple targets. A commander's independent sight would become a common feature in later tank designs, but it first entered service on the Leopard 2. (124)

In the 1980s, the German army suffered a reduction in the amount of ammunition available for tank gunnery training, and the length of service for its conscripts shrank from 15 to 12 months. These developments encouraged a greater reliance upon simulators in training. Simulators reduced the amount of live ammunition necessary for training and vehicle wear. They further enabled the training and sustainment of gunnery skills, although the Germans considered a mix of simulator and live training the optimal approach to training. (125)

Various types of simulators had been used for years. These devices included wooden replicas of crew stations supplemented with films, photographs, and charts. A modified Leopard 1 replaced the turret with a cab for training drivers, and a similar platform was built for the Leopard 2. For gunnery training, crewmen utilized a gun mounting that depicted the entire main gun assembly on a mobile platform. For gun laying, an entire, powered turret assembly was used. The main gun could not be fired, but the device could be used with a sub-caliber device on a scaled range. Computer-based simulators assisted training in vehicle electronics, weapons, and driving not unlike those that began to emerge in other nations, particularly the United States. In the early 1980s, a new device under development included a replica of the turret stations. Computer screens enabled the crew to "see" a battlefield and engage targets based on scenarios provided by the instructor, who could also observe the crew's actions during target engagement. The computer not only determined the effectiveness of gun laying, it also recorded the data for future review. (126)

By early 1985, the Germans had begun pilot testing of a new device for tank gunnery training. A camera mounted inside a tank turret showed the gunner's view from his sight. Transmitted via radio link to the instructor's station, it permitted the latter to see the gunner's actions. When the gun fired, the image sent to the instructor also included fire control data. Other cameras set up on the range enabled observation of the fall of shot. They could be moved remotely, and, together with the gunner's sight image, enabled a more effective assessment of gunner's action and gun lay. The cameras transmitted their imagery via a radio link, but the instructor could use a similar link to speak directly to the crew. In the event it became obvious a gunner was going to miss his target, the instructor possessed the means to interrupt the firing circuit and prevent firing, thereby saving the cost of a live round. The voice links could be monitored or recorded to permit analysis of fire commands. Collectively, the system offered a powerful tool for live fire, dry fire, and competition preparation, since it was possible to offer a much more detailed assessment of a target engagement than otherwise possible. It was not a computer-based simulator, but it provided a means to see both the gunner's view and the point of impact while communicating with the crew. (127)

The Dutch recognized the value of the system and played a role in its testing. Indeed, Dutch confidence was reflected in the early order of 22 units for their own trials, and in the weeks before CAT 1985, several were already in service. Other nations followed suit and began their own tests of the German system. (128)

The combination of a new tank and training devices with traditionally robust training ensured a strong German performance in CAT 1985. Indeed, a platoon from Panzer Battalion 244 with Leopard

2 tanks became the top scoring platoon of the competition with a score of 22,037 points. The unit achieved one of the highest scores at the first bound and never faltered thereafter. It performed well in its machine gun engagements and earned the highest score in CENTAG for engaging targets while moving. Despite this stellar performance, it only beat the second place American platoon by 103 points — evidence of the strong competition present. The other platoon of Panzer Battalion 244 garnered fewer points at every bound, but it turned in a credible performance, including one of the highest scores for hitting targets on the move, and secured fifth place overall. (129)

Panzer Battalion 24 platoons, also equipped with the Leopard 2, did not perform as well. They placed eighth and 11<sup>th</sup>, which still constituted a strong showing against the other participants. The Panzer Battalion 63 CAT team competed with Leopard 1 tanks. Despite the older platform and fire control system, these platoons remained highly competitive. Indeed, one platoon placed higher than a Leopard 2 platoon from Panzer Battalion 24, indicating the importance of training and factors other than materiel. In general, the performance of German platoons in the 1985 competition proved much more consistent than in previous years. The point spread between platoons of the same CAT team lacked the wild variance that characterized earlier battle run scores. (130) Asked about the German performance by a journalist, the commander of the top scoring platoon responded, “I think we had sort of a Bavarian coolness, you know.” (131)

At the start of the 1980s the Netherlands sought to upgrade its tank fleet, then consisting of a mix of Leopard 1s and obsolescent Centurions. For the former, a modernization program provided additional armor, fire control improvements, and the addition of thermal imaging. Holland’s positive experience with the Leopard 1 encouraged early interest in the Leopard 2, but the American XM1 also attracted its attention. Based upon its own assessment of the 1976 comparative evaluation of the XM1 and Leopard 2 AV, the Dutch opted for the latter. In 1980, they also entered into an agreement with the Federal Republic of Germany to cooperate upon future development of the Leopard 2. By 1983 the Leopard 2 had entered service with Dutch units, first equipping the 41st and 43rd Tank Battalions, stationed in Germany. (132)



*The CAT 1985 patch worn by the Panzer Battalion 24 team. (Ron Mihalko)*

At CAT 1985, despite the absence of any Bavarian coolness, one platoon from the 43rd Tank Battalion earned the third highest platoon total, less than 700 points behind the top scoring German platoon. The other Dutch platoon placed ninth, still among the top tier of finalists. The Dutch CAT team included 80 percent conscripts, including its commander, who had all joined the military in November 1984. In a seven-month timeframe, these new soldiers had learned basic military skills and mastered a new tank sufficiently to execute a very credible CAT performance. (133) Indeed, following the competition, the British and Dutch teams conducted an impromptu gunnery competition of their own. Once again, the Dutch performed well, leading one British journalist writing about the event to note that “the disparity between the performance of the untutored Dutch and British crews in their standard unburnished Leopard 2 and Chieftain tanks was said to be even more damning.” (134)

Like their competitors, the Dutch sought to assemble the best possible tank crews for the competition, but the shorter duty hours of the conscript army reduced available training time, particularly in comparison with the U.S. Army. (135) Similarly, the 43rd Tank Battalion ostensibly possessed a home court advantage, since it was permanently stationed at Bergen-Hohne. However, the unit did not have unfettered access to the gunnery ranges, having instead to compete for range access like every other NATO user. The Dutch military, however, made a national commitment to the Canadian Army Trophy, and their performance at CAT 1985 ensured that the Netherlands would remain strong competitors in upcoming contests. (136)

Unlike their neighbors, the Belgians participated in CAT 1985 without the benefit of a new tank fleet. Instead, the 2d Lancers competed with their Leopard 1s. It lacked the state of the art fire control systems represented by the Abrams and Leopard 2. The Belgian CAT team did not achieve the highest placements either at the platoon or company level, but it did outperform many of the teams equipped with older platforms, including the British, Canadians, and the American 3-32 Armor equipped with the M60A3.

The Canadians did not fare well at CAT 1985. The competing platoons from the Royal Canadian Dragoons placed 18th and 20th, while the CAT team overall finished in last place. The lowest scoring platoon started with a strong performance at the first bound, performed only average at the second bound, but scored only 652 points at bound three, an exceptionally low score that could not be offset by solid scores for firing on the move and engaging machine gun targets. Its competition fate was sealed by earning a penalty for failing to arrive at a bound in the allotted time. The other Canadian platoon performed better, but not sufficiently to be competitive with other national platoons, and overall its Leopard 1 tanks only managed to beat one of the American platoons from 3-32 Armor equipped with M60A3s. (137)

The poor relative performance of the Royal Canadian Dragoons became the target of the Canadian press. Ottawa's *The Citizen* attacked the unit, noting that “the miserable Canadian performance also cost NATO's Central Army Group, to which Canada is assigned, the overall competition with the Northern Army Group.” The newspaper also seemed to delight in contrasting the performance of Canada's professional soldiers with the conscripts of other participating nations, including Germany and the Netherlands. It acknowledged the inferiority of the Leopard 1 in comparison with the Leopard 2, but noted that the Canadians were also outshot by other teams equipped with the Leopard 1. Reflecting upon the competition, General Leopold Chalupa, commanding NATO forces in Central Europe, commented that “What we have here is a fair representation of the standards across the board.” The *Citizen* used this expression to further underscore just how low Canadian Forces standards must be. (138)

Such scathing press attacks reflected both the rising prominence of the Canadian Army Trophy and criticism of military readiness. By the mid-1980s, the competition began to be depicted in the same light as the Olympic games or the American Super Bowl — major, prestigious events that reflected national capabilities. Strong performances generated and received accolades, while the related tank program received a publicity boost that might translate into increased foreign sales or



some similar vote of financial or political confidence. Poor or even mediocre performance, however, came to be associated with institutional problems within the military. As a result, CAT performance was being equated with military prowess and readiness.

Unfortunately, such association did not take into account the rigorous training undertaken by all CAT team personnel, the feats accomplished by individual soldiers and crews, the myriad factors that could derail a battle run, or the stiff competition represented by the other NATO teams. CAT represented national efforts to push the achievable standards of tank gunnery. It occurred in an artificial environment that differed from combat in significant ways, but all CAT personnel represented some of the best tankers available to each participating army. Press accounts that treated the competition like major sporting events ignored the value of the competition and undermined its purpose of promoting a sense of fraternity and interaction among allies who might one day have to fight together against a Soviet threat. The Canadian Forces, however, were not the only army to suffer negative media coverage for its CAT performance.



*Canadian tankers pose in front of the Leopard 1. (Royal Canadian Armoured Corps School)*

### The United Kingdom's CAT Conundrum

The Royal Scots Dragoon Guards' CAT team placed eighth with its platoons finishing 14th and 17th place in a field of 20 platoons. This performance did not mark an improvement over the previous competition. It proved particularly disappointing in the context of the British training efforts and IFCS modifications. The observation by a Canadian journalist that even with their outdated tanks, the British had still outshot the Canadian platoons proved cold comfort. British press coverage proved brutally honest, exemplified by a *Times* headline that read "British Tank Fares Badly in Contest." (139)

British performance at CAT 1985 proved disconcerting since conditions seemed optimal. An observation made shortly after the competition ended underscored the point:

The training was thorough and the preparation of the equipment meticulous. We had access to the competition range until shortly before the competition. During the competition we had ideal shooting conditions, no breakdowns and the crews shot coolly and well. (140)

Moreover, the reduction in team size to just two competing platoons and a reserve helped the Royal Scots Dragoon Guards cope with other non-CAT commitments. Nor were there any changes since 1983 in the competition platoon size or the total number of targets to be hit. The size of the targets had changed, but their dimensions had been known well in advance. (141)

The same squadron competed in 1983. In its preparations for CAT 1985, it benefited from advisors from the Royal Armoured Center Gunnery School and individuals with prior CAT experience. Major N.D.A. Seymour led the CAT team in 1983, and he continued in this capacity as the squadron commander for CAT 1985. In addition to his competition experience, he also had served in the Gunnery School from 1976 until 1978. The School also provided Majors Cec Swinden and Charlie Pyman to provide additional gunnery expertise and mentor the CAT crews. Another eight soldiers among the competition crews also possessed prior CAT experience. The combination of experience and gunnery expertise resulted in a sound training regimen that progressively honed CAT-critical skills. (142)

During the actual competition, the British platoons benefited from firing in good light and in favorable conditions. The first battle run appeared to go well but only obtained about 15,000 points. Physical inspection of the targets immediately afterward revealed that several targets had been clipped, resulting in no points earned. One battle run had to be discounted due to multiple target malfunctions, but another resulted in a score of nearly 18,000 points. This level was considered the best likely to be achieved by a Chieftain-equipped platoon. (143)

Stress may have influenced performance, particularly during the first battle run, but experienced observers saw no evidence crews became frazzled by the competition atmosphere. This assessment says much about the demeanor of the crews, particularly since the arrival of the Chieftain platoons for their battle runs was greeted by tumultuous crowds yelling "here come the dinosaurs." (144)

**CAT 1985 Performance Statistics (145)**

Rank	Unit	Tank	Kills	Hits	Rounds	MG	Average Kill Time (sec)
1	<i>Pz Bn 244</i>	Leo 2	23	25	33	76	9.36
2	<i>3-64 AR</i>	M1	22	31	40	80	6.20
3	<i>43<sup>rd</sup> Tk Bn</i>	Leo 2	23	27	39	80	10.94
4	<i>3-64 AR</i>	M1	23	26	35	80	11.47
5	<i>Pz Bn 244</i>	Leo 2	22	25	38	69	9.77
6	<i>2-66 AR</i>	M1	22	28	40	80	11.66
7	<i>2-66 AR</i>	M1	22	33	37	76	11.47
8	<i>Pz Bn 24</i>	Leo 2	22	26	31	80	12.55
9	<i>43<sup>rd</sup> Tk Bn</i>	Leo 2	23	24	37	80	15.42
10	<i>Pz Bn 63</i>	Leo 1	23	24	32	77	15.50
11	<i>Pz Bn 24</i>	Leo 2	21	24	39	79	13.72
12	<i>Pz Bn 63</i>	Leo 1	22	23	38	80	16.78
13	<i>2d Lancers</i>	Leo 1	21	25	40	79	16.00
14	<i>RSDG</i>	CH	20	25	39	80	11.83
15	<i>3-32 AR</i>	M60A3	20	26	40	77	13.52
16	<i>2d Lancers</i>	Leo 1	20	27	35	71	12.73
17	<i>RSDG</i>	CH	18	22	38	74	14.26
18	<i>RCD</i>	Leo 1	18	20	39	78	17.93
19	<i>3-32 AR</i>	M60A3	17	24	40	71	14.75
20	<i>RCD</i>	Leo 1	16	21	40	80	19.00

The kill number refers to the number of main gun targets physically inspected and ruled destroyed. The number of hits refers to targets that were clipped or otherwise caused to fall down. The other columns show the number of rounds fired by the platoon, the number of machine gun targets hit, and the average time in seconds taken to kill a target.

**CAT 1985 Vehicle Engagement Speed and Accuracy Data (146)**

Vehicle Type	Average Kill Time (sec)	Percentage of Hits
M1 Abrams	10.23	75.66
Leopard 2	11.93	70.89
Chieftain	13.00	<b>61.04</b>
M60A3	14.10	62.50
Leopard 1	<b>16.22</b>	64.86

With weather conditions, training, and human error largely ruled out, analysis shifted to materiel as the root cause of the poor performance. The data outlined in the charts above reinforced this focus. In terms of hitting targets accurately and quickly, the Chieftain fared poorly in comparison with the M1 Abrams and the Leopard 2. Its engagement time proved faster than the M60A3 or the Leopard 1, but even this favorable statistic was offset by the Chieftain achieving the lowest percentage of hits of any competing tank. Hence, Chieftain became the center point of the competition's postmortem analysis and spurred the desire to employ Challenger in the next CAT event.

The Royal Armoured Corps emphasized the importance of frequently zeroing weapons. Before the first battle runs began, each British tank conducted zeroing procedures that included firing 21 rounds at targets ranged at 1,100, 1,500, and 2,000 meters. At the end of each day of the competition, each tank also conducted accuracy checks, firing seven rounds at a target 1,500 meters distant. (147)

Despite the daily zeroing, improvements in the shot groupings tended to be instantly degradable. On the competition's first day, for example, one platoon zeroed its tanks, but poor results in stark contrast to previous iterations led one crew to exchange its vehicle for a reserve platform. Only two tanks, including the reserve, managed to achieve their previously high zero standard. Part of the problem lay in winds that gusted and kept changing direction. A mean wind reading was therefore utilized, but the wind gusts made its accuracy questionable. During the actual battle run, the wind proved fortuitously constant. The crews also relied upon boresighting and the muzzle reference system to offset the zeroing problem. (148)

Excellent maintenance support for the British CAT team ensured the absence of problems on battle runs. Major components were replaced much sooner than they would have been in a line unit to minimize the risk of failure. Component replacement and continuous adjustment to optimize performance resulted in the competition vehicles being virtually rebuilt in the process. Hence, the competition tanks were probably at their peak performance level, but the continuous work required to reach this state during the months leading up to CAT may well have undermined crew confidence in their vehicles. Neither the German nor American CAT teams required such extensive overhauling of their tanks. (149)

The main armament of the competition platforms proved very reliable. Technical support provided by contractors helped each crew to make adjustments based on individual gunner preference. Accuracy improved by removing shims from the traverse and elevation gearboxes and by tightening the mechanical linkage between the sight and main gun. These refinements reduced free play and facilitated fine adjustment when laying the gun on target. However, they exceeded normal adjustment standards and were not considered desirable for the entire Chieftain fleet. Related changes included the replacement of MRS mirrors to maximize the effectiveness of the sighting system and the deliberate selection of ammunition from lots known to have a low dispersion rate. (150)

CAT gunners found the smaller aiming ellipse a success during the competition, but they were less sanguine about gun sights that tended to mist. Sight wipers also proved less than ideal, resulting in the local manufacture of better quality replacements from automobile windshield wipers. (151)

Adjustments to the weapon system and sights lay within the crew's capability, but they could not make the tank move faster. Chieftain remained a slow tank. During battle runs, its sluggish pace reduced the time available to prepare for a new engagement after moving to a new firing point and similarly shortened the time available to identify and engage targets. While in motion, Chieftain proved prone to vibrations and shudders that impacted its ability to fire quickly and accurately on the move. It compared unfavorably to the much smoother rides of the Leopard 2 and Abrams. (152)

Analysis of the Chieftain's performance necessarily involved a comparison with the newer Leopard 2 and Abrams. Previous views that a 120-mm gun was less accurate than a 105-mm could no longer be sustained, given the demonstrated effectiveness of the 120-mm on the Leopard 2. Comparing the performance of Leopard 2 and Abrams crews with those of Chieftains inspired this comment by the commander of the Royal Scots Dragoon Guards: "To add insult to injury we had the impression that the Germans, Americans, and Dutch, the latter who only joined the Army last November simply climbed in their tanks, nonchalantly sailed down range and felt aggrieved when they did not hit all the targets!" (153)

The Chieftain's reliance upon separated ammunition facilitated handling in the cramped confines of a tank turret, and its stowage reduced the risk of a catastrophic explosion in combat. It was slower to load, although each of the separated components was considerable lighter than the fixed ammunition used by other nations. Unfortunately, the training ammunition used in the competition was both lighter and smaller than service rounds, thereby offsetting the potential handling advantage of separated ammunition. (154)

The Chieftain relied upon a gas-operated coaxial machine gun that utilized spring stored energy. This generated a more violent action when the weapon fired that made consistent firing more difficult, and it released carbon monoxide into the turret. When a misfire occurred, the weapon had to cease fire while the gunner manually cleared the round — a time consuming process in comparison with the mechanism used for the Abrams coaxial machine gun that simply ejected the misfire and continued to fire. (155)

The Chieftain's target engagement process did not facilitate high scoring in Canadian Army Trophy conditions. The gunner or tank commander first slewed the gun in the direction of the target. After lasing the target to determine the range and manually inputting data not automatically determined by onboard sensors for a ballistic solution, the gunner waited while the computer laid the gun on target and determined the correct elevation. He could see the target and aiming ellipse, but his responsibilities did not normally include keeping the reticle on the target as with Leopard 2 and Abrams gunners. After autolay completed, the gunner resumed control. He had to confirm the autolay before firing, but criterion for assessing the computer's work remained subjective. The gunner could simply override the computer and lay the gun on his own but at a cost in time. The emphasis upon rapid engagement during the Canadian Army Trophy encouraged gunner's to accept the computer lay without question to expedite target engagement. (156)

Unfortunately, such reliance did not always ensure accuracy, since the Chieftain's fire control computer proved sensitive to slight movements. An accurate autolay necessitated no hull movement between the moment of lasing the target and firing. This stationary status enabled the tank and gun to settle into a stable position. Hull movement within this time window impacted autolay accuracy. Since CAT required moving between bounds, it proved difficult under the pressure of rapid engagement to pause and permit this settling. The precision of the fire control system paralleled its sensitivity, ensuring that "a millimeter or two on the suspension, triggered by the reaction to gun movement for example, is enough to upset the lay." Still the level of inaccuracy thus infused into the autolay proved small. It did not result in the round wildly missing the intended target. However, the significance of this inaccuracy increased as target size diminished — not a good omen for engaging the smaller targets used in CAT. Firing at moving targets posed a different challenge, since "unless the track between lase and autolay is perfect and the apparent rate of the target a constant, autolay will not work." Hence when firing at moving targets or while on the move, the gunner often took control of the fire control system to ensure a more accurate if slower gun lay. (157)

The Chieftain relied upon a mechanical link between the main gun and sight. This arrangement improved reliability, but moving the sight also moved the gun albeit with computer assistance. In the Abrams and Leopard 2, the gunner moved his primary stabilized sight independent of the gun, thereby enabling faster target acquisition. The computer moved the gun in response to data inputs to provide a correct gun lay, effectively slaving the gun to the sight. A loading constraint further diminished the acquisition rate of the Chieftain in comparison with the newer American and German tanks. The Chieftain gunner could not use the laser rangefinder with the main gun breech open. Hence loading had to complete before lasing began. (158)

In CAT 1985 target positions were not identified by pyrotechnic displays. Instead, the targets were pre-heated with charcoal burners to enable their view via thermal imaging. Some observers suspected that these burners could be seen with thermal sights even before the targets were raised. Range personnel placed several burners in locations unrelated to targets to discourage cheating. Nevertheless, the combination of heated targets and the narrowness of the range on which four tanks were operating provided an advantage to those platforms equipped with thermal imaging. The Chieftains participating in CAT 1985 possessed none. (159)

Unfortunately for the Chieftain's reputation, many of its attributes were not visible or put to the test in the Canadian Army Trophy, while many of its drawbacks received heavy emphasis. The

Chieftain's design emphasized survivability. It possessed high ballistic protection, subsequently increased further through the addition of Stillbrew applique armor, but CAT targets did not shoot back. The use of separated ammunition facilitated handling and reduced the risk of a catastrophic explosion, but it took longer to load. Chieftain offered better protected sighting systems that only exposed a fixed prism mirror. The Leopard 2 and Abrams housed their sights externally atop the turret. CAT offered no means of evaluating the impact upon engagement speed and accuracy should these sights be damaged or destroyed. The competition generally encouraged tank commanders to operate partially exposed with their hatch open. Chieftain was optimized for closed hatch operations on a battlefield; open hatch operations effectively separated the commander from his crew and controls. (160)



*A British Chieftain in the field. (U.S. Army Armor School Archives)*

British analysis of the CAT 1985 experience underscored the limitations of Chieftain. This tank's performance proved disappointing despite a robust training period, highly qualified crews, and reasonable competition conditions in terms of vehicle reliability and weather. Therefore, the British army continued to place its hopes upon Challenger, Chieftain's intended replacement. Challenger offered a more reliable and stable platform, while the combination of Thermal Observation and Gunnery Sight (TOGS) and ICSS represented improvements in the fire control system. These qualities were estimated to improve engagement times by three seconds. In CAT 1985 terms, such improvement placed the Challenger on equal footing with Abrams and faster than the Leopard 2. (161)

British planning for the next Canadian Army Trophy competition intended Challenger to replace Chieftain. Early selection of the regiment to represent the United Kingdom coupled with an early start to competition training offered a path forward. However, it remained unclear whether the next CAT would occur in 1987 or 1988. This variation had significant consequences, since the development schedules and funding for Challenger and its principal components (including ICSS) had long been established. Accelerating these timelines threatened widespread disruption to the Challenger program and a boost in cost. Final development of the TOGS/ICSS interface was not thought likely before December 1986, while fielding ICSS before 1988 was considered an optimistic goal at best. (162)

Challenger was a more reliable and faster platform than Chieftain, but without ICSS, it labored under the same fire control system issues as Chieftain. Related estimates of its likely CAT performance without TOGS and ICSS indicated only a 500- to 1,000-point increase over Chieftain — not enough to place in the top tier of competitors. This realization resulted in calls for a radical change in the Challenger design to make its gunnery comparable to that of the Leopard 2. Indeed, one recommendation called for mating a Leopard 2 turret with a Challenger hull. (163)

Realization that few good options existed to improve British gunnery before the next CAT competition generated concern. A poor showing would directly impact soldier morale, Britain's standing in NATO, and foreign sales prospects upon which armor programs relied. The Canadian Army Trophy had become not simply a gunnery competition but a showcase for a nation's newest tank design and a reflection upon its stature as a potential combatant. While a variety of technological paths to improve Challenger's likely CAT gunnery were explored, the viability of such solutions may have suffered from the general absence of British tank industry representatives at CAT 1985. This absence contrasted sharply with other NATO allies, whose teams and vehicles attracted a very high level of interest. (164)

Britain's best option for the next CAT competition lay with Challenger. It clearly marked an improvement over Chieftain in many areas. Only in rapid, precision gunnery — the essence of the Canadian Army Trophy — did it constitute a marginal enhancement, pending the fielding of a new fire control system and thermal imaging. Every effort would be made to prepare Challenger for competition, but optimism in the corridors of power remained noticeable by its absence. Indeed, just days after CAT 1985 ended NORTHAG Commander General Sir Nigel Bagnall expressed few illusions about British performance in the future, noting the likelihood of more poor showings and negative publicity until the fielding of a tank equal in capability to the Leopard 2 and the Abrams. Still more disconcerting was his observation that "... even the Belgians with Leopard 1 and the improvements which will be introduced are likely to outmatch our performance." He therefore recommended making Challenger as competitive as possible, but he also suggested to the Chief of the General Staff that "... in view of the unfavourable publicity that we may receive in two year's time, that the situation is drawn to the attention of the Ministers now." (165) Similarly, the commander of the 33<sup>rd</sup> Armoured Brigade found little reason to expect Challenger to outperform Chieftain. (166)

### **CAT 1985 Through American Eyes**

Once again, three American CAT teams participated, one each from 2-66 Armor, 3-64 Armor, and 3-32 Armor. The first two organizations used the M1 Abrams, while 3-32 Armor retained the M60A3. The latter unit placed only 15th and 19th among the competing platoons. Its lowest scoring platoon garnered just 14,909 points during a battle run influenced by clouds and rain. Its performance decreased from bound to bound, and it received the lowest score in CENTAG for firing on the move. It also received a penalty for not arriving at a bound in time, making it only one of two CENTAG teams to receive such a decrement. (167) The other unit was a Canadian platoon that finished in last place. The second platoon from 3-32 Armor performed credibly, but not well enough to beat any platoon equipped with an Abrams or Leopard 2, underscoring the generational gap in capability between these platforms and the M60A3. (168)

The 3-64 Armor CAT team with its M1s performed much better. One platoon performed so well during its battle run that it was cheered on by American spectators, including general officers. The platoon scored 21,934 points, the highest number earned at that point in the competition. Despite foggy weather conditions, its tanks engaged every main gun target at each bound with an accuracy of 95 percent and an average time to score an initial hit of 11.47 seconds. While firing on the move, accuracy rose to 100 percent and the time to score the first hit fell to just 7.25 seconds. (169) Upon completion and in expectation of a win, the tank crews danced on top of their turrets, adding to the sense of victory. However, this expectation was shattered when a German Leopard 2 platoon earned a score of just 103 points more. The American platoon ended in second place among the competing

platoons. (170) The other platoon from 3-64 Armor also performed very well, ending in fourth place among platoons with a score of 21,321 points. Less than 700 points separated these two platoons from the same unit, indicating a degree of consistency in their performance. Their scores for firing on the move were also among the highest in CENTAG, surpassed only by the winning CAT team from Panzer Battalion 244. The platoons from the M1-equipped 2-66 Armor CAT team placed sixth and seventh. More significantly, their final scores proved exceptionally consistent, separated by just 36 points. (171)

The American performance, particularly among the Abrams-equipped platoons, placed them in the top tier of competitors. Such outcomes reflected well upon competition preparations and the growing effectiveness of U.S. Army training reforms in general and the specific improvements to tank gunnery in particular. For CAT, the Army also increased the attention given to preparing its participating teams. In 3-64 Armor competition tank crews were drawn from among the entire parent division, and they included two gunners who had participated in CAT 1983. The CAT team spent considerable time on or near the competition range over a three-month period. The top scoring platoon leader recalled that “in the evening hours, when we still had light, we’d just walk the range, figuring out how we were going to distribute our fire.” (172)



*The colorful and distinctive patch worn by the 3-64 Armor CAT team members in 1985. (Ron Mihalko)*

The American CAT teams benefited from command support within their respective brigades and divisions. Training priorities were adjusted to provide more time for gunnery training, and participating units gained freedom from administrative and installation-specific responsibilities. Priority for range access, gunnery training devices, and logistics support went to the CAT units, who also benefited from a CAT liaison team provided by the Seventh Army Training Command to ensure a broad range of support, including tank inspection teams provided by the manufacturer. While such support ensured a high level of training and logistical support, it also resulted in an unusually high level of interest in the CAT teams, reflected in the frequency of visits from senior military and civilian personnel. (173)

The American CAT teams utilized similar training strategies. The use of snakeboards in combination with either the gunner’s controls or tank commander override helped to build hand-eye



coordination in tracking targets. Video arcade games provided both an outlet for tension and another method of building hand-eye coordination. Crew and platoon conduct of fire training occurred through the use of scaled tank ranges or unit-unique classroom methods. However, "in all cases, conduct of fire was taught by Bergen-Hohne lane assignments using training media that were constructed to mirror the four lanes of the CAT competition range." Rotating training schedules were designed to incorporate variety and address identified weaknesses. Principal focus areas included maintenance, platoon and crew conduct of fire, hand-eye coordination, testing and diagnostics, and special classes focused upon NCOs. All units embraced continuous training, reflecting an understanding of the importance of repetition to gunnery skill sustainment. In the highest scoring platoon, training emphasis embraced platoon training as a team rather than as a collection of individual tanks. (174)

The American CAT teams benefited from significant advances in tank gunnery simulators. The Unit Conduct of Fire Trainer (UCOFT) proved of particular value. In 1979 the Army awarded contracts for the development of trainers for the M60-series and the Abrams tank, the latter then still in development. (175) Fielding of UCOFT began in the 1980s on the basis of one per each active component battalion or squadron. The UCOFT was housed in three standard military shelters. One contained the instructor station, a set of computers and monitors connected to the crew compartment. The latter constituted a replica of the tank commander and gunner station in a tank turret. The crew members viewed a battlefield landscape populated with varied moving and stationary targets through computer screens. Both crew members had use of all tank weapons and sights, unless deliberately forced to operate in degraded mode by the instructor. Main gun recoil was simulated in addition to the effect of vehicle motion. (176)

Successful UCOFT engagements required a team effort by the tank commander and gunner using fire commands and correct data input to generate an accurate firing solution. All actions and fire commands were monitored and recorded by the instructor, who could also see everything the crew did. Upon completion of a training session, this data became the focus of a detailed analysis of crew performance during each target engagement. With over 390 multi-engagement scenarios available, UCOFT offered considerable variety. It was ideally suited to both training and sustainment of those skills critical to effective gunnery. It tracked the proficiency of each tank commander-gunner team through a progression of increasingly challenging exercises, and it provided an accessible means of accomplishing remedial training. Nor did it mandate a special contractor to operate, since the instructor station was designed for operation by a platoon sergeant or platoon leader. Moreover, the cost of each simulated engagement proved a fraction of the expense associated with live gunnery. (177)

The first use of UCOFT to support training for the Canadian Army Trophy occurred with the 1985 competition. UCOFT was only just starting to appear in USAREUR. Therefore, 3-64 Armor made two separate one-week trips to the principal UCOFT facility in Florida. It later received the first UCOFT fielded in Europe, ensuring that it received the most training with the device. 3-32 Armor also made two trips to Florida for UCOFT training, while 2-66 Armor spent one week in Florida and one week in Vilseck after that installation received the gunnery trainer. All three units used UCOFT to help select and train competition tank crews. (178)

UCOFT provided repetitive training in gunnery skills in a manner more immersive and comprehensive than otherwise possible short of live fire. Although it did not target drivers or loaders, it provided highly effective in honing the gunnery skills of commanders and gunners. All units noted a performance improvement in target engagement time and accuracy. Indeed, the trainer helped to increase the speed of engagement by reducing the time the gunner used to make a fine lay on the target. Hand-eye coordination and repetition facilitated these improvements. Unit commanders had little but praise for the UCOFT and found its effectiveness further enhanced by mixing its use with other types of training, including sub-caliber devices and live fire. Such variety prevented crews from developing device-specific habits that might undermine their actual battle run performance. (179)

The American teams also benefited from the UCOFT's ability to represent different landscapes, including the CAT range. Although the actual competition target arrays would not be known until the battle runs commenced, such virtual training on the competition range helped crews familiarize themselves with the lanes, firing points, and likely target locations. The second UCOFT training iteration conducted by each American unit utilized this virtual CAT representation. Simulation compensated for otherwise restricted range access and the limitations placed on all participants regarding the use of live ammunition for competition-related training. (180)

In the wake of CAT 1985 the Army Research Institute (ARI) completed a detailed study of the American performance. It found a correlation between UCOFT usage and competition performance, noting in particular a link between engagement speeds during the second iteration of UCOFT training (which utilized a virtual depiction of the actual CAT range) and those achieved during the actual contest. The highest scoring American team received the most UCOFT training time, underscoring the benefit of the trainer to performance. This conclusion had obvious implications for tank gunnery training in general. However, the ARI study also noted that the most effective training encouraged mastery of gunnery techniques through a combination of training devices, simulators, and live fire. (181)

In assessing personnel factors the ARI study found no significant relation between the Armed Services Vocational Aptitude Battery (ASVAB) scores of individuals and their CAT performance. A high ASVAB score was not indicative of high competition performance, and it did not constitute a useful measurement of whether a soldier should be considered for inclusion on a CAT team. Similarly, other assessments of a soldier's mental category or aptitude had little relevance to CAT performance, whether in the capacity of a gunner or tank commander. More surprisingly, the ARI analysis also found no correlation between crew stabilization and competition scores. The highest scoring American team suffered the most personnel changes. However, the study noted that crew stabilization among CAT crews was generally high in comparison with armored units throughout the Army. In 3-64 Armor a single platoon possessed the lowest commander/gunner stabilization rate of any American CAT unit at 75 percent. Crew stabilization for the same stations in 2-66 Armor and 3-32 Armor ranked 88 and 94 percent respectively. Moreover, the study suggested that the high skill levels of CAT soldiers offset the potential negative impact of crew turbulence, and that such skill levels were likely not indicative of conditions in standard line units. (182)

ARI concluded that the Canadian Army Trophy provided an opportunity for an armor unit to determine how proficient it could become in gunnery if given a year to focus upon the related skills. In



*2-66 Armor's decorative CAT 1985 team patch.  
(Ron Mihalko)*

so doing it necessarily raised questions about existing standards and how they might be raised. The training period provided an opportunity to observe the level of creativity among trainers, since they had to sustain crew concentration over a protracted time for a single chance to engage 24 targets during a battle run. Somehow the crews had to be kept motivated and focused upon gunnery — clearly a challenge for all concerned. ARI also suggested that doctrinal changes might be in order, particularly through the use of abbreviated fire commands to accelerate engagement time and boost battle run scores. Moreover, the study authors believed that competing units needed to gain as much range time as possible above the authorized live fire opportunities. They believed this objective might be obtained by having non-firing platoons conduct dry fire exercises while shadowing platoons actually firing on Bergen-Hohne. They noted how some units also used sand tables similar to the ranges on this installation and videotaped their live fire and dry fire activities for subsequent analysis. (183)

However, not all of these recommendations met with agreement. The suggestion to use abbreviated fire commands was not a new one. It had been made before, and in fact, modified fire commands had been used in combat at least since World War II. Nevertheless, in terms of teaching crews how to engage targets properly, the fire command sequence remained without equal. It had been developed and refined over several decades to address combat rather than competition conditions, and it served to ensure proper target identification, use of the correct ammunition, and to ensure the best likelihood of hitting the target without mishap. The doctrinal fire command sequence constituted the standard for all armored units. Nothing prevented individual unit commanders adopting a variation — after mastery of this standard.

The question of a shortened fire command sequence dovetailed with broader concerns surrounding the Canadian Army Trophy. The competition was not combat, and critics feared lest competition-specific techniques begin to shape doctrine and training practices in lieu of combat lessons learned. Moreover, too much emphasis upon CAT resulted in a divergence from those tasks and methods dictated in gunnery manuals. Therefore, recommendations for changes in gunnery training based upon CAT became immediately suspect. In the immediate aftermath of CAT 1985, all three American teams were required to execute Tank Table VIII at Grafenwoehr. Their performance was scored according to existing doctrine, including the use of proper fire commands. Based on the results of this impromptu qualification, “Not too surprisingly, the unit that had the most difficult time scoring points at the CAT competition did better on the traditional Table VIII than did the other two CAT units.” (184) Ironically, the emphasis on the individual crew tasks addressed in Table VIII contrasted with the focus given to section and platoon gunnery by the top scoring American platoons. CAT was not combat, but it did encourage development of unit skills likely required in wartime.

Discussion about the relative merits of adopting techniques and training strategies used for CAT on a regular basis throughout the armored force made sense. The press criticism of American performance during CAT 1985 did not. By the mid-1980s, the U.S. Army had made major strides in transforming itself, reflective of the major investment in training, doctrine, and material begun in the previous decade. Training standards and combat readiness had risen appreciably, reflected in the steady improvement of American performance in the Canadian Army Trophy. Acting TRADOC Systems Manager Lieutenant Colonel James C. Barbara accurately summarized this trend:

During our first year, the United States came in 6th place; 1979, 4th place; 1981, 3d place; this year the United States came in 1st place if you calculate by national companies, which is not part of the official rules. This was due to our increased emphasis on gunnery techniques and an improved vehicle. We did it on someone else’s range with someone else’s rules of engagement; all main gun engagements were fired well within 2,000 meters; no main gun firing on the move was required [sic]; artificial illumination was available; — none of which really capitalizes on the M1’s capabilities. (185)

In CAT 1985 American tank platoons placed well and missed seizing first place by a narrow margin. Nevertheless, one article covering the competition ran with the headline “If Military Contests Were Real War, U.S. Might be in a Pickle.” It placed CAT in the context of other international competitions in which American participants did not win or secure the top score. This article underscored the significance of the “loss” by noting that CAT had become the “Olympics of tank warfare.” Such negative coverage stemmed from broader skepticism regarding the Army and the expansion of military spending under President Reagan. Hence, the article noted that “Despite the huge Reagan military buildup, the U.S. keeps losing.” (186)

The Army’s public perception suffered from the 1970s, post-Vietnam legacy, but the 1980s Army of Excellence was not the same force that emerged from Southeast Asia in disarray. It had become a much more professional and capable force, but in the absence of a major military action this development remained invisible to the public. The Army too often received press coverage in the form of costly acquisition programs that resulted in substandard or controversial products. At a time when popular perception of acquisition was shaped by stories of \$600 toilet seats, largescale increases in military spending were bound to be met with a degree of cynicism. Hence, the 1985 Canadian Army Trophy performance of American soldiers and Abrams tanks did not receive the positive attention it deserved. Only an outright win would silence the critics and overturn the skepticism surrounding Army actions. (187)

## Notes

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180. Black and Abel, “Review of U.S. Armor Crew and Platoon Training in Preparation for the 1985 Canadian Army Trophy (CAT) Competition,” p. 7; Caldwell, “Americans on Target: U.S. Army Tank Gunnery Excellence,” p. 25.
181. Black and Abel, “Review of U.S. Armor Crew and Platoon Training in Preparation for the 1985 Canadian Army Trophy (CAT) Competition,” p. vii.
182. Ibid, pp. vii, 12, 14, 15.
183. Ibid, pp. 15-16.
184. Ibid, p. 16.
185. Memorandum, Acting TRADOC Systems Manager LTC James C. Barbara to Deputy

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Commanding General, Subj. Canadian Army Trophy Competition, Jul. 5, 1983, USAARMS archives, Box 322.

186. Fialka, "If Military Contests Were Real War, U.S. Might Be in a Pickle."

187. The story of the overpriced toilet seat continues to circulate over 30 years later. See William D. Hartung, "Only the Pentagon Could Spend \$640 on a Toilet Seat," *The Nation*, Apr. 11, 2016, at: <https://www.thenation.com/article/only-the-pentagon-could-spend-640-on-a-toilet-seat/>.

## Chapter 4

### America First at the 1987 Canadian Army Trophy Competition

The Canadian Army Trophy competition of 1987 marked the last time that all NATO members contributing armored forces to the Central Region participated. It had become a highly visible international occurrence directly associated with the combat readiness of the participating nations. This year's competition witnessed the first time an American platoon finished first. It also proved the first and only time the British Challenger tank competed. The competition served as a testimony to the value of teamwork and sharply focused training. In the years to follow the competition remained prestigious, but international developments eclipsed its visibility on the world stage.

### The Cold War at High Tide

In 1987 the Hague Platform on European Security Interests ensured the commitment of conventional and nuclear capabilities to regional defense. NATO continued to build the military muscle to execute AirLand Battle in the event of a Soviet attack. The alliance also undertook new initiatives to improve its defensive capacity. It worked with Spain to determine how best to incorporate that nation's armed forces into the defense of Europe. The Federal Republic of Germany proposed the creation of a joint Franco-German brigade as the first step in the creation of a European fighting force. Canada shifted its commitment to reinforce the Northern Region instead to bolstering the Central Region directly in the path of any likely Warsaw Pact invasion. These actions paralleled simultaneous efforts to negotiate limitations on nuclear and conventional forces directly with the Soviet Union in an attempt to lower the military threat posed to Central Europe. (1)

NATO commitment to European defense confronted a Soviet Union experiencing growing challenges to its military, economic, and political authority. Soviet efforts to expand its global influence carried costs and consequences detrimental to domestic stability. The invasion of Afghanistan begun in 1979 generated casualties, drained finances, and damaged Soviet credibility without creating a stable proxy state. In Angola, Soviet weapons, advisors, and a strong Cuban military presence could not secure victory for the People's Armed Forces of Liberation of Angola (FAPLA) against the National Union for the Total Independence of Angola (UNITA) supported by the South African Defense Force. In August 1987 FAPLA opened a major offensive near Cuito Cuanavale with Cuban and Soviet support. The ensuing fighting continued into 1988 with little gain despite significant FAPLA and Cuban losses. Subsequent negotiations resulted in the withdrawal of Cuban and South African forces from Angola and curtailed Russia's African aspirations.

Within the Soviet Union the centrally controlled economy struggled to sustain the war in Afghanistan and the military buildup necessary to match growing U.S. and NATO strength amid calls for reform. In 1986, the state experienced the worst nuclear accident to date when the Chernobyl plant exploded. The government responded with costly mass evacuations and decontamination efforts. The following year Soviet plans to expand phosphorite mining in Estonia triggered a public backlash with demonstrations and public debates. The mining venture collapsed, and the Soviet Union faced increasingly vocal and nationalist opposition in Estonia.

Mikhail Gorbachev struggled with these problems as General Secretary of the Communist party of the Soviet Union. In response he privatized farming and implemented industrial reforms. He sought to reduce the military strain on the economy by reducing and terminating global

interventions. Hence, Soviet forces began to withdraw from Afghanistan, advisors and military assistance to Angola diminished, and support to Nicaragua, Cuba, and Vietnam fell. He worked to ease tension with China and reduce the risk of a border conflict. Economic imperatives also encouraged negotiation with the West. In December 1987, Gorbachev and President Ronald Reagan signed the Intermediate-Range Nuclear Forces Treaty, agreeing to eliminate short range and long range land-based nuclear and conventional missiles. Subsequent negotiations toward a Strategic Arms Reduction Treaty continued. (2)



*T72s in a movement to contact exercise. (U.S. Army Armor School Archives)*

Despite the thaw in East-West relations exemplified by the direct, personal interaction between Reagan and Gorbachev, the threat of conflict remained. Warsaw Pact forces represented a danger to Central Europe, even if the member state governments were becoming less subject to centralized Soviet influence. The capability of Warsaw Pact forces remained high, while the continued production and improvement of the T-64, T-72, and T-80 main battle tanks reminded NATO of the mechanized nature of the military threat. In this context the Canadian Army Trophy served as a public display of NATO's armored prowess.

### **The State of American Armor**

At the start of the 1980s, however, addressing the challenge of a mixed tank fleet constituted a higher priority for the American armored force than the Canadian Army Trophy. The M60 remained the principal platform, but it existed in several different configurations. In 1970, the M60A1 predominated, but continuous component upgrades resulted in its evolution to the M60A1 with add-on stabilization (AOS) and the M60A1 with the Reliability Improvement of Selected Equipment (RISE) engine. The addition of passive sights resulted in the M60A1 (RISE Passive), which in turn received a laser rangefinder, a new coaxial machine gun, and smoke grenade launchers. Thus modified, the platform became the M60A3. Tank thermal sights and an engine-generated smoke capability resulted in the M60A3 (TTS). These changes did not occur uniformly throughout the force. Nor were units upgraded to newer platforms in their entirety. Consequently, many tank battalions included a mix of different M60 configurations with concomitant logistical, maintenance, and training issues. (3)

Consideration of the tank fleet as a whole underscored this lack of uniformity. In addition to the M60A1 and A3 configurations, the M60A2 remained in service until 1981, while the M551 Sheridan equipped armored cavalry organizations and one tank battalion assigned to the XVIII Airborne



Corps. Army National Guard tank units still retained the M48. M1 fielding only increased fleet management chaos. The new tank also became the subject of upgrade programs that resulted in the M1 IP (Improved Performance), M1A1, and M1A1 HA (Heavy Armor). Fielding of the M1 occurred slowly, thereby aggravating the problems associated with too many different tank types in service. The 1<sup>st</sup> Armored Division, for example, did not begin a two-year process to replace its M60A3s with the M1A1 Abrams until late 1986. (4)

To one German observer, this variety of tank models made little sense, particularly when viewed in the context of Germany's problems in World War II managing and maintaining a highly variegated tank fleet. His preferred solution of replacing this mix with the Leopard 2, however, fell on deaf ears, particularly given the enthusiasm with which American tankers embraced the Abrams. (5)

Despite the variety of tanks in service, they all adhered to the same gunnery principles articulated in FM 17-12: *Tank Gunnery*. Updated in 1980, this well written manual offered understandable guidance to the novice and served as a useful reference for more experienced soldiers. Like previous iterations, it addressed weapons operation, maintenance, and training standards. (6) It included detailed coverage of Warsaw Pact platforms, organizations, and capabilities, coupled with tips and techniques to mitigate the danger they posed. However, no amount of careful battlefield maneuver could change the reality that American tanks would be significantly outnumbered, a fact underscored by the manual's emphasis on the need for tank crews to achieve favorable kill ratios of 5:1 or higher and the attention given to first round kills. (7)

Teamwork was essential to the achievement of this objective. Hence platoon operations received expanded coverage. Standards for effective platoon gunnery included the engagement of multiple targets in priority of the threat posed, effective maneuver, and the application of direct and indirect fires. Platoons were expected to use accurate fire distribution to engage large numbers of targets while conserving ammunition. In short, "to win in modern war, US tankers must be more knowledgeable, more capable, and better trained than any enemy they meet." (8)

To generate such tankers, the manual provided examples of annual tank gunnery training programs that mapped out the progression of events leading to qualification and related sustainment actions. The authors understood well the constraints that units labored under. Therefore, they provided techniques to help commanders achieve training standards despite inadequate training facilities, limited ammunition, time shortages, and shortfalls in fuel and spare parts. (9)



*3rd Armored Division M60A3 tanks in Germany near Sembach Airbase. (Wikipedia Commons)*

The Tank Tables constituted the central focus of gunnery training. Tank crews executed Tank Tables I-VII to progressively hone their skills and prepare for Tank Table VIII with live ammunition on a gunnery range. Their performance on this table determined their qualification status. The table itself necessitated navigating a range course in which they engaged pop-up targets within a time limit, receiving boosts to the final score for speed of engagement, accuracy, and ammunition conservation. The overall score determined whether a crew rated distinguished, qualified, or unqualified. Unqualified crews had to retrain and be re-evaluated. The Tank Crew Gunnery Skills Test required individual crew members to demonstrate their ability to execute the duties associated with their station. Passage was a prerequisite for live fire qualification, and the test had to be administered within six months of conducting Tank Table VIII. The soldier was to remain in the same station from the time of the skills test through crew qualification — a potential problem for units experiencing high personnel turnover. (10)

Tank crew qualification in turn became the prerequisite for platoon evaluation. Tank Table IX required platoons to conduct multiple main gun engagements, perform simultaneous main gun and machine gun engagements day and night and in a nuclear, chemical, and biological (NBC) environment. Platoons were expected to fire on the move, utilize both precision and battlesight gunnery techniques, and conduct open and closed hatch engagements. Success required tank commanders to develop and use range cards, conduct engagements from their station, and utilize fire control procedures to maximize platoon firepower. Targets included representative tanks and personnel that remained exposed for up to 40 seconds (60 seconds at night). In order for the platoon to be considered qualified, it had to hit 70 percent of all targets presented and receive a satisfactory rating for all other tasks. Evaluation of fire control measures, reporting procedures, movement techniques, and ammunition conservation occurred on a more subjective basis by a designated evaluator. (11) Although not its primary purpose, Table IX's platoon battle run in which units sought to engage targets rapidly and accurately with the least ammunition paralleled the basic nature of the Canadian Army Trophy battle runs.

**Tank Gunnery Tables 1980 (12)**

<b>Tank Table</b>	<b>Principal Task</b>	<b>Training Medium</b>
<b>I</b>	Weapon zero, manipulation exercise, range card	Laser or sub-caliber device
<b>II</b>	Adjust fire versus stationary targets	Laser or sub-caliber device
<b>III</b>	Adjust fire versus moving targets	Laser or sub-caliber device
<b>IV</b>	Fire from stationary tank versus stationary and moving targets	Laser or sub-caliber device
<b>V</b>	Fire from a moving tank versus stationary targets	Sub-caliber device
<b>V Platoon</b>	Stationary tank platoon firing at static and moving targets	Sub-caliber device
<b>VI</b>	Stationary tank firing at stationary and moving targets	Live fire with main/machine gun ammunition
<b>VII</b>	Tank combat course (practice)	Live fire with main/machine gun ammunition
<b>VIII</b>	Tank combat course (qualification)	Live fire with main/machine gun ammunition
<b>IX</b>	Platoon battle run (qualification)	Live fire with main/machine gun ammunition

**Note:** Ammunition allocation for active component units intended to support firing Tables I-V/V Platoon four times per year and Tables VI, VIII, and IX twice.

The 1980 gunnery manual provided a sound doctrinal baseline for gunnery instruction that built upon lessons learned from the preceding decade, but it was not without its shortcomings. The chapter devoted to the preparatory checks to be completed before firing the main gun spanned 14 pages, and it was considered too complex. Therefore units created their own standards from which tank commanders generated abbreviated, individualized checklists. The absence of a standard approach resulted in confusion when soldiers transferred from one tank to another and created problems during crew qualification. (13)

The nature of the Table VIII course differed from a combat environment. Terrain use could not be measured since vehicles moved along an established course road from one defined firing position to another. Pop-up targets introduced a degree of healthy uncertainty offset either by evaluators showing crews which target to engage or through the use of gunfire simulation devices that marked their position. Crews did not have to distinguish enemy from friendly vehicles, and tank commanders were not required to prioritize targets. Defensive engagements did not necessitate firing on multiple moving targets while displacing from one battle position to another amid threats steadily closing the range. In the offense, tanks constrained to the course road could not exploit terrain or cross country mobility. (14)

Determination of crew marksmanship depended upon whether main targets were hit or not. A tank crew evaluator subjectively ruled whether machine gun engagements provided sufficient area suppression. Little analysis of each target engagement occurred, but crews received a bonus for using less than the allotted amount of ammunition. This combination tended to reward lucky crews and encourage others to simply skip particular engagements to obtain the ammunition bonus. Crew qualification on Table VIII required most but not all tasks to be performed to standard. Therefore, a crew could be rated “qualified” without engaging any target at night or with the coaxial machine gun. Moreover, qualification did not require full use of vehicle capabilities. Smoke grenade launchers were not utilized, no engagements were fired from the tank commander’s station, and none involved the auxiliary sight. Where speed of engagement was scored, the emphasis shifted to rapid engagement rather than accuracy. Some units further discouraged high performance by making successful crews provide remedial training for crews that did not qualify rather than offering more rewarding training activities. (15)

Tank Table VIII provided a means of identifying trained crews, but it did not generate them. Crew qualification assessment “has as much in common with armor combat as trap shooting does with infantry combat.” It did not require terrain usage or tactical skills. (16) Another assessment of Tank Table VIII also found it of limited value:

The measurement of a tank crew or platoon’s effectiveness in gunnery has always been determined by a readily “G-2’d” live fire run down a safety-oriented range. Weapons are fired at stationary or predictably moving targets that bear little resemblance to real Threat vehicles. Additionally — because smart crews can often predict the sequence of target appearance — targets are too often unrealistically acquired. Nor do the targets fire back — not even with simulated fire as do targets on some of our allies’ ranges. And, finally, present day ranges do not adequately exercise the mobility, agility or survivability of our newest combat vehicles. (17)

One USAREUR tank company commander considered crew qualification nothing more than an exercise oriented upon achieving the highest scores rather than realistic gunnery training. He noted the effort made to provide crews detailed information concerning their qualification run in advance. Forewarned with this knowledge, crews focused their effort on point scores rather than skill mastery. Consequently, the qualification became more of a sporting event rather than combat preparation. (18)

Nevertheless, Tank Table VIII constituted the climax of most unit gunnery programs. Success hinged on the number of crews rated “distinguished” or “qualified.” It was usually preceded by several weeks of intense training, but afterward sustainment training proved limited. This cycle proved common among armor units, though variations certainly existed and some battalions proved more adept at making their training program more challenging. Tank Table VIII remained the defining event in gunnery training, even though it only addressed crew rather than section and platoon skills, and it did so in a sterile, predictable environment. (19)

In the 1980s this status quo was becoming less acceptable and the subject of increasing criticism. Although crew qualification remained an important training milestone, its value dissipated if sustainment training did not occur. In Europe, one officer recommended the incorporation of no notice gunnery training during the monthly alerts combat units experienced. Too often these alerts became predictable affairs and soldiers strove to execute them with the minimum of effort. Incorporating gunnery training into these events forced attention to gunnery skills and enhanced the overall combat readiness value of the alerts. Other recommendations focused upon the conduct of gunnery within a more realistic tactical environment that utilized combat skills, cross country maneuver, and threat representation more akin to a battlefield. (20)

### **Tank Training Areas and Gunnery Ranges**

Most armor units utilized training areas close to their home station to prepare for formal live fire qualification. In the Federal Republic of Germany many of the local training areas originated in the early days of the Cold War. Subsequent land usage agreements often restricted training and in some cases prohibited mechanized activities. Such restrictions resulted in the non-use and effective abandonment of these lands by the U.S. Army. Local communities seized upon this opportunity, using the sites as nature preserves or trash dumps. This state of affairs continued for years, but in the late 1970s, faced with a growing need for more training space, the U.S. Army began to reassert its legal land usage rights. The action constituted part of a larger effort to reevaluate training facilities and develop a modernization plan, but after years of neglect, this sudden, renewed interest came as a jarring shock to local communities, generating friction between the Army and the civilian populace. (21)

Live fire gunnery qualification typically occurred at a major training facility. For USAREUR, these sites included Wildflecken, Hohenfels, and Grafenwoehr. Wildflecken’s small size could only support single battalion training rotations, but it could accommodate sustainment gunnery training. Hohenfels constituted the only free maneuver area under U.S. control in Europe. Grafenwoehr served as USAREUR’s primary gunnery site. Able to support large groupings of units, it benefited from efforts to acquire more reliable moving gunnery targets and upgrades to support the capabilities of newer tanks. By the mid-1980s, Grafenwoehr had become the target of major range modernization, but this development coincided with increased pressure from the local German communities to reduce weekend and nighttime training. (22)



*Grafenwoehr's Gate 1 entrance.  
(Ron Mihalko)*

The combined land mass of these major training areas proved smaller than Fort Hood — a clear indication of the limited range space actually available in Germany. German army training centers at Bergen-Hohne and Baumholder were made available to American forces, but such access was offset by the similar use of American training areas by NATO allies. Wildflecken, Hohenfels, and Grafenwoehr became unavailable for American training for over three months each year. The periodic use of Grafenwoehr to support the Canadian Army Trophy further reduced its availability for annual training. (23)

A common challenge to addressing range issues in the United States and Europe lay in the nature of military construction. Tank gunnery ranges received no higher priority than other types of military construction, including office buildings, child care centers, dining facilities, etc. An average of five years separated project approval and the start of actual construction work. The failure to integrate range requirements into the early phases of weapon system development resulted in new weapons reaching the force without ranges able to support their capabilities. Many of the tank ranges available in the early 1980s had been designed for the M48 and M60-series tanks, but they predated the emergence of laser rangefinders, stabilized guns, and better vehicle suspensions. No range properly supported the ability of the M60A3 or the M1 to fire on the move. In the case of the Abrams, "...it can overrun many of the targets on existing ranges before being able to engage them." (24)

No centrally coordinated, Army-wide effort to improve training facilities existed. Responsibility for planning tank range improvements lay scattered among FORSCOM, TRADOC, the National Guard Bureau, the Army Reserve, and other organizations. The Department of the Army provided neither guidance nor standards to govern range development. In essence, "worldwide priorities for range construction, based on force modernization considerations, force structure, or weapons systems densities, have never been established." (25)

The need for more capable ranges to support the fielding of the Abrams tank, Bradley Fighting Vehicle, and improved artillery systems raised the visibility of range development. Assessments by the Government Accountability Office and the Department of the Army Inspector General highlighted shortcomings in the facility improvement process. Consequently, the Army began to develop its first master range plan. TRADOC followed suit with more specific range construction instructions oriented upon the new weapon systems. These steps toward a more uniform and effective range modernization effort took time to take effect, but they did result in Grafenwoehr's mid-1980s upgrade. (26)

### **Improving Realism in Gunnery Training**

In the 1980s the fielding of new materiel and a command emphasis upon raising training standards stimulated efforts to improve armor training realism. In USAREUR the formulation of new proficiency standards linked to existing soldier manuals and Army Training and Evaluation Programs (ARTEPs) provided clear training goals. Opportunities to meet these proficiency goals occurred during battalion and brigade field training exercises – each held three times a year, annual division exercises, and biennial corps field exercises. USAREUR also approved its own gunnery regulations that included guidance for the evaluation of tank crews and platoons together with a recommended skill sustainment program. (27)

For units struggling to build and sustain gunnery skills amid range access challenges, budget constraints, and ammunition limitations, training devices became critical tools. A variety of sub-caliber and laser training devices became commonplace in the 1970s, but in the 1980s the advent of computer-based training aids and more sophisticated laser systems offered a range of much more capable devices. More training activities could be accomplished at home station at less cost. More importantly, computer analysis enabled a better understanding of the relationship between crew action and the fate of a round when it left the gun tube. It enabled a more nuanced assessment than the time-honored method of counting holes in targets. (28)

The variety of accessible training aids stimulated unit improvisation. One such ad hoc system utilized a sub-caliber device mount, a video camera, and a television lens — all common training aids. Mounted on a tank and used in conjunction with the vehicle's gun sights, the video camera provided real-time recording of what happened when a round was fired, including an accurate and recorded sensing of where the round went in relation to the target. The camera also captured the crew conversation before the engagement occurred. This audio/visual record then became the focus of an after action review aimed at understanding why each engagement was a success or failure. (29)

The Tank Gunnery and Missile Tracking System (TGMTS) entered service with the Army in the late 1970s. It trained tank commander/gunner teams on their tank. Principal components included a projector, screen, and the tank. Through their sights, the commander and gunner viewed a battlefield landscape on the screen. When targets appeared, they laid the gun on target and fired an eye-safe laser. A bright dot appeared on the screen to show where the round went. This system proved useful in practicing and evaluating engagements between a stationary tank and either moving or non-moving targets, and upgrades improved its reliability and enabled machine gun engagements. The TGMTS found favor among armor personnel, and it experienced widespread use in Europe and Korea in the 1980s. Later models relied upon a micro-computer that utilized ballistic data, trajectory, and flight of the round to determine point of impact. Moreover, the computer enabled recording and storage of performance data to facilitate analysis and subsequent training. (30)

However, in the 1980s, the Unit Conduct of Fire Trainer (UCOFT) became one of the most acclaimed gunnery training devices. Its ability to provide a wide variety of training for tank commander/gunner teams, including scenarios not possible on ranges, ensured its value to building proficiency and skill sustainment after the completion of qualification at much less expense than live fire. Fielding plans included one per battalion to support tank and Cavalry Fighting Vehicle training. Vilseck and Schweinfurt were among the first USAREUR facilities slated to receive UCOFT. Fielding also included maintenance support, operator training, and a training support package to facilitate UCOFT use in training plans. (31)

The growing prevalence of UCOFT led to a formal evaluation of the device's training value by reviewing the experiences of six tank battalions over a year. Only five used the UCOFT, the last serving as a baseline for comparison. All units trained for and conducted a live fire Tank Table VIII at Grafenwoehr. Three months later 15 crews from each battalion repeated this crew qualification. The findings showed a strong correlation between UCOFT use and live fire performance. Crews that trained with UCOFT completed live fire engagements an average of two seconds faster than crews that did not. Moreover, the further crews progressed through the UCOFT training matrix, the better they performed during live fire. Ironically, the most significant constraint to UCOFT usage existed in the original maintenance agreement with the manufacturer, capping device usage at one two-hour session a month for each tank commander/gunner team. The study's findings facilitated a modification to the contract, boosting total usage hours. (32)

Operator training accompanied a unit's receipt of the UCOFT. A small group of NCOs and officers received this instruction, which was then repeated over time to expand the number of qualified operators in the unit. Battalions also received the training material to develop operators on their own. This deliberate effort to build the operator pool simultaneous with fielding served to make UCOFT operation self-sufficient, though maintenance remained contractor supported. (33)

Unit commanders welcomed UCOFT, but they expressed concerns over the related operator workload that grew steadily with its popularity and usage. Other computer-based training devices were also arriving in units, and simulators for tank driving, platoon training, and company operations were in development or already fielding. Who would operate these devices? Master gunners at battalion and company levels made obvious choices. However, not all tank battalions possessed their

full complement of these gunnery experts, and mastery of the new devices required training time. By 1987 many battalion master gunners had yet to receive UCOFT training. (34)

Still, the selection and training of military operator/instructors constituted a short-term personnel problem. It did not detract from the home station training value of UCOFT, which was complemented by the use of the Multiple Integrated Laser Engagement System (MILES). This system began to enter service in the late 1970s. It relied upon lasers to simulate weapon effects, including tank main guns. It utilized a laser module attached to the gun barrel and a receiving unit affixed to soldiers and vehicles. When the weapon fired, the laser emitted a burst in the direction fired. When it hit a receiver, a beacon sounded and flashed to indicate the destruction of the target soldier or vehicle. A blank adaptor provided the audio effect of the weapon's discharge. Upgrades in the early 1980s enabled the recording and analysis of each laser engagement. (35)

MILES soon became a commonplace training device, readily available to units at home station. It did not require a special gunnery range, and thus could be utilized anywhere maneuver training occurred. For tank units it facilitated the integration of fire and maneuver in training exercises against an opposing force with the means to shoot back. MILES did not constitute a precision gunnery instrument, but it did provide sufficient fidelity to force tank crews to properly utilize their weapon systems to acquire and hit a variety of target types that generally sought to avoid simulated destruction. Field training realism rose, but MILES did require time and some familiarity to install and to make subsequent, meaningful evaluation of the data compiled for each engagement.



*Tank from 2-64 Armor on Grafenwoehr's Range 109. (Ron Mihalko)*

In October 1981 the National Training Center conducted its first training rotation. Located on 642,805 acres at Fort Irwin, California, the site offered a maneuver area much larger than any current training facility. Designed to accommodate the capabilities of the newest weapon systems, it also featured a dedicated opposing force organized and trained to fight as a Soviet motorized rifle regiment. Units arriving at the NTC for training faced nine days of MILES-enabled combat. A simulated battlefield strewn with flashing MILES lights quickly provided a stark indicator of the realities of modern war. (36)

NTC rotations also immersed training units in five days of live fire. The gunnery range measured 68 by 25 kilometers. It featured over 550 pop-up targets, remotely controlled and arranged in belts. Activated in sequence, they represented a Soviet motorized regiment as it moved to attack the firing unit. Smoke and flash indicators helped to create the sensory effect of an actual regimental size attack. Soldiers found themselves in a high stress firefight against a relentless horde of targets advancing upon them in Soviet battle formations. One participant noted that “in the live fire phase it doesn’t seem like pop-up targets... doesn’t look like a range with red flags right and left although the safety considerations are real enough.” Success in the live fire phase necessitated teamwork and mastery of gunnery skills at crew through company and battalion levels. (37)

Upon completion of their training rotation, units received a detailed assessment of their performance to help shape subsequent training plans. Lessons learned and unit experiences at the Army’s premier training site quickly gained attention. Within the armor community, it became apparent that small numbers of tank crews were having a disproportionate battlefield effect during each rotation. For example, one crew from the 5th Battalion, 33rd Armor Regiment (5-33 Armor), accumulated 25 kills during one battle. The crew repeatedly used the tank’s smoke grenade launchers to create a smokescreen from which it emerged, fired, and then withdrew back into the smoke. When ammunition ran low, the crew salvaged additional rounds from other vehicles ruled knocked out. The OPFOR finally surrounded the lone tank with BMPs and “destroyed” it with a Sagger antitank missile. (38)

Review of such killer crew exploits found a similarity in their battlefield techniques. They regularly scanned broad sectors, which facilitated faster target acquisition and rapid engagement. They used terrain reference points and precision gunnery techniques coupled with accurate vehicle recognition. Their movements routinely utilized covered paths, and their movement into battle positions occurred slowly and quietly so as not to alert the enemy to their presence. When advancing, these crews used a short halt technique in which they periodically halted to scan a sector before moving again. Whenever possible, they employed full hide positions and keyhole shots. These and similar actions made these crews better able to survive and eliminate large numbers of hostile forces — exactly the requirement for combat units facing a numerically superior threat. Consequently, their exploits tended to reinforce the attention given to crew proficiency and related efforts to make crew qualification more challenging. (39)

Increased rigor and realism in training, however, came at a price. In the early 1980s the Department of Defense faced rising training costs associated with the fielding of new weapon systems, range upgrades, and the construction of the NTC. New platforms like the M1 Abrams provided a significant boost in combat capability, but they carried a hefty price tag. In the case of the M1, the vehicle’s cost triggered a reduction in tank platoon size and the elimination of tanks from division cavalry squadrons. Efforts to trim training costs also resulted in close scrutiny of training activities and the related ammunition requirements.

In 1980 the Weapons Crew Training Study Group was established to assess how the U.S. Army and its allies conducted weapons training. In particular it sought to understand how unit combat readiness assessments remained high when training resource requirements were not met. A credibility gap existed. Either the requirements or the readiness assessment were overstated. The Group found U.S. training heavily based on live ammunition with only a limited use of training devices in comparison with other nations. For example, each American tank expended an average of 134 main gun rounds annually for training purposes. This number contrasted with 70 for the Federal Republic of Germany, 44 for France, 40 for the Israel, and just 21 for the United Kingdom. The U.S. Army used no standard methodology to determine annual training ammunition requirements. Moreover, “there were no weapons standards across the U.S. Army against which units could measure relative readiness. The costs of training ammunition were escalating geometrically and stockpiles remaining from previous conflicts were almost exhausted.” The fielding of new weapons and platforms further



increased the cost of ammunition. The cost of a main gun round for the Abrams tank, for example, rose from \$227.90 for the M1's 105-mm gun to \$924.56 for the M1A1's 120-mm. (40)

These findings led the Army vice chief of staff to establish the Standards in Training Commission (STRAC) Program Directorate in 1982. The mission of the new organization lay in developing training standards for all weapons systems and recommending programs that maximized usage of training devices, sub-caliber firing, and simulators to achieve these standards and sustain the related skill sets. These actions served to establish ammunition requirements for training. In 1983 the directorate issued a draft circular that included these objectives. The standards and ammunition allocations described became the subject of an Army-wide testing and evaluation period that involved some 100 battalions over nine months. Following revisions based upon unit input, the circular was published in December 1984 as DA Circular 350-84-2: *Standards in Weapons Training*. Dissemination was accompanied by a deliberate effort by the Department of the Army to educate field units on the circular's contents and their application to training. Further changes focused upon the reserve component and training divisions resulted in the publication of a second circular. (41)

These efforts to standardize weapons training and determine realistic ammunition requirements also became the focus of the Army Audit Agency. This organization undertook a study of the management of training ammunition between October 1984 and October 1985. It also reviewed the work of the STRAC Program Directorate and found the directorate's efforts to be an improvement. However, the Army Audit Agency considered the training ammunition requirements overstated. It recommended further evaluation, resulting in the establishment of the Standards in Training Commission. This body reviewed the training standards outlined in the DA circulars, the validity of the related ammunition requirements, and training device utilization. (42)

The Commission's findings related to Armor found most units struggling to meet the new standards. The principal reasons for this difficulty included personnel turbulence, range access, and insufficient training time. Range issues included the absence of accessible facilities capable of supporting the training required. This longstanding problem, however, slowly began to be addressed through the completion of range upgrade projects begun in 1982 and the centralization of range modernization management. No such relief existed for the personnel issues that constituted the most significant problem for active component units. Tank battalion commanders undertook a variety of measures to stabilize crews, including making themselves the approving authority for all crew changes. However, such action could not stop personnel changes generated by promotions, duty rotations, punitive actions, or school attendance. (43)

Despite the difficulties in attaining the STRAC standards, most unit commanders found them to be valid. They supported the requirement for tank units to conduct platoon gunnery qualification and ARTEPS. Indeed, the standards were considered a good measure of combat readiness. Commanders did not want them revised or lowered. Instead, they wanted the obstructions to realizing them removed. Moreover, most units experienced no training ammunition shortfall, even though the yearly ammunition allocation was slated to fall as units received their own UCOFT simulators from 134 to 100 rounds per tank. Indeed, large quantities of unused training ammunition were actually turned in. The STRAC report provided a basis for more realistically matching training with resource requirements. For armor units, this alignment provided a means of reducing main gun ammunition and realizing a cost savings without undermining training effectiveness. (44)

### **To Zero or Not to Zero?**

Efforts to reduce the training costs led to closer scrutiny of zeroing and boresight procedures to determine whether a savings in training ammunition might be realized. In the 1970s armor units generally boresighted and zeroed before every live fire event. Boresighting aligned the center axis of the gun tube with the gunner's line of sight at a set range. The process involved stretching two

threads horizontally and vertically across the gun muzzle at right angles to one another. A strap or tape held the threads in place while a crewman sighted through the gun breech with binoculars, giving directions to the gunner to manually move the gun so that the intersection of the threads fell on the upper left corner of a square boresight panel set at 1,200 meters (the standard battlesight range). The gunner then aligned the reticle for each sight to the same point. (45)



*Old fashioned boresighting with tape and thread. (U.S. Army Armor School Archives)*

With boresight complete, the crew then fired three rounds at a panel 1,200 meters distant. Based on the results, the gunner then adjusted his sights to the center of the shot group. Done correctly, most rounds fired would then strike within two feet of the aiming point at this range. In effect, zeroing corrected for the difference between the gunner's line of sight and the actual point where rounds struck the target. This difference, sometimes referred to as "gun jump," tended to be constant and unique for each gun tube over its life. The sight adjustment settings were then recorded and always available to the gunner, who could use them to consistently correct for a gun's now known peculiarities. In this manner, the established zero for the tank had been determined and little need existed to re-zero the weapon. (46)

Done correctly, the combination of boresight and zeroing theoretically provided an accurate weapon system. However, a study conducted by the Army Research Institute Field Unit at Fort Knox in 1977 indicated that many crews did not understand these procedures and conducted them with less than precision. In the tank battalion that served as the study's target "most tank crews believe that boresighting is used only as a means of getting the initial shot 'in the ball park' so that zeroing can begin in earnest." They did not understand the difference between the two actions or the importance of an accurate boresight to zeroing. Too many tank commanders did not supervise and check the

work of their crewmen. The string and binoculars method also did not take into account gun droop or bend. Hence without careful oversight, an already imprecise process became even more so through injected human error. The lack of understanding and insufficient emphasis upon precision resulted in crews that expected to hit the zero panel with their first round only about 60-80 percent of the time. At the time of the study, the battalion zeroed 34 tanks, each requiring an average of 6.36 rounds to complete. Only 75 percent of all rounds fired struck the eight-foot square panel, and only 56 percent hit the panel on their first shot following a warm-up round. (47)

Less than one in three tanks possessed a recorded established zero, and its use to improve accuracy was not well understood. Most crews simply re-zeroed before each live fire event, effectively re-determining the established zero repeatedly. The combination of overreliance upon zeroing coupled with less than optimal boresight practices posed a problem for tanks that relied upon lethal, accurate gunnery to offset the Warsaw Pact's numerical advantage in combat. Based upon its observed results on the zero range, less than 60 percent of the unit's tanks could expect to score a first round hit if thrust into battle without a chance to re-zero. Worse, it could expect 25 percent of all rounds fired at 1,200 meters to completely miss their target. (48)

Based upon its findings, ARI recommended that frequent zeroing be eliminated as a training practice. Instead, each tank should be zeroed once in its lifetime and the established zero and related sight settings recorded for future use. Before each live fire event, the vehicle would fire a single round to verify its zero. This recommendation became established doctrine, and only changes to major components of the main gun necessitated an additional zero. For the actual zero process, the study recommended the use of larger, 12-foot square panels to minimize the chance of a miss and enable crews to determine their zero from a three-round shot group. The smaller panels used by the unit observed resulted in numerous misses, necessitating either the use of more ammunition for zeroing or determining the zero from either one or two rounds — a much less accurate measurement. The study also stressed the importance of precision boresighting in attaining an accurate zero. (49)

In the wake of the ARI study the Armor Center opened a detailed investigation into boresighting and the zero process to standardize the best practices across the force. To conduct this work, the Armor Center relied upon the U.S. Army Armor and Engineer Board, collocated at Fort Knox. The Board published its findings in 1980 under the title "Concept Evaluation of Battlefield Boresight Techniques and Zero Retention." It questioned the existing policy of zeroing tanks once in their lifetime with reliance upon confirmation checks before each live fire event. Failure of this confirmation necessitated re-zeroing the tank, and in fact most tanks had to be re-zeroed many times. (50)

Confirmation failures stemmed from the imprecision of the test itself and the related boresight procedure. While determination of the established zero for each individual tank enabled crews to identify and adjust for gun jump, they could do little to compensate for other variables impacting gun accuracy. Crew induced errors posed one hazard not always recognized by the personnel who generated them. Gun tube wear, the presence of a cross wind, air pressure, and the condition of the fire control system also influenced zeroing. In effect, when a zero was conducted, it locked in the conditions at that time. It provided the best chance of hitting a target as long as those conditions remained constant, but the weapon lost accuracy as those conditions changed. (51)

Ammunition posed a different set of problems. Observation of differences in ballistic performance among ammunition lots meant determination of a zero would not necessarily generate the same accuracy when applied to the same type of round drawn from a different lot. Moreover, the ammunition used for training possessed ballistic differences from the service ammunition intended

for combat. (52) Even if service rounds were provided for zeroing, environmental considerations precluded the use of kinetic energy rounds with depleted uranium on most ranges. Hence, zeroing with training rounds offered no assurance of similar accuracy with service rounds. In essence:

... if you zero with training ammunition you will undoubtedly hit panels on a range, but ... training round zeros do not enhance the capability to hit combat targets with service ammunition, no matter how refined your training ammunition is. Even if you could zero with service ammunition, the simple act of changing to a different lot of ammunition might not only make the initial zero ineffective, but may reduce your real probability of hit (PH) capability. (53)

The problem of zero instability coupled with the limited value of applying zeros obtained with training ammunition to service rounds encouraged zeroing tanks just prior to combat. The tank could then be zeroed with the ammunition it would carry into battle under conditions hopefully more similar to those prevalent when live fire began in earnest. This approach, however, added another task to a unit likely already scrambling to prepare for combat. The zero process required time, precision, and careful organization — qualities that might not be readily achievable in a field environment for a unit going to war. (54)

Therefore, the Armor Center sought to determine whether calibration of the fire control system without precision zeroing could provide equivalent accuracy. The Armor and Engineer Board served as the investigating agency. The Board reviewed a variety of calibration options, and it compared boresighting with the traditional binoculars and string method with use of a muzzle boresight device. A similar comparison conducted in 1965 found little need for such devices, since the study sought only to determine which type of boresight method offered the greatest reduction in rounds necessary to zero a tank. (55)

The later study, however, sought to focus on boresighting with a muzzle boresight device in lieu of zeroing. The muzzle boresight device was a manufactured item inserted into the gun tube to provide a more precise boresight adjustment. Such devices were not a new invention and several units were already familiar with them, particularly the British designed Pye Watson device. The Board found that the combination of a muzzle boresight device and application of a common zero in which every tank carried the same settings provided the greatest accuracy. (56)



*Using the in-bore muzzle boresight device. (Carl R. Johnson)*

These results led the Armor Center to direct a field validation of them in 1981. Three USAREUR units (3-63 Armor, 1-64 Armor, and 3-7 Cavalry) did so during their annual live fire gunnery. Each unit applied a different calibration technique, including the traditional individual zero and thread/binocular boresight. This field validation confirmed the Armor and Engineer Board findings:

... tanks calibrated by boresight only or common zero had an equal percentage of first-round hits on Table VIIIA [daytime] and qualified at a higher rate than the tanks calibrated by individual zero. Additionally, there were no noticeable differences between the performance of the tanks calibrated by common zero and those calibrated by simply boresighting. (57)

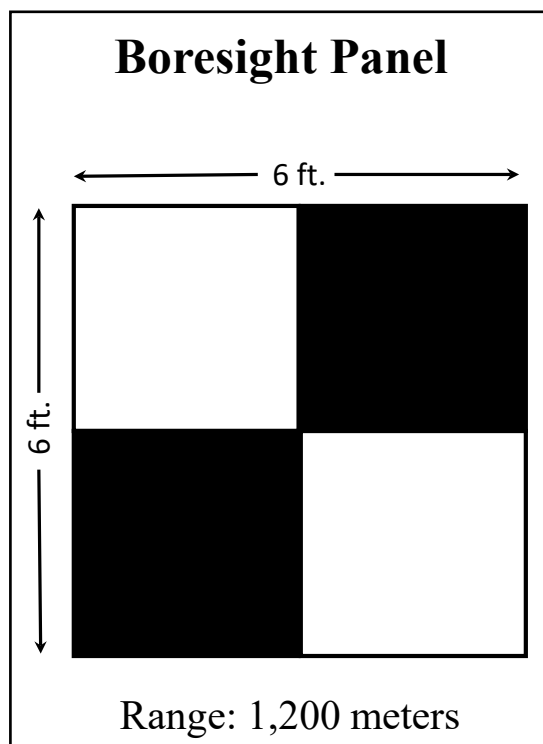
Based on these findings, in 1982 the Armor Center implemented a new calibration policy equally viable for training and combat. It abandoned the zeroing process in favor of an emphasis upon boresighting with a muzzle boresight device. However, the new policy emphasized command-driven maintenance of tank fire control systems to ensure they remained in peak running order. If allowed to fall into disrepair all calibration policies would be irrelevant — the fire control system would not retain its boresight and the weapon would be inaccurate. Therefore preventive maintenance received considerable attention. Noting the lack of boresight knowledge highlighted in the earlier ARI study, the Armor Center wanted the purpose and importance of boresighting clearly articulated in manuals. It specifically wanted to discourage crews relying upon a live fire exercise (like zeroing) to discover a problem. Instead, crews needed the knowledge and skills to detect faults and ensure their repair before arriving on a firing range or battlefield. (58)

In training, upon completion of their boresight, crews were to conduct a live fire screening test to confirm the accuracy of their system. This test entailed firing a single round at each of three targets placed at 950, 1,200, and 2,200 meters. The three rounds did not serve as a zeroing shot group. Instead they served to confirm an accurate boresight and build crew confidence in the accuracy of their tank. Tanks that failed this test then became subject to scrutiny to rule out human error and determine the actual nature of the failure and see to its repair. This approach also marked a departure from the more traditional practice of simply re-zeroing the vehicle without really identifying or fixing the problem. The new policy's emphasis upon fire control system maintenance and command involvement ensured that failure of a screening test became an issue for the entire unit rather than just one crew. (59)

The new calibration policy served to improve tank accuracy, reduce the number of rounds used in training for zeroing, and increase the time available for combat training. Yet the policy's success hinged upon the availability of suitable muzzle boresight devices. In the early 1980s, the Pye Watson muzzle boresight device was favored by the Army for acquisition and fielding. Securely mounted into the main gun's muzzle, it offered a more precise means of adjusting boresight than possible with the binocular and thread method, and it could identify and correct for minor errors. However, the device itself could fall out of adjustment, making an accurate boresight impossible and necessitating repairs generally not possible in a field environment. Still, use of the muzzle boresight device improved boresight accuracy, and the Army sought to field it at the rate of two devices per platoon with an optimal goal of one per tank. (60)

In 1981 the Armor Center conducted evaluations of different boresight devices to determine the best one to pursue for procurement. With the adoption of the boresight only policy in January 1982, this action accelerated. Many units, particularly in USAREUR, already had familiarity with the Pye Watson device manufactured by the Optic Electronic Corporation. In November, this company received a contract to produce and deliver these devices to the Army. The action was challenged by Wild Heerbrugg Instruments, Inc. whose tunable muzzle boresight had been considered but not adopted. The Army Audit Agency responded to the specific allegations raised by Wild Heerbrugg by directing the cancellation of the existing contract and more evaluation of different boresight devices.

It furthermore recommended the prohibition of local purchases by units until the issue had been settled. In July 1984, the Assistant Secretary of the Army directed the implementation of the first year's buy of 2,500 devices and adherence to the Audit Agency's recommendation for further evaluation. Continued study and testing continued until the adoption of the Lenzar M26A1/M27A1 muzzle boresight device in 1988. In the meantime, units used previously acquired muzzle boresight devices or continued with the now discredited practice of individually zeroing their tanks. (61)



Nevertheless, the new calibration policy required crews to carefully maintain their fire control systems and acquire a basic understanding of the boresight process. The background analysis that triggered the new calibration policy also encouraged much more attention to the factors that influenced gun accuracy. Consequently, the relevance of the Canadian Army Trophy rose. A competition focused upon precision gunnery in which participants spent the better part of a year honing the related skills necessarily attracted the attention of an armored force increasingly attentive to the science rather than the art of tank gunnery. USAREUR underscored this scientific linkage by seeking the assistance of the U.S. Army Ballistic Research Laboratory to enhance gunnery in its preparation for the 1987 CAT competition. In addition, the experience of 2-66 Armor in the 1983 competition in which the unit relied upon boresighting and system maintenance in lieu of more traditional zeroing offered confirmation of the new calibration policy, particularly since the unit utilized older and less capable M60A1 tanks. The experience of the German Panzer Battalion 293 in the same competition also illustrated the pitfalls of overreliance upon zeroing.

### **Tank Gunnery Skills and the People Factor**

Noncommissioned officers played a critical role in boosting tank gunnery skills and related tactical competencies. These leaders constituted the bulk of tank commanders and all master gunners. However, the 1980s began with a significant shortfall in the ranks of sergeant (E5) through master sergeant/first sergeant (E8). Only 79 percent of staff sergeant (E6) positions were filled, a number that plummeted to an exceptionally low 42 percent in Europe. Part of the problem lay in the

large number of sergeant and staff sergeant authorizations in the branch unmatched by a larger base of privates. This imbalance originated in the reduction in tank crew size from five men to four that accompanied fielding of the M48 in the 1950s. Force developers simply dropped the fifth man from manning charts without accounting for the impact upon the personnel health of Armor. In effect, the grade pyramid morphed into something more akin to a cylinder that reduced the number of privates potentially eligible for promotion while retaining a similar number of NCO positions. Shortages resulted, but the grade structure was never adjusted. (62)

Attrition aggravated this shortfall. Increasing numbers of senior NCOs simply retired, while more junior NCOs ineligible for promotion resigned. A different type of problem stemmed from the short time soldiers spent stationed in the United States between overseas postings. Most armor NCOs could expect to spend more time in Europe than at home. Unfortunately, a shortage of government quarters in Germany generated family separations that in turned fueled discontent and morale issues. The impact could be seen in the migration of Armor soldiers to other military occupational specialties, with many soldiers transferring out of Armor Branch at the time of reenlistment. Efforts to stabilize NCO duty assignments and permit more time in the United States between overseas tours of duties remained an ongoing objective with the goal being 36 months between assignments. (63)

No simple solution to the NCO shortage existed. The Armor Center considered a reduction in the rank of tank commanders from E6 to E5 but remained uncertain whether the more junior NCOs possessed the requisite experience and skills for combat. Involuntary reclassification of NCOs from other branches into Armor solved the numerical problem, but created a new training problem, since these novice tankers would be responsible for developing their own crew members. Pay incentives to help retain NCOs offered a possibility, but required significant funding. The optimal solution lay in raising the branch's end strength, but such an act required congressional approval — and considerable money. (64)

Faced with a major problem that defied resolution, the Armor Branch worked to limit the number of duty assignments that took tankers away from field units. It especially sought to preclude consecutive postings in assignments that did not require the skills of Armor NCOs. It wanted its sergeants and staff sergeants spending most of their time in tactical units honing their proficiency as tankers. In 1985 a sergeants first class promotion board found significant numbers of NCOs spending too much of their careers working outside Armor. Such diversions from troop assignments reduced promotion prospects. Armor therefore recoded duty positions in training formations and higher formation staffs so that they did not require Armor NCOs. This action increased the number of branch-qualified NCOs for field assignment and reduced the potential for future assignments that removed NCOs from troop duty. (65)

In the period 1985-1987 promotion rates for senior NCOs (E7 to E9) fell consistently, although retention rates among Armor NCOs proved higher than the Army average. However, in order to attain the rank of command sergeant major, an NCO had to graduate from the Sergeants Major Academy. With insufficient Armor graduates, units had to accept sergeants major from other branches, a condition the branch found unacceptable. The command sergeant major was the senior trainer in his unit. He therefore had to possess the requisite proficiency and skill mastery of his branch. (66) In the 3rd Infantry Division, several tank battalions possessed airborne or infantry command sergeants major — a recurring situation. It caught the attention of the Armor Center commander when he visited the formation in 1985. At the time, two non-Armor command sergeants major served in tank battalions. To his staff he noted:

Both appear to be doing a good job in the mind of the commander; however, this is a very difficult challenge. We simply should not be doing this. I thought we had it fixed. What's the problem? (67)

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Unfortunately, no amount of effort could ensure that personnel assignments placed soldiers in positions suited to their branch background and skill sets.

Master gunners with their related gunnery and training expertise proved critical to enabling combat units to overcome personnel difficulties and boost combat readiness. Between 1976 and 1981 the Armor School's master gunner course generated over 500 master gunners for the force. The course remained highly sought by Armor NCOs, many of whom waited over a year for a chance to attend. Candidates had to satisfy stiff prerequisites to become immersed in highly technical and rigorous instruction over a three month period at Fort Knox. Each class included 25 students, but over a third generally failed to graduate. Hence, the Armor School encouraged units to select candidates from among their best NCOs and prescreen them. By 1987, the course had opened to E5 sergeants. The branch sought to ensure the availability of sufficient master gunners to every major command and formation in the Army, but the combination of small class size and high attrition made this process a slow one. (68)



*M60A1 tanks mired in mud during training exercise. (National Archives and Records Administration)*

Upon graduation, master gunners returned to field assignments. They represented a link between their unit and the schoolhouse that the Armor School actively encouraged. Moreover, master gunners were encouraged to share ideas and best practices among themselves, thereby providing an informal gunnery network that units could leverage to overcome specific training challenges. The Armor School established a point of contact program that associated geographic regions in the United States and formations stationed overseas with a specific master gunner. In this manner every armor unit had an additional gunnery expert to assist them, while the Armor School possessed a conduit through which to pass information to the field, reinforced by publication of a regular master gunner column in *ARMOR*. (69)

Commanders held their master gunners in high esteem, and the value of these experts to building combat readiness was undisputed. However, a perception spread among soldiers that becoming a master gunner undermined professional advancement. Too many of these specialized soldiers felt unappreciated and overworked. They had to be equally proficient as master gunners and NCOs in



order to obtain promotion. At the company level, master gunners experienced frustration in trying to serve simultaneously as a platoon sergeant and the unit master gunner. The high workload proved difficult to satisfy, often resulting in subordination of the master gunner duties. Conversely, repetitive assignments as master gunners without the opportunity to serve as a platoon or first sergeant hurt promotion prospects. (70)

The Armor Center sought to address these problems through several actions. At the company level, an organizational change moved the master gunner into the headquarters section, eliminating the dual workload. Increased gunnery instruction in the Basic and Advanced Noncommissioned Officer Courses broadened the scope of expertise in the field, thereby reducing the demand for master gunner involvement in the more basic gunnery tasks. The master gunner's talents could be employed where most needed or in accordance with command emphasis. In 1984 changes to career management field 19 (Armor) resulted in an upgrade in the rank of battalion master gunners to master sergeant. (71)

Within their units master gunners provided weapons and training expertise. They played a central role in increasing the efficacy of armor training in the 1980s. However, some aspects of field service were beyond their influence, including command climate and leadership style. In 1983 the Army Research Institute's Fort Knox Field Unit conducted an assessment of armor training in Europe. The study sought to determine whether a tank battalion could maintain high performance over a six-month period. In the process, the ARI team found two tank battalions from the same brigade similar in terms of resources, training time, range access, vehicles, general training strategy, and qualification outcomes. On paper, the units seemed identical, but the soldiers in one battalion considered their training experience entirely negative. In the other battalion training was considered an outstanding success. (72)

Where the training experience was considered poor, the unit commander had little experience with his company commanders. Hence, he centralized authority and planning for tank gunnery, leaving subordinates with little ability to influence its execution or contribute to its preparation. Lacking empowerment, these officers largely awaited prompts from higher to implement training activities they did not own. One result lay in the battalion soldiers seeing little command involvement or interest in their training. They considered much of their pre-live fire training of little value and did not see the overall training experience as constructive or overly successful. (73)

In the second battalion, the company commanders considered themselves empowered by their commander. They felt free to plan and execute training, resulting in more imaginative approaches, including the temporary conversion of a nearby airfield into a Tank Table VIII dry fire range. The ability to innovate resulted in a greater commitment by the company commanders, who in turn had a vested interest in the execution of their training events, resulting in a highly visible command presence actively involved in achieving training objectives. Platoon leaders followed suit and acted as instructors for their soldiers. Tank crews spent less idle time awaiting guidance from higher headquarters. They considered their training meaningful and possessed confidence that each task performed met the doctrinal standard. The key distinction lay in the degree of trust placed in company commanders and the active involvement of the company leadership in all aspects of training. Such interaction in a training context to achieve training goals not only prepared crews for qualification, it built unit cohesion and boosted morale. (74)

The Armor School bore responsibility for building leaders capable of generating such cohesion. At the start of the 1980s changes to officer instruction included an extension of the Armor Officer Basic Course (AOBC) to 15 weeks and an emphasis upon platoon leader responsibilities. Refinement of AOBC led to training tailored to the organization type (tank or cavalry) and equipment of their first duty assignment. This approach enabled an immersion of lieutenants in the technical and tactical skills they would need upon assumption of platoon command. The course culminated in a continuous

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10-day field exercise in which students applied the skills taught. In its new form AOBC featured more field activities, higher standards, and increased opportunities for outstanding performance to be acknowledged. It sought to provide more capable platoon leaders to the force and reduce the need for units to groom their own junior officers. Unit responsibilities could shift to refinement of the new platoon leader's ability to lead and interact with his soldiers and chain of command. (75)

At the company and troop level, the Armor Center sought to develop leaders able to fight according to a standard doctrine. In turn, such leaders would begin to train their units according to a uniform standard of performance. Utilizing the company commander to promote standardization served to create an environment in which "ultimately, soldiers joining a unit will find that the way it operates is much the same as it was within his last unit." (76) By the mid-1980s, the Armor Officer Advanced Course had been retooled. It spanned a 20-week period in which students received increased amounts of tactical and technical training that included expanded time in the field and addressed new weapons systems, training devices, and doctrine. About one third of the course focused upon preparing students for operations at the battalion and brigade levels, including an exposure to staff responsibilities. (77)

Changes to NCO instruction paralleled the efforts to improve the tactical and technical competency of officers and encourage standardization within units. The Advanced NCO Course (ANCOC) underwent conversion into an armor platoon sergeant course with separate versions for tank and cavalry NCOs. The Armor School executed a pilot version of the revised course that completed in April 1980 before full implementation later the same year. The program of instruction emphasized combat leadership, training management, tank gunnery, and platoon tactics. The 11-week course was taught at Fort Knox, and it integrated training with AOBC students when viable. It included more field time and culminated in a four-day exercise. (78)



*An M1 churns its way through a muddy field. (National Armor and Cavalry Museum)*

The new ANCOC also incorporated master gunner skills. Indeed, “A new platoon sergeant is expected to return to his unit as an accomplished master gunner, fully prepared to teach correct gunnery methods to his platoon.” Hence the course included considerable refresher training and gunnery techniques taken from the Master Gunner course. Ammunition constraints, however, forced more attention to training management rather than actual live fire events. Nevertheless the influx of this gunnery expertise, centrally taught at the Armor School, helped to standardize gunnery training across the force and offset personnel turbulence. (79)

In 1986 ANCOC again became the focus of revision in response to changes in doctrine and materiel. The new design sought to reduce the extent of refresher training for basic skills. ANCOC students were expected to be qualified tank commanders before attendance and demonstrate their proficiency. Reducing the time spent retraining basic skills permitted the inclusion of instruction devoted to UCOFT. Indeed the course designers sought to make ANCOC graduates qualified instructor/operators for the device. However, the redesign remained a work in progress throughout 1987 with implementation set for the following year. (80)

BNCOC, too, became the target of change. In 1980 the Armor Center sought to create a single course taught at Fort Knox that focused upon preparing tank commanders in an immersive, vehicle-specific regimen. Consideration was given to integrating NCO and basic armor crewman training during the final phase of the course to enable new tank commanders to gain experience working with soldiers in field situations. Cost issues prevented implementation and led the Armor Center to focus upon revising rather than replacing the existing BNCOC. Changes in doctrine and materiel made this action a priority. Consequently, the program of instruction focused upon teaching critical skills to new tank commanders before they went to their unit. It also sought to make students into effective trainers. The final phase of the planned program of instruction included field training that incorporated MILES and live fire. Students were expected to demonstrate their proficiency in all crew positions. Although intended for NCOs, the course was also open to officers requiring training as tank commanders. The finalized course was intended to be exported to other installations with NCO academies, although the preferred objective lay in executing all tank commander training at Fort Knox where entire crews could be trained together. (81)

Implementation of the revised BNCOC occurred in the mid-1980s. It was taught on all installations where an NCO academy existed. Consequently, adherence to the new program of instruction varied, and a standardized approach to tank commander training did not result. In 1986 the Armor Center again undertook the revision of BNCOC. To ensure greater uniformity in execution, every installation offering BNCOC was briefed on the new course design. It retained many features of the earlier course, including an emphasis upon tank commander proficiency. Each student had to demonstrate effective use of every weapon on the vehicle in order to graduate. Tactics were taught in a classroom setting and tested in the field. Basic skills taught at the junior enlisted level were tested but not taught in the new BNCOC. The Armor Center wanted unit commanders to have faith in the competence of their BNCOC-educated tank commanders. Hence, while the course focused on generating proficient crew leaders, it also served as a mechanism to identify individuals deficient in the requisite skill sets for removal from Armor Branch. (82)

The implementation of One Station Unit Training (OSUT) in the latter 1970s marked a major change in training. OSUT integrated basic combat training and advanced individual training into a single curriculum, providing a continuous, progressive development from new recruit to loader, gunner, or driver. Unfortunately, nearly 50 percent of OSUT graduates found themselves assigned to crew stations for which they had not been trained. Simple mismanagement accounted for part of this problem. However, “the combination of the wrong man in the job and the normal personnel turbulence in the unit place an added unacceptable training burden on a unit commander.” Therefore the Armor Center reoriented Armor OSUT from a crew station focus to a vehicle one. New armor crewmen would graduate from OSUT qualified as a tank loader, driver, and gunner. This change

served to provide unit commanders more flexibility in dealing with personnel changes and simplify crew assignments within platoons. (83)



*Soldiers securing a Hoffman tank gunfire simulator to an Abrams tank during training at Fort Knox. The device generates the sound and smoke associated with a main gun round without one actually being fired. (National Archives and Records Administration)*

The Armor Center sought to offer opportunities for additional training and faster promotion to soldiers who excelled. In 1984 it implemented the Excellence Track. It began with the 1st Armor Training Brigade, responsible for OSUT execution. This unit's chain of command selected promising new tankers to receive additional training in tank driving, maintenance tasks, UCOFT, and fire control system calibration. This added instruction facilitated faster promotion to private first class. Once selected for this program, which became known as the Excellence in Armor program, soldiers were tracked and identified. When they reached units, commanders continued to provide them with additional training opportunities to build and expand their skills. Overall, the program helped the Armor Branch to identify, reward, and incentivize high performing soldiers who could then be further groomed into exceptionally capable NCOs. The program proved popular and gained strong unit support. The Army Deputy Chief of Staff for Personnel made it a permanent program in October 1987. (84)

Certification tests also emerged in the schoolhouse to confirm skill proficiency. The Tank Commanders' Certification Test-I became an annual requirement for all armor officers and NCOs. It was also considered as a prerequisite for ANCOC and AOAC and a graduation requirement for BNCOC and AOBC. The test itself proved similar to the Tank Crewman Gunnery Skills Test normally conducted by a unit chain of command in preparation for live fire. The Tank Commanders' Certification Test-II targeted sergeants (E5) in the Excellence in Armor program who had completed BNCOC. The test entailed eight hours of hands-on and written responses related to tank commander skills. Issued on a volunteer basis by a unit chain of command, it served to encourage professional development by junior NCOs. Passage of the exam offered the prospect of accelerated promotion to staff sergeant (E6) and identified potential candidates for the master gunner course. Tank Commanders' Certification Test-III served as a recertification of master gunner skills. Master gunners had to take this test on a biannual basis to demonstrate their continued proficiency. Senior

master gunners attended a refresher course at Fort Knox, and after passing this certification exam, returned to their units to recertify subordinate master gunners. (85)

In 1986 the 2d Armor Training Brigade at Fort Knox implemented retraining and refresher training for NCOs and officers who had been away from tanks for two or more years. (86) The Tank Commander Certification Course provided vehicle-specific refresher training for soldiers slated as vehicle commanders. It also helped to offset the complications of a mixed tank fleet. Officers and NCOs assigned to a new unit equipped with vehicles with which they had no or limited experience could attend the course before their duty assignment began. The Armor Commander's Course provided a similar purpose for active and reserve component officers. (87)

### When Training Standards Became the Enemy

The new calibration policy and efforts to improve realism in gunnery training found reflection in FM 17-12-1: *Tank Combat Tables M1*. (88) This manual appeared in a widely circulated final draft form in 1984, and it was supplemented by similar publications for the M60A3 and the M1A1. (89) Collectively, these manuals sought to address earlier training criticisms and raise the standards for gunnery.

The M1 manual included over 700 pages, suggestive of its comprehensive and explanatory nature. It restructured the tank tables, grouping them into basic, intermediate, and advanced levels. Progression from one level to the next required passage of a "gate" or test table. The number of tank tables increased from nine to 12. Tank Tables I-VIII focused upon individual and crew skills, while Tables IX-XII addressed section and platoon gunnery. Crews had to qualify before moving from crew to the section and finally to the platoon tables. Tank Table XI constituted a tank and wingman combat qualification course, while Tank Table XII now served as a platoon combat qualification course. (90)

**Tank Gunnery Tables 1984 (91)**

Tank Table	Nature	Personnel
I	Basic Gunnery Skills	Individual
II	Basic Gunnery Course	Individual/Crew
III	Basic Training Course	Crew
IV	Basic Qualification Course	Crew
V	Machine Gun Training	Crew
VI	Main Gun Calibration & Preliminary Main Gun Training	Crew
VII	Intermediate Training Course	Crew/Tank with Wingman
VIII	Intermediate Qualification Course	Crew/Tank with Wingman
IX	Advanced Training Course	Section
X	Advanced Qualification Course	Section
XI	Advanced Training Course	Platoon
XII	Advanced Qualification Course	Platoon

The platoon battle run that constituted the new Tank Table XII traced its roots to 1975. At that time a training circular provided a simple layout for a course that emphasized gunnery skills at the platoon level. Its intent lay in providing another level of training to build upon crew skills. Dry fire and sub-caliber training preceded execution of the battle run. However, in 1978, the focus shifted to place gunnery in a more realistic tactical context in which platoon maneuver and decision-making paralleled in importance hitting targets. This shift in nature complicated the development of effective and objective evaluation criterion. The battle run had no set layout. Unit commanders were

encouraged to avoid predictability and change situations, forcing platoon leaders to react. As the tactical emphasis became more pronounced, the platoon battle run ceased to be a natural progression of the gunnery skills honed from individual to crew level. Following Tank Table VIII qualification, tank crews were thrust into a fundamentally different environment requiring application of the full suite of platoon capabilities and skills. Evaluation became more complicated, particularly since units utilized their platoon battle runs to acclimate soldiers to the realities of the battlefield, identify weaknesses for further training, or to qualify as platoons. The manner of performance assessment necessarily varied with the training objective. A disconnect emerged between the focused nature and evaluation of tasks culminating in Tank Table VIII and the much more fluid and dynamic nature of the platoon battle run. (92)

The 1984 manual shifted the emphasis of the platoon battle run back to gunnery, embellished with a sprinkling of tactical considerations. Tank Table XII focused upon platoon qualification, preceded by preparatory exercises and section qualification. The traditional hierarchical development and evaluation of gunnery skills now progressed in a logical manner from individual crew through platoon. However, Tank Table XII did not provide a prescribed course or mandate the precise manner in which platoon gunnery would occur. Instead the manual offered the tasks, conditions, and standards to be met together with the related scoring procedure. Units received the flexibility to build their own Table XII range suited to their local conditions and training needs, provided they met the stipulated criterion for platoon qualification. Principal areas of evaluation included command and control, fire distribution, tactical movement, and reporting procedures. Scorecards provided a simple means of tracking targets destroyed, engagement times, ammunition usage, and fire commands. Engagements included a mix of moving and stationary targets with all weapons during day and night conditions. Platoons also had to engage both multiple and simultaneous targets in offensive and defensive postures and utilize vehicle smoke grenade launchers. (93)

Tank Table VIII remained crew qualification with crews required to complete five day and five night firing tasks that included NBC conditions and firing while moving between 15 and 25 miles per hour. Crews were evaluated on their ability to hit stationary and moving targets with their own tank moving or remaining in place. They were also required to conduct simultaneous target engagements, use both the primary and auxiliary sight, and successfully hit targets despite malfunctions. Targets required the use of both HEAT and TPDS/T ammunition. Engagement scoring resembled that used for CAT. Crews had 40 seconds to acquire and hit a target once it appeared, with faster hit times earning a higher score. Targets had to be hit squarely; they could not be clipped or rounds skipped into them. Penalty points accrued for incorrect actions, while the overall scores required to become qualified rose. Three levels of qualification now existed: distinguished, superior, and qualified. (94)

Armor units proved slow to embrace the revised and expanded tank tables in their entirety. Tank Table VIII remained the principal gauge of unit proficiency at every command level, since the number of qualified crews provided a simple indicator of training effectiveness. The continued emphasis upon crew proficiency resulted in confusion when units first attempted the new section and platoon tables. At Fort Hood the 17th Cavalry Regiment forced personnel to engage in section training involving a wingman. Coordination and control issues soon emerged, since these challenges did not exist on Tank Table VIII. The unit continued its movement into uncharted waters and gradually gained in proficiency. This section emphasis built upon existing efforts to improve crew skills. Indeed, the regiment relied upon another unit to organize and administer its crew qualification to ensure an objective assessment. (95)

Such growing pains did not invalidate the new tank tables. By raising the scope and standard of what had to be qualified at the individual, crew, and platoon levels, the new manual forced training changes. In order to qualify and assert combat readiness, tank units had to meet the qualification

standards. Tank tables, however, only addressed a portion of training. Armor units had both to maneuver and employ precision firepower, and critics of gunnery training had long noted the absence of tactical maneuver from live fire gunnery executed on familiar ranges against predictable targets.



*Two M60A3 tanks move along a road near Giessen, Germany, during REFORGER 1985. (Wikipedia Commons)*

The new manual addressed this criticism through the introduction of 12 tactical tables. These tables addressed fire *and* maneuver skills from crew through platoon. These tactical tables paralleled the progression in skills and complexity found in the tank tables that they were intended to complement, and they included similar test gates between crew, section, and platoon. However, whereas the tank tables focused upon gunnery, the tactical tables focused upon movement, navigation, decision-making, and maneuver. The tactical tables provided a means for tank units to conduct training in the full range of activities expected in combat. At the platoon level, the tactical tables provided a means of assessing performance without detracting from the specific skills necessary for gunnery — now the primary focus of Tank Table XII. (96)

Each tactical table included the task, conditions, and standard to be achieved, but it was left to the unit commanders to determine how best to execute with commonly accessible training aids on local training areas. With the advent of MILES, for example, units could conduct tactical exercises against an opposing force and conduct a detailed analysis of each simulated battle. While tank battalions did not have the means to replicate the magnitude and training scope available at the NTC, they could adapt and apply a similar methodology to their particular training environment. The tactical tables thus constituted a tool with which unit commanders could organize their training plans to achieve a higher combat readiness, particularly through implementation of wingman training and platoon actions, without reducing the attention given to those specific skills necessary to put steel on target. (97)

Indeed the combination of tactical and tank tables for platoons made it possible to learn how to employ the unit's weapons on a range and then apply these skills in a maneuver environment. In both instances, the importance of coordinated action among tank crews became clear, and the Canadian Army Trophy provided a source of lessons applicable to building team cohesion at the platoon level.

Armor Center commander MG Thomas H. Tait identified the utility of the competition to American armor training in 1986 when he noted:

One of the most demanding platoon tests — and I do not use this term lightly — faced by our tankers is the Canadian Army Trophy competition conducted by USAREUR. Here, the platoons are trained as teams. If one member of the team does not pull his weight, the entire team will do poorly. The stress is tremendous, and those units that practice and understand teamwork excel. (98)

Overall the revised tank tables and new tactical tables effectively raised the training standards that units now worked to attain. In the 1st Squadron, 10th Cavalry Regiment (1-10 Cavalry), a year-round gunnery program emerged to help establish and sustain well trained crews and subordinate units. Like many units, 1-10 Cavalry faced the challenge of limited training time, training area access, and ammunition constraints. The unit therefore focused upon identifying the most critical individual and crew tasks associated with gunnery. Training then targeted these tasks. The squadron also implemented a two-step crew gunnery skills test. First, each crew member received training related to his specific responsibilities followed by an evaluation. Once each soldier passed, the entire crew then prepared for crew qualification conducted on a cross country course overseen by a master gunner. A video system set to record through the gunner's sight, coupled with the use of a laser engagement system similar to MILES provided the tools for detailed analysis of each engagement, which in turn drove sustainment training. Using these training devices permitted the squadron to save live ammunition, which was then used for platoon battle runs. The unit also modified its Tank Table VIII course to include scouts, tanks, night movements, boresighting, navigation, terrain use, overwatch, and defilade use to generate the challenges and stresses associated with cavalry operations. (99)

Other units began to see the tactical tables as diagnostic tools with which to assess training. The flexibility of these tables made them well suited to modification by unit commanders to shape identified shortcomings and provide a sense of combat readiness. When the 3rd Brigade, 4th Infantry Division (Mechanized) returned to its home station at Fort Carson, Colorado, following participation in a Return of Forces to Germany (REFORGER) exercise, the leadership was less concerned with basic combat skills than with other capabilities not so recently assessed. It wanted to focus upon tasks associated with preparation for combat, assembly area actions, minefield breaching, hasty decontamination, hasty attack, and reporting procedures. To achieve these goals, the unit modified the basic tactical tables and established its own evaluation measures without reliance upon external funding or training support. (100)

Unit training programs assumed resource limitations, range access issues, ammunition constraints, and personnel turnover. They offset these issues through emphasizing the importance of active command involvement in training preparation and evaluation, particularly at the battalion level, bolstered by reliance upon master gunners as subject matter experts and evaluators. Moreover, units were encouraged to build crew member knowledge of their vehicle, its capabilities, and individual crew responsibilities. They also began to offset the impact of personnel turnover through shortened but intensive gunnery training prior to crew qualification, condensing instruction normally provided at a more relaxed pace over several months into just a few weeks. (101)

The 3rd Battalion, 69th Armor Regiment, 3rd Infantry Division (Mechanized) became one of the first armor battalions to meet the emerging new gunnery standards. It completed its transition to the M1 in March 1983, followed by maneuver training at Hohenfels Training Area. Returning to home station, it had just 45 days to prepare for gunnery qualification at Grafenwoehr. Therefore, the battalion first addressed individual crew training followed by the tank crew gunnery skills test, which enabled a shift to crew proficiency. The home station training culminated in platoon battle runs in offensive and defensive settings. Master gunners and turret mechanics then conducted



screening tests for each vehicle to confirm their accuracy before the unit traveled to Grafenwoehr. There it conducted crew and platoon qualification. All but three crews qualified on their first try at Tank Table VIII, and every platoon passed its Tank Table XII qualification. Critical to this success lay the use of integrated fire and maneuver exercises at the platoon level, careful attention to boresight, crew stabilization, and seven-day training weeks. (102)

Similarly, the 3rd Battalion, 64th Armor Regiment found itself faced with little time to prepare for live fire qualification. It, too, adopted a short but immersive training schedule that included 12-hour training days. Exercises focused upon full crew activities. The unit sought to achieve a sufficiently high level of proficiency that crew actions became automatic reflexes, but it faced the reality of a 75 percent personnel turnover within a year. Intensive training provided a short-term fix to this problem. (103)



*An M60 tank platoon in echelon. (Carl R. Johnson)*

Greater attention to sustainment training helped to prevent the rapid dissipation of gunnery skills following qualification and offset the worst effects of personnel changes. UCOFT proved one of the most powerful sustainment tools available to battalion commanders, but it was not the only one. Properly planned training programs oriented upon the skills embedded in the tank and tactical tables and implemented throughout each annual training cycle served to preserve a baseline competency. Freed from relearning basic gunnery skills before each qualification, units could broaden training to address more advanced techniques and their application to varied tactical environments. (104)

Indeed, a culture of confidence began to emerge in which training standards became an enemy to be defeated. Qualification events became opportunities to demonstrate unit skills rather than just mandatory training events. Formations encouraged competition among subordinate units to encourage ever higher accomplishments. Publication of qualification scores served to permeate a similar competitive spirit throughout the force. Crew qualification scores on Tank Table VIII and the number of crews qualifying on their first try became measures of unit achievement. In 1985, the 1st Battalion, 33rd Armor Regiment, 3rd Infantry Division, earned an average crew qualification score of 807/1000 points, with a high of 956/1000 points achieved by a tank commanded by a first lieutenant. The same unit, however, qualified only 14 of 38 tanks on their first attempt, compared to 27 of 52 tanks in the 3rd Battalion. Both battalions fielded the M1 IP, but the commander of the 3rd Battalion, 35th Armor Regiment quickly offered a reminder that his unit already had achieved the highest first time qualification for the year with 38 of 58 tanks — and those the older M60A3 platforms. *ARMOR* published these scores, which became records for other units to beat. (105) In

1986, the 2nd Battalion, 66th Armor Regiment did just that when it qualified 52/58 tanks on their first run with each tank scoring an average of 839/1000. (106) In January 1987 the 3rd Armored Cavalry Regiment conducted the Army's first crew qualification with the M1A1 with 33/41 crews qualifying on their first run. The top scoring crew earned 996/1000 points. (107)

These numbers underscored the sense of pride units felt in their achievements, but it also underscored the importance attached to gunnery training in general, and crew proficiency in particular. Achieving ever higher scores occurred during a time when training standards and evaluation criteria had risen and become more objective. Unit pride, coupled with more effective and sustained training, generated more effective combat organizations that in turn reflected the confluence of new materiel, more capable training devices, and better doctrine.

### **A British Challenger**

While the Americans focused upon training improvements, the British sought a replacement for Chieftain. Concept development began shortly after Chieftain's initial fielding, but in the 1970s the Future Main Battle Tank subsumed this effort. This Anglo-German program sought to share design costs while providing a common tank for both nations. The program ended without a product in 1977. In its wake the Germans focused upon Leopard 2 development. The British began a new national program known as MBT 80 with emphasis upon mobility, reliability, and survivability improvements for fielding in the mid-1980s. Rising costs and slippage in the research and development timeline pushed availability into the 1990s. These delays forced a continued reliance upon Chieftain, despite its known flaws. (108)

The Shah of Iran constituted the largest overseas purchaser of Chieftain. His government sought to overcome the tank's shortcomings through purchasing upgrades from the United Kingdom. In the 1970s, Iran ordered and received some 200 Chieftains with improved protection and increased fuel capacity. The Shah placed an additional order for a redesigned Chieftain featuring a more powerful engine and a robust suspension. This vehicle became Shir 1, and it emerged in prototype form by 1977. Iran also sought an entirely new vehicle with significant improvements in mobility and protection matched to the Improved Fire Control System and a laser rangefinder. This vehicle received the designation Shir 2, and Iran ordered 1,225. In preparation the Royal Ordnance Factory at Leeds began to build the production facilities and assemble the necessary workforce. (109)

These preparations abruptly ceased in 1979, when revolution toppled the Shah and an Islamic republic replaced the pro-Western monarchy. The new Iranian government refused to honor the contracts for the Shir 1 and 2, leaving the British without buyers for either tank. In late 1979 Jordan provided a partial solution, when it agreed to buy nearly 300 Shir 1 tanks, which became the Khalid in Jordanian service. (110)

The Shir 2, however, lay in an advanced state of design, but it had yet to enter production. Upon completion of the Jordanian tank order, the Leeds production facility would become idle and its workforce unemployed. The MBT 80, though preferred by the Army for its newer technology, remained in concept development. In the fiscal and political climate of the 1970s, shutting down Britain's tank production lines temporarily while the MBT 80 design matured carried the real risk of becoming a permanent cessation, leaving the nation little option but to rely upon foreign manufacturers. The merits of purchasing the American Abrams or German Leopard 2 received some consideration, but neither tank could use the large stocks of 120-mm separated ammunition on hand. The British people might also have difficulty accepting that the nation that invented the tank could no longer build one. (111)

Consideration of the Shir 2's fate occurred while the British Army of the Rhine (BAOR) continued to face a formidable armored threat in Central Europe and clamored for the replacement of its Chieftains. Shir 2 offered significant capability increases over Chieftain, although it did not

include the latest emerging technologies. Unlike MBT 80, however, Shir 2 was nearly ready to enter production. Even a small scale production run would provide BAOR with newer tanks, ensure the continued employment of the Shir 2's workforce, and avoid a complete shutdown of British tank production. These considerations led the government in July 1980 to order sufficient Shir 2 tanks to equip several armored regiments with an option to buy more vehicles in the future. This purchase effectively ended the MBT 80 program. (112)

Shir 2, renamed Challenger, became the British army's new main battle tank. Its design was fixed in 1981, production began in 1982, and the first delivery to the army occurred the following year. The Royal Hussars began to receive their first Challengers in April 1983, followed by the 2d Royal Tank Regiment in 1984. Other regiments followed, and the Ministry of Defense exercised its option to build more tanks. (113)



*Britain's CAT 1987 hopes—the Challenger. (U.S. Army Armor School Archives)*

Challenger offered better protection, mobility, and reliability than Chieftain. Chobham armor constituted a major advance in protection against the shaped charge munitions becoming prevalent on the battlefield. Indeed, Britain shared this technology with the United States where it became incorporated into the M1 Abrams design. Challenger also featured a new hydrogas suspension that provided a smoother ride and better cross country mobility. The engine, cooling system, and transmission constituted a single package to facilitate rapid removal and repair. The designers also made components requiring frequent checking readily accessible. Commonplace in American and German tank designs, these features had long been absent from British ones. A 1,200 horsepower Rolls-Royce diesel engine provided a significant boost in power without the proverbial white clouds that surrounded Chieftain tanks on the move. The comparative agility of Challenger, however, was not faultless. Crews receiving their new steeds quickly experienced faults caused by excessive vibration, noting that “when we received brand new tanks they tended to dismantle themselves, particularly after long periods on metaled roads.” (114)

Challenger possessed many commonalities with Chieftain. Chobham armor gave the Challenger a sleek, angular look, but its turret was largely the same as that of Chieftain, including the absence of a traditional gun mantlet. Both vehicles carried the same gun, used a loader's hatch of similar design,

featured a foot pedal as an alternate means of firing the coaxial machine gun, and suffered from the same poor ergonomic layout. The Challenger offered limited stowage beyond the tools and equipment issued with the tank. Crew needs did not constitute part of the official load plan, resulting in field improvisations to boost stowage capacity. (115)

Challenger's lethality offered few advantages over Chieftain. Both vehicles carried the same main gun and the Improved Fire Control System. Challenger did not feature stabilized sights like Abrams or Leopard 2, and, following British preference, relied upon electrical rather than hydraulic gun control equipment to reduce the risk of fire. The use of separated ammunition lowered the risk of an ammunition fire but slowed loading. Nor did the first Challengers possess a thermal sight, although it was planned for subsequent retrofit. (116)

Nevertheless, following the poor showing of Chieftain in CAT 1985, the British committed to debuting Challenger in the next competition. The vehicle needed to make a strong showing to reassure foreign markets that the United Kingdom remained a leader in tank design, restore confidence in the armored force, and stifle the media criticism that followed CAT 1985. The consequences of poor competition performance and exposure of the Challenger's fire control system limitations were clear: damage to Challenger's overseas sales potential, undermining of Britain's standing in NATO, and an adverse impact upon army morale. (117) Unfortunately, initial estimates suggested that without any modification Challenger-equipped platoons would only achieve 500-1000 points more than Chieftain units — an insufficient increase to beat American M1 or German Leopard 2 platoons. (118)

Britain's challenge lay in boosting the performance of a new tank with an old weapons system. Work began within weeks of CAT 1985. With the support of the Chief of the General Staff, the initial focus lay in acceleration of a suite of upgrades planned for Challenger. This course of action necessarily required upsetting the already established balance between development and acquisition timelines. It also necessitated changing existing funding and fielding priorities based upon BAOR combat needs to suit the Canadian Army Trophy. (119)

The upgrade of the tank's gun control equipment, responsible for the traverse and elevation of the main gun, exemplified the problem. Challenger's gun control equipment reflected a minor redesign of that carried on the Chieftain. It relied upon rotary electronic equipment, evidenced in the tank by the large numbers of relays, cable runs, and connectors—each one a potential source of failure. The age of the equipment meant that “it is a common sight on exercise to observe a significant portion of a squadron's tanks traveling with the gun in its crutch because of GCE [gun control equipment] failure.” Solid state gun control equipment offered improved reliability, simplified maintenance, and built-in diagnostics. It nearly doubled the rate of turret traverse and required less power. Nor did it require a warming up period, unlike rotary electronics that also made a distinctive, high pitched whirring sound when first activated, thereby compromising the tank's silent watch capability. Solid state gun control equipment also enhanced stabilization and enabled faster engagement speeds. (120) Despite these advantages, it remained unfunded in favor of outfitting all BAOR tanks with the Thermal Observation and Gunnery Sight (TOGS) to facilitate combat operations at night and in other poor visibility conditions. (121)

The British lobbied for the next CAT competition to be held in 1988 to provide additional time to improve Challenger's capabilities. In January 1986, however, it became clear the competition would occur the following year. The shorter timeline narrowed the possible upgrade options for Challenger. It precluded use of the Solid State Gun Control Equipment, which would not be available before 1988 even if funded. The shorter timeline served to reinforce the importance attached to reliance upon gunnery experts to maximize performance of the fire control system, modeling and statistical analysis, ammunition selection, training measures, and crew composition — actions that did not require a major materiel development solution. (122)

The British further resolved to build 24 brand new Challengers, modified through the application of select improvements, to equip the CAT team from each nominated regiment. Representatives from the Royal Armoured Corps and the materiel development community would oversee the building of the CAT tanks and support the user in subsequent training and competition preparation. Once it became clear that the Royal Hussars would represent the United Kingdom in CAT 1987, that unit became the recipient of a priority maintenance and supply effort to keep the competition tanks at peak performance. The unit's operational chain of command oversaw this effort with visibility at the Chief of the General Staff level. (123)

The most important technical upgrade to the Challenger tanks lay in the installation of an early version of the Improved Computerized Sighting System (ICSS). ICSS included a software-generated, stabilized aiming mark in the gunner's sight. The gunner moved this aiming point with a thumb controller that determined the speed with which the gun control equipment moved the gun in response. The tank's computer maintained the coincidence between the gun and sight while automatically calculating and adjusting for any ballistic or lead angle offset. Once the gunner designated a target, the rest of the engagement process proved automatic. ICSS separated target tracking and gun laying, enabling these functions to be conducted simultaneously, thereby shortening engagement time. (124)

ICSS provided an ergonomically simpler, more accurate, and faster means of engaging targets in comparison with IFCS. The aiming mark was essentially a software modification, and it carried a low technical risk. Moreover, it could be utilized with the older IFCS of the Chieftain and early production Challengers. Hence, it could be — and was — argued that ICSS insertion into CAT tanks simply represented an advanced copy of an upgrade intended for the entire tank fleet. (125)



*Another view of Britain's newest main battle tank—the Challenger. (U.S. Army Armor School Archives)*

The combination of enhanced accuracy, shorter engagement times, and low risk made ICSS too attractive to ignore. The British considered it the only way to improve gunnery speed and accuracy. The low scores of Chieftain crews in CAT 1985 despite an intensive training effort suggested that the upper bounds of performance with IFCS had been reached. Something new was required. Therefore, the British undertook acquisition of an early version of ICSS through a limited run production at extra cost. The small number of tanks required for CAT simplified this acquisition. (126) This action, occurring outside the normal scope of existing procurement schedules, drove the price per unit from £600 to £1,000, the difference representing a “CAT premium.” (127) As one Ministry of Defense official noted:

This I believe to be fully justified in procurement terms given the need to sustain Challenger sales prospects at a time when RO [Royal Ordnance] plc are likely to be fighting hard for Middle East orders, quite apart from the operational and morale factors of concern to the General Staff. (128)

ICSS, however, was not a panacea for Britain’s CAT gunnery woes. It was not a stabilized sight like that found on the M1 or Leopard 2. Those vehicles relied upon an electronic servo link between the sight and gun that simplified the gunner’s task and hastened target acquisition. Even with the new Challengers, “the older mechanical link which we have means the gunner has to wait for the gun to settle before making his final lay.” (129) At best, ICSS mimicked the responsiveness of a stabilized sight, but its full effect could not be realized without installation of a new elevation gearbox that enabled smoother and more precise gun movement, in turn allowing a more accurate gun lay. The development timeline for the gearbox, however, precluded its early acquisition and installation on the tanks designated for CAT 1987. (130)

The rapid development and fielding of even a small number of early ICSS systems still posed a challenge. Under normal circumstances hardware and software development completed before unit training began. To ensure crew familiarization and competency with ICSS, special measures were undertaken to build gunnery drills and crew conversion courses. The Army Trials and Development Unit (ATDU) possessed the only armored soldiers with ICSS experience. These personnel were slated to provide advice and training to CAT crews, although their testing mission did not include training support. Nevertheless, the accelerated fielding of the early ICSS proved successful, and users benefited from publication of an operator’s manual. (131)

The CAT Challengers also featured other modifications to improve their competition performance. They all carried TOGS to ensure a comparable ability to see heated targets as other participants. To address the difficulty experienced by crews in sensing APDS/T rounds, the gunner’s sight reticle for this ammunition was modified to facilitate tracking and engaging Grafenwoehr’s targets. Symptomatic of the importance and national pride represented in Challenger’s performance, the firm of Barr and Stroud performed this work at no cost. The tank commander’s cupola received a 15-power sight to further assist in target acquisition and sensing. Based on a similar successful change for the Chieftain gunner’s sight in CAT 1985, a software modification adjusted the aiming ellipse to fit the size of the CAT targets. (132)

Like other competing teams, the British sought careful selection of the ammunition to be used in the battle runs to minimize any performance degradation due to the rounds themselves. Indeed, “it was agreed that the possibility of optimizing the ammunition during manufacture should be investigated.” (133) The addition of the Chase modified loading guard eliminated the need for the loader to manually close the breech after each round. Closure occurred automatically, shaving time off the loading process and partially offsetting the lengthier time required for the separated ammunition. Tests on both Chieftain and Challenger showed the device helped to shorten engagement times by up to 2.5 seconds. (134)

The modified Challenger tanks raised concerns about potential violations of the CAT rules. The competition emphasized the use of tanks representative of the national fleet rather than customized oddities with performance enhancements. Throughout the development of the CAT Challengers, this concern repeatedly became manifest. Every modification generated discussion of whether it contradicted the rules. Should the chief judge find that tanks had been specially modified, they could be barred from the competition. For the British such a ban constituted a public relations nightmare. Yet with the exception of the loader's firing guard, modified sight reticle, and altered cupola, the modifications made to the CAT tanks generally did represent changes intended for the rest of the Challenger fleet. The British emphasized care in not bending the rules too far, particularly since "soldiers have an unfortunate habit of saying too much and the consequences, if we are considered to be breaking the rules, could be quite dramatic!" (135)

A discussion on the issue of rules violation among representatives from I (BR) Corps, the Royal Armoured Corps, and unit leaders concluded that the improvements to the CAT Challengers were part of the normal improvement package for the tank fleet. Nevertheless, "care was to be taken by all to check loose or ill-informed talk inferring contravention of the rules. The official line is that CAT crews are being issued with the latest mark of the Challenger as part of the normal issue of TOGS tanks to 7 Armd Bde units." (136)

The new tanks were expected to come off the production lines with TOGS between April and August 1986. By November they were to have ICSS and completed their initial commissioning firing. This schedule was kept, with BAOR receiving 16 tanks by year's end and the Gunnery School at Lulworth, England, six in October. As the tanks became available, they were to be "mollycoddled" to minimize the risk of equipment failure. (137)

However, symptomatic of the accelerated fielding, the vehicles delivered to the Gunnery School had not been fully tested and development trials remained incomplete. Hence initial test firing with the ICSS at Lulworth offered an exposure to discovery learning, since problems normally identified and corrected during testing were left to the Gunnery School. In preparation, a collection of gunnery instructors assembled at Lulworth, where ATDU personnel trained them on the new tank systems. These instructors then trained the actual CAT crews as they rotated through the Gunnery School in small numbers between November 1986 and April 1987. (138)

ATDU did attempt to test the new fire system upgrades before they were delivered to the Gunnery School and BAOR. Ongoing range construction resulted in the temporary closure of those facilities best suited to testing the new Challengers. The gunnery ranges at Castlemartin offered a viable alternative, but an agreement with the Federal Republic of Germany permitted the Germans to use these ranges from July through November of each year. They paid the related usage and upkeep costs. ATDU noticed that the Germans had regular stand down days when they did not use the ranges — times that might be used for testing Challenger. British range control personnel proved happy to support this proposal and the following stipulation:

The Germans should not be made aware of the main purpose of the ATDU firing. They and the German liaison officer in particular need only be informed that ATDU is carrying out two day trials of equipment due to the unsuitability of facilities at Lulworth. (139)

The Ministry of Defense did not concur with this action. It rejected the notion of deceiving the Germans in order to test fire vehicles that would be used against them in competition — and leaving them with the bill. Indeed, "... the idea that we should ask for it [Castlemartin range] back, even for a couple of days, seems distinctly odd, and the desire that the Germans should not be made aware of the main purpose of the firing certainly does not improve matters." ATDU was instructed to use the range after the Germans concluded their annual firing period. (140)



*A closeup shot of the Challenger. (The Tank Museum)*

As the new Challengers became available for training, a host of supporting organizations established to support them. The most significant included the CAT 87 Support Committee responsible for logistics, the Joint Scientific/User Study Group charged with addressing fire control hardware and software issues, the I (BR) Corps responsible for CAT equipment management and readiness, and the 1st Armoured Division CAT Support group focused upon maintenance. (141) BAOR also sought to secure contractor support from the manufacturers of the key tank components, particularly those associated with the sights and fire control system. Such support proved invaluable in the preparation for CAT 1985, and equivalent support was considered essential for CAT 1987, particularly since “no User or Troop Trial will be carried out on the ICSS equipment prior to CAT 87.” Moreover, “ICSS is a new system. In the area of tank turret systems all new equipment in recent years has exhibited teething problems. This particularly applies to software related equipment.” (142)

The rush to field upgraded Challenger tanks for the CAT teams resulted in crews receiving tanks that outstripped the ability of training aids to support them. Simple recording devices could be used to help observe shots during live gunnery, providing an engagement record for analysis and subsequent training adjustment. SIMFICS, a laser based engagement system similar to the American MILES, facilitated integrated fire and maneuver training, but it had been designed to support IFCS. It had to be modified to represent ICSS capabilities before issuance to the CAT teams. (143) The insufficiency of gunnery training aids threatened to undermine the tank’s performance in CAT 1987, which in turn might “... not only have far reaching service repercussions but could affect overseas sales and UK’s standing as a main tank producing nation.” (144)

To compensate for its lack of training aids, the British sought the loan of Singer Link-Miles’ Precision Gunnery Crew Training Demonstrator. This computer-based device simulated a tank’s fire control system. The crew operated controls built to represent those of their actual tank to engage targets that appeared on a television screen. The system provided precise data on the gun lay and point of impact. It could be used to provide a variety of different target engagement settings, including CAT target arrays. British interest in the device was stimulated by its successful use by the Dutch in their training for CAT 1985. Once set up, the system could be utilized 24 hours a day without need of a special instructor. Singer Link-Miles, the manufacturer, offered to modify a unit to



represent Challenger with ICSS and loan it to the British for two months to help them with CAT training. Although accidental loss of the device carried a financial penalty of £1.2 million, this cost was considered an acceptable risk when weighed against the potential training value. Consequently, the British accepted the loan offer in January 1987 for the period February to April to enable 2nd Royal Tank Regiment crews to gain additional familiarity with ICSS just before they began their live fire gunnery. This plan received a setback when the Royal Hussars were instead selected to provide the competing CAT team. (145)

Senior leader concerns over Challenger's likely CAT performance stimulated the early development of a public relations strategy. Suitable talking points began to circulate in draft form by December 1986, months before the June 1987 competition date. Areas of emphasis included the improvement to survivability that Chobham armor enabled, increased lethality through development of a new armor piercing, fin stabilized discarding sabot (APFSDS) round, TOGS, and the 120-mm gun. Highlighted mobility and reliability advances over Chieftain included the combination of a new suspension with the Rolls-Royce V12 engine. Overall Challenger was touted as a well-armed, heavily armored, mobile tank capable of effective day and night engagements. Its qualities made it a capable combat platform, but they were less suited to the environment of a shooting competition. Indeed, "CR [Challenger] represents earlier technology and we do not expect to emerge as clear, outright winners." (146)

Moreover, the talking points noted the tendency of the Leopard 2 and M1 tanks to fire practice HEAT rounds in the competition. This ammunition left large holes in the target that simplified hit confirmation. The British did not believe HEAT to be the proper combat choice of ammunition with which to engage tanks. Moreover, the British equivalent, HESH, was better suited to area targets. Therefore the British relied upon APDS/T for the competition—ammunition with a high velocity that made small holes in the target and made hit confirmation more difficult. Hence, "... for competition purposes our crews will be at a disadvantage in comparison with crews from some of the other nations."(147)

The public relations strategy sought to highlight the qualities of Challenger and downplay the significance of the CAT competition. Foreign buyers and the British nation constituted the principal audiences. Success seemed assured as long as the British CAT team did not get beaten too badly. Indeed, the Chief of the General Staff, recognizing the limitations of the Challenger's fire control system compared to that of the M1 and Leopard 2, considered CAT 1987 a "damage limitation exercise." (148)

### **The Diplomatic Niceties of CAT 1987**

Following CAT 1985 preparations began for the next competition. Central to this work lay the development of the rules to govern training, team selection, and the competition's actual conduct. In the weeks following CAT 1985, CINCENT sought input regarding the format, location, and frequency of future competitions. The Canadian Director of Armour generated a rules draft based upon these comments and recommendations from CAT 1985. This draft then circulated among the participants and became the start point for further discussion and negotiation. (149)

The Committee of Control played a central role in this process. It served to prepare the rules and conditions for the competition, determine whether to act on participant proposals, and supervise the actual event. Afterward, its responsibilities shifted to acting on protests and disseminating the official results. The Committee included a chairman and projects officer appointed by HQ AFCENT, representatives from the Canadian government, CENTAG, NORTHAG, and each of the nations that provided armored forces to the Central Region. All members except the chief judge for the competition served as voting members, of whom 70 percent had to support any decision for it to be enacted. Securing this majority ensured lively debate and discussion surrounded each proposed action. (150)



*CAT 1987 patch that was worn by  
NORTHAG team members.  
(Ron Mihalko)*

In February 1986 the Committee of Control convened to address the concerns and comments of the participants concerning the draft rules. Debate and further recommended changes ensued. They served as the focus of the second Committee meeting in April that resulted in preliminary approval of the rules by the participants with the exception of the British. After a final round of negotiation and resolution of concerns, in May CINCENT approved the rules, which became somewhat irreverently referred to as the “Bible.” Participants had a year in which to build and train their CAT teams. (151)

The heightened visibility of the Canadian Army Trophy and the related press attention ensured that the rules generation process became an exercise in NATO diplomacy. Although the competition officially pitted CENTAG against NORTHAG, it proved impossible to divorce entirely the event and its outcome from national interests. Each participant sought to ensure a fair competition for its team, although just what “fair” meant varied from one nation to another. The United States considered that other nations relied too much upon a pool of personnel with CAT experience groomed specifically for the event. Such gladiatorial teams were not representative of the capabilities of the national forces. The United States, a relative latecomer to CAT, lacked a large pool of personnel with competition experience. Hence, the Americans sought a more random process of selecting the actual CAT teams and a prohibition against tank commanders and gunners serving in successive competitions. (152)

The Canadians, Dutch, and Belgians similarly supported a random selection of competitors. Canada proposed the nomination of three units eight months before the competition. Each unit would prepare a single company as a potential CAT team, with a random selection of the actual team a month before the event. (153)

The British sought the most favorable conditions for a strong performance by Challenger. Only too aware of the limitations of Challenger’s fire control system, they feared lest the competition devolve into a contest between the M1 and the Leopard 2. This fear was not allayed by the American decision not to enter any M60 tanks in the competition or the perception that both the Americans and Germans sought rules changes beneficial to their tanks. They could take some consolation from Committee of Control Chairman Brigadier General Dr. D. Genschel working to ensure a fair

competition for all tanks. Nevertheless, the CAT preparations encouraged a degree of cynicism, reflected in the following British observation:

CAT has always been bedeviled and corrupted by equipment salesmanship and 1987 promises to be worse than ever. Those nations on the sidelines i.e., ourselves, the Belgians and Canadians and even the Dutch who, despite have LEO 2, have not had the benefit of German ammunition, are all irked by this and our representatives are taking a robust line to ensure fair play for those of us with “obsolete tanks.” (154)

In response the British supported actions to increase operational realism while discouraging gamesmanship. They specifically criticized efforts to make teams overly familiar with the competition range. The Royal Armoured Corps Director noted:

There is no operational reality in the fact that competing crews should have practiced on, and memorized so completely every aspect of the competition range. We would very much like a set of rules devised that will remove the pressure on the competitors to conduct such detailed range familiarization. (155)

NATO tank crews would possess considerable advance knowledge of likely battlefields in the Federal Republic of Germany should the Warsaw Pact invade. This fact might offer some rationalization for competition range familiarization, but intimate range knowledge clearly violated the spirit of CAT. For years the United States considered itself at a disadvantage when competing on Bergen-Hohne, precisely because American units did not regularly train there. For CAT 1987, however, the U.S. possessed the home advantage at Grafenwoehr — a fact exploited by its CAT teams in their use of terrain boards, sub-caliber ranges, and simulators all configured to represent the competition range.

The British had better success in refining the method of team selection. They sought to minimize the number of units required to prepare CAT teams for random selection, and they desired the option of configuring CAT teams in platoons of either three or four tanks. No such option had been allowed in past competitions, but British tank platoons included just three tanks. Competing with the same size CAT platoons simplified training and reduced the number of tanks and personnel to be prepared. For an armored force in the midst of converting to a new tank, creating multiple four-tank platoons represented considerable disruption. (156)

The advantages of a three-tank platoon could be nullified if participants were required to nominate three companies from three different units as the potential CAT team. The British had determined upon building its CAT team from the 2d Royal Tank Regiment. Having to nominate additional regiments threatened to upset this selection. There were few Challenger regiments, with only four expected to be fielded with TOGS before CAT 1987. Some crews possessed only limited experience with their new tanks, undermining their potential effectiveness in a precision gunnery competition. Hence the pool of viable Challenger regiments shrank, forcing the British to consider nominating a Chieftain unit. They pressed for the nomination of only two regiments to enable reliance upon the two regiments with the most Challenger experience. The impact of CAT preparations upon units re-equipping and retraining with Challenger served as justification. (157)

Even if these concessions could be secured, the British also wanted the greatest amount of time to train the finally selected CAT team. They objected to the original proposal that the random determination of the actual CAT team identities would occur only one month prior to the competition. Instead, they wanted this selection done two or three months before the event to ensure maximum preparation of the actual team that competed. (158)

In fact, the British successfully negotiated their desired changes to the team selection process. The final rules permitted either three-tank or four-tank platoons to participate according to national preference. With the competition scheduled for June 1987, the British would have to nominate just two regiments by January 1. Final selection of the actual competing squadron followed on April 1, over two months before the competition began. This schedule also suited the timeline for annual gunnery training, which for the British spanned the period March 24 to May 8. Once the CAT team's identification became known, it could be immersed in live fire gunnery until about a month before the actual competition. (159)

The original draft rules called for heated competition targets 1.9 meters by 1.6 meters. The British sought the use of the larger, standard NATO targets, which measured 2.3 meters by 2.3 meters. Gunnery standards and tank sights were oriented upon this target size. In fact, the British had advocated this same point in previous CAT competitions, but they had been overruled. Given the need to ensure the best performance of Challenger, the issue of target size assumed greater importance. Established gunnery standards required a 70 percent chance of hitting a standard NATO target at 2,000 meters. This standard compared poorly with the actual results American tankers were achieving in training, and the disparity would only worsen if smaller targets were used for CAT. (160) Indeed the Americans opposed the proposal for a larger target, and generally opted for most stringent competition conditions possible. The British found this opposition to their preferred target size somewhat misplaced, since as one officer noted, "We shall counter by pointing out that the targets they display at Grafenwoehr, even in their most demanding firing tables, are 2.3m by 3.4m!" (161)



*The CAT 1987 patch of the Netherlands 43rd Tank Battalion Team with its distinctive tank-eating feline. (Ron Mihalko)*

With Dutch support and despite U.S. opposition, the British succeeded in getting the Committee of Control to agree to the use of the standard NATO size target. (162) However, not every British officer involved in the rules preparations supported the larger target size. One colonel, for example, did not believe it promoted operational realism, since "this target is a training target, which is bigger than the Soviet tank and if you hit the edges of the tank — the round would bounce off." (163) In effect, the smaller CAT targets used in past competitions were closer in dimensions to the center mass target that would have to be hit to secure a kill in battle.

The larger size made it easier to determine if a target had been hit. This benefit proved particularly important to tanks firing APDS/T, the practice round used to represent the kinetic energy ammunition intended for use against enemy tanks. Its high velocity made it difficult to sense, a characteristic that led one British platoon in CAT 1985 to hit the same targets more than once, expending time and ammunition while lowering the overall battle run score. In CAT 1987, TOGS would help gunners see through dust, mist, and smoke, but it was considered of marginal value for hit confirmation. Other participants were expected to use practice HEAT ammunition. Although slightly less accurate than APDS/T, it created a larger hole in the target thereby simplifying hit confirmation. Larger targets made HEAT use even more desirable. The British did not possess a HEAT round, and could not use it to improve hit confirmation. They did have HESH, but this round was of lower velocity and subject to wind effects. Therefore, the British found themselves at a disadvantage against other participants equipped with HEAT, despite the larger target size. They sought a rule mandating all teams use only ADPS/T in the competition, arguing that this round was the preferred round against tanks in combat. In short, "being consistent operationally all competitors should fire KE as opposed to HEAT rounds as the latter would not penetrate the frontal arc of T72." The Committee of Control rejected these arguments, leaving the choice of ammunition to each participant. (164) The Dutch quickly opted to use HEAT. (165)

The problems associated with target identification and hit confirmation on a range that could become obscured through dust, smoke, and inclement weather led the British to recommend that each individual target be accompanied by a puff of smoke when it appeared. Similarly, when hit, they wanted targets to emit an indicator. In the latter case a hit indication helped crews to avoid losing time, ammunition, and ultimately points firing at targets already knocked out. (166) The British were not alone in their concern over target sensing, since this became a significant training issue for the American CAT teams. However, neither recommendation was adopted. Instead, each set of targets would be accompanied by a single puff of smoke, regardless of the total number of individual targets appearing. Thermal decoys would also be used as potential distractors to tank crews. Hit indicators were not adopted, since their reliability could not be assured, essentially guaranteeing a host of contested battle run scores after the competition's conclusion. (167) Worse still for the British, "there would be a time penalty for targets not hit so observation of hits would be critically important." (168)

The British also sought modifications to the competition's scoring. They considered it unbalanced with too small of a bonus offered for hitting all targets. Moreover, they wanted an efficiency bonus that rewarded platoons that attained a high ratio of targets hit to ammunition expended. They also considered it unrealistic to reward engagement times of 1-2 seconds, believed achievable only by shortcutting operational techniques. (169) Instead the British wanted all hits scored in under seven seconds to receive the maximum score for rapid engagement. The Committee of Control did not agree to this change. The United States also opposed this change and sought the same scoring system used for CAT 1985, which gave equal credit to speed and accuracy. A compromise resulted in the form of a sliding scale weighted in favor of rapid target hits. Given the known limitations of Challenger's fire control system, such an arrangement would not benefit the British. (170)

Despite the failure to shape scoring and secure a requirement for all teams to use APDS/T ammunition, the British nevertheless managed to shape the competition conditions to provide a Challenger a reasonable chance of a solid performance. They lobbied hard throughout negotiations to ensure their national concerns found reflection in the final rules and conditions adopted. They could find some solace in English being the official language of the competition and all related administrative actions, though crews used their own national language during actual battle runs. (171)

This spirited effort found reflection in the parallel efforts of the other competitors, and, indeed, had become an integral part of the Canadian Army Trophy. The British secured the most favorable conditions possible for their new tank, but they also understood its limitations. Their CAT team did not have to win; simply avoid a disaster. A respectable performance, coupled with the right media narrative, offered the best course of action. As one official summarized:

I also believe that if defence correspondents can be briefed on the positive advantages of Challenger: protection, penetration of 120-mm APFSDS and TOGS, then the press will have the information to write properly balanced appraisals of the competition should the results go against us. (172)

### **Rules and Conditions**

The final rules for CAT 1987 became available to the participants in June 1986, providing a year for competition preparation. The CENTAG commander served as the host for the event. His command became responsible for overall conduct of the competition and the related preparation and planning. He nominated the chief judge, made arrangements for the lodging of the CAT teams, and posted the results of the competition. Planning responsibilities also included identification of the specific range on Grafenwoehr to be used for the competition. The host of administrative functions, many of which would involve the chief judge, led CENTAG to recommend the early appointment of the next CAT competition judge to enable him to observe CAT 1987 and become familiar with the broad range of responsibilities he would assume. (173)

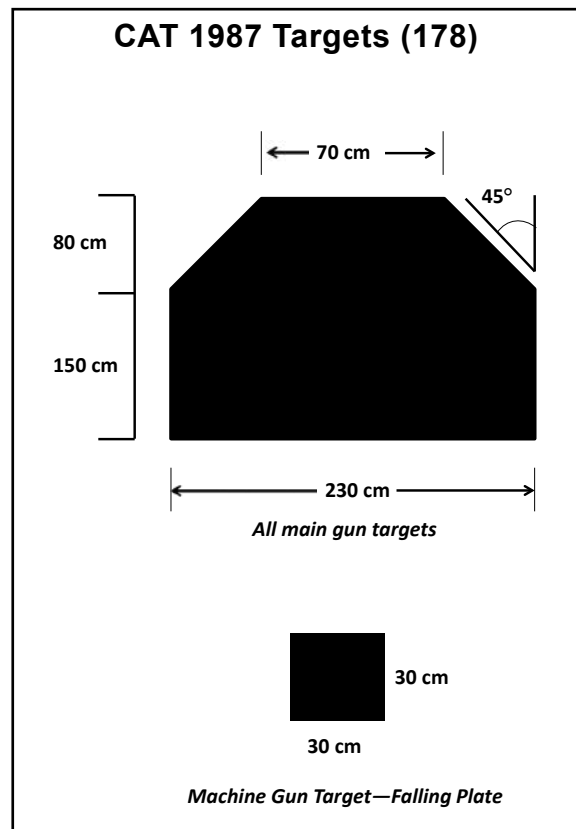
Under the CAT 1987 rules, each army group corps nominated two companies, each from different battalions. Separate brigades (i.e. — the 4th Canadian Mechanized Brigade Group and the 2nd Armored Division (Forward) nominated two companies. The Dutch, however, could not meet this requirement due to an ongoing troop test linked to force structure manning requirements. They successfully lobbied for an exception, nominating only a single company from one battalion with the promise to return to a two-battalion nomination in subsequent competitions. The composition of the nominated companies varied, with the British and Americans providing three-platoon companies, while the Belgian, Dutch, German, and Canadian companies included just two platoons. Platoon size in turn reflected national standards, which permitted the British to employ their standard three-tank platoons and avoid generating a special organization for the competition. Within the platoon a new restriction prompted by American efforts to avoid professional CAT teams barred tank commanders and gunners from competing in the same duty position in successive competitions. Violation disqualified the platoon. The chief judge received a complete roster of the crews in each company with subsequent changes prohibited. Each company included replacement tanks and crews, however, to address unexpected problems with either man or machine. (174)

The nominations for each army group were submitted to HQ AFCENT by January 1, 1987. On April 1 that headquarters made a random selection of the company nominations provided by each nation to identify the actual companies that would compete. The final CENTAG and NORTHAG teams each included five companies and a total of 12 platoons. To coordinate the preparations of its team, each army group appointed a lieutenant colonel to serve as a team leader, reporting directly to the army group commander. He was supported by the commanders of each CAT company, who apprised him of competition training activities. In this manner each army group remained apprised of its team's training and could provide assistance as needed. (175)

As in past competitions, the rules provided guidelines for training. Main gun firing was limited to the normal annual gunnery cycles of each nation. Each competition tank could fire no more than 134 main gun rounds during preparation, although enforcement proved difficult. The competing tanks were to represent the standard national tank fleets without special modifications to enhance competition performance. The competition range remained off limits to CAT teams from January 1, 1987 with the exception of a short safety orientation. However, each army group team received two

and half days of live fire on a different range one week before the competition. During the competition, once platoons moved to the zero range prior to their battle runs, maintenance support became restricted to those assets available in combat, which did not include civilian technical advisors. (176)

For the battle runs each participating tank carried 10 main gun rounds and 250 machine gun rounds. A further four main gun and 125 machine gun rounds constituted an ammunition reserve available only on the authorization of the chief judge and generally for target failures or other potential mishaps during a battle run. Each platoon faced between 18 and 36 main gun targets, depending upon platoon size. In the actual event, three-tank platoons faced 24 targets and 4-tank units 32. The main gun targets included a mix of static and moving ones in groups of between two and eight with a staggered appearance. Target ranges varied out to a maximum of 2,000 meters. A single puff of smoke accompanied the presentation of target groups, simultaneous with heated decoys. Machine gun targets offered no indication when they appeared, but they only did so between bounds. Each platoon from the same army group fired a different target array randomly determined, but only 12 layouts existed for the 24 platoons competing. One platoon from each army group would shoot the same array. Hence, the later in the competition a platoon conducted its battle run, the more likely that its target layout would be known. (177)



Each competing platoon was allocated one hour on the designated zeroing range before their battle run. Upon completion they moved to a waiting area, where the chief judge had the authority to place them under quarantine, restricting their communication to just the control tower. The competition judges notified the platoon when to begin its battle run, providing an escort from the waiting area to the competition range. Before each battle run began, the firing points at each bound were watered to minimize dust. At bound 1, weapons were loaded and the platoon's readiness indicated. The platoon received an alert to watch its front, and the targets began to appear. They remained upright for a maximum of 40 seconds or until hit. On order the platoon then began its

movement to the second bound which it had to reach in formation and within a specified time. En route, it encountered machine gun and main gun targets that had to be engaged on the move. The entire platoon received a null score if any vehicle halted for any reason and then fired. The rest of the battle run followed a similar pattern, engaging targets from fixed positions at the second and third bounds while firing on the move between them. Upon completion, weapons were cleared, ammunition consumption checked, and the targets assessed for hits. Misfires and mechanical failures were considered normal combat hazards that did not stop the battle run. Crews were expected to resolve the problem. If they could not do so, their parent platoon continued the battle run without them. For scoring purposes, misfires counted as an expended round. (179)

Target failures could not be considered combat hazards. Devices sometimes only partially appeared or not at all. Rounds impacting close to a target without hitting it might still damage or deform it. Whatever the cause, the chief judge possessed the authority to stop the engagement. Depending upon the severity of the problem, the platoon might be presented with fresh targets or directed to repeat the engagement in which the target failure occurred. The chief judge also possessed the authority to direct the entire battle run to be repeated in the event of other, uncontrollable circumstances, including inclement weather. (180)

The scoring for each battle run focused upon the speed of target engagement and accuracy in terms of targets hit. While speed and accuracy constituted staples in the scoring of all CAT competitions, the point award was weighted in favor of accuracy. Platoons that hit every target earned an accuracy bonus further enhanced by the number of unused main gun rounds at the battle run's conclusion. This emphasis reflected the importance of achieving first round hits in combat. Engagement speed earned points on a sliding scale that rewarded shorter times, but missed targets reduced this score on a proportional basis. Hitting a small number of targets exceptionally fast would earn a lesser total than hitting all targets in a longer time. (181)

<b>CAT 1987 Scoring (182)</b>		
<b>Weapon</b>	<b>Point Calculation</b>	<b>Maximum Total</b>
<b>Main Gun Hit Score</b>	$\frac{(\text{Total Targets Hit} \times 100)}{(\text{Total Targets})} \times 100$	10,000
<b>Main Gun Time Score</b>	$\frac{\text{Total Time to Hits} + (\text{Max Exposure Time} \times \text{Non-hits})}{\text{Total Targets} \times \text{Max Exposure Time}} \times 100$ <i>Result applied to Time Score Table for point total</i>	8,500
<b>Main Gun Hit Bonus</b>	Hit every target presented	500
<b>Main Gun Ammunition Bonus</b>	$\frac{(\text{Rounds Remaining})}{\text{Total Rounds}} \times 100 \times 40$ <i>Only applicable if all targets hit</i>	1,600
<b>Machine Gun</b>	$\frac{\text{Targets Hit} \times 100 \times 20}{\text{Total Targets}}$	2,000
<i>Highest score theoretically possible</i>		<b>22,600</b>
<b>Penalty</b>	Failure to arrive at bound in specified time	-600
<b>Penalty</b>	Unauthorized use of reserve ammunition—per round	-1,000

Once the final scores were determined and protests resolved, they became official. In addition to providing the grist for international media coverage, the results dictated the distribution of awards. The highest scoring army group received the actual Canadian Army Trophy. The unit team leaders from each army group received replica models of a Centurion tank. Each army group in turn



provided awards to each of their three highest scoring platoons, and all official participants in the planning and execution of the competition received certificates of appreciation. (183)

### CAT 1987

In preparation for CAT 1987, the 3rd Armored Division Commander MG Thomas N. Griffin Jr. directed the organization of trial competitions. He had participated in an earlier CAT competition as a junior officer and remembered the pressure generated by the international event. Therefore he directed the organization of mock events that resembled the actual CAT competition, to include VIPs and flag waving spectators. For the American teams, he believed that soldiers “would have a better chance of winning if the first time they saw an Iron Cross painted on the side of a Leo II was not at the actual competition.” (184)

These mini-CATs, better known as “Kitty CAT I” and “Kitty CAT II” occurred during April 25-28 and May 24-26, respectively. Both events occurred on Grafenwoehr’s Range 117. Scored battle runs, similar to those that would occur during CAT, constituted the culminating activity. Beforehand, each participating platoon received an opportunity to prepare through dry fire actions, sub-caliber firing, and a main gun practice run. The battle runs themselves represented actual CAT conditions, complete with a quarantine area, bounds, and target arrays. Kitty CAT I included only CAT teams from CENTAG, including 4-8 Cavalry, the Royal Canadian Dragoons, and Panzer Battalion 363. However, the NORTHAG teams conducted their own mock CAT competition over a four-day period in April, involving American, British, Dutch, and German teams. Kitty CAT II involved teams from both NORTHAG and CENTAG, but despite the positive reviews of the first event, only one American CAT company, D/4-8 Cavalry, participated in Kitty CAT II together with the Royal Canadian Dragoons, and the British Royal Hussars. (185)

CAT 1987 Scores (186)							
Hit Score	Time Score	Ammo Bonus	Hit Bonus	MG Score	Platoon Total	Rank	Targets Hit
<b>NORTHAG—2-66 Armor (M1 IP)</b>							
9,062	6,290			2,000	17,352	11	29/32
9,062	6,290			2,000	17,352	12	29/32
8,750	6,375			2,000	17,125	14	28/32
<b>NORTHAG—43<sup>rd</sup> Tank Battalion (Leopard 2)</b>							
9,375	6,885			2,000	18,260	5	30/32
8,750	5,865			1,750	16,365	21	28/32
<b>NORTHAG—4<sup>th</sup> Lancers (Leopard 1)</b>							
9,062	5,610			1,750	16,422	20	29/32
9,375	6,325			2,000	17,700	9	30/32
<b>NORTHAG—Panzer Battalion 324 (Leopard 1)</b>							
9,062	5,610			2,000	16,672	18	29/32
8,750	5,695			2,000	16,445	19	28/32
<b>NORTHAG—Royal Hussars (Challenger)</b>							
9,166	5,440			2,000	16,606	N/A	22/24
7,500	4,760			2,000	14,260	23 (rerun)	18/24
7,083	4,590			2,000	13,673	24	17/24
7,916	4,590			1,800	14,306	22	19/24
<b>NORTHAG Total Points: 195,727</b>							
<b>CENTAG—Panzer Battalion 124 (Leopard 2)</b>							
9,687	6,035			2,000	17,722	8	31/32
10,000	6,715	500	500	1,975	19,690	2	32/32
<b>CENTAG—4-8 Cavalry (M1 IP)</b>							
8,750	6,205			1,975	16,930	15	28/32
9,375	6,630			2,000	18,005	7	30/32
10,000	7,165	800	500	1,925	20,490	1	32/32
<b>CENTAG—Panzer Battalion 363 (Leopard 2)</b>							
9,375	6,035			2,000	17,410	10	30/32
9,687	6,970			2,000	18,657	4	31/32
<b>CENTAG—Royal Canadian Dragoons (Leopard 1)</b>							
9,062	6,120			1,975	17,175	13	29/32
9,687	6,375			2,000	18,062	6	31/32
<b>CENTAG—3-64 Armor (M1 IP)</b>							
9,062	5,780			1,950	16,792	16	29/32
8,750	5,950			2,000	16,700	17	28/32
9,687	7,140			2,000	18,827	3	31/32
<b>CENTAG Total Points: 216,492</b>							

CAT 1987 occurred on Grafenwoehr's Range 301 during the week of June 15-19. The weather proved cold and unseasonably rainy. Heavy rains, hail, and high winds periodically reduced visibility to naught, but at other times the overcast sky would clear, providing better visibility and the ability to see targets. Because of the dampness, target obscuration from dust and propellant smoke proved nonexistent. (187)

CENTAG won the actual CAT competition with a score of 216,492 to the 195,727 of NORTHAG. The CENTAG platoons secured eight of the top 10 scores. In contrast, seven of the 10 lowest scores came from NORTHAG. Part of the discrepancy in performance can be attributed to equipment. In CENTAG, 10 of 12 platoons were equipped with either the M1 IP or the Leopard 2, both featuring more modern fire control systems than other tanks in the competition. The NORTHAG team, however, included only five platoons equipped with these platforms. The remaining seven platoons included four equipped with the Leopard 1 and three with Challenger. Although Challenger was the newest tank in CAT 1987, its fire control system remained a generation behind that of Abrams and Leopard 2. (188)

<b>Tank Type</b>	<b>Percentage of Hits</b>	<b>Average Engagement Time (Seconds)</b>
Challenger	75	12.61
Leopard 1	85	11.10
Leopard 2	92	9.60
M1 IP	94	9.10

The Belgian 4th Lancers competed with two platoons. This unit had participated in the Canadian Army Trophy six prior times since 1963, the most recent being 1981. The unit was also the first Belgian armor unit to receive the Leopard 1 in 1968. Beginning in 1975 Belgian Leopards received a thermal sleeve for the main gun and the SABCA fire control system. The latter included an optical sight with integrated laser rangefinder and an analogue computer. Sensors measured temperature, air pressure, gun wear, crosswind, cant, and rate of turret traverse. The computer used this data to develop a more accurate ballistic solution. (190) By 1987 the Leopard 1 lagged behind the ability of the M1 and Leopard 2 to fire accurately and fast whether moving or stationary. While Belgian crews aspired to a more modern tank, they remained confident in the capabilities of their older Leopards. As one Belgian CAT tank commander noted:

Despite being 20 years old it can do still its job well. The main armament is a British gun. It's a good weapon and we can acquire and take out targets quickly. It is a fast tank and our laser rangefinder is excellent, but if I were to be given the choice of any of these tanks I would choose Leopard 2. (191)

Despite their older tanks, one Belgian platoon beat several other units equipped with the Leopard 2 or M1 IP to secure a ninth place finish with 17,700 points. It hit 30 out of 32 targets, achieved a perfect machine gun engagement score, and tied with a Dutch Leopard 2 platoon for the highest hit score in NORTHAG. The second Belgian platoon fared worse, earning only 16,422 points. It finished in 20th place. It did not hit every machine gun target, but it did hit 29 of 32 main gun targets. (192)

The Netherlands contributed a CAT company of two platoons to the NORTHAG team. The company was drawn from the 43rd Tank Battalion, which had participated in three prior competitions. Equipped with the Leopard 2, the unit's home station lay near Bergen-Hohne. Dutch training benefited from the use of a through-the-sight video device that enabled commanders and

instructors to see on a television screen the same sight picture as a tank gunner while engaging targets. The entire firing process could be recorded and analyzed to guide future training. This system proved successful and popular among NATO forces. Indeed, all CAT teams desired it, evidenced by the unsuccessful effort by the Seventh Army Training Center to obtain it for CAT 1987. (193)



*The patch worn by the Belgian 4th Lancers team at CAT 1987. (Ron Mihalko)*

In CAT 1985 a Dutch platoon from the 43rd Tank Battalion earned the top score among the NORTHAG platoons and placed third overall. In 1987 a platoon from this unit once again became the top scoring NORTHAG platoon with 18,260 points. It also placed fifth among all 24 competing platoons. The Dutch tankers hit 30 out of 32 main gun targets, and they earned a perfect score for their machine gun engagements. They also tied with the high scoring 4th Lancer platoon for the highest hit score on the NORTHAG team, while attaining the highest time score of any platoon on this team. This strong performance by the Dutch underscored their commitment to the competition despite the comparatively weak showing by the 43rd Tank Battalion's other platoon. It placed 21st with a total score of 16,365, hitting just 28 of 32 targets and garnering lower points for speed and accuracy. (194)

The Germans provided three CAT companies for the competition, one with NORTHAG and two with CENTAG. Panzer Battalion 324 competed on the NORTHAG team, and it was the only German company to participate with the Leopard 1A1. Its last CAT experience dated to 1966. The two platoons scored 16,672 and 16,445 points, a close point spread reflective of the consistency of their performance. One platoon hit 29 of 32 main gun targets, while the other hit just 28. These platoons placed 18th and 19th out of 24 total competing platoons. (195)

In CENTAG, Panzer Battalion 124, stationed near Amberg, provided a two-platoon company for the competition. The battalion enjoyed a partnership program with the American 1-35 Armor battalion, but it had no prior CAT experience. Nevertheless, its two platoons equipped with the Leopard 2 did very well. One platoon scored 17,722 points, hitting 31 of 32 targets to finish in eighth place. The other platoon attained a score of 19,690 points. It hit all 32 main gun targets presented, earning the hit bonus and additional points for ammunition conservation. The platoon achieved the maximum possible hit score and the fifth highest time score. When this platoon completed its battle run, it appeared to be the top platoon of the competition. However, despite its stellar performance, it ended in second place. (196)



*Distinctive patch worn by the Panzer Battalion 124 CAT 1987 team. (Ron Mihalko)*

Panzer Battalion 363 also competed on the CENTAG team. Stationed near Kuelshheim, this unit maintained a partnership with the American 4-66 Armor. It also possessed no CAT experience, although it did participate in Kitty Cat I. One of its platoons placed fourth overall. Hitting 31 of 32 main gun targets, it earned the second highest hit score, although it shared this honor with three other CENTAG platoons. However, the German unit also earned the third highest time score of all competing platoons. The other platoon from Panzer Battalion 363 placed 10th overall. It hit 30 out of 32 main gun targets, earning a hit score of 9,375 that placed it in the top tier of achievers. However, its time score of 6,035 points proved only average. (197)

### **The Canadian Success in Preparing Not to Win**

The Canadian experience in CAT 1987 exemplified damage control. The last place finish of the Royal Canadian Dragoons in the 1985 competition garnered nothing for Canadian Forces except adverse media coverage and questions concerning its readiness for a future conflict. In the earlier competition, Canada's Leopard 1 tanks had performed poorly in comparison with the American M1 and the German Leopard 2. In CAT 1987 the Royal Canadian Dragoons would once again field the Canadian CAT team, since they were the only Canadian Forces armored unit in Central Europe. The challenge lay in improving performance with the same Leopard 1s so soundly trounced in 1985. (198)

In the wake of the earlier competition, the Canadian Defense and Civil Institute of Environmental Medicine (DCIEM) undertook an assessment to determine the reasons for the poor Canadian performance. In its initial study, DCIEM found two areas of concern: the tendency of crews to take too long to fire their first shot and the poor accuracy of second shots at targets. A second study used the CAT 1985 firing data to explore the likely outcome if Canadian crews became engaged in force on force engagements. It found the likelihood of Canadian tankers surviving such engagements to be low — a particular concern for an armored unit in Central Europe. The study concluded with the assessment “the ranking of the two Canadian teams as dead last [was] not a random artifact, but a truly poor performance.” (199)

Therefore Canada undertook a thorough preparation of its CAT team for 1987. The Leopard 1 tanks of the Royal Canadian Dragoons became the focus of a concerted effort to ensure their readiness. These vehicles mounted the Belgian SABCA fire control system with its laser rangefinder, computer, and sensors. Additional personnel and resources were made available to support training and technical preparations. Worn or suspect parts were replaced, technical faults addressed, and all

competition vehicles scrupulously maintained to ensure peak performance. Technical problems, particularly those related to the fire control system, received the direct attention of the Director of Combat Mobility Engineering and Maintenance. (200)



*Canadian Leopard 1s at CAT 1987 with their distinctive Pink Panther turret art. (Ron Mihalko)*

The Royal Canadian Dragoons developed an improved training program for the Canadian Army Trophy. In 1986 all three squadrons in the regiment were to develop CAT teams for potential selection in April 1987. Gunnery instruction began with the basics and progressed to more complex tasks, partly to offset the documented tendency of Canadian crews to overkill their targets in CAT 1985. The regimental gunnery officer and subordinate gunnery instructors played a key role in this program. They were supported by the Director of Land Requirements and the Armoured School, whose personnel provided improved procedures for zeroing and accuracy confirmation. Existing unit gunnery techniques were assessed and confirmed for effectiveness, while normal training practices were modified to suit the specific conditions and requirements of the competition. The collaboration continued between the unit and Canada in the development of platoon fire control and distribution measures to shorten target acquisition and engagement times. The creation of an indoor miniature range permitted crews to continuously development and practice fire procedures, while DCIEM oversaw the delivery of a prototype gunnery trainer to the Royal Canadian Dragoon home station at Lahr. Within the tank, Canadian tank commanders trained to scan and identify targets, handing them off to their gunners, and immediately seeking the next targets. Commanders trusted their gunners to complete the engagement without direct oversight, an approach that accelerated engagement times. (201)

The regimental leadership believed their range time in preparation for CAT 1985 to be insufficient. Therefore they planned more live fire time than generally available for the regiment during annual gunnery and availed themselves of every training opportunity. Hence, the unit participated in each of the Kitty Cats sponsored by the American 3rd Armored Division. The regiment also benefited from access to the American SIMNET facility at Grafenwoehr, which enabled repetitive battle runs in a computer-based simulator with a terrain set resembling the actual CAT competition range. This training proved invaluable in building target acquisition and fire distribution skills at the platoon level. (202)

Overall the Canadian training effort marked a comprehensive one involving multiple organizations on both sides of the Atlantic Ocean. The Canadian government and military sought to ensure a sound training strategy matched with sufficient materiel, personnel, and expertise for implementation. Indeed, the CAT team benefited from the support of a sports psychologist who

helped crews focus on their tasks and cope with stress during the actual competition. In prior competitions, crews experienced nervousness early in the competition that negatively impacted their performance before it dissipated, leaving no time to repair the damage done to battle run scores. Indeed, a parallel existed between the stress generated by the Canadian Army Trophy and major sporting events, particularly the high visibility clashes between the Canadian and Soviet hockey teams during the Olympics. (203)

When CAT 1987 began, the Canadians were ready. They understood the limitations of their tanks in comparison with the Leopard 2 and Abrams, but the novelty of the Challenger made it an unknown. However, the Canadians believed they had maximized the potential performance of their personnel and platforms. Moreover, the senior leadership sought a solid performance rather than an outright win. The principal objective lay in stifling criticism of Canadian Forces' readiness and avoiding the negative media attention that surrounded CAT 1985.

The combination of a realistic objective and sound training strategy constituted the foundation of a Canadian success story. In CAT 1987, the two platoons of the Canadian team outperformed other platoons equipped with more modern tanks. They completed their battle runs without incident, and they exceeded the speed and accuracy requirements stipulated by the Canadian Armoured School. During engagements that required more than one round per tank, particularly when more targets than platoon tanks appeared, the Canadians proved no slower than other national teams.



*Royal Canadian Dragoon CAT  
1987 team patch. (Ron Mihalko)*

The first Canadian platoon to execute a battle run did so early in the competition. It hit 29 of 32 main gun targets and earned a respectable hit score of 9,062 points. It scored 17,175 overall, and placed 13th among all competing platoons. The other platoon executed its battle run on Wednesday, June 17. Despite bad weather, it still hit 31 of 32 main gun targets and every machine gun target. It was one of just four platoons to earn a main gun hit score of 9,687 points, outperformed by just two platoons that achieved a perfect score of 10,000. The maple leaf platoon placed sixth among the 24 competing platoons. By the time both platoons had finished their battle runs, half of the competing teams had also completed. Canada stood in second place. (204)

This standing did not last. German and American teams firing late in the week achieved higher scores. However, the Canadian performance proved strong and clearly helped CENTAG win. The Canadian CAT company placed fourth, and its showing demonstrated a clear ability to hit targets and by implication a high state of Canadian readiness. The strong showing earned the praise of the senior Canadian Forces leader in Europe, and direct acknowledgement from Allied Forces Central Europe

Commander-in-Chief General Leopold Chalupa, who highlighted the Canadian leadership, teamwork, and esprit de corps — factors considered equally important if not more so than materiel. Another German general noted with pride the accomplishments of the Canadian team using a German tank. These public acknowledgements of the performance of Canada's CAT team were echoed in the 4th Canadian Mechanized Brigade Group chain of command. A Canadian Forces Network film crew also ensured the event and the experience were captured live. Canada's good news story from CAT 1987, however, would not result in the acquisition of newer tanks. Although the event prompted interest and discussion regarding a possible future acquisition of either the M1 or the Leopard 2, such an action was considered unlikely for at least five years. (205) In fact the Canadian armored force would wait much longer.

### **A Challenger's Debut**

The British entered CAT 1987 with cautious optimism. In Challenger, they had a new tank. Its fire control system had been modified to the extent possible. Crews felt confident in their ability and performed well during training and in Kitty Cat II. The overall objective of ensuring a solid performance by Challenger seemed reasonably assured. Like the Canadians, the British did not seek a first place finish; simply a placement that showed Challenger could compete effectively with the M1 and Leopard 2 in a gunnery competition. Rules modifications to facilitate this goal had been largely achieved and a public relations strategy implemented to highlight Challenger's qualities.

The British path to CAT 1987, however, had not been a smooth one. Early efforts to groom the 2nd Royal Tank Regiment for the competition resulted in the selection of the unit to represent I (BR) Corps even before CAT 1985. The unit thus received a long lead time in which to prepare its training program and optimize its human talent. Impressive gunnery results in 1984 triggered this early selection, and the regiment benefited from observation of CAT 1985. In its wake the unit began to plan its training strategy and identify the personnel and technical expertise required. Throughout 1986 the regiment's gunnery program focused upon the standards and conditions of CAT. Annual gunnery in July served to identify the competition crews. Every effort was made to involve the unit in equipment decisions related to the Challenger and maximize the level of logistical, maintenance, and gunnery support provided. These efforts coincided with more general efforts to shape the rules for CAT 1987 and maximize the performance of Challenger's fire control system, including procurement of an early version of ICSS. (206)

The British nominated the Royal Hussars to prepare a second CAT team in keeping with the competition rules. This unit was the first to be equipped with Challenger, and it shared its home station with the 2nd Royal Tank Regiment, facilitating the adoption of the best practices from both units. However, the Royal Hussars were scheduled to perform a training rotation at the British Army Training Unit Suffield (BATUS) in Canada in 1986. Not only did the nature of this training differ sharply from the precision gunnery focus of CAT, it also necessitated use of the Chieftain tanks housed at the Canadian site. Hence, the Royal Hussars would lose time both to train and improve their use of Challenger. Nor was BATUS the only routine training obligation of the unit. Typical annual Challenger training in Germany included a two-week live fire period at Bergen-Hohne, a two-week tactical exercise at the Soltau training area, and further participation in brigade and divisional field training exercise. The British did not relieve their CAT teams from participation in these training events. Hence they could not provide the type of disciplined focus upon training that had become an unwritten prerequisite for CAT. Nevertheless, the British still possessed an even chance of having their preferred candidate actually participate. (207)

Training of the CAT crews from both regiments on their new tanks occurred between October 1986 and March 1987. Three crews at a time received training over a five day period to permit entire platoons to be trained at once. The overall training program entailed regular unit training events that became more CAT-focused following instruction on the new Challengers. Once all crews had been trained, the tanks delivered to the Gunnery School shipped to the BAOR for incorporation into the

two CAT teams. Further crew training then occurred in Germany in early 1987. All of the potential CAT teams were offered two days to familiarize themselves with the competition range on Grafenwoehr before it was quarantined, but regular training commitments unrelated to the Canadian Army Trophy prevented the British partaking of this opportunity. (208)

Since Bergen-Hohne constituted the primary gunnery training site for the British, they did not possess the intimate range knowledge of Grafenwoehr borne of continuous usage. Bad weather in February and March 1987 tended to curtail British training activities in general, further undermining CAT preparations. In April, the Royal Hussars were randomly selected to represent the United Kingdom at CAT. B Squadron provided the actual CAT team. Preparation for the competition intensified. A period of live fire between April 2 and May 1 helped to select the actual crews that would participate, who then continued to hone their skills before taking a short break in May. The unit was hardly untrained, but it had not been groomed for the competition in the same manner or for the same length of time as the 2nd Royal Tank Regiment. (209)



*The patch worn by the British Royal Hussars CAT 1987 team. (Ron Mihalko)*

Nevertheless, the British focused their energy upon building the most effective team possible. The Royal Hussars squadron became a permanent fixture on Range 9 at Bergen-Hohne, which was reconfigured to represent the competition range. The British did not know the actual target arrays that would be used, but the CAT 1987 rules provided the parameters necessary to build challenging engagements and execute practice battle runs. The immersion of the crews in continuous, competition-focused training honed their skills and permitted a high degree of familiarization with the Challenger, particularly the ICSS and related modifications made to the competition tanks. Participation in the NORTHAG shoot-off in April, followed by Kitty CAT II in May enabled the crews to experience the atmosphere of the competition and compare their capabilities with those of other CAT teams. Kitty CAT II helped stimulate training and readiness in the final weeks before CAT 1987 commenced, evidenced by the ability of the British crews to achieve comparable scores to the Americans and Canadians. Tank crews were routinely hitting nearly every target and achieving scores between 16,500 and 17,500 points with regularity. (210)

Further stimulation came from the use of a sports psychologist to help crews cope with stress and remain focused upon their tasks amid a tense, competition atmosphere. The parallels between the tank gunnery contest and major sporting events in terms of the mental and physical challenges upon



participants encouraged this action, which was mirrored at least by the Americans, Canadians, and Germans. In these final weeks of preparation, the Royal Hussar team began to wear distinctive insignia and act as an elite group, steadily imbibing ideas to make them more centered individuals. As one analyst noted: “Within a short time, Hohne witnessed the spectacle of British tank crews humming mantras and dropping ping pong balls onto each other’s stomachs to enhance inner awareness.” (211)

Compared to the training program of other participating nations, the British preparations for CAT proved more limited. The overall program focused on modification of annual gunnery training, and indeed was interrupted by previously scheduled training events that did not necessarily exercise the skills required for CAT. With so much energy devoted to the 2nd Royal Tank Regiment, the random selection of the Royal Hussars in April left less than three months for focused preparation. Other competitors spent a year or more grooming teams, including those nominated but not ultimately selected. Nor did the British benefit from a computer simulator like SIMNET capable of providing an accurate depiction of the competition range and an endless variety of target arrays. SIMNET enabled American and Canadian teams to conduct platoon battle runs on the competition range in a simulated environment day and night. While the British were able to compete with their standard three-tank platoons, thereby eliminating the need for building a competition-specific organization, the smaller number of tanks reduced the number of platforms able to simultaneously scan and engage targets. (212)

In early June the Royal Hussar team deployed to Grafenwoehr, where vehicles, crews, and support personnel finalized preparations for the competition that began on June 15. On the opening day of the competition, the British were selected to perform the first battle run. Thus they did not have the opportunity to first observe the terrain and layout of the range, let alone begin to develop a sense of potential target arrays. Nevertheless, the first British platoon to compete hit 22 of 24 main gun targets with an average hit time of 13.64 seconds, and it successfully engaged all machine gun targets. It achieved the second highest hit score of any NORTHAG platoon and earned a total point score of 16,606 points. Target malfunctions plagued the platoon’s actions and led the chief judge to offer the platoon the opportunity to redo its battle run on condition that only the second score would stand. The platoon agreed to a rerun. It had a sense of the terrain and targets, and the leader believed the platoon could improve upon its original score. The second battle run occurred on Wednesday, but the platoon focused too much upon speed at the expense of accuracy. It hit only 18 of 24 targets, resulting in a hit score of just 7,500, and one of the lowest overall scores with just 14,260 points. (213)

The other two British platoons fared little better. One achieved the fastest average engagement time for a British unit with 11.7 seconds. Indeed one of its tank commanders urged his crew to shoot faster after a successful three-second engagement. Accuracy suffered, and the platoon missed seven main gun targets. With the main gun hit score influenced by the number of missed targets, this failure resulted in an overall score of 13,673 points—the lowest of any competing platoon. It also achieved the lowest hit and time scores. The second platoon ran its battle run on Friday. While the Germans and Americans were edging closer to a perfect score, the British lay firmly in last place. Their chance for redemption lay with their last platoon battle run. Shortly after completing the first bound engagement, the platoon leader’s tank experienced a coaxial machine gun malfunction. The loader tried unsuccessfully to fix the problem, before returning his attention to the main gun. Another mishap resulted in a jammed breech. Under the competition rules, the battle run continued. The platoon hit 19 of 24 targets, missed several machine gun targets, and achieved low main gun hit and time scores. Overall, it garnered just 14,306 points. (214)

When the competition dust settled, the British team finished last. A 2,000-point spread separated the highest scoring British platoon and the lowest scoring competitor. Challenger performed worse than Chieftain, but at least the argument could be made that in CAT 1985 Chieftain was an aging

system. Challenger was Britain's newest tank. Moreover, it had been outperformed by every platoon equipped with a Leopard 1, considered in the same class in terms of fire control technology as Chieftain. Before the end of the competition, every British officer had left the scene — except a junior officer tasked with public relations. Not long after the competition, none of the participating platoon leaders from the Royal Hussars remained in the British army. (215)

CAT 1987 effectively destroyed British efforts to secure foreign sales of Challenger. Not one Challenger was sold overseas, and the impact of CAT had to have played a role, particularly given the high visibility of the event. The media was unforgiving, epitomized by an article in *The Times* entitled "Challenger Tank Loses NATO Fight." The initial British response to the failure lay in emphasizing the differences between the competition and combat environments. Challenger, like Chieftain, possessed strong qualities. The tank possessed excellent ballistic protection, mobility, and reliability, but with its outdated fire control system and the absence of an independent commander's sight like that of Leopard 2, it simply lacked the capabilities to perform effectively in a competition that rewarded speed and accuracy. The Challenger was not an inaccurate vehicle, but it lacked the stabilized sights of the M1 and Leopard 2, and it required a longer firing sequence. (216)



*British Challenger at CAT 1987. (Ron Mihalko)*

A detailed analysis of Challenger's CAT performance followed. The average time for a Challenger to fire the first round in an engagement was 9.34 seconds, compared to 7.12 and 8.08 seconds for the M1 and Leopard 2. Similarly, the Challenger averaged 12.88 seconds to score a first round hit versus 8.02 and 9.01. Abrams and Leopard 2 possessed a 95.8 percent hit probability against targets at all ranges; Challenger just 84.7 percent. Overall the British platoons each hit the smallest number of any competing unit, their highest scoring platoon missing five main gun targets — more than any other competing platoon. These numbers did not make the Challenger an ineffective combat vehicle, but once again they demonstrated the generational gap between fire control systems. CAT demonstrated that select tweaking of components did not level the playing field. (217)

British analysis highlighted problems in the team selection process, the inadequate provision of training simulators and aids, and the small platoon size as contributing factors. They also noted that the extensive training commitments of British armored units prevented the immersion of CAT teams in competition preparation in contrast to the other participants. Nor did the use of prototype equipment, particularly ICSS, help performance to the extent expected. However, while these factors

contributed to Challenger's failure, the British ultimately considered the complexity of the tank's design, its poor ergonomics, and the susceptibility of turret systems to failure to be critical reasons. Challenger's turret derived from that of Chieftain and shared the same systems and layout. Hence problems with the earlier tank also applied to Challenger. All of these issues contributed to the poor showing and slow engagement time of Challenger, which, compounded by separated ammunition, made human error more likely. Post-competition demonstrations of Challenger versus the Leopard 2 and the M1 tended to confirm these assessments as well as the deficiency of Challenger when firing on the move. (218)

Challenger failures, however, could not entirely explain the dismal British performance. Too much of the related training program incorporated previously scheduled training events unrelated to CAT or emphasized mastery of the new systems installed on the competition Challengers. Whereas the Canadians, forced to rely upon an aging tank, built and implemented a training program based upon a detailed review of basic gunnery principles, the British simply struggled to "keep calm and carry on." The comparison is all the more telling, given the similarities in competition goals between the two nations and the devastating press attacks each army incurred in the wake of CAT 1985. Britain and Canada both sought not to win in CAT 1987 but merely to avoid disaster. Canada succeeded, but Britain failed—in large part because of a patchwork training program overly concerned with material modifications rather than the science of tank gunnery and team building.

Challenger's faults influenced ongoing plans for modernizing the tank fleet. Initially intended for a foreign power and pressed into British service to save time, money, and the means to produce tanks, it possessed all the hallmarks of an interim platform. If Challenger did not possess the capabilities of current main battle tanks and suffered from similar firepower — related deficiencies as Chieftain, what should replace it? Hence British tank development in the wake of CAT 1987 focused upon a new tank to replace Chieftain and field a truly state-of-the-art platform — precisely the objective of the now defunct MBT 80. Discussions regarding the upgrading the tank fleet once again included the purchase of a foreign design, potentially the newest version of the Abrams, the Leopard 2, or the first digital tank — the French Leclerc. However, the quest for a new tank ultimately led along a very British development path to Challenger 2. (219)



*Challenger on the gunnery range. (The Tank Museum)*

The British also opted to focus upon a tank program without the distraction of the Canadian Army Trophy. Following CAT 1987, the British withdrew from the next competition, leaving the question of future participation an open one. The corresponding public relations talking points emphasized the discrepancy between the Challenger, built for the battlefield, and the artificial conditions of the competition range. They acknowledged Challenger's outdated fire control and sighting systems, but carefully and in some detail highlighted the tank's key selling points: firepower in the form of a 120-mm gun matched with APFSDS ammunition, protection epitomized by Chobham armor, mobility through a powerful engine matched to hydrogas suspension, and thermal imaging. The most important justifications included:

Peacetime restrictions limit the CAT competition to tank gunnery firing practices on purpose-built NATO ranges. Consequently, important battle winning tank crew skills, such as command and control, tactics and the handling of armour are not assessed. Since the competition does not test the full range of battle skills required of tank crews, we do not feel it makes the best use of our training resources to divert a squadron to this specialist competition from more comprehensive training. The UK intends to re-enter CAT at some future date. (220)

Throughout the 1980s the British had considered withdrawing from CAT, but they sought to do so only after a solid if not winning performance. After CAT 1987, the British had few options. With foreign sales, credibility, and readiness all at issue — at least in the public sector — competing under the same conditions with the same tank would only subject the British to more negative press and further erode foreign sales potential.

### **America Prepares To Win**

The United States determined to win CAT 1987. Although the competition pitted one NATO army group against another, national considerations and standing remained central features. Media coverage tended to focus upon national rather than army group performance. The showing of American teams had risen steadily since 1977, but the inability of a U.S. platoon to secure a first place finish consistently generated negative publicity.

In 1986 USAREUR Commander-in-Chief General Glen K. Otis challenged his subordinate commanders to win CAT 1987. This message was in turn communicated to division, brigade, and battalion commanders. Lieutenant General Colin L. Powell, who commanded V Corps for just five months before becoming President Ronald Reagan's national security advisor, ensured that his entire command understood the intent to win. General Otis designated the Seventh Army Training Center as the central coordinating center for the American CAT teams, while marshalling further support from the Armor Center at Fort Knox and the program manager for the Abrams tank. (221)

The CAT 1987 rules required the American V and VII Corps to nominate two companies from two different armor battalions, while the 2nd Armor Division (Forward) nominated two companies from its single tank battalion. Within the V Corps, the 3-8 Cavalry and 4-8 Cavalry, both from the 3rd Armored Division, were selected to form CAT companies. (222) The VII Corps selected 1-64 Armor and 3-64 Armor from the 3rd Infantry Division, while the 2nd Armored Division (Forward) chose two companies from 2-66 Armor. On April 1, 1987 random selection of the nominated American units identified one company from 2-66 Armor, 3-64 Armor, and 4-8 Cavalry as the CAT participants. (223)

At the battalion level, special arrangements were made to permit each potential CAT team to focus upon competition training free from routine training and administrative requirements. The parent battalions assumed these duties, while their commanders and staffs oversaw and provided support to CAT training activities. Battalion commanders played a central role in this process, but all of them received their duty assignments independent of CAT. USAREUR made no effort to optimize battalion command slots for the competition, but these officers could rely upon their parent brigade and division staffs for assistance. (224)



*A tank from the 3rd Infantry Division's 3-64 Armor CAT 1987 team on Grafenwoehr's Range 301. (Ron Mihalko)*

The 3rd Armored Division became a pool from which 3-8 Cavalry and 4-8 Cavalry could select their CAT company commanders, executive officers, and first sergeants. Although the selection of personnel with prior CAT experience was desirable, the lack of sufficient soldiers with a competition background shifted the emphasis to assembling a concentration of talent in training, gunnery, and the M1 IP. In 4-8 Cavalry, the CAT company commander was selected for his training ability and knowledge of the battalion, while the executive officer and first sergeant possessed extensive M1 IP experience. The first sergeant also served as a tank commander in CAT 1981. Determination of the CAT company platoon leaders and platoon sergeants derived from their overall experience and performance during platoon gunnery qualification (Tank Table XII). Crew selection focused upon Tank Table VIII performance together with input from the battalion leadership. A variety of soldier skill metrics were utilized, including participation in the Excellence in Armor program, and each prospective CAT team member underwent a personal interview from the company leadership. All soldiers were volunteers, and ultimately all but four men among the crews that actually participated in CAT 1987 came from 4-8 Cavalry. (225)

This unit's CAT team, however, proved unusual. Upon its creation it included four platoons, which provided flexibility in training and offset personnel losses. The company reverted to a standard three-platoon organization in March 1987, before the random determination of competing CAT teams. Each platoon included its own master gunner, supported by the company and battalion master gunners and Armor School gunnery instructors at Fort Knox. In addition support personnel in the battalion headquarters and headquarters company were permanently assigned to the CAT company. Integrating logistical and maintenance assets with the competition crews ensured continuous support and unity of command. The CAT company support team members were selected through a process similar to that applied to the tank crew members. Once identified, support personnel became members of the CAT team. They received the same distinctive CAT uniforms and continuously interacted with the tank crews they supported. Deliberate efforts were made to ensure the inclusion of these soldiers in all training, command, and social activities. (226)

Consequently, the 4-8 CAT team included a large 163-man company that suited the commander's belief in the mutually supporting nature of logistics and training. The high tech nature of the M1 tank tended to blur distinctions among maintenance, electronic, and training problems — all tended to be interrelated. The integration of support and training assets facilitated rapid problem identification, isolation, and correction. It also provided the CAT company a degree of autonomy within the battalion that simplified implementation of its separate and specialized training program. The larger company size, however, did create several administrative challenges, including the issuance of

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orders, securing extensions for personnel due to leave the unit before the competition, and rescheduling military school attendance for company members. (227)

The 3rd Infantry Division followed a similar process to select the CAT team members for 1-64 Armor and 3-64 Armor. The talent pool, however, was restricted to a single brigade rather than the entire division. In the determination of CAT company leadership, prior CAT experience and M1 knowledge received the greatest emphasis. Platoon leaders and sergeants numbered among the best in the respective battalions. Crews were selected on the basis of talent, prior CAT knowledge, M1 familiarity, and overall competence. The 3-64 Armor CAT company also had maintenance, medical, communications, and cooks assigned to it from battalion, boosting its total strength to over 90 soldiers. Team master gunner augmentation did not occur, but several of its tank commanders were already master gunners. (228)



*A-12, a tank belonging to the American 3-64 Armor team at CAT 1987. (Ron Mihalko)*

In 2-66 Armor selection of company leadership focused upon prior CAT experience, M1 knowledge, and training ability. However, the small pool of available officers available to staff two CAT companies posed challenges. The commander of one company was due to end his tour of duty before the competition, resulting in a special personnel action to ensure the team did not become leaderless halfway through its training program. Similarly, at the platoon level, the limited number of lieutenants and platoon sergeants forced reliance upon new and untested personnel. This inexperience was partially offset by the presence of several platoon sergeants who had participated in earlier CAT competitions as tank commanders. Still, the battalion lacked its full complement of master gunners. This shortfall resulted in a single NCO serving as the master gunner for both the battalion and one of the subordinate companies. Similarly, the small personnel pool precluded exclusive reliance upon volunteers for CAT tank crews or the integration of logistics and maintenance soldiers into each CAT company. The battalion as a whole underwent a complete restructuring, with two newly organized competition companies with much of the personnel talent and two other companies that included the newest and least experienced soldiers. Readiness suffered. (229)

The nominated American battalions began to assemble their CAT teams in the summer of 1986. Most of these units sought to finalize crew assignments before October 1. From this date until the

competition, the rules limited the number of main gun rounds available for training to 134 per CAT crew. The U.S. teams therefore scrambled to execute Table VIII crew qualification to help determine their competition crews before this cap went into effect. The delivery of a .50 caliber in-bore sub-caliber device to all American CAT teams in April 1987 also served to facilitate live training without expending any of the main gun ammunition allotted for training. This device was developed by the New Jersey Army National Guard. Designed for insertion in the tank's main gun breech, it could be installed and zeroed in five minutes. Moreover, it functioned as a bolt action, single shot weapon to replicate the main gun, thereby giving the loader a role when in use. The device experienced heavy usage by all American units in the final weeks before the competition for platoon battle runs and gunnery training. (230)

The CAT teams also sought to maximize their time on Grafenwoehr's Ranges 117 and 301 before January 1, 1987. On this date, one of these ranges would be identified as the competition range and become off-limits to all CAT participants. The Seventh Army Training Center built and distributed to each nominated battalion detailed, scale model terrain boards of each range, complete with lights to show known and likely competition target locations. These boards facilitated platoon fire distribution planning and classroom discussions of battle runs. Since Grafenwoehr constituted the principal training site for the 3rd Armored and 3rd Infantry Divisions, these formations controlled considerable range time there, which they internally reallocated in favor of their CAT teams. When Range 301 was identified as the competition range and placed under quarantine, the Seventh Army Training Center provided each American CAT team with software to permit virtual training via UCFT on this range. (231)

Materiel preparations included careful selection of the ammunition to be used during training and the competition. The Army Test and Evaluation Command screened the entire inventory of ammunition before selecting the rounds to be used. All ammunition chosen came from the same lot to minimize variance in performance. This selection was made on behalf of all the American CAT teams. The ammunition was shipped to Europe before October 1986, where the CAT companies validated its accuracy upon receipt. (232)

All nominated CAT teams received the option to replace their tanks with new manufactured vehicles. The teams from 2-66 Armor and 3-64 Armor accepted this offer, but 4-8 Cavalry opted only to replace its gun tubes, finding little reason to replace two-year-old tanks already broken in and generally reliable. All competition tanks from the 3rd Armored Division and 3rd Infantry Division teams in CAT 1985 benefited from a pre-event "peak-up." A similar action was sought for the CAT 1987 teams, and it was performed by General Dynamics technicians in April 1987. They assessed each vehicle and made adjustments to improve performance with particular attention paid to the fire control system. Not all teams found this expert attention useful. In 4-8 Cavalry, crews already possessed high levels of confidence in their tanks. They found no significant performance improvement after the "peak-up," but tended to blame any faults that occurred upon the civilian technicians. Crews experienced recurring problems with vehicle wind sensors. They secured replacement sensors by removing them from other, non-CAT tanks in the battalion. They also received a delivery of brand new ones shortly before the competition. (233)

The "peak-up" coincided with the installation of a new filter to the gunnery's primary sight. In the wake of CAT 1985, the existing filter had proven acceptable for most tactical situations, but under competition conditions it made target identification more difficult. The new filter addressed this issue, and the Army accelerated its production in order to permit its use in CAT 1987. (234)

The training program for each CAT company included a mix of classroom instruction, simulator exercises, and live activities. The classroom instruction included subjects related to gunnery, the M1 tank and related technology, and the Canadian Army Trophy rules. In addition, the Armor School provided a team that traveled to each CAT team to provide a week-long course derived from the

master gunner program. It particularly focused upon the M1 fire control system, main gun operation, ammunition, conduct of fire, degraded mode operations, and range determination. The value attached to this course resulted in it being taught a second time to each unit. (235)

In 2-66 Armor, a gunnery standard operating procedure (SOP) served as the foundation for all CAT training. It established unit procedures for platoon fire distribution, command and control measures, and target identification and acquisition. It originated with analysis of the experience of the battalion's CAT 1985 experience. Emerging ideas underwent refinement during live fire exercises, culminating in a finalized company SOP in January 1987. The central concept of this SOP lay in the adoption of a general grid system to help distribute fires. Applicable to most ranges or battlefields, it was not specifically oriented to the competition range, in part because the battalion had few opportunities to train at Grafenwoehr. As part of NORTHAG, the unit's principal gunnery training occurred on Bergen-Hohne. (236)



*Patch worn by the 2-66 Armor CAT 1987 team. (Ron Mihalko)*

In preparation for CAT 1987, 2-66 Armor did not have the luxury of relief from other missions. Its subordinate companies remained committed to various activities, precluding an exclusive focus upon the competition until April 1987. However, the battalion made the most of the resources at its disposal. It conducted its first practice battle runs in August, participated in NATO maneuvers in September, and conducted crew, section, and platoon gunnery at Bergen-Hohne in October. When the 3rd Infantry Division offered the battalion the opportunity to use Range 117 or Range 301 whenever not in use during the last week in December, 2-66 Armor sent a platoon of tanks and the personnel of both CAT companies. They gained several days to train and study on both ranges. When it became clear that Range 301 would be the competition range, they spent the last days of 1986 learning the range layout and proofing their unit SOP, supplementing earlier work done by small teams who visited the range to walk and photograph it. (237)

The battalion returned to Bergen-Hohne in January 1987 for crew qualification and CAT practice, sharing its range time with the Dutch 43rd Tank Battalion with whom the American unit had established an informal partnership since CAT 1985. Indeed, 2-66 Armor conducted extensive training with the Dutch, and the two units routinely engaged in social activities. In the process American



personnel learned about Dutch training methodology, the Leopard 2, and related training devices. This interaction satisfied one of the principal objectives of the Canadian Army Trophy. (238)

In March the battalion conducted crew qualification and CAT training on Range 117 at Grafenwoehr. It had just four days to complete all training events, which were not limited to CAT. The unit managed to conduct 24 CAT battle runs in 16 hours of firing time, but the fast pace left little time to assess target engagements, improve target sensing, or adjust battle run scoring. The battalion also acquiesced to a request from the British 2nd Royal Tank Regiment to share its range time. The British were allowed to observe training, execute dry run exercises behind firing American platoons, and conduct live fire after 2-66 Armor completed training. The battalion then road marched to Hohenfels, where it participated in tactical maneuver training. (239)

In April, the British made range time available for all NORTHAG CAT teams to participate in a rehearsal competition over a four-day period. 2-66 Armor participated along with British, Dutch, and German units, with the Dutch 43rd Tank Battalion performing the best. Despite the value of this mock competition, time, money, and prior obligations prevented 2-66 Armor from participation in CENTAG's Kitty CAT II the following month. (240)

In June 1987 the battalion conducted live fire gunnery at Bergen-Hohne. It made final adjustments to its platoon fire control in preparation for CAT, while once more training together with the Dutch 43rd Tank Battalion. It then deployed to Grafenwoehr, where each platoon in the American battalion's CAT company was permitted one final battle run before the competition. (241)

Between gunnery and tactical exercises, 2-66 Armor utilized UCOFT to hone its CAT gunnery skills and refine its fire distribution SOP. Like the other American CAT teams, it benefited from the range software provided by Seventh Army Training Center. It used UCOFT to conduct crew training and platoon exercises, logging 290 hours on the device between October 1986 and May 1987. However, this usage reflected the need to prepare two CAT companies prior to the April 1987 selection and preparation of the non-CAT battalion elements for crew qualification. (242)

In contrast with 2-66 Armor, the CAT team from 3-64 Armor benefited from the support of its parent 3rd Infantry Division and general relief from many routine duties. It began development of a fire control SOP earlier than the NORTHAG unit, and finalized it in June 1986. It proved much more range-specific and derived from a detailed leaders reconnaissance of Ranges 301 and 117 on Grafenwoehr, where the unit routinely trained. Layouts of these ranges were recreated as sand tables, scaled target ranges, and a miniature tank range. The Seventh Army Training Center's issuance of terrain boards for these ranges offered another asset for training. Once Range 301 was selected for the competition, all training aids focused exclusively upon it. Crews were required to memorize a numbering system that corresponded to target pit locations on the competition range. This simple reference system facilitated faster target acquisition and engagement. Crews also generated range sketches during live fire events of what they could and could not engage, noting the distance and angle to targets. Platoon fire distribution in accordance with the SOP served as a central theme to ensure the unit engaged targets as a team rather than a collection of individual tanks. (243)

The CAT company replaced its 14 tanks with brand new ones in July and August 1986. The new vehicles boosted morale, but they also benefited from the prioritization given to maintenance and supply for the CAT team. In August and September 3-64 Armor began to conduct crew qualification for its CAT company on Range 117. The unit also conducted both live fire and dry fire platoon battle runs on both Ranges 117 and 301. Each crew fired some 200 main gun rounds during a three-week period in September, the ammunition being made available by the parent 3rd Infantry Division. It completed tank commander and gunner certification in November with UCOFT. In December, the unit returned to Grafenwoehr for live fire training on Ranges 117 and 301. It also conducted a detailed range reconnaissance of both ranges and revised its SOP. The following March and May

3-64 Armor returned to conduct platoon battle runs against increasingly difficult target arrays. It did not participate in Kitty CAT II, but the CAT team did conduct final platoon battle runs prior to the competition in June. The period February to April also witnessed 304.5 hours of UCOFT time used to build team skills. (244)

When 4-8 Cavalry began its preparation for CAT 1987, it was considered an underdog. It possessed few soldiers with prior CAT experience, and it began the creation of its competition team some two months after the other American units. Nevertheless, the 4-8 Cavalry team determined upon a continuous training program that integrated home station activities with those conducted during major gunnery deployments. CAT preparation focused upon building an integrated team of tank crews, maintenance, logistical, and administrative support personnel. The competition mission was analyzed, the rules studied, and an attack plan developed. All potential assets were utilized to support training, including training aids, simulators, classroom instruction, range time, and subject matter expertise. Throughout the training period, input was deliberately sought from all team members, regardless of rank or duty position. (245)

Finalization of the CAT team occurred between September and December 1986. UCOFT played a central role in identifying crew members and optimal tank commander/gunner combinations. The device also helped to familiarize soldiers with the conduct of gunnery on a competition range under CAT rules. Aiming skills, section drills and emergency actions were inserted into the training exercises, and crews were forced to use abbreviated fire commands rather than those indicated in gunnery manuals. (246)



*Patch worn by the CAT 1987 team from 4-8 Cavalry. (Ron Mihalko)*

This period also marked the development of 4-8 Cavalry's "CAT Attack" SOP. This document represented the consolidation of best practices from each of the subordinate platoons. After December the SOP became the basis for all training activities. It provided guidance for the operation of each platoon during the CAT competition. It addressed actions prior to the actual battle run, and it provided guidance for target acquisition, including crossfire techniques, engagement of moving targets, scanning, and target handoff. The SOP stressed the importance of abbreviated fire commands, maintaining a running count of targets hit, and addressing malfunctions. It marked the culmination of a deliberate effort to build a team-oriented training process focused entirely upon the mission — winning the Canadian Army Trophy. (247)

The closest local training area for 4-8 Cavalry lay at Campo Pond near Hanau-Wolfgang. In September individual tanks began to practice movement along firing lanes there under CAT standards that varied considerably from crew qualification runs. Starting in October engineers from the 3rd Armored Division began to transform the training area into a quarter scale CAT battle run site modeled upon Grafenwoehr's Range 117. The small size of the targets made them much harder to identify and acquire than the actual targets used in the competition. When it became clear that CAT 1987 would occur on Range 301, Campo Pond again underwent reconfiguration to resemble this site. (248)

The CAT team conducted gunnery at Grafenwoehr from September 20 through October 4. Efforts to maximize tank accuracy through individual zeroing, however, revealed a problem. Zeroing helped to achieve greater precision for a competition environment, especially through the identification and correction of each tank's unique performance anomalies. Variables related to atmospheric conditions could be identified via the vehicle's sensors and inputted into the onboard computer, while use of ammunition from the same lot for training and the actual competition eliminated another potential source of inaccuracy. The actual zeroing process proved a different matter:

Zeroing the CAT tanks proved to be much more difficult. Since the Army adopted calibration as the approved method of screening and proofing the 105-mm main gun on the M1, zeroing has become a lost art in the Armor force. Calibration alone is an unacceptable method for preparing tanks for CAT gunnery. To obtain the precision and crew confidence needed to win CAT, tanks must be zeroed.

Master gunners responsible for overseeing the zeroing process had never zeroed tanks themselves, having been trained according to the calibration policy. Reliance upon manuals soon revealed that "the procedure for zeroing the M1 detailed in the -10 [operator's manual] and FM 17-12-1 is too complicated." Fortunately, the week of October 20 witnessed the arrival of a mobile training team from Fort Knox to provide the first of two iterations of an abbreviated master gunner course. (249)

4-8 Cavalry returned to Grafenwoehr for more live gunnery between November 14 and December 5. Although fog resulted in the loss of six potential firing days, the company conducted battle runs, used sub-caliber devices, and participated in a shooting competition with the 3-8 Cavalry CAT team. During periods of range maintenance, personnel walked the ranges, determining the best means to engage the various targets, and saw the range from the perspective of the targets. Once again, zeroing posed a significant challenge. The crews found:

the formula for converting raw data to azimuth and elevation corrections that are then entered into the CCP [computer control panel] is so complicated that it is extremely easy to make mistakes. When mistakes are made the result was that master gunner's 'chased zeros.' ... The zero range was disorganized. Disorganized master gunner zero teams only compounded the problem mentioned above. The net effect was a loss of crew confidence in their tanks and master gunners. (250)

On January 1, Grafenwoehr's Range 301 was designated as the competition range. It was placed off limits to all CAT teams until the competition the following June. For the 4-8 Cavalry team, notice of the range selection resulted in the reorientation of training upon Range 301. All scenarios, battle runs, and simulator training became singularly focused upon this range. A standard blueprint of the range and the rules were used to determine likely target locations, including ones expected to be added. The CAT Attack SOP adjusted to accommodate the range's known features. The range was divided into four lanes, corresponding to each tank of a platoon. Within each lane targets were numbered to provide a quick and simple reference system to facilitate target acquisition. The platoon

leader's and platoon sergeant's tanks occupied the interior lanes to ensure they had the best view of the range. (251)

Undulating terrain and a mix of natural and man-made features ensured that portions of the range would be invisible to the entire platoon. Range improvements also resulted in newly bulldozed areas amid previously forested terrain, making target berms more difficult to see — a problem intensified by engineers deliberately adding new earth to areas to make the acquisition of the dark colored targets harder. Some targets would likely be hidden by terrain or other targets, mandating crossfire techniques and a clear division of responsibility for target servicing among the platoon and subordinate sections. The SOP emphasized section gunnery and the use of cross scanning and crossfire techniques to overcome the problem of targets hidden behind one another, tucked into tree lines, or near range fan markers. Since firing tanks were known to have difficulty determining whether they hit targets due to the high velocity of the APDS/T rounds used, sensing became the duty of the firing tank's wingman. (252)

At the end of January 1987, the 4-8 Cavalry CAT team conducted three weeks of gunnery at Baumholder. This live training period reflected the support of the 3rd Armored Division, which organized the range time. It proved critical, since the unit was not otherwise scheduled to live fire until April. Nevertheless, six of the potential 15 firing days were lost to fog conditions. While the unit continued to fire during snow and ice conditions, inclement weather reduced the number of actual platoon battle runs executed. Since this firing was intended to help determine which crews remained in the CAT company after it shrank from four to three platoons, the impact of weather proved disproportionate. (253)

The gunnery at Baumholder proved crucial to the subsequent training and competition performance of the CAT team. It helped to resolve the problem of how to score accurately each battle run, so that areas of weakness could be identified and addressed in subsequent training. Poor battle run data generated misguided and inaccurate assessments of platoon performance. Part of the problem resulted from the inability to shut down high use ranges after each battle run to physically inspect targets and get a precise determination of which targets were hit and missed. Physical inspection done during range downtime showed a discrepancy between what crews and spotters reported and the actual number of confirmed hits. (254)

After the Baumholder gunnery, the team adopted a new method of scoring each battle run. It increased the number of spotters to ensure that each one bore responsibility for observing a single target. The use of artillery spotting scopes and the issuance of high powered, wide angle binoculars for tank commanders eased target sensing. Recorders posted the time and sensing for each main gun round fired. Safety officers equipped with spotting scopes moved as far down range as permitted after each battle run. Each target was then raised for them to observe and count holes with spotting scopes. Their tally was then compared with the other spotters to provide a more accurate assessment of each battle run. The data compiled for each battle run was also entered into a computer to assist subsequent analysis and after action review. These measures were further supplemented by a physical examination of each target after the day's firing concluded. Hence the CAT team managed to get a much more precise tabulation of its actual gunnery, and the data collected drove training refinement. (255)

Accurate firing data held little value for tanks struggling to zero their weapons. The CAT team had been unable to match the performance of their tanks with the known maximum for the Abrams tank. Zeroing problems resulted in lost time, ammunition, and confidence. After the October 1 ammunition limit went into effect, only master gunners were allowed to zero the tanks. In this manner rounds fired during the process would not count against the competition limit for the crews, but the master gunners continued to experience difficulty zeroing. Nor did reliance upon doctrinal guidance provide a solution, since the depicted procedure proved overly complicated. (256)

In January, Dr. Doug Watters arrived from the Army Armament, Munitions, and Chemical Command to provide assistance. He offered a simplified zeroing procedure to improve accuracy. It utilized a zero panel divided into 12" grid squares. At its center lay a bull's eye that was perfectly encapsulated by the gunner's primary sight aiming reticle at 1,200 meters. Each tank fired five rounds in succession at the panel. Based upon their location, the mean point of impact was then plotted on the panel. A simple conversion table provided the correction factor to be entered into the computer to account for each gun's unique performance, or gun jump. Two additional rounds were then fired as confirmation, with the expectation they would land within a 24" circle. A second computer correction was then calculated to ensure rounds would strike within an 8" bull's eye. Crew skepticism turned to confidence after tanks carefully zeroed according to Watters' method at 1,200 meters then hit 8" bull's eyes at 2,000 meters. (257)

The criticality of accurate boresighting was the cornerstone of the armored force's calibration policy, and it proved fundamental to crews seeking to optimize competition performance through individual zeroing. Muzzle boresight devices were deemed preferable to the use of binoculars and thread. Therefore the 4-8 Cavalry CAT company sought to secure a boresight device for each crew. With only four available initially, the company secured the shortfall from Seventh Army Training Center stores, but the additional boresight devices proved in poor condition. Under Dr. Watters supervision, they were reserviced. (258)



*Tanks lined up on the boresight line. (Carl R. Johnson)*

The CAT crews, however, wanted to tighten the tolerances of these devices for greater precision. This work normally necessitated sending the devices to a specially equipped rear area maintenance organization — a process that might leave the crew without its boresight device for weeks. Depending upon how the work was performed, the device might return to the unit in a worse state. To avoid this problem, a combined effort by 2-64 Armor, the Armor School, and the U.S. Army Ballistic Research Laboratory resulted in the fabrication of new tools to enable tank crews to adjust the boresight device themselves. This initiative had broader application, since the tool also enabled crews to adjust devices no longer in acceptable performance parameters without sending it off for repair. (259)

Problems with use of the muzzle reference system (MRS) proved more difficult to resolve. When and how often to conduct an MRS update become points of debate with no simple resolution. Several crews considered the MRS unreliable, and the company leadership finally banned all MRS updates unless a sudden change in temperature occurred or the crew experienced at least two rounds falling short during a battle run. (260)

The next live fire phase for 4-8 Cavalry occurred in April. By then, it was known that the battalion's CAT team would participate in the actual competition. This gunnery phase also occurred on Grafenwoehr, and it provided an opportunity to use the new scoring system. A computer placed in the range tower collected firing data and helped to score each platoon battle run conducted. At day's end this data was analyzed and the conclusions drawn used to prepare scenarios for the next day's firing. (261)

The CAT team participated in Kitty CAT I on April 25-28. This event, with its spectators, general officer presence, flags, loudspeakers, and an announcer, prepared the CENTAG teams for the actual competition environment. It gave crews a sense of what the actual competition would feel like, including the pressure to perform well. All participating platoons had an opportunity to make dry runs, execute sub-caliber battle runs, and perform a practice run with live main gun ammunition. The 4-8 Cavalry team used this opportunity to test its CAT Attack SOP. It discovered that faster engagement times resulted in more first round hits, and affirmed its faith in its target numbering system. It noted the importance of engaging far targets first, lest firing at closer targets obscure the distant targets. Target sensing, however, remained a problem. Most targets missed were not re-engaged, indicating that the crew did not realize they had not hit the target. Crews also tended to get caught up in the heat of the moment and stopped following the SOP. (262)

The lessons learned from Kitty CAT I became the focus of the home station training that followed. UCOFT became an obvious venue to address weaknesses. Between February and June 1987, the team logged 162.5 hours on UCOFT. All of this time focused upon platoon training directly associated with CAT battle runs on Range 301. (263)

In May 4-8 Cavalry returned to Grafenwoehr for its final live fire before the competition. The team focused on remedial measures based on the Kitty CAT I performance. Harder training scenarios were designed to challenge identified weaknesses in each platoon. Battle runs included more moving targets, masses of targets on only one side of the range, and routinely featured the most difficult targets to identify and hit. Platoons were forced to apply crossfire techniques, and found themselves subjected to a barrage of sudden malfunctions in the midst of engagements—all deliberate actions by the leadership to generate challenging training that stressed crews and pushed them to higher levels of performance. (264)

The team also benefited from the arrival of Dr. Dennis Forbes during this period. He came to the unit from the U.S. Military Academy's Department of Physical Education. With 20 years of experience in coaching sports teams and teaching stress reduction, Dr. Forbes helped the CAT team to remain focused on performance without becoming distracted or unsettled by competition stress. His value, however, stemmed less from the provision of theories and stress reduction concepts than it did from his direct support of training. He possessed CAT experience, having coached 1-32 Armor in CAT 1981. He became a sounding board for soldier concerns that he relayed to the chain of command. He also offered critical assessments and training recommendations that helped refine the CAT team's performance in the final weeks before the competition. (265) The 3-64 Armor and 2-66 Armor teams also included stress management in their training, but generally in the form of classes. They did not integrate stress management techniques into training activities to the extent of 4-8 Cavalry. (266)

Dr. Forbes' arrival occurred shortly before Kitty CAT II from May 24-26. This event also featured a mock competition, but it was open to all NORTHAG teams. 4-8 Cavalry, the Royal

Canadian Dragoons, and the Royal Hussars were among the participants. This event, occurring less than one month from the CAT competition provided participants the chance to test corrective measures and lessons learned from the first Kitty CAT. In this sense the two live fire practice events provided participating CAT teams constructive training in a competition format. For the 4-8 Cavalry team, in particular, platoons repeatedly came close to achieving perfect scores. (267)

### **The SIMNET Factor**

All American CAT teams benefited from access to Simulations Networking (SIMNET). SIMNET featured a set of simulators, each one representing a different weapon system (tank, helicopter, infantry fighting vehicle, etc.), linked electronically. The tank simulator included replicas of all crew stations on the M1. Crew members observed a computer-generated battlefield when they looked through the vehicle sights or vision blocks. The tank fire control system was replicated in addition to communications within the vehicle and with other platforms. Groups of individual simulators could be linked to create a platoon or company capable of maneuvering and engaging in combat on the computer generated landscape. In effect, SIMNET offered the ability to conduct a virtual force on force field training exercise on variable terrain with a comprehensive after action review capability. (268)

SIMNET developed from a 1983 Defense Advanced Research Projects Agency (DARPA) initiative in partnership with the U.S. Army and Air Force. Intended ultimately to depict a combined arms team, its initial focus lay upon close combat heavy forces. In May 1986 DARPA demonstrated two dueling M1 simulators. Fort Knox was identified as the principal development site for SIMNET and home to a facility intended to include 82 simulators representing the basic platforms of a heavy task force. The first two platoons of simulators were planned for operational use by September 1986 with the remainder installed over the following year. Similarly, Fort Benning was planned for a facility to house simulators for a mechanized infantry battalion. (269)

SIMNET's association with CAT dated to 1977. In that year Colonel Gary W. Bloedorn commanded 2-81 Armor in the U.S. Army's uninspiring CAT debut. Upon retirement, he worked with the Armor Center as a DARPA consultant in the development of SIMNET. Together with an officer assigned to Department of Army headquarters, Bloedorn proposed the use of SIMNET to help train the American teams. DARPA, USAREUR, and the Armor Center approved and supported the concept. The Seventh Army Training Center prepared a facility at Grafenwoehr for SIMNET and secured the chief judge's approval for its use. An officer in this command with CAT 1985 experience facilitated preparation of a Range 301 terrain database. Rapid work by engineers and technicians ensured the small SIMNET facility was ready for use by April 1987. (270)



*The 3-64 Armor CAT 1987 team patch with its pouncing feline.  
(Ron Mihalko)*

Each of the three American CAT teams received two weeks of training on SIMNET, broken into two periods. The first day of training included instruction on system usage by DARPA personnel. This familiarization included guidance on the design and modification of training scenarios. The first week of SIMNET training proved one of discovery learning for each CAT team. The 2-66 Armor team used the facility first, but experienced numerous equipment failures in the recently installed simulators. Worse, the small SIMNET facility proved a curiosity that attracted high ranking officers and senior civilians eager to observe its operation, resulting in a loss of training time. The 3-64 Armor team also experienced significant equipment failures, leaving only 4-8 Cavalry to benefit from few breakdowns and minimal visitor interference. (271)

The early exposure to SIMNET was not an unparalleled success. Team personnel struggled to master the new system while their commanders worked to determine how best to incorporate it into the overall training programs. The simulator tanks did not require gunners to perform all of the steps necessary on an actual tank to successfully engage targets, creating the risk of bad habits creeping into training just weeks before the competition. Drivers experienced significant difficulty remaining in formation and found manipulation of the actual tank an easier task than maneuvering the simulator on a computerized battlefield. Initial efforts to utilize SIMNET as a precision gunnery trainer quickly foundered on virtual ranges that never experienced target obscuration or bad weather. Nor did the tank simulators replicate machine gun fire, making practice of the competition machine gun engagements an impossibility. (272)

The CAT teams adjusted to the idiosyncrasies of SIMNET. They all utilized the device to conduct platoon battle runs focused upon fire distribution plans oriented upon Range 301, using the comprehensive after action review capability to refine their training. The use of additional monitors enabled the command groups to assess how crews scanned sectors and identified targets, while audio recorders permitted monitoring of crew conversations and reporting during engagements. They also focused upon platoon and section teamwork in the identification, acquisition, and engagement of targets with the active involvement of the chain of command. Integration of SIMNET training with live and UCOFT activities prevented gunners from becoming accustomed to simulator-specific practices without parallel on the actual tank. (273)

Some variation in SIMNET usage occurred among the American CAT teams. The 2-66 Armor team used the system for a total of just nine days with an emphasis upon platoon exercises. It conducted 131 battle runs and supplemented this training with UCOFT. The 3-64 Armor team completed 100 battle runs in SIMNET, using much of its time conducting free play exercises. In its second week of SIMNET training, the 4-8 Cavalry team emphasized its CAT Attack SOP in scenarios specifically designed for complexity and characterized by the use of clustered targets and high numbers of moving targets. Platoons were routinely subjected to sudden hardships and evaluated on their response. Overall, the team conducted 151 platoon exercises during its SIMNET time, which it shared with the Royal Canadian Dragoons, who managed to complete 34 battle runs. (274)

SIMNET provided another tool for the CAT teams to use in preparation for the actual competition. It enabled the execution of multiple battle runs without scheduled range time or the expenditure of live ammunition. It provided an excellent means by which to practice fire distribution plans on a virtual depiction of the actual competition range. The broad range of scenarios gave commanders the tools to challenge their teams, address weaknesses, and conduct detailed evaluations. All teams used SIMNET as a means to make final adjustments to their competition SOPs, and it proved invaluable for practicing command and control, reporting procedures, and platoon target engagement. SIMNET would not win CAT, much less battles, but it provided a means of repetitive training with scenarios, maneuver techniques, and firing patterns hard to replicate on gunnery ranges where time, ammunition limits, and movement constraints prevailed. (275)



## **America First**

By June 1987 the American CAT teams were at peak readiness. They had each followed different training programs over a 10- to 12-month preparation period. In the case of 3-64 Armor and 4-8 Cavalry, both units benefited from an exclusive focus upon the Canadian Army Trophy. They received extensive support from their division and brigade chains of command, manifested through range accessibility and freedom from other obligations. They had integrated their support personnel with their CAT companies, and maximized range familiarization in their competition fire distribution plans. In contrast, the 2-66 Armor team's preparation resembled a modified training schedule rather than a focused CAT program. The unit supported other mission requirements beyond the Canadian Army Trophy. It had less time to conduct gunnery at Grafenwoehr or study the competition range. In many respects, the experience of 2-66 Armor's CAT team resembled that of the British Royal Hussars without the added complexity of fielding a tank with new components.

Ironically, the American CAT teams had less interaction with each other than they did with participants from other nations. Only once on the eve of the competition did the American teams meet to share training strategies. (276) Conversely, the 4-8 Cavalry team developed a strong relation with the Royal Canadian Dragoons, while 2-66 Armor benefited from shared training experiences with the Dutch and the British. The mock competitions conducted by NORTHAG and CENTAG also provided opportunities for participants to mingle and share ideas. In effect the preparation for the Canadian Army Trophy as well as the actual competition helped to realize the oft stated objective of permitting the participating teams "to meet in a true spirit of comradeship and fraternity." (277)

The Canadian Army Trophy competition occurred during the week of June 15. Once the teams arrived at Grafenwoehr, they engaged in several pre-competition activities. These included practices for ceremonies, a safety briefing, and a terrain walk of the competition range. Not all soldiers, however, were impressed by Range 301. For the 4-8 Cavalry team:

After our extensive UCOFT and SIMNET training, the actual range was literally boring. We all experienced an increase in our adrenaline as we approached ..., but that quickly dissipated when we saw the actual range. I had a hard time getting the troops to concentrate on viewing the range after their first glance. (278)

The other principal pre-competition activity aside from maintenance and personal preparations included tank beautification. The intent lay in sharpening the tanks' appearance to make a positive impression at the competition. The action also served to keep the soldiers busy. After initial grumbling, the crews threw themselves into the effort. For 4-8 Cavalry, the tanks were cleaned and festooned with U.S. flags. The special CAT insignia for the 3rd Armored Division and the team's "Bill the Cat" sticker were also painted onto the vehicles to give them a distinctive look. The other American teams similarly adorned their tanks. (279)

During the competition, the 2-66 Armor platoons placed 11th, 12th, and 14th. Their highly consistent performance resulted in a point spread of just 227 points. Moreover, the 11th and 12th place platoons actually tied each other, earning the same hit score, time score, and machine gun engagement score. They each hit 29 of 32 main gun targets, and secured the second highest hit scores for NORTHAG, sharing this achievement with a Belgian and German platoon. The 14th place platoon managed a better time score, but it missed four main gun targets, lowering its overall score relative to the 2-66 Armor team. Among the ten companies participating, it ranked sixth. (280)



*A-33, a tank of the 3-64 Armor CAT 1987 team with its distinctive turret art work. (Ron Mihalko)*

The high scoring platoon from 3-64 Armor placed third in the competition. It conducted its battle run under cloudy but clear skies without rain. The targets were clearly visible, and the platoons hit 31 of 32 main gun targets and all the machine gun plates. They just missed earning the time and ammunition conservation bonuses that would have made them a contender for first or second place. Indeed, the winning platoon possessed a time score of just 25 points more than the 3-64 Armor unit. Nevertheless with an overall score of 18,827 points, the second highest time score, and one of the better hit scores, the platoon completed a strong performance that validated the unit's training program. The other platoons of the 3-64 Armor team placed 16th and 17th with just 92 points separating their scores. Given the array of other platoons equipped with the M1 IP or Leopard 2, their performance proved solid, but still just behind the Leopard 1s of Canada. Indeed, the 3-64 Armor company placed fifth, just below the Royal Canadian Dragoon company. (281)

4-8 Cavalry began its Canadian Army Trophy foray on a sour note. Its first competition battle run occurred on Monday. One tank from the platoon threw a track after leaving the zero range when it hit a patch of newly laid gravel of which the crew was unaware. A reserve tank had to be used. During the series of checks to be completed before a battle run, a second tank experienced a laser rangefinder malfunction, necessitating its replacement — an action completed just before the platoon moved to the first bound. The platoon began its battle run under weather that alternated between light rain and clear skies. Adhering to the CAT Attack SOP, the four tanks hit every target with one shot until they reached the final bound. In training, this platoon had always found targets at this point the easiest to acquire and hit. It was well on its way to hitting every main gun target, potentially earning the hit and ammunition conservation bonus. However, at the third bound the light rain transformed into a torrential downpour with hail. To make matters worse, fog obscured the far targets. With the thermal imaging system washed out, and the principal and auxiliary gunner sights either fogged over or distorted by rain drops, the range became largely invisible. Only one of the four remaining targets was spotted, but it was not hit. Weather, however, did not stop the battle run. The platoon managed to hit just 28 of 32 targets, scoring 16,930 points, and finishing 15th. A protest was lodged with the chief judge, but after consideration, it was rejected. (282)

The next platoon conducted its battle run on Wednesday, June 17. After leaving the zero range, it also experienced a downpour. The weather cleared to sporadic rain and sunshine, but one of its tanks experienced repeated communication problems. The crew shifted to a replacement tank with minutes to spare before the targets began to appear at the first bound. Nevertheless, the platoon began its battle run with a strong performance, quickly and efficiently servicing targets. At the second bound, a faulty target handoff resulted in a missed target. Continuing to the final firing point, the platoon found targets massed on the right side of the range. The section responsible for this area failed to call for assistance in sufficient time to hit all the targets. The platoon finished its run with 30 of 32 main gun targets hit, a score of 18,005 points, and a respectable seventh place finish. (283)



*“Bill the Cat,” found on the turret of every tank in 4-8 Cavalry’s winning team. (Ron Mihalko)*

The last 4-8 Cavalry platoon conducted its battle run on Friday, the competition’s last day. Indeed, this unit was the last of 24 platoons to fire — and the last chance for an American platoon to secure first place. With a contingent of three- and four-star generals in attendance, and an exceptional performance by a platoon from Panzer Battalion 124 on Thursday, the 4-8 Cavalry unit was not an odds-on favorite to win.

In preparation the platoon soldiers watched a rerun of the U.S.-Soviet Union hockey game at the 1980 Olympics in which the American team secured an upset victory at the last moment. A similar feat was sought at CAT 1987, but the probability seemed unlikely, especially when one of the tanks was found to fire low on the zero range before the battle run. The crew switched to a reserve tank. The weather at least cooperated with clear and cool conditions. The battle run commenced with the platoon hitting targets quickly and efficiently. En route to the second bound, however, one of the tanks had a coaxial machine gun malfunction. The crew called upon its wingman for assistance in knocking out the machine gun targets, but only seven of ten were hit. Nevertheless, the platoon completed its battle run and hit every other target that appeared. When the final score was tabulated, the platoon achieved a score of 20,490 points, gaining the hit and ammunition conservation bonuses, and achieving the highest time score of any competing platoon. First Platoon, D Company, 4-8 Cavalry became the first American unit to place first in the Canadian Army Trophy, beating its German rival for the posting by 800 points. (284)

The American victory received immediate and positive publicity in the press and throughout the Army. Indeed, it was noted at the White House by President Reagan’s National Security Advisor Colin Powell, who considered it “the equivalent of winning the World Series and the Super Bowl in one season.” (285) The victory was only enhanced by a similar first place win by an American team

in the Boeselager Cup competition that focused upon cavalry skills. At CAT, all of the U.S. teams had executed a solid performance that paid tribute to the Abrams tank and the careful teambuilding and training each company completed.

Nevertheless, the Canadian Army Trophy had always been criticized as being artificial and unrealistic, and its competing teams little more than one-trick ponies suited only to the sterile conditions of the competition range. CAT 1987 was no different. A member of the Royal Hussars considered the 4-8 Cavalry team little more than “gladiator troops.” American critics similarly questioned the ability of this team to perform adequately the full range of tactical tasks required of armored units. Analysis of the final scores also found a correlation between how well a platoon scored and its firing order. Those units firing later in the competition tended to perform better with the exception of the British. No clear reason existed for this trend, since the weather varied throughout the week, but some observers believed it reflected growing familiarity with the range. With only 12 different target arrays for 24 platoons, later firing platoons were more likely to know exactly which target array they would face. Indeed, this information was made available to the winning platoon’s chain of command — but it was deliberately not shared with the platoon leadership or crews. (286)

In July the 4-8 Cavalry CAT team accompanied its parent battalion to Hohenfels to participate in scheduled and evaluated field training exercises. The CAT team had no time to hone its non-gunnery skills or practice those field activities neglected during the 10-month competition train up. Nevertheless, the CAT team outperformed every company in the battalion, and the battalion as a whole executed one of the best performances in the 3rd Armored Division. These outcomes underscored the basis of the 4-8 Cavalry’s CAT success: teamwork. The CAT team approached the competition as any other mission. It assessed the problem, assembled the necessary talent, and relentlessly worked to win. The team methodology proved successful and applicable to both competition and tactical environments. (287)

The American victory at CAT 1987 reflected the growing culture of confidence permeating the U.S. armored force as a whole. The winning platoon did not comprise specially groomed soldiers, but rather a collection of volunteers from a single armor battalion. The wealth of talent available in this single unit was indicative of the major strides made in Armor training throughout the decade. Whereas units took pride in beating training standards, the CAT team applied the same philosophy to the competition range.

Indeed, the American performance at CAT 1987 was considered indicative of U.S. Army readiness to confront Soviet aggression in Central Europe. A study of the competition compiled by the battalion commander of one of the U.S. teams opened with the following notice:

Warning to the Warsaw Pact. If you make the decision to attack NATO ground forces in Western Europe, the most highly skilled, best equipped and supported armored forces in the world will cut you to ribbons... We, the American victors in the 1987 Canadian Army Trophy competition, issue this warning on behalf of our allies and from a position of strength. (288)

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## Chapter 5

### The Canadian Army Trophy's Final Years

The period 1988-1993 marked the twilight years of the Canadian Army Trophy. After the 1987 competition in which Britain's newest tank made a poor showing and a U.S. platoon finished in first place, the last competitions held in 1989 and 1991 proved anticlimactic. The British abstained from both events, and the United States failed to repeat its earlier win. Instead, a host of technical issues plagued American efforts to win CAT 1989 and the First Gulf War precluded participation in CAT 1991. Plans for a 1993 competition died amid the collapse of the Soviet Union and the Cold War's end. With the threat to Central Europe gone, Canadian Forces returned home, and the Canadian Army Trophy became a footnote to the history of NATO during the Cold War.

#### End of the Cold War

In the late 1980s NATO remained poised to counter the persistent threat posed by the Warsaw Pact to Central Europe. NATO readiness remained high, spurred by continued military investment. The United States in particular continued to pour resources into its armed forces as part of President Ronald Reagan's ongoing effort to exude strength in dealings with the Soviet Union. Return of Forces to Germany (REFORGER) exercises demonstrated a commitment to the defense of Central Europe and America's ability to deploy combat power rapidly to the region in the event of hostilities.

When President George H.W. Bush came into office in 1989, he continued Reagan's emphasis upon negotiating with the Soviet Union from a position of strength. He also demonstrated a willingness to employ American combat power, particularly in Panama. There, a U.S. invasion ousted Manuel Noriega from power, following an escalation of tension and growing concerns about the Panamanian's drug trafficking. Operation JUST CAUSE overthrew Noriega's regime and resulted in his imprisonment in the United States.

Bush also continued the direct interaction begun by President Reagan with Soviet General Secretary Mikhail Gorbachev. Relations between the United States and the Soviet Union continued to improve, underscored by the signing of the Strategic Arms Reduction Treaty and the diminishing danger of a nuclear war between the two superpowers.

The improved relations owed much to Gorbachev. With the Soviet economy faltering, he encouraged private business ownership. The granting of individual rights and promotion of a free press stoked the fires of reform, while Gorbachev restructured the Soviet government and enabled open elections in 1989. He also sought to reduce the strain on the economy created by military and foreign commitments. A foreign policy aimed at reducing international tension resulted, coinciding with American and NATO efforts to reduce strategic and conventional forces in Europe. The Soviets also withdrew from Afghanistan after a 10-year conflict that failed to create a stable proxy state.

Soviet controls over Warsaw Pact states loosened, triggering a surge in nationalist sentiment in those countries. In 1989 a non-communist government assumed leadership authority in Poland without interference from the Soviet Union. The following year, similar transitions in political and governing authority occurred in Hungary, Bulgaria, and Czechoslovakia. These developments generally happened without widespread violence, but in Rumania Nicolae Ceausescu's efforts to

increase police authority and remain in power led to rioting, violence, and ultimately his execution. In East Germany, a new government came to power, and the Berlin Wall came down. The future of a non-communist East Germany ended with the formal announcement of its reunification with West Germany in 1990.

The sweeping changes to Europe's political landscape coupled with a Soviet Union focused upon internal reform ended the Cold War. The changes being pushed by Gorbachev and gaining traction throughout the Soviet Union removed the communist monopoly on political power. They stimulated separatist sentiment among the subordinate republics sometimes accompanied by violence, particularly in the Caucasus. In 1991, against the backdrop of a faltering economy, new elections lifted Boris Yeltsin to power. A coup launched by hardline communists failed, leaving Yeltsin to become president of a Russian Federation. The Soviet Union ceased to exist, and many of its former republics secured their independence.



*Throughout much of the Cold War the U.S. Army maintained stockpiles of weapons and materiel in Europe for use in the event of war with the Warsaw Pact. This image shows the first Abrams tank to be drawn from a prepositioning of materiel configured to unit sets (POMCUS) site. (National Archives and Records Administration)*

The Soviet Union's dissolution and the end of the Cold War augured in a new era of regional crises in lieu of superpower rivalry. The death of Yugoslavian leader Josip Broz Tito in 1980 generated instability. Yugoslavia devolved into a collection of states split along ethnic lines with Serbia seeking to retain a dominant influence against the opposition of Croatia, Slovenia, Macedonia, and Bosnia-Herzegovina. In 1991 Croatia and Slovenia declared independence. Fighting began between Serbia and Croatia, marking the onset of a civil war and the breakup of Yugoslavia. The spike in ethnic violence spread to Bosnia-Herzegovina, Kosovo, and Macedonia. In response the United Nations dispatched military peacekeepers from several European nations to the region to quell the violence, which continued throughout the 1990s and culminated in direct military action by NATO against Serbia in 1999.

In the Middle East, Iraq invaded and occupied Kuwait on August 2, 1990. Iraq's aggression stemmed from a longstanding dispute with Kuwait over finances and territory, and the state of Iraq's economy after its long war with Iran in the 1980s. Iraq gained control over 15 percent of the world's oil supply through the seizure of Kuwait. Moreover, Iraqi forces continued to pour into Kuwait in a

military buildup that posed a direct threat to Saudi Arabia. Should the Iraqis invade and defeat the desert kingdom, they would then have a controlling influence over nearly half of the world's oil resources.

Reaction to the Iraqi invasion of Kuwait proved swift. International condemnation, particularly from Western powers, occurred simultaneous with U.S. efforts to create a military coalition and secure a United Nations resolution calling for Iraq's withdrawal. The U.S. began the immediate deployment of forces to Saudi Arabia to protect the kingdom from invasion. Other nations followed suit. In addition to American and British forces, the coalition also included combat formations from France, Saudi Arabia, Kuwait, Syria, Morocco, and Egypt. USAREUR, intended to be the recipient of reinforcements during the Cold War, found itself instead preparing and deploying its assets to support the coalition in Southwest Asia. As the military buildup continued, it included the largest concentration of armored combat power since World War II — a development that reflected the large size of the Iraqi army and its strong mechanized component. Among the steady flow of armor and cavalry units leaving Germany were those with prior CAT experience and the three battalions preparing for CAT 1991.

On November 29, the United Nations directed Iraq to withdraw from Kuwait by January 16 or face military action. The deadline passed without Iraqi action. On January 16, the U.S.-led coalition began a four-week air campaign targeting Iraq's military capabilities. The ground campaign, Operation DESERT STORM, began on February 24. While Marine Corps and Arab forces directly threatened Iraqi forces in Kuwait, the main coalition effort unfolded to the west where the XVIII Airborne Corps and VII Corps entered Iraq and moved across the desert in a giant wheeling movement intended to cut off and destroy Iraqi forces in Kuwait. The Iraqi Republican Guard formations, considered the best trained and equipped in the Iraqi force structure, constituted high priority targets. However, the Republican Guard formations deployed behind entrenched regular Iraqi army units. To reach them coalition forces would have to move around or breach these forward defenses. They did both.

Across the breadth of the coalition frontage, Iraqi forces struggled to defend against combat forces better equipped, trained, and generally more capable. The result lay in a series of engagements that rapidly destroyed Iraqi combat capability, accelerated by the rapid tempo of operations. A ceasefire went into effect on February 28, but many Iraqi combat units endeavored to escape into Iraq. Sporadic engagements continued after the ceasefire, generally resulting in more Iraqi defeats. When combat operations finally ended and the war concluded, much of the Iraqi army's combat power, particularly its Republican Guard armored and mechanized formations, had been destroyed.

The Gulf War demonstrated the capabilities of an American army at the apex of its Cold War readiness. It benefited from the training reforms of the 1970s and 1980s, the fielding of new equipment, a doctrine understood at all command echelons, and well trained and led combat organizations. The high training standards established in the 1980s offset the lack of combat experience throughout the force. In particular, the attention paid to rapid, accurate tank gunnery in the Canadian Army Trophy competition and in the American tank tables ensured the rapid destruction of Iraqi armored fighting vehicles wherever encountered. For the British, too, operations in Southwest Asia removed the stigma associated with the Challenger tank as a result of its poor showing in the 1987 CAT competition.

The successful conclusion of the Gulf War and the destruction of much of Iraq's ground warfare capability marked the end of an era. With the collapse of the Soviet Union, the end of the Cold War, and the elimination of one threat to Middle Eastern stability, the principal Western powers anticipated budget reductions and downsizing. Indeed, the first reductions to the Cold War inventory began before Operation DESERT STORM. In its aftermath and notwithstanding the ongoing conflict in the Balkans, this divestiture of military power accelerated. For the U.S. Army the 1990s became

characterized by the conduct of operations other than war and experiments intended to harness the emerging power of the internet to tactical organizations and command networks. The resultant series of initiatives, collectively known as Force XXI, pioneered the development of digitized systems, organizations, and command structures that became commonplace in the 21<sup>st</sup> century. Similarly, the NATO powers sought lighter, more readily deployable forces suited to contingency operations abroad rather than the defense of Central Europe against a mechanized threat. The importance and visibility associated with CAT waned. The last Canadian Army Trophy competition occurred in June 1991, four months after the successful liberation of Kuwait.

### The Training Revolution Continues

The American first place finish in CAT 1987 helped to stifle press criticism of Army readiness and the related Defense investments in the 1980s. For Armor units, training standards remained high, characterized by increased realism and the desire to close the gap between training and combat environments. Hence, units began to integrate tactical skills into their live gunnery training. The 1<sup>st</sup> Squadron, 10<sup>th</sup> Cavalry Regiment (1-10 Cavalry), for example, modified its Tank Table VIII qualification course to ensure gunnery training occurred in a tactical atmosphere. The generation and issuance of a platoon operations order, uploading ammunition at night, executing a movement to contact, demonstrating navigational ability, terrain usage, and the integrated action of scouts overwatched by tanks served to change the tank table into a tactical encounter without eliminating any of the basic crew skills evaluated. (1)



*For much of the Cold War, REFORGER exercises demonstrated the ability of the U.S. Army to deploy reinforcements rapidly to Europe in the event of war. Here a column of M1 tanks maneuver during a REFORGER exercise. (National Archives and Records Administration)*

The example of 1-10 Cavalry served as an inspiration for other units. The 2nd Battalion, 69th Armor Regiment (2-69 Armor), stationed at Fort Benning, similarly modified its gunnery program to incorporate tactical skills as well. Based on training observations from the National Training Center (NTC) and the command's perception of its own training deficiencies, a gunnery program emerged to emphasize those tactical and gunnery skills requiring improvement. Upon completion of the tank crew gunnery skills test, all further training activities served to link gunnery training to the battalion's combat mission. The use of operational orders down to platoon level, tactical reporting procedures, and map reading skills served to build platoon leadership ability. For the battalion as a whole, the use of a non-standard firing range with few range markers or identified target pits forced an emphasis on target acquisition. Movement to the range occurred as a night road march into an



assembly area. During live fire, non-firing elements employed camouflage, established hot loops, and prepared their tanks to fire. The final crew qualification on Tank Table VIII also included nonstandard activities, including the use of smoke, mandatory call for fire, terrain usage, and wingmen. (2)

Gunnery qualification standards remained high, but units routinely strove to exceed them. A healthy competitive atmosphere existed in the armor force, as published scores served as challenges for other units to beat. Moreover, these scores began to reflect platoon as well as crew qualification. In 1988 the 2nd Battalion, 37th Armor Regiment (2-37 Armor) set a record when it qualified all tanks during the first run of crew qualification. Three crews earned perfect scores and 26 rated distinguished with an average battalion score of 878. (3)

The 4th Battalion, 34th Armor Regiment (4-34 Armor) received special coverage when in 1989 all of its tank platoons earned distinguished ratings while firing Tank Table XII at Grafenwoehr. The qualification course required each platoon to hit at least 38 targets from a mix of 42 moving and stationary targets. They also had to conduct engagements at longer distances and call for indirect fire. In preparation, the battalion relied upon the UCOFT, a sub-caliber range, and force-on-force exercises with MILES. The unit also qualified 58 tank crews on their first run with 80 percent of targets being struck by first round hits. This performance resulted in 18 crews receiving the distinguished rating. (4)

While other units strove to beat these scores, 4-34 Armor returned to Grafenwoehr in 1990 to raise the bar of achievement still further. The unit qualified all tank crews on their first run, with an average score of 862 out of a possible 1,000 points. Moreover, 14 crews earned the distinguished rating, and two shot a perfect score. On both counts, 4-34 Armor led USAREUR. It also once again set the standard for platoon qualification. All 12 platoons qualified, with four rated distinguished, hitting on average 89.9 percent of all targets presented. Personnel shortfalls resulted in each platoon possessing only three tanks, making these accomplishments on Tank Table XII even more remarkable. (5) Moreover, the Seventh Army Training Command had also modified its Tank Table VIII range scenarios to increase difficulty in August 1989. Firing data from units that experienced the revised table indicated a drop in the average scores achieved by most tank battalions. (6)

Training activities also reflected the growing prevalence of the M1A1. This version of the Abrams upgraded the main armament to a 120-mm smoothbore, similar to that carried on the Leopard 2. The change in armament reduced the number of main gun rounds that could be stored, and it necessitated changes to the fire control system. The increased lethality, however, made it a priority for fielding in Europe, where NATO and the Warsaw Pact remained poised for a potential clash. By late 1988, USAREUR included 20 tank battalions equipped with the M1A1, including those of the 3<sup>rd</sup> Armored Division that completed its transition that year. (7)

The principal doctrinal publication governing tank gunnery training remained FM 17-12-1: *Tank Combat Tables*. First published in November 1986, it underwent three changes by 1990 that reflected changes in technology and lessons learned. Its principal objective remained the provision of a “standardized way to train weapon system proficiency through the conduct of tank combat exercises — both gunnery and tactical tables.” Oriented upon the Abrams tank, its tactical tables had applicability to the other platforms still in use by the Army, including the M48A5 and M60-series. Although not the only manual applicable to tank gunnery, FM 17-12-1 constituted the primary reference. It addressed the basic gunnery components of the tank, their use, and the techniques relevant to accurate shooting. Symptomatic of the complexity of the M1-series lay the coverage given to the myriad factors influencing an effective ballistic solution, including cant, crosswind, lead, range, ammunition propellant temperature, gun tube wear, air temperature, air pressure based on elevation, and ammunition type. The manual provided accepted procedures for target identification, acquisition, and direct fire engagement. Further chapters addressed fire control, training programs, and range operations.

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The second volume focused upon the gunnery and tactical tables, with appendices addressing special subjects such as fire control system calibration, armament accuracy checks, smoke usage, and nuclear, biological, and chemical (NBC) procedures. The manual provided clear, effective guidance and information reflective of the experiences gained with the Abrams tank since its fielding and the continuous exchange of information and best practices between units in the field and the Armor Center. (8)

The Armor School continued to work with the technical and science communities to help crews improve their accuracy. The master gunner community remained active in this area and often served as the conduit for new concepts and techniques. The May-June 1988 issue of *ARMOR*, for example, included an article jointly written by a physicist in the U.S. Army Atmospheric Sciences Laboratory and a master gunner from the Armor School. The article focused upon the influence of barometric pressure upon the flight of a tank round. The tank's onboard computer accurately calculated this influence, provided correct pressure readings were available. Crews were trained to input a standard value when accurate data could not otherwise be obtained. Unfortunately, as the tank moved over different elevations, this value became less relevant and actually reduced main gun accuracy. In response the authors provided a table with barometric pressure values for the tank's computer based upon altitude. Intended to be readily available in the tank, it marked a significant improvement over the standard value and reduced related inaccuracies. (9)



*A tank platoon from 3-64 Armor at Hohenfels. (Ron Mihalko)*

Despite the improvements in materiel and doctrine, personnel still represented the Armor Branch's most precious resource. Hence efforts begun earlier in the decade to improve training, particularly among NCOs, continued to receive senior leadership attention. Through a combination of policy changes, steady command support, and improved standards, the branch built a strong NCO base and boosted promotion rates to sustain it. (10)

ANCOC and BNCOC continued to undergo refinement. In August 1988 the ANCOC curriculum increased its coverage of tactics. The course also adopted small group instruction to provide more attention to individual students. Each small group instructor became responsible for 16 students and ensuring course standards were met. Students were expected to learn from instructors and through greater interaction among themselves. Maximizing the value of small group instruction necessitated student preparation for ANCOC in advance. BNCOC continued to prepare tank commanders. Indeed, 75 percent of all tank commanders needed to attend the course — a clear testimony of the NCO's importance within Armor. BNCOC changes focused upon keeping the program of instruction updated to reflect current vehicle capabilities. In July 1988 it underwent revision to incorporate more emphasis upon troubleshooting skills pertinent to the electronic systems on the M1 tank. (11)

The Excellence in Armor program provided a means of early identification and grooming of highly capable soldiers for careers as NCOs. Indeed, the Armor Center associated a robust EIA program with a strong NCO corps. By late 1989 the program included 3,200 soldiers in the active and reserve components. Indeed the number of soldiers who passed the Tank Commanders' Certification Test II (TCCT-II) nearly equaled the number of Armor soldiers promoted to staff sergeant, making the test a critical gate for NCO development. Test candidates had to be EIA soldiers, BNCOC graduates, possess a high skills qualification test score, and be recommended by their commanding officers. Since candidates received only one opportunity to take the exam, they were encouraged to develop a study plan and receive assistance from a master gunner. Passage led to early promotion to staff sergeant and identification as a potential candidate for the master gunner course. The Armor Center urged careful monitoring and encouragement of EIA soldiers, but it had to overcome the indifference of some unit commanders who neither promoted the program nor permitted eligible soldiers to take TCCT II. (12)

### **American Preparations for CAT 1989**

While the Armor Center and School worked to sustain the quality of the branch training base, USAREUR prepared to secure another first place finish in CAT 1989. The American competition teams came from the 2nd Armored Division (Forward)'s 3rd Battalion, 66th Armor Regiment (3-66 Armor) in NORTHAG, and the 3rd Armored Division's 4th Battalion, 32nd Armor (4-32 Armor) and 3rd Infantry Division's 2nd Battalion, 64th Armor Regiment (2-64 Armor). Both of these latter units constituted the U.S. component of the CENTAG team. (13)

In preparation each team generally followed the training pattern established by 4-8 Cavalry for CAT 87: team selection that included attached support personnel, development of a competition SOP, regular live fire events reinforced by simulator training, a maintenance "peak-up," special gunnery instruction from a Fort Knox mobile training team, and a rehearsal competition involving other participants.

The experience of 4-32 Armor typified this approach. C Company was selected as the actual CAT team. Following the establishment of a headquarters element and determination of the team leaders, efforts then focused upon soliciting volunteers for the tank crews and support component. A shoot-off in August 1988 identified the initial team members for a four-platoon organization that was then reduced to the standard three-platoon configuration in December. The team leaders were selected on the basis of their competency and maturity with platoon leaders being encouraged to volunteer from both within and outside the battalion. Selection derived from gunnery skills, leadership, and the ability to learn from criticism. Tank crew volunteers were sought from across the division. Throughout July and August each potential crew member underwent a screening process that included a personal interview, a written exam, and a careful assessment of the soldier's UCOFT performance, crew qualification, peer teamwork rating, and a written evaluation from the pertinent chain of command. Where possible, soldiers who possessed a high general technical (GT) score were sought on the assumption that they would better assimilate new knowledge and demonstrate superior performance. Nevertheless, many soldiers possessed lower than desired scores, necessitating remedial training. Despite the diversion of time and resources, the battalion considered the effort a worthwhile investment in its soldiers. The personnel selected for the team's administrative, maintenance, and logistics component underwent a similar but less rigorous screening process. (14)

Prior CAT experience played only a marginal role in personnel selection. This deliberate decision in part reflected conditions beyond the unit's control. For example, soldiers who had participated in CAT 87 with 4-8 Cavalry proved reluctant to leave the better facilities available at their home station of Gelnhausen for those of 4-32 Armor. Family impact played a role in this reluctance. (15)

Within the battalion staff, 4-32 Armor established a CAT cell to help coordinate and plan team training. The cell included the battalion master gunner and S-3, and it served to relieve other battalion staff elements from CAT responsibilities. Other members included a master gunner with CAT

1987 experience, a tank commander from the winning team of 4-8 Cavalry, three other master gunners, and an NCO with expertise in CAT rules and conditions. This concentration of talent provided critical support during the CAT team’s formative period from September to December 1988. Afterward, a diminishing workload resulted in the cell’s downsizing and the reassignment of many of its members throughout the CAT team to maximize use of their expertise. (16)

The 4-32 Armor CAT team also included 88 officers and men responsible for administrative, maintenance, and logistics support. Nearly half of these soldiers came from the 503rd Forward Support Battalion, 1st Brigade, 3<sup>rd</sup> Armored Division. Their presence represented a significant investment in CAT, since once assigned to the CAT team they would be unavailable for other duties for over a year. The support team proved especially critical to vehicle maintenance, and they received periodic support from manufacturer representatives, especially for the tank’s fire control system and thermal imaging system. The CAT support personnel wore the same NOMEX uniforms as the tank crews, including a distinctive CAT patch. Their efforts were further reinforced by the battalion S-4, who ensured all materiel and transport needs were met. (17)

The training plan for the unit included four distinct phases. The period June through September 1988 focused upon building the CAT team through shoot-offs and competitions to determine tank crew composition. From September to April 1989, the team focused upon the progressive training development of crew, section, and platoon skills simultaneous with SOP development. Range time was scheduled on both Bergen-Hohne and Grafenwoehr. This period also marked the company team’s reduction from four to three platoons and participation in a rehearsal competition known as Kitty Kat I. The final weeks between April and June marked training refinement, live fire gunnery, and Kitty Kat II. SIMNET provided the means to practice and make final adjustments to platoon fire distribution. June marked the actual Canadian Army Trophy competition, followed by the rotation of unit personnel, including the unit’s commander. (18)

<b>Timeline</b>	<b>Event</b>
<b>1988</b>	
August 15-30	Shoot-off among CAT team candidates
September 7-23	Live fire at Bergen-Hohne
October 3-7	Mini-master gunner course
October 16 – November 2	Live fire at Grafenwoehr
November 4-18	Live fire at Bergen-Hohne
November 28 – December 2	SIMNET
December 17 – January 3	Holiday block leave
<b>1989</b>	
January 5-13	Live fire at Grafenwoehr
January 14-22	Live fire at Bergen-Hohne
February 13-17	Mini-master gunner course
February 27 – March 12	Live fire at Grafenwoehr/Platoon COFT
March 13-17	Kitty Kat 1 at Bergen-Hohne
March 29-31	Platoon COFT
April 3-5	Platoon COFT
May 2-4	SIMNET
May 7-10	Kitty Kat 2 at Grafenwoehr
May 15-29	Platoon COFT and SIMNET
May 17 – June 2	Live fire at Grafenwoehr
June 12-18	Pre-competition week at Bergen-Hohne
June 19-23	Canadian Army Trophy competition at Bergen-Hohne

The training schedule ensured periods of live fire in nearly every month prior to the competition. It also marked the active involvement of 3rd Armored Division, which helped to make range time available. However, the 4-32 Armor CAT team was not entirely freed from routine training events. In December, two platoons participated in Spearhead Shock, a live fire exercise conducted on Grafenwoehr's Range 301. Weather conditions proved typical of Germany at this time of year with prevalent fog and low visibility. While one platoon experienced bouts of clear weather, enabling the use of daylight sights, the other fired in fog, relying upon its thermal sights to see heated targets. The non-heated targets proved invisible. The overall experience did little for CAT preparation. Targets often failed to function and differed in size from what the competition required. They also fell when hit without any sensing challenge, while the rushed firing timeline precluded any detailed analysis of the CAT crew's performance. Indeed, one of the CAT platoons had no time to boresight and zero its weapons beforehand. It therefore utilized its last known boresight and zero data and conducted an MRS update. Despite the poor weather, the unit hit 23/27 targets — an outcome that raised crew confidence in their equipment. (20)

In January 1989 the entire CAT team returned to Grafenwoehr for live fire training. The experience helped to boost target acquisition skills, and the percentage of targets hit rose. Moreover, it provided the chance to revise the fire distribution plan and determine how best to apply it to Bergen-Hohne's Range 9 that had been identified as the competition site. In comparison with the vegetation and deadspace found on Bergen-Hohne's ranges, Grafenwoehr possessed open, rolling terrain. Only two ranges supported platoon battle runs, one very narrow and the other, Range 301 and the site of the CAT 1987 competition, wide open. Both ranges bore little resemblance to Bergen-Hohne's Range 9, where the actual competition would occur. More stringent safety measures implemented in 1988 and 1989 forestalled range modifications at Grafenwoehr that might have familiarized crews with the potential challenges of the competition range. (21)

However, the CAT team received the opportunity to train on Bergen-Hohne the same month. It shared Range 9 with the Dutch and 2nd Armored Division (Forward) CAT teams. Training on Bergen-Hohne proved a novel experience for most American units other than those assigned to NORTHAG. The site was administered by either the British Army of the Rhine or the German army, depending upon which nation was scheduled as the prime user with authority over access to the ranges. Each nation followed different range policies. In comparison with Grafenwoehr, Bergen-Hohne proved more restrictive in its firing hours. On weekdays, live fire could not begin before 0800, and it had to conclude by 1530. Night firing was possible, but only for a total of six hours per week and only between the hours of 2000 and 2300. This usage constraint reflected the influence of local communities, but it reduced available firing time on a high usage range complex already subject to the vagaries of north German weather. The absence of available billeting for the American CAT team resulted in its reliance upon an outdoor bivouac site — a shared experience in adversity. (22)

Still the 4-32 Armor team received rare firsthand experience with the competition range, since as a CENTAG unit it did not routinely train at Bergen-Hohne. Nevertheless the experience proved somewhat chaotic, since the CAT platoons utilized three different ranges. Shuffling from one to another resulted in lost training time, crew confusion, and firing engagements that bore little resemblance to the CAT competition.

Home station training with sub-caliber devices and simulators sustained training in between live fire events. Two iterations of a mini-master gunner course were conducted by a mobile training team from the Armor School, building crew knowledge of their tank's weapons and gunnery principles. Range familiarization was assisted by the use of a light and terrain board depicting Bergen-Hohne's Range 9. In January 1989 the unit made full use of the tank crew proficiency course built at the nearby Butzbach Training Area with division and corps assets. Similar to the special training site built for 4-8 Cavalry in its preparation for CAT 1987, the course was intended to resemble a scaled

version of the competition range and permit CAT-type battle runs with MILES. Its value lay in providing a means to practice the CAT SOP, acquire battle run experience, and provide sustainment training. It served as a bridge between simulator training and live fire gunnery. (23)

Special effort went into building a reliable scoring system applicable to all live fire events. The CAT team leadership understood the importance of ensuring that all crews had confidence in the scoring, lest review of each live fire event devolve into arguments without training value. Therefore, 4-32 Armor relied on a 20-man team to spot and score each live fire engagement, tracking each main gun firing, machine gun use, ammunition expenditure, and related time. Through the use of varied equipment, including TOW sights and a ground vehicle laser locator designator, the unit managed to attain nearly 100 percent accuracy in its scoring. It also used computer printouts of data entered during live fire engagements. Nevertheless some crew members could only be convinced of the veracity of their score by an old fashioned physical count of target holes. (24)



*The CAT team patch worn by the 4-32 Armor team in CAT 1989. (Ron Mihalko)*

On March 15-17, CENTAG sponsored Kitty Kat I on Bergen-Hohne's Range 9, the site also selected for the CAT competition. Participants included the American and Canadian CAT teams with German observers in attendance. Amid snow, fog, and rain, 14 platoons conducted daytime battle runs on a range populated by 32 main gun targets. Night runs also occurred in which 12 main gun targets appeared. The highest scoring platoon came from the 2nd Armored Division (Forward), but administrative issues limited the potential value of executing battle runs on the actual CAT 1989 range. The 8th Canadian Hussars were the only CENTAG unit routinely allotted range time at Bergen-Hohne. Their scheduled firing time included five days in March, three of which they donated to enable Kitty Kat I. However, securing a zero range and a quarantine area necessitated the intervention of the 3rd Armored Division staff with Range Control. Even so, other higher priority training impacted the event, resulting in the periodic cessation of activity on the zero range and a sharp reduction in the amount of space available on Range 9 for gunnery. Modifications to the range's target array ensued, resulting in targets presented in a much more constricted area than in an actual CAT competition. (25)

Following Kitty Kat I, 4-32 Armor spent the next several weeks training with the Platoon Conduct of Fire Trainer (PCOFT). The high value associated with UCOFT on training firing skills

for tank commander/gunner combinations stirred interest in a similar training aid suited to section and platoon gunnery. This desire was met by networking four individual UCOFT devices together to enable an entire platoon to execute gunnery training on a simulated battlefield. PCOFT was born, and it became available to USAREUR in February 1989. The terrain database provided an accurate depiction of Bergen-Hohne's Range 9, complete with vegetation, range markers, lanes, and targets. Software also provided an accurate representation of the ballistic performance of the M1A1's 120-mm gun, including the impact of gun tube bending and droop and the periodic need to conduct an MRS update. After each engagement, the system automatically scored each battle run according to the CAT rules and conditions and provided data on each engagement for review. (26)

PCOFT was not entirely worry free. Operators required special instruction in its use by General Electric technicians. The four UCOFTs necessary for PCOFT came from the 1st Armored Division and the M1A1 Fielding Team. All four devices were networked at Vilseck. The combination of a single PCOFT site coupled with split ownership created scheduling difficulties, particularly given the 1st Armored Division's preparation for qualification gunnery. Nevertheless, the 3<sup>rd</sup> Armored Division CAT team soon found its own niche in the training schedule between midnight and 0600 hours. (27)

The American CAT teams also utilized SIMNET, but they experienced less success with this device than their CAT 1987 predecessors. A Bergen-Hohne terrain database did not become available until April 1989, but it proved a flawed product with bugs and program errors. Crew members found its image resolution poor, complicating target acquisition, particularly when moving. SIMNET required extensive use before crews could begin to identify targets at longer ranges. Gunnery in the simulator proved harder than live engagements, but SIMNET did provide training for entire crews, enabled platoon battle runs, and permitted instructors to modify target arrays. Ultimately, the CAT teams rediscovered the simulator's value in honing platoon fire distribution skills rather than accurately depicting tank gunnery. (28)

From May 8-10, CENTAG hosted Kitty Kat II on Grafewoehr's Range 301. This event was only open to the CENTAG teams, all of whom participated. NORTHAG sent observers from the 2<sup>nd</sup> Armored Division (Forward) and Panzer Battalion 203. The open space of Range 301 permitted the use of a larger range fan and more targets, but the targets were operated by three different systems controlled from two separate locations. Careful coordination became necessary to avoid confusion, delays, and degraded target arrays. Despite this added complexity, most teams found the battle runs and target engagements among the most challenging to date. More importantly, they exposed weaknesses to be addressed in remedial training in the final weeks before CAT 1989. For 2-64 Armor, such deficiencies proved especially difficult to rectify, since they had no more live fire events scheduled. (29)

Performance at Kitty Kat II proved less than ideal for the American teams. 4-32 Armor, for example, found that it hit more targets than its competitors, but it proved slower to engage. It averaged 15 seconds per kill versus 10 seconds for the platoons of 2-64 Armor and Panzer Battalion 123. The platoons of 4-32 Armor also proved the only ones to miss targets while firing on the move, and its crews continued to struggle with target sensing. Battle run analysis found multiple instances in which crews failed to reengage a missed target or engaged a single target repeatedly, indicating the difficulty crews experienced in determining where rounds went after they left the gun tube. With just five weeks before the CAT competition, the unit was not matching the performance of the high scoring platoons in CAT 1987. Worse, German platoons were firing consistently faster and just as accurate, particularly when moving. (30)

4-32 Armor needed more training, but time was running out. The unit spent the latter half of May immersed in SIMNET, PCOFT, and live fire to hone section and platoon skills. With several of Grafenwoehr's ranges at its disposal, the unit established different ranges for zeroing, section and platoon gunnery, specific problem engagements, and platoon battle runs under CAT conditions. This

period marked an intensive effort to ready all platoons for the actual competition. It also marked the arrival of Dr. Dennis Forbes from the U.S. Military Academy's Department of Physical Education. He had received high praise for his work with 4-8 Cavalry in 1987, and his support was again sought in preparation for CAT 1989. In the final days before the competition, he concentrated on the mental preparation of the CAT crews. His efforts had a positive effect, despite initial skepticism from soldiers, but the short time of his interaction with the unit limited their impact. (31)

The tanks used by 4-32 Armor benefited from several changes intended to improve accuracy. The unit opted to replace the gun tubes of its CAT tanks, since they would be near the end of their service life when the competition training concluded. The new gun tubes were installed in February 1989. After installation the crews found that their tanks achieved better results when zeroing, particularly when using improved training ammunition. In March all American CAT teams benefited from the installation of the Optics Improvement Package by a General Dynamics teams. This modification addressed issues identified during the initial fielding of the M1A1. It included a different filter for the gunnery's primary sight, improved fire control system reliability, and a modification to the muzzle reference system (MRS). In April manufacturer teams provided a "peak-up" as in prior competitions to all American CAT teams with emphasis upon the fire control system and its components. Communication systems received similar attention in early June. (32)

### **The Trials and Tribulations of Precision Gunnery**

American armor doctrine eliminated the need to zero individual tanks unless a major change occurred to the main gun or fire control system. Instead, units relied upon a fleet zero, an average value derived from firing data associated with the different tank guns and ammunition in service. Applying the fleet zero to the vehicle's onboard computer ensured a good chance of meeting accuracy requirements even at extended ranges. In the quest to boost performance, some crews used the fleet zero as a starting point from which to refine further individual weapon accuracy to place rounds within a one meter circle. (33)



*Tanks from the 24th Infantry Division (Mechanized) participate in NATO exercises. (National Archives and Records Administration)*



Ironically, this desire to improve accuracy rekindled interest in individually zeroing to maximize weapon performance. This trend among crews reflected the general attentiveness to the science of gunnery evident throughout the decade. Nevertheless, it resulted in no doctrinal changes, since the factors that led to the adoption of calibration in lieu of individual zeroing remained valid. Depleted uranium service ammunition could not be fired in peacetime on most ranges. Hence, crews had to use training rounds with different performance characteristics. The data obtained through zeroing with such ammunition would not ensure similar performance when applied to rounds fired on the battlefield. Conversely, testing and analysis continued to validate the calibration policy, and the steady accumulation of firing data over time generated more accurate fleet zero settings. Calibration and screening, not individual zeroing, supported the Army's general concept of training as it would fight. (34)

The Canadian Army Trophy's emphasis upon accuracy, coupled with the absence of any need to fire service ammunition, however, encouraged competing crews to zero their tanks. Zeroing provided the best means to maximize performance, and it permitted American participants the ability to surpass the accuracy standards associated with a fleet zero. In general, the zero procedure entailed firing five rounds at a target panel and determining the mean point of impact for the resultant shot group. This point and its relation to the target aiming circle enabled calculation of the computer correct factor to be applied to the fire control system in subsequent firing. Any rounds that struck the panel far from the shot group were ignored and their variation attributed to differences in ammunition, particularly in the specific composition of the propellant. A further three rounds served to confirm the zero data and veracity of the computer correction factor by striking on or very close to the target panel's aiming point. (35)

Unfortunately, in preparation for CAT 1989 every U.S. team experienced significant problems with its zero efforts that defied simple resolution. The 3rd Armored Division responded by seeking the assistance of Dr. Doug Watters from the Army Armament, Munitions, and Chemical Command (AMCCOM). In preparation for CAT 1987, Watters helped 4-8 Cavalry overcome zeroing problems with a simplified process. After boresighting, the tank fired five rounds at a panel with a grid layout. The center of impact was associated with a specific grid square and a corresponding correction factor applied to the tank's computer. Three confirmation rounds were then fired, refinements made, and a final shot made to confirm accuracy. In 1987 crews found this approach simple, effective, and quick to execute. Similar results were expected two years later. (36)

While the 3rd Armored Division considered Watters the solution to their zero problems, the Armor Center and Armor and Engineer Board viewed his CAT association with consternation. CAT 1989 marked the competition debut of the M1A1 and the use of smaller targets, necessitating careful attention to detail in weapon accuracy. In this context Watters was considered well intended but not cognizant of the implications of his actions. Indeed,

it is not clear what the effect of the procedures were. We strongly believe that the change to 120-mm and increased system accuracy requirements, due to smaller targets, preclude use of his techniques. They may have been satisfactory in CAT 87, but the precision requirements are much more stringent for CAT 89. (37)

When the Armor Center commander learned of Watters' involvement with the CAT teams, he responded with the query, "How did this guy get on board?" A November 1988 AMCCOM CAT coordination meeting addressed a variety of actions related to competition preparation, including Watters' role. His boresight procedures were considered overly complicated, and his zeroing method received particular criticism:

The calculations used for the corrections were demonstrated as wrong by the AMSAA [Army Materiel Systems Analysis Activity] representative. More importantly, this represents an averaging method while our procedures call for exact measurements. Our master gunners are very uncomfortable with this process. (38)

Consequently, the Armor Center sought to impose centralized management of all CAT issues, starting with the issuance of approved boresight and zero procedures. (39)

Neither the Armor Center's rejection of Watters nor its determination to centrally manage CAT preparation issues resolved the zero problem. Therefore each CAT team strove to find its own solution through experimentation. 3-66 Armor conducted its zero process according to the published technical manual for the M1A1, although it sought to ensure each confirmation shot struck within a smaller circle than required. 2-64 Armor zeroed at 1,600 meters rather than the standard 1,200 meters. It, too, sought to place confirmation rounds inside a smaller circle — a standard made more challenging by the longer range to the zero panel. 4-32 Armor generally followed established procedures but deviated in its use of the MRS during zeroing. (40)

Unfortunately all three teams experienced unsatisfactory and confusing results during gunnery at Bergen-Hohne in January 1989. Analysis of the zero results proved even more disconcerting. Some vehicles experienced extremely high dispersion of the initial rounds fired to determine the mean point of impact, resulting in an inaccurate computer correction factor that defied subsequent refinement efforts. Some crews achieved tight zero results and calculated an accurate computer correction factor. Despite validation of their measurements and calculations, subsequent confirmation rounds proved much less accurate than their zero procedures warranted. In some instances the fire control system failed to apply the computer correction factor to the ballistic solution, resulting in a confirmation round no more accurate than an initial zero round. In the case of 2-64 Armor, it proved unable to zero five of its 16 tanks. (41)

More experimentation ensued. The 3-66 Armor team, for example, began its competition training using the doctrinal procedure, but in both Kitty Kat events, it opted to zero weapons at 500 meters, the distance used by the German Leopard 2 crews. The shorter range simplified laying the gun on the zero panel's center and reduced the effects of low visibility conditions. Since the effect of wind on a round might vary significantly between the target and the vehicle's wind sensor, the shorter range also reduced this variable. However, the short range necessitated careful measurements and calculations, since errors would have a greater impact upon longer range accuracy — more so than a weapon zeroed at the standard 1,200 meters. Still, "the fire control system in the M1A1 tank is capable of zeroing at almost any range, because once the zero range is properly entered, the onboard computer will automatically adjust for all other ranges." Crews, however, proved wary of this different zero procedure. (42)



*Patch worn by the 3-66 Armor CAT 1989 team. (Ron Mihalko)*

The 2-64 Armor and 4-32 Armor teams adopted the method of Doug Watters with its gridded zero panel to expedite execution and calculation of the appropriate computer correction factor. 2-64 Armor also preferred to zero at 1,600 meters, but it, too, used a gridded panel that enabled calculation of zero calculations without making any physical measurements on the panel. 4-32 Armor preferred zeroing at 1,200 meters with more easily identified impact holes. These units generally determined the computer correction within 30 minutes in comparison with the more deliberate approach of 3-66 Armor that required 90 minutes. To one observer, however, neither method made much difference. Little discernible difference existed between either the shot group pattern or subsequent gun accuracy regardless of team. Moreover, the differences among the CAT teams led to the observation that “the US has no national policy concerning zero.” (43)

It remained unclear to what extent MRS problems accounted for zero issues. Reports also emerged regarding MRS breakage and susceptibility to moisture. When Doug Watters arrived in Europe, the discovery of many damaged, missing, or poorly performing devices led him to implement an MRS inspection and replacement program. Some MRS suffered from production deficiencies that resulted in ballistic solution errors when used. A redesigned MRS increased reliability, but it still suffered from weld failure. Determination of a fix and the timeline for retrofitting it to the tank fleet remained works in progress. (44)

MRS usage proved inconsistent and varied without a commonly accepted approach. Although approved procedures existed, the mixed experiences with the MRS undermined the credibility of any one method — approved and published or not. Established policy called for an MRS update after each zero round fired, but this practice proved contentious among master gunners, the tank manufacturer, and CAT personnel. 3-66 Armor opted to omit the MRS update while zeroing, and its team members achieved much better results. Hence, the unit conducted MRS updates only when on the range and while firing in a competition setting (to include the Kitty Kat events). (45)

Analysis of 4-32 Armor’s experience also suggested a negative correlation between MRS usage and zero results. According to one assessment:

Results of experimentation by 4/32 Armor have indicated that a more accurate zero can be obtained by utilizing boresighting between each zero round, instead of an MRS update. This would tend to indicate that the MRS is not accurate enough for the level of refinement that the CAT units are trying to achieve. In some isolated cases, analysis of the shot pattern during zeroing has indicated that some of the MRS update data is not being applied to the Ballistic Solution. (46)

This unit’s crews found the MRS a source of confusion and controversy. The team’s master gunners opted to check and update the MRS repeatedly during the course of a battle run to offset the effect of thermal bending of the gun tubes. They succeeded in convincing tank crews and the chain of command of the necessity of these actions. Vehicle technicians, however, argued that conducting an MRS update on a recently zeroed tank after firing only a few rounds simply induced error into the system. When and how often to conduct an MRS update therefore remained a subject of controversy throughout the entire competition training period. The CAT team “struggled with the issue throughout the training year, collected MRS data and came to no clear conclusion.” By June 1989, the team’s SOP called for checking MRS at each of the three bounds during the CAT battle run and updating only if warranted by even minor degrees of boresight loss. (47)

With the exception of the MRS, the CAT vehicles proved generally reliable, with two of the teams reporting few problems. 2-64 Armor, however, suffered from turret and fire control system issues that deadlined several of its tanks. Questions also surrounded the reliability of the computer electronics unit. Malfunctions in this component directly impacted weapon accuracy and offered a possible reason for the poor zero results. In April 1989, just weeks before the CAT competition, the

USAREUR commander expressed concerns about M1A1 gunnery, following live fire at Grafenwoehr in which the results proved significantly inferior to prior performance by the M1. It remained unclear whether these results reflected training, equipment, or ammunition issues. (48)

The M865 Target Practice, Cone Stabilized, Discarding Sabot-Tracer (TPCSDS-T) constituted the principal training round for the M1A1's 120-mm gun. The round was designed to possess similar accuracy and time of flight to the service round. Moreover, the cone stabilization limited the overall flight range of the round, reducing the related safety footprint. (49) A product improvement served to reduce performance variance among rounds. Often referred at the time as PIP (product improvement program) ammunition, it was available only in small quantities when the American CAT teams began training. The PIP round possessed an improved penetrator and offered better and more reliable performance. (50)

CAT teams utilized existing ammunition until the newer PIP round became available. Unfortunately, differences in the performance of the PIP versus unimproved ammunition added to the technical difficulties plaguing the crews. Crew confidence in unimproved ammunition proved low, and it became difficult to determine whether poor zero and gunnery results stemmed from the ammunition, the gunner, or both. Ammunition performance issues resulted in more time spent by crews zeroing their weapons, thereby amplifying the impact of zero procedure difficulties and resultant experimentation. These problems persisted until sufficient quantities of PIP ammunition became available late in the training program. Teams were able to use the improved ammunition in the Kitty Kat rehearsal and the actual CAT competition. Until then crews trained and zeroed with ammunition that performed differently from what they actually fired in competition environments. (51)



*An Abrams tank of 2-41 Infantry, 2d Armored Division, moving to contact across an open field. (National Archives and Records Administration)*

The CAT competition required the participating teams to identify the type of ammunition they would fire to the chief judge. The latter incorporated the appropriate safety requirements into the range layout and target arrays. The Dutch traditionally fired HEAT, since they produced the round themselves and controlled its quality. In 1989 they purchased sabot training rounds from the Germans, but considered them of inferior quality. The American teams also considered firing HEAT, since it left a larger hole in the target that eased sensing. A test conducted at Fort Knox also indicated that HEAT training rounds fired from a stationary tank to be more accurate at CAT competition ranges than TPCSDS-T. Crew qualification results from Grafenwoehr tended to confirm this finding. Despite these advantages, the American teams rejected HEAT as their competition ammunition. (52)

By the time of the CAT competition in June the American teams had resolved their ammunition issues. Sufficient quantities of PIP ammunition existed for all teams to use it regularly. Crew confidence in their zero results and ability to hit targets rose. On the eve of the competition, crews believed they could hit CAT targets consistently. (53) Unfortunately, this confidence in their equipment and their own ability came very late. For much of the preparation period, the problems with ammunition, zeroing, and MRS usage distracted crews from training, immersing them in technical issues rather than building the team skills necessary to defeat the CAT range. The adoption of team procedures to address each of the technical challenges encountered did not stop crews from continuing to debate and experiment. For the commander of 4-32 Armor, “the end result was that some team members felt they knew a better way, leaving us with a constant battle to enforce team SOP’s.” (54)

### **German CAT Team Preparation**

The German path to CAT 1989 proved free from the technical obstacles confronting the American teams. Instead it was shaped by a continued reliance upon conscription. Unlike the all volunteer and multi-year service soldiers found in American armor units, draftees generally served as loaders, gunners, and drivers under the oversight of a career soldier tank commander. German tank battalions, like their American counterparts, also experienced regular personnel turbulence through the quarterly turnover of conscripts. (55)

However, the Germans considered the high number of draftees an asset, since the soldiers proved eager to learn and a blank slate for training without accumulated bad habits. The 12 month term of service proved sufficient to train the soldiers to perform to CAT standards. Indeed, the armies of both the Netherlands and the Federal Republic of Germany considered “the less previous CAT experience (among the cadre) on the team, the better, because there will be less interference in the training program.” (56)

In preparation for CAT 1989 the Germans identified a pool of 150 conscripts for potential duty as tank gunners. By July 1988 these soldiers were immersed in gunnery instruction. September witnessed efforts to determine optimal gunner and loader combinations based upon a set of related skill tests. Following a set of firing exercises, the Germans then made their final CAT gunner selection in December. Evaluation criterion included the ability to score first round hits and engagement time. Soldiers not selected as gunners often served as loaders. This period also included continuous training in gunnery skills that prepared them for five live fire iterations, each lasting one to two weeks at Bergen-Hohne between January and June 1989. This intensive firing served to hone gunner performance. (57)

Platoon leaders were trained at the German Armor School, which served as the home of armor, armored reconnaissance, mechanized infantry, and anti-armor. The school trained officers and NCOs who then returned to their units to train new recruits. Unlike the American Armor School, the German institute did not conduct basic combat training or advanced individual training — these functions were provided in a soldier’s first unit assignment. The platoon leader’s course spanned three months, nearly one third of which was dedicated to tank gunnery. Upon completion, graduates were rated either an NCO or an officer and considered a qualified gunnery instructor for the Leopard 1 and 2 tank. Unlike the American army, many German platoon leaders were NCOs, with each armor company having only one officer platoon leader. The training of these leaders occurred in a small group setting with a teaching emphasis upon tactical proficiency in a combined arms setting, technical ability, and instructional skills. (58)

CAT preparation was overseen by a tank gunnery training team staffed with gunnery experts with competition experience. Associated with the German Armor School, the team bore responsibility for the overall direction of the CAT training program. The team served as central advisory cell that

assisted all of the German CAT teams, ensuring a degree of continuity and standardization in training. Each CAT team established a series of training phases that had to be completed to a satisfactory level before proceeding to the next one. Initial training focused upon crew gunnery and demonstration of rapid, accurate firing before progression to platoon training. (59)

During live fire training, the Germans relied extensively upon the Weggmann Through the Sight Video device. Although considered cumbersome and complicated, the device utilized multiple cameras and monitors that enabled observers in a range tower to see the gunner's reticle. They also possessed the ability to view the range simultaneously from different perspectives corresponding to camera placement. Commanders could use the device to ensure the gunner had a perfect lay before firing. The camera and monitor combinations enabled the view to shift to the target impact point for each round fired. As a training tool, the device showed each gunner precisely where each round hit and helped to identify mistakes. It also helped gunners to adjust their fire control system for optimal performance. The device provided a computer printout of the firing data and assisted the gunner to determine the exact aiming point based upon the number of rounds fired from the same weapon. Given the Leopard 2's lack of an MRS, the Germans used the Weggman device routinely through CAT training, since the data obtained helped to offset the impact of gun tube bending. (60)



*The CAT 1989 patch of the Panzer Battalion 203 team with its cat's eyes in the night. Despite the patch, the U.S. teams cleaned house during nighttime firing. (Ron Mihalko)*

German platoon training focused upon fire distribution and control. Only after platoons had mastered these skills in a simulated environment did they begin live fire activities. However, the advisory cell ensured that the basics of tank gunnery continued to receive emphasis throughout the entire training period — presumably a necessary action given the relatively short one year tour of duty served by German conscripts. (61) To offset the lack of an effective platoon gunnery simulator, each CAT team traveled to Switzerland to use the Swiss army's Elsaleo Leopard 2 simulators at Thun. These simulators included four crew compartments similar to a Leopard 2 and permitted varied types of terrain, exercises, and visual effects. Moreover, its terrain could be configured to represent the actual CAT competition range at Bergen-Hohne. The German experience with the Swiss simulator spurred their own efforts to develop a combat and gunnery simulator for use at the German Armor School at Munster. (62)

To American observers, German preparations for CAT seemed to emphasize basic crew gunnery skills, training quality oversight, and the use of the Weggman device as a workaround for the lack of

an MRS on the Leopard 2. Given the issues experienced by American CAT teams with the Abrams MRS, the Americans sought to secure one of the German devices for testing in an MRS application. They also considered leasing the system to help American teams prepare for CAT 1991. The central and dominant role of the German training advisory cell was noted, but “the way we do business will preclude a tank gunnery ‘gestapo’ from operating.” Other variations in the selection and training of tank crews also ruled out a simple adoption of German methods. Each national army had evolved over time training processes that suited their separate and unique military needs and culture. (63)

### **CAT 1989**

The 1989 competition occurred on Bergen-Hohne’s Range 9 during the week of June 19-23. NORTHAG hosted the event, providing the administrative support for the participants and operating the ranges used for quarantine, zeroing weapons, and the conduct of the actual battle runs. Weather proved clear, warm, and dry for the entire week. (64)

The competition rules resulted from a negotiated process among the participants that had become as much a part of the event as the actual battle runs. In general, the basic nature of the competition remained much the same as CAT 1987. Platoons faced varied target arrays that included moving and stationary targets representative of hostile combat vehicles and troop concentrations. Platoons conducted defensive engagements while stationary at fixed firing points, or bounds, and offensive engagements while moving from one to the other. While awaiting the start of their battle runs, each unit remained in quarantine with communication restricted to the range tower. Upon completion, a scoring process similar to that used in CAT 1987 determined their competition standing with a potential maximum point score of 22,600. As in prior years, the battle run range remained off limits to participating teams for several weeks before the competition.

CAT 1989 also introduced new features. Target arrays represented both full vehicle profiles and tanks in hull defilade with only their turrets visible. The different target sizes increased the level of competition difficulty, while closed hatch engagements simulated battlefields in which a high risk existed for exposed tank commanders. Since all tanks were designed for buttoned up operations, this requirement tested the platoon’s ability to identify and engage targets with reduced situational awareness and visibility. Ironically, the British had long advocated such engagements, since they better suited the design of the Chieftain and Challenger. The inclusion of night battle runs for platoons equipped with thermal sights marked the final major change to the competition. (65)

Determination of the firing order for each participating platoon became colored by the efforts of each team to be among the last to shoot. This desire reflected prior studies that suggested firing later in the week resulted in higher scores — whether from greater knowledge of the range or simply a better sense of what an actual competition battle run looked like. A British Army of the Rhine (BAOR) paper circulating before the competition reinforced this correlation. The Canadians accordingly sought to have both of their platoons fire on the competition’s last two days. Given the scramble to be among the last to shoot, the judges instead adopted a random determination process to ensure each team had elements firing early and late in the week. (66) In retrospect the time of day at which a battle run occurred proved more significant than the day of the week. The highest scoring platoons all fired in the early afternoon. The last four platoons to fire during the week were all American, and none of them achieved particularly high scores. (67)

Range conditions tended to make the firing order less significant. The clear, dry conditions ensured obscuration from dust and smoke, particularly when targets had to be reengaged. A lingering haze remained despite regular watering of the course lanes and firing points. Range fires posed another recurring problem. The dry conditions facilitated the generation and spread of fires, but one observer noted that German main gun ammunition seemed to exacerbate the problem. Main gun rounds fired from the Leopard 2 seemed slower, had a highly visible trace, “and set fire to everything in sight.” (68)



*Panzer Battalion 123's Leopard 2  
CAT 1989 patch. (Ron Mihalko)*

On the first day German Panzer Battalion 123 successfully lodged a protest over a fire in the target area. Afterward the chief judge ordered all battle runs stopped whenever a range fire occurred until extinguished. Consequently, battle runs that typically required 20 minutes to complete took much longer. Another platoon from Panzer Battalion 123 took over two hours to complete its run, while a platoon from Panzer Battalion 203 had to stop after each engagement to enable fires to be put out. The winning platoon experienced similar delays. These continuous firefighting delays added to the competition tension, but attempts to control fires proved only partially successful. One observer noted that “at one time there were three fire trucks on Range 9 and five CH-53 helicopters fighting fires in the impact area.” (69)

The fire delays resulted in some platoons firing much later in the day than initially scheduled. On at least two occasions American platoons found themselves executing battle runs after 2000 hours, with the crews confined to the quarantine area for extended periods. Hence they began their battle runs battling fatigue, failing light, and shadows on the range. The overall range conditions led one senior American observer to comment that “in my view, range management was deplorable. I would have been fired if I ran a range the way Bergen was run.” (70)

Despite the range conditions, the competition included 21 platoons from the Netherlands, Belgium, Germany, Canada, and the United States. NORTHAG won the competition, despite having only 10 platoons to the 11 of CENTAG. The army group scores, however, were very close. NORTHAG's winning total of 158,895 points edged by CENTAG's 158,817 by only 78 points. The margin of victory proved only slightly larger at the platoon level. The average NORTHAG platoon score of 13,951 points beat CENTAG's average of 13,436 by 515 points. (71)

The Leopard 2 again dominated the competition. The top six scoring platoons all utilized this tank out of a total of eight Leopard 2-equipped participating platoons. NORTHAG teams counted five of these platoons. With the introduction of the M1A1 by the American teams, 17 of 21 platoons all mounted essentially the same 120-mm smoothbore gun built by the German firm of Rheinmetall. The absence of the British also eliminated concerns regarding loading speed, since neither the Leopard 2 nor the M1A1 used separated ammunition. (72)



<b>CAT 1989 Scores (73)</b>								
<b>Hit Score</b>	<b>Time Score</b>	<b>Ammo Bonus</b>	<b>Hit Bonus</b>	<b>MG Score</b>	<b>Penalty</b>	<b>Platoon Total</b>	<b>Rank</b>	<b>Targets Hit</b>
<b>NORTHAG—41<sup>st</sup> Tank Battalion (Leopard 2)</b>								
9,375	5,440	0	0	1,000	0	16,565	6	30/32
9,687	6,460	0	0	2,000	0	18,147	1	31/32
<b>NORTHAG—Panzer Battalion 203 (Leopard 2)</b>								
9,375	6,460	0	0	1,900	0	17,735	2	30/32
9,062	6,035	0	0	1,700	0	16,797	4	29/32
9,062	4,930	0	0	1,000	0	14,992	12	29/32
<b>NORTHAG—2<sup>nd</sup> Regiment de Guides (Leopard 1)</b>								
8,125	5,270	0	0	1,700	600	14,495	16	26/32
8,437	5,015	0	0	1,750	0	15,402	10	27/32
<b>NORTHAG—3-66 Armor (M1A1)</b>								
7,812	5,185	0	0	1,950	0	14,947	13	25/32
9,375	5,525	0	0	1,000	600	15,300	11	30/32
7,812	4,930	0	0	1,775	0	14,517	15	25/32
<b>NORTHAG Total Points: 158,895</b>								
<b>CENTAG—Panzer Battalion 123 (Leopard 2)</b>								
8,437	5,525	0	0	1,925	0	15,887	8	27/32
9,062	6,290	0	0	1,875	600	16,627	5	29/32
9,375	6,205	0	0	1,950	0	17,530	3	30/32
<b>CENTAG—2-64 Armor (M1A1)</b>								
8,437	5,100	0	0	1,250	0	14,787	14	27/32
8,750	5,780	0	0	2,000	600	15,930	7	28/32
7,500	4,335	0	0	1,325	1,600	11,560	21	24/32
<b>CENTAG—4-32 Armor (M1A1)</b>								
9,062	5,355	0	0	1,700	600	15,517	9	29/32
6,562	3,910	0	0	1,600	0	12,072	20	21/32
6,875	4,165	0	0	1,950	0	12,990	19	22/32
<b>CENTAG—8<sup>th</sup> Canadian Hussars (Leopard 1)</b>								
8,437	4,080	0	0	1,975	600	13,892	17	27/32
7,500	3,825	0	0	2,000	0	13,325	18	27/32
<b>CENTAG Total Points: 158,817</b>								

The Dutch 41<sup>st</sup> Tank Battalion won top honors. Its CAT team ranked first among the competing companies, while one of its companies earned the highest platoon score. Indeed, this unit received the highest score and tied with a German platoon for the best time score. A perfect machine engagement score ensured a sound finish. The platoon actually hit all 32 main gun targets, but the final strike fell just after the engagement time limit elapsed. Equipped with the Leopard 2, the Dutch platoons moved and fired quickly and accurately, using the vehicle commander's independent sight to sense shots fired rather than acquire new targets. (74)

Dutch performance on the night battle run, however, proved less stellar. Dutch training focused exclusively upon daytime engagements — a focus driven in part by ammunition constraints. (75) They also used a HEAT training round in the belief that the larger holes generated in the target would facilitate sensing. In fact the HEAT rounds created more obscurity around the firing tank and in the target area, making an accurate hit determination more difficult at night. (76)

Ironically, the cost associated with preparing for the competition led the Dutch to enter CAT 1989 only reluctantly after being prodded into doing so by the continued exhortations of the Commander-in-Chief of Central Europe. Nevertheless, once committed the Dutch prepared with

determination. Although often depicted by the Americans as building and maintaining a professional CAT team, the Dutch never actually possessed such an organization. Like the other participants, they possessed a small cadre of personnel with CAT experience, but draftees constituted the bulk of their tank crews. With only eight month service tours, the CAT team leadership had to train soldiers in their basic tasks and prepare them for the competition environment. Therefore the Dutch adopted a unified command approach to preparation in which the company commander and master gunner planned and executed a crawl, walk, run program that was not allowed to be modified. (77)



*The patch worn by the Dutch 41st Tank Battalion team at CAT 1989. (Ron Mihalko)*

The Dutch CAT team trained on a tight time and ammunition budget. Although stationed near Bergen-Hohne, the 41st Tank Battalion did not possess free access to the range complex. The high usage rate of the site resulted in a constant struggle to secure range time and limited the extent of range familiarization. Moreover, the need to train draftees in their basic skill sets before immersing them in CAT training resulted in a shorter time to practice competition battle runs, particularly in comparison with the year or more afforded American teams. Dutch training did not begin to focus on competition specific skills until January 1989. Even then, they remained focused on individual and crew skills, rather than platoon operations. As an American officer noted:

When we saw them shooting in January, A/41 TKBAT trained single tank engagements, stressed dry runs and made extensive use of the Wegmann device. They fired at a rate of 20 or so rounds per day of range firing. At the same point in time all of the US teams were stressing full up battle run training. (78)

To offset their time and range constraints, the Dutch relied heavily upon simulators to supplement their live fire. They divided training time among simulators, dry fire, and live fire events for individual and platoon operations. Following CAT 1985 the Dutch had developed a platoon simulator that received high usage. Dutch simulators in general were considered on par with or superior to American devices, particularly their Through Site Video that permitted accurate assessments of the gunner's target lay based on reticle imagery. (79)

The Dutch liked their Leopard 2 tanks, but they expressed a desire for an MRS, which the vehicle lacked. Crews found that the gun barrel tended to shift after firing about 50 rounds. The equipment to measure this shift and incorporate adjustments already existed in the fire control system. Only the reference mirror on the gun muzzle was lacking. German Leopard 2s experienced the same issue, and an MRS began to equip new production vehicles in 1990. Older platforms began to field the MRS in the mid-1990s. (80)

**CAT 1989 Night Firing Scores (81)**

Unit	Score	Targets Hit	Rank
<b>NORTHAG</b>			
3-66 Armor	10,800	12/12	1
41 <sup>st</sup> Tank Battalion	6,666	6/12	5
Panzer Battalion 203	5,000	5/12	6
<b>CENTAG</b>			
4-32 Armor	10,500	12/12	2
2-64 Armor	9,166		3
Panzer Battalion 123	8,333		4

The German CAT teams from Panzer Battalions 123 and 203 placed second and third, respectively. Platoons from these battalions filled the second through fifth place finishes. The other two platoons secured eighth and 12th place. Both CAT teams employed the Leopard 2, and like the Dutch, they used the commander's independent sight to help sense targets rather than acquire new ones. A platoon from each battalion team also participated in the nighttime battle runs, but their performance lagged behind the Americans. One of the German platoons secured a last place finish just behind the Dutch. Like their European allies, the Germans relied upon a HEAT training round with similar, unfulfilled expectations of its value in target sensing at night. Unofficially, the Germans were reputed to be unhappy at their loss to the Dutch, but with the winning tank a German-built Leopard 2, at least the competition outcome was kept "in the family." (82)

The Belgians competed with their Leopard 1s. Although outclassed technologically by the newer Leopard 2 and the M1A1, the Belgians had a long association with CAT. The Belgian 2nd Regiment de Guides provided the CAT team. It possessed no prior CAT experience, and it brought tanks essentially the same as those that competed in CAT 1987. Like its aging tanks, the Belgians also worked with older simulator technology, including a simple slide projector based platoon gunnery trainer to practice fire control. For traversing and elevation skills, gunners used the SABCA Tank Level Aiming and Firing Trainer. Nevertheless, the Belgians made a respectable performance, with one platoon earning a 10th place finish. It beat seven of nine American platoons and one German platoon. (83)

Like the Belgians the Canadians remained dependent upon the Leopard 1. In 1987, the Canadian team implemented a sound training program that resulted in a strong performance against more modern vehicles. Shortly after that competition, the Royal Canadian Dragoons completed their tour in Europe and rotated back to the homeland. The 8th Canadian Hussars (Princess Louise's) replaced them as the armor component of the 4th Mechanized Brigade Group. The unit developed and implemented a training plan, relying upon and receiving access to American UCOFT devices to build and sustain gunnery training. However, despite their efforts, the Canadians finished 17th and 18th. Both platoons gained high scores for their machine gun engagements and above average hit scores. Their time scores, however, proved among the lowest of the competition. Nevertheless, they beat three M1A1-equipped platoons. (84)



*The CAT 1989 patch of the 8th Canadian Hussars team. (Ron Mihalko)*

The British did not participate in CAT 1989, but they still made their presence felt. During the competition week, the Deputy Minister for Ordnance, a general officer, requested an orientation of the M1A1. Having driven and fired the tank previously, he visited the 4-32 Armor CAT team and talked with the tank crews, asking general questions about the platform. The American assessment was that his purpose was to “demonstrate continued British interest in the M1A1.” (85) Similar interest had been indicated when soldiers from the 3rd Royal Tank Regiment visited 2-70 Armor at Grafenwoehr. Over a two-day period, the British tankers drove and fired the M1A1. They appreciated the turret’s space and layout, particularly in comparison with Chieftain and Challenger. They found it an easy tank to fight, with one soldier hitting three targets with single shots at different ranges within 30 seconds. From the British perspective:

The sighting and firing sequence and the gun control equipment is again really slick and simple to use. There is no complex graticule, no ellipse, no autolay, etc. All the gunner has to do is lay a circle on the target, press one button on the joystick-type gunner’s control, then immediately press the adjacent firing button — shouting “on the way” at the same time!

American spectators found that “the relief with which British crews greeted a simple, clear, gunner’s sight had to be seen to be believed.” (86)

However, the British soldiers found problems with the vehicle. They disliked its limited stowage, considered the thermal sights inferior to TOGS, and found the brakes overly responsive. The electrical systems seemed just as unreliable as those on Challenger, and the gunner’s sight proved too vulnerable and lacked the wiper normally found on British tanks. With antiquated radio equipment and no boiling vessel, the British tankers ultimately indicated a preference for their own tank.

The majority view of the party was that they would prefer to go to war on Challenger, rather than Abrams; but if the fire and gun control system of Abrams was put in Challenger, the general belief was that Challenger would then be outstanding. (87)

Few American tankers evinced any interest in Challenger. These interactions, however, occurred at a time when the United Kingdom was pondering the fate of its Challenger fleet. It faced the options of modernizing the fleet, building a new platform, or buying a proven foreign tank like the Abrams, Leopard 2, or Leclerc. Vickers Defence Systems anticipated a British design, having completed a demonstration vehicle in January 1989.

### **Assessing American Performance**

One the eve of the CAT 1989 competition, the conditions seemed ripe for another American win. Nine platoons had completed over a year of comprehensive training. Although significant differences existed among how each CAT company prepared, by June all tank crews professed confidence in their equipment. Automotive problems proved nil and fire control systems functioned according to manufacturer specifications. Confirmation shot groups were tight, indicating accurate weapons. It appeared likely that the Canadian Army Trophy would remain in American hands. (88)

Expectations of another victory, however, quickly ran afoul of reality. During zeroing in the competition, six crews experienced malfunctions with their onboard computers, which failed to accept inputted correction factors. Several of the effected crews therefore used replacement tanks for their battle runs. (89) On the zero range, 4-32 Armor's C Company found the rules governing its operation confusing. Nevertheless all three platoons left the range confident in their zero results. The company's 1<sup>st</sup> Platoon was selected randomly to execute the first battle run of the competition on Monday, June 19. The tanks moved to the quarantine area only to receive a warning from the chief judge for the stowage of a dummy main gun round in the hull ammunition well. They did not receive any penalty points, but other American platoons similarly stowed extra machine gun ammunition and dummy main gun rounds. One platoon incurred the chief judge's ire for carrying expended brass cartridges. A mechanic had acquired them and stowed them on a maintenance truck that accompanied the platoon into the quarantine area. German platoons were also found guilty of similar infractions. Fortunately for the competitors, the chairman of the CAT Committee of Control intervened to excuse the infractions and ensure the platoons in question avoided penalty points. (90)

The 1st Platoon's battle run began at 0930 and went smoothly until the tanks began their first offensive engagement while moving from the first to the second bound. The appearance of five targets simultaneously surprised the crews, who proved slow to react. The problem stemmed from the rules governing the competition. When originally issued, the CENTAG teams understood that no more than four tank targets and four sets of troop targets would be presented during offensive engagements. Changes to the rules were published in March 1989, but CENTAG found no reason to alter its understanding of these conditions or modify its live and simulator training target arrays. Overcoming its surprise, the 1st Platoon completed its battle run, but the delayed response to the higher than expected number of targets resulted in a penalty for arriving late at the second bound. There the crews experienced fire and smoke obscuration, while gunners proved reluctant to fire quickly and risk missing a target. Nevertheless the crews anticipated some surprises and generally reacted well. Indeed, their performance marked a significant improvement since Kitty Kat II the previous month. They hit 29 of 32 targets and placed ninth overall — the second highest performing U.S. platoon. (91)

Unfortunately, the impact of the rules change negatively impacted most U.S. platoons. One senior observer noted:

Most notably, all the U.S. firing units misinterpreted the rules concerning the moving engagement from Bound 1 to Bound 2. When five main gun targets appeared, the U.S. contingent was shocked — and maybe spooked.

Other platoons that fired early in the competition shared this confusion, and many of them incurred penalties for moving too slowly to the second bound. (92)

A platoon from NORTHAG Panzer Battalion 203 executed the second battle run. The unit surprised many CENTAG observers when it fired upon troop targets missed during the first offensive engagement. They received credit for this action, which was approved by the chief judge. Many observers were taken aback, since it was not clear to all participants that re-engagement of troop targets was permissible. However, “some teams were not surprised... it is worth noting for 1991 that the German translation of the rules may have made the intent of the rule changes more apparent to a German reader.” Clearly, American teams would need to do a better job of understanding the rules and the significance of any changes. (93)

On the second competition day, the 2nd Platoon, C Company, 4-32 Armor executed the last battle run at 1600. The unit experienced significant delays caused by frequent range fires. After the first engagement at Bound 1, one crew conducted an MRS update, but the device became stuck in the engaged position. The malfunction eliminated power elevation and made the gunner’s primary sight useless. The crew continued to function, using the auxiliary sight and a mix of manual elevation and power traverse. Another tank experienced intermittent laser rangefinder failures, forcing the crew to fire half of its engagements using battlesight range. Discomfort compounded misfortune with the temperature inside the turret reaching nearly 100-degrees Fahrenheit. A third tank lost its wind sensor at Bound 2. Despite these problems, the platoon had only missed two targets by the time it reached Bound 3. There the combination of significant dust obscuration, tank malfunctions, and the appearance of an eight-target array overwhelmed the platoon. It finished the battle run hitting just 21 main gun targets and placed 20th. (94)



*The patch worn by the 3<sup>rd</sup> Infantry Division's 2-64 Armor CAT 1989 team. (Ron Mihalko)*

The 4-32 Armor CAT team’s 3rd Platoon executed its battle run on the morning of the competition’s last day. One of its crews, however, made a mistake during the preparatory boresight procedures. The crew then conducted an MRS update during their battle run, which served only to induce further errors into the ballistic solution. Consequently, the tank fired all of its rounds short. Worse, a radio failure in the same tank prevented the crew from receiving any transmissions. The tank also experienced difficulty in sensing its own rounds. Hence the crew did not realize they were shooting short and could not be apprised by a wingman. When the run completed, the platoon placed 19th, hitting 22 main gun targets. (95)

The experiences of the other American CAT teams proved similar — and disappointing. The 2-64 Armor team included the highest scoring U.S. platoon with 15,930 points and a seventh place finish.

It had respectable hit and time scores while earning the maximum points available for the machine gun engagements. It hit 28 main gun targets, but it suffered from a penalty accrued for arriving late at a bound. Another platoon hit 27 targets and avoided penalty points, but its mediocre time score earned it a 14th place finish. The third platoon of this team fired on the competition's first day. However, range fires delayed the actual timing of its battle run for seven hours with the crews confined to the quarantine area. When the battle run began at 2130, failing light, fatigue, and emotional exhaustion undermined their performance. The crews hit 24 targets but low time and machine gun scores minimized the points earned. The platoon earned the highest penalty through a combination of arriving late at Bound 2 and unauthorized use of coax ammunition. In the latter case, a loader added a reserve belt of machine gun ammunition — likely an oversight triggered by fatigue — that was discovered during the ammunition count conducted at the end of the platoon's battle run. The platoon finished in last place. (96)

The CAT team for 3-66 Armor constituted the only American component of the NORTHAG participants. Part of the 2nd Armored Division (Forward), this battalion possessed more range time at Bergen-Hohne than most American units stationed in Germany. Therefore it was considered better suited to cope with range issues encountered during the competition. One of its platoons was among the first to fire, but it, too, suffered from confusion over rules and suffered a penalty for late arrival at Bound 2. It missed half of the machine gun targets and scored only an average time score. However, it achieved a high hit score and placed 11th. Moreover, it hit 30 of 32 targets — the best number for any American platoon. The other two platoons turned in only average performances, each hitting just 25 targets but avoiding penalties. They finished in 13th and 15th places. (97)

CAT 1989 introduced night firing for participants whose tanks included thermal sights. Three American, one Dutch, and two German platoons conducted nighttime battle runs. In effect the night phase proved a competition between the Leopard 2 and M1A1. The principal challenge lay in engaging 12 main gun targets. Despite its feline name, the Leopard 2 did not perform well in these nocturnal engagements. The top three scores fell to American platoons. The 3-66 Armor platoon hit every target, earned bonuses for accuracy and ammunition conservation, and achieved a perfect score. Its performance was almost matched by 4-32 Armor, whose platoon also hit every target, earned an accuracy bonus, and nearly achieved a perfect score. 2-64 Armor's platoon earned the lowest of the three American platoons, but still beat the Germans and Dutch by a sizable margin. Night firing constituted part of American training, but the Dutch trained only for daytime engagements. Both the German and Dutch platoons demonstrated poor fire distribution and failed to engage several targets. The use of HEAT by the Dutch 41st Tank Battalion and Panzer Battalion 203 did little to boost their respective night scores. (98)

American success in the darkness, however, could not offset disappointing performances in the daylight. When the competition dust settled, analysis and explanations began. Range familiarization emerged as one reason for the better Dutch and German performance, since they utilized Bergen-Hohne much more than American armor units. (99) Rules knowledge became another identified factor, spurring a desire to devote more care in the selection of the U.S. national judge, particularly one with CAT experience. The failure to do so led to the conclusion that "we do not and are continually being detrimentally effected by that lack of CAT knowledge in our U.S. judges." (100) Similarly, the U.S. needed to be represented on the CAT Committee of Control by someone with extensive CAT experience. (101)

Materially, the commander's independent sight was considered an advantage for the Dutch and German teams equipped with the Leopard 2. The sight provided stabilized optics for sensing, observation, and re-engagement. (102) The Canadian Chief of Armor endorsed this viewpoint, noting:

Overall, the difference in my view was clearly target acquisition and time of engagement. GE [the Germans] had a clear edge with their independent crew command station. I believe this to have been the most important factor in the results of CAT 89. (103)

More objective assessments noted that other tanks without such a device had outperformed the Leopard 2. Indeed, the “Leo 2 ‘peri’ issue should not be overemphasized, since in previous competitions the M1 has competed on a fairly equal basis.” (104)

CAT 1989 witnessed a continuation of the contest between main battle tanks. With the withdrawal of the British, only the Leopard 1, Leopard 2, and M1A1 remained. The Leopard 1s of Belgium and Canada struggled to secure honorable mentions against the modern fire control systems and optics of the other platforms. The table below shows basic performance comparisons based upon the competition results. These simple values illustrated a harsh reality for American crews expecting to repeat the 1987 win. Not only did the Leopard 2 outperform the Abrams, so too did the Leopard 1 in terms of targets hit and speed of engagement. In stationary engagements, the M1A1 proved at least one second slower, a discrepancy that rose to four seconds for moving engagements. M1A1 crews also proved slower in their reengagement of targets and simply missed more targets than Leopard 2 crews, who also achieved a higher probability of a first round hit. (105) Given the time, energy, and command support invested in preparing the American CAT teams, what went wrong?

#### CAT 1989 Comparative Vehicle Performance (106)

Vehicle	Targets Hit (Average)	Time Score (Average)	Platoon Score (Average)
<b>Leopard 1</b>	26	4,547	14,278
<b>Leopard 2</b>	29.375	5,918	16,785
<b>M1A1</b>	25.666	4,920	14,180

Closer analysis of the competition, however, suggested that materiel issues did not constitute the only or even the most important reason for poor performance. Competition observers noted that the crews of the top scoring German and Dutch platoons did not announce when targets began to appear — they simply opened fire. Their radio usage in general proved much less than that of other nationalities. They used assigned, overlapping sectors of fire for each tank in the platoon, and fired almost simultaneously. They emphasized and secured first round hits, resulting in fast engagement times, and generally fired far less than the 40 main gun rounds carried by each platoon. Most German crews saw and engaged all 32 targets. They communicated very little by radio unless calling for assistance. Overall the German teams seemed more at ease in the conduct of their battle runs. (107)

#### Comparison of American and Dutch Performance (108)

Action	U.S. Platoons (Average)	Winning Dutch Platoon
<b>Probability of target detection</b>	.87	.97
<b>Time to fire first shot</b>	11.5 seconds	9.13 seconds
<b>Time to fire subsequent shot</b>	15.88 seconds	16.0 seconds
<b>Probability of hit</b>	.75	.83
<b>Score</b>	14,180	18,147

A computer based analysis of the American and Dutch performance concluded that training rather than materiel solutions should be the focus of U.S. preparations for CAT 1991. Increased range familiarization and target detection drills coupled with mastery of platoon crossfire techniques and section gunnery skills offered primary areas of emphasis. Indeed, all of these actions constituted part of the CAT 1987 winning platoon’s SOP. American crews in CAT 1989 tended to be slower in firing, partly due to a deliberate effort to first count and confirm targets before firing. Suggested remedies included permitting crews to fire upon target presentation and shortening the fire command process. Although the platoon leader’s control lessened, it could be offset by training platoons to automatically distribute fires without a command. Other nations clearly traded control for faster engagement times. (109)



Observation of the CAT 1989 battle runs revealed numerous differences between the conduct of American platoons and those of other nations. The U.S. units invariably associated individual tanks with firing lanes rather than sectors. American tank commanders remained high out of the turret, using the radio to report on target and ammunition status. The continuous chatter, however, did not improve target acquisition, and sometimes created confusion over target responsibility. A number of targets were never spotted, particularly in the morning and late afternoon. Engagement times proved noticeably slower than for other national platoons. Too often crews did not engage main gun targets quickly, even when the weather was clear, resulting in targets being spotted by spectators up to five seconds before some initial engagements occurred. Machine gun engagements posed problems, and the falling plate targets had to be re-engaged. Poor crew drills seemed in evidence, contributing to the more general impression that the American platoons lacked rhythm and flow as they executed their battle runs. (110) Some analysts proved more caustic in their assessment of American performance:

I conclude our crews went to the Competition expecting to shoot the same way they train everyday — having memorized a range and expecting targets to appear as they know they will. CAT Competition this year more realistic. It rewarded crews trained to work and fight together. (111)

Many of these observations called into question the training programs implemented by the American CAT teams. Each unit devoted considerable time to technical issues without necessarily resolving them. Doubt and confusion continued to surround MRS usage, exemplified by the commander of 4-32 Armor's conclusion in the wake of CAT 1989.

In retrospect, I personally believe we made a grave mistake. Two of our three firing platoons performed miserably due to problems directly related to the use of MRS. One platoon suffered from an MRS failure and the other from a gunner's misuse of the system. It should be noted that all three platoons used the systems at bounds 1, 2, and 3. While some experienced CAT personnel (both 3AD and 3ID) still believe the MRS should be used in this way, the jury is still out on this issue. My personal opinion is that it is a mistake to use the MRS during a battle run. I regret not making a command decision to remove the MRS. We have asked Fort Knox to look at this issue closely and provide us some definitive answers on MRS updating before we launch into CAT 91. (112)

Another battalion commander, reflecting upon his unit's CAT experience, offered a much more direct MRS solution: "If I had to do it all over again, I'd take a sledgehammer and knock the \_\_\_\_\_ thing off!" (113)

MRS usage, zero procedures, ammunition issues plagued the American CAT teams, but these same issues were also the subject of debate throughout the U.S. armored community. (114) However, the immersion of the CAT teams in technical issues occurred at the detriment of their teambuilding efforts, SOP refinement, and platoon gunnery skills — actions that had proven critical to 4-8 Cavalry's 1987 win. As one unit commander concluded of his training program:

There was one key ingredient missing, however, as I now review the year and the results. We failed to stress strongly enough the absolute need for discipline. By this I do not mean individual soldiers conduct. I mean the discipline required for a team to carry out a play without deviating and without second-guessing the coach. We built a team of superstars and perhaps over-educated them in technology. (115)

Still, the immersion of experienced tank crews in technical issues was not without merit. The ensuing debates raised the visibility on issues facing the entire tank fleet and which would have to be addressed in preparation for future CAT competitions and combat operations. Hence, "the

competition is a unique tank platoon evaluation laboratory, from which much can be learned by trainers, developers, CAT 91 teams, and the Armor force itself.” (116) In the wake of CAT 1989, many voices began to urge early preparation for CAT 91 and the adoption of a uniform standard and approach for all U.S. CAT teams. Indeed planning could not start soon enough, since “As our system works, all the people who gained valuable experience during the last year will move on, and there will be little or no continuity, consistency, or uniformity in the CAT effort unless command emphasis is given early on.” (117)



CAT 1989 coin. (Ron Mihalko)

### **A Winning Approach to CAT 1991**

In July USAREUR Commander General Crosbie Saint recommended the immediate start of planning for CAT 1991. He stressed the need for improvements to tactics and training to make U.S. forces competitive in battle and in CAT. He also identified several areas in which the USAREUR tank force needed assistance to prepare for CAT 1991. They included simulator upgrades, ammunition, provision of an equivalent capability to the Leopard 2's commander's independent sight, and the early designation of Excellence in Armor soldiers for assignment to CAT teams. In response the Armor School began to act upon these concerns, marking the start of American preparations for CAT 1991. (118) By month's end the list of issues to be addressed included the following: (119)

- M865 PIP ammunition tracer
- M865 ammunition deliveries to USAREUR
- PCOFT Upgrade
- SIMNET Upgrade
- Zero procedures
- MRS fix
- MRS procedures
- Commander's Independent Thermal Viewer (CITV)
- CO<sub>2</sub> Laser rangefinder
- EIA soldiers

On August 11, 1989 the first CAT 91 Working Group session convened in the Pentagon. The meeting served to develop an Army-wide action plan for CAT 1991. Representatives from the field, training, and technical communities met to assign responsibility for resolution of the issues identified and a timeline for completion. In addition to the items listed above, the Working Group also sought the development of an overall training strategy for all American CAT teams and the replacement of

aging tank radios. (120) Continuous coordination among Army organizations on both sides of the Atlantic Ocean continued and resulted in the emergence of a Department of Army CAT 1991 action plan to realize the Army Chief of Staff's mission guidance: "I want to win CAT 91." The plan assigned responsibility for related actions among the Armor School, Army Materiel Command (AMC), Department of Army, TRADOC, and USAREUR. The creation of a general officer steering committee provided centralized oversight. Its first meeting occurred on October 17, 1989. (121)

By then the CO<sub>2</sub> laser rangefinder and the commander's independent thermal viewer (CITV) had become dead issues. Both items were associated with the M1A2, which would not begin fielding until 1993 at the earliest. Interest remained in the construction of a device similar to the CITV that could be fitted to the CAT tanks, but the related cost and rules prohibiting competition-specification modifications precluded this course of action. In lieu of a CITV, USAREUR supported the possible issuance of stabilized binoculars to tank crews, and the Armor School planned to test their use in December. However, to avoid a rules violation, these binoculars would have to be issued to the entire tank fleet. (122)

Similarly, the replacement of existing tank radios with the Single Channel Ground and Airborne Radio System (SINCGARS) would be fielded in 1993, too late for CAT 1991. USAREUR efforts to utilize Excellence in Armor soldiers for CAT crews and rely upon officer recommendations received only limited support from Fort Knox. The Armor School provided USAREUR with a list of recommended master gunners and platoon sergeants with an Excellence in Armor pedigree, but opposed efforts to provide officer candidates. It considered such action an infringement on the prerogative of battalion commanders to make their own CAT team officer selections. (123) The Armor School sought to support USAREUR rather than dictate or barrage the command with recommendations, since:

CAT training and manning are and must remain USAREUR sandbox stuff. We must help when they ask, but not muddy the water with unsolicited wisdom which merely wastes time and effort on both sides of the pond. We must confine our actions to those things which will pass the user's "so-what-test." (124)

Early interest in upgrading SIMNET waned in the face of related costs and the greater importance attached to improving PCOFT. While SIMNET's utility to the CAT 1989 teams had proven marginal, PCOFT proved an effective platoon gunnery trainer. However, it suffered from insufficient image resolution and the inability to modify the preprogrammed target arrays. (125) PCOFT also experienced reliability problems, acknowledged by one senior leader with the comment, "Only thing I heard was terrain wasn't realistic and they broke a lot." (126)

In preparation for CAT 1991, the Army wanted to improve PCOFT with better graphics and reliability combined with the ability to generate and modify scenarios. Thus transformed, the resultant platoon gunnery trainer (PGT) would include new threat targets, friendly forces, smoke, illumination, artillery, and aircraft. Moreover, it would permit crew, section, and platoon training while permitting instructors to induce tank malfunctions that forced crews to operate in a degraded mode without warning. The PGT also featured record and playback capabilities to facilitate detailed analysis of each engagement. These changes reflected an intent to increase the PGT's overall training value to the force as a whole. Hence, by August 1989 the Army planned to establish four PGT sites and 13 smaller, section configurations to support gunnery training throughout the armored force. (127)

The PGT required four UCOFTs that would be networked together to permit platoon and section gunnery training. Several formations, however, expressed concern that once networked for platoon training, the individual UCOFTs would be unavailable to support crew training. UCOFT had become an integral part of every unit's preparation for Tank Table VIII qualification, and its potential

inaccessibility generated concern in several divisions. Formation commanders sensed a shift in the use of UCFT to support platoon training at the expense of individual gunners and tank commanders. This perception generated unease and at least some resistance to the planned PGT expansion. (128)

Other challenges existed in the form of funding and the acquisition of sufficient UCFTs to realize the PGT expansion goals. For the CAT teams, time constituted another challenge. Therefore the general officer steering committee opted to focus upon the immediate creation of two PGT sites in Europe, one at Vilseck the other at Friedburg. The committee intended to secure the necessary UCFTs by taking them from field formations and converting older devices from an M1 to an M1A1 configuration. The Vilseck PGT was to be operable by December 1990 and the Friedburg facility a month later. General Electric received the contract to perform this work in December 1989, and it became responsible for the operation and maintenance of the PGTs at each site. (129)

Only the Vilseck PGT site would incorporate the most advanced graphics and features — a time saving and cost cutting measure. Both sites, however, needed a terrain database for Grafenwoehr's Range 301 where the competition was expected to be held. To maximize range familiarization, the computerized terrain needed to recreate accurately range roads, target pits, foliage, range fans, and the impact of different visibility conditions. (130) This type of detail required extensive imagery. In September 1989 the Armor School dispatched a master gunner team to film the range and capture how the range would appear from a tank crew's perspective. Two tanks with crews were required to support the filming, but coordination between the Armor School and the Seventh Army Training Command responsible for Grafenwoehr proved less than ideal. As a result the Fort Knox master gunners "wound up personally installing over 50 targets on Range 301 on the 15<sup>th</sup> and personally 'tin-cupped' around Vilseck to find two tanks and crews for the filming." (131)

While PGT provided a virtual training tool, a parallel effort sought to improve the ammunition used for live fire. Most main gun rounds included a tracer element that burned when fired to simplify gunner sensing. In CAT 1989 U.S. crews experienced difficulty seeing this tracer in contrast with German rounds whose tracer appeared brighter and visible from the spectator stands. For CAT 1991, the Americans tested different tracer elements for the PIP round to make it more visible. The requirement proved straightforward: a tracer consistently visible out to 1,500 meters through the gunner's primary sight and out to 2,000 meters with binoculars. By February 1990 a superior tracer had been identified, but the sterile and optimal visibility setting in which testing occurred offered little indication of its performance under competition conditions. Testing continued into the spring and summer months, generating concerns lest the final selection and fielding of a solution occur too late to support the CAT teams' first gunnery event in October. On the other hand, the desired ammunition for the CAT teams had already been manufactured. It lay in storage awaiting the tracer installation, after which it would be delivered to USAREUR via aircraft. (132)

Ammunition safety concerns posed a different problem. The CAT 1989 teams discovered that ammunition stored outside in wooden packing crates — a common practice — became susceptible to moisture problems. The HEAT training round, in particular, sometimes swelled when they became wet and could not be loaded. When the PIP rounds became available, they shipped in metal containers and were kept centrally stored in covered shelters to reduce moisture problems. (133) While these measures helped the CAT 1989 teams, more general concerns about ammunition remained, exemplified by an article published in *ARMOR*, entitled "120-mm Tank Main Gun Ammunition: An Accident Waiting to Happen?" The article noted that the ammunition proved too fragile for field use, and it often became damaged and unusable. One battalion found one third of its ammunition prone to rapid wear, scratches, and moisture damage that degraded its performance. These issues appeared to impact both training and service rounds, resulting in several tank units downloading ammunition despite the potential risk of combat operations on short notice against the Warsaw Pact. (134)

The Armor Center defended the method of packing and shipping 120-mm ammunition. It also highlighted the increased lethality of the ammunition and the utility of the combustible cartridge cases. However, the Armor Center acknowledged the need for care in handling the ammunition and the need for regular inspections. Service ammunition was designed to last 20 years in controlled storage but only three years otherwise. While service ammunition included a protective finish and a propellant largely immune to moisture, training ammunition did not and remained sensitive to moisture. Both ammunition types proved prone to damage if roughly handled and swelled if they became damp, making their use problematic. This sensitivity posed a challenge for tank stowage. Leaks and condensation in the tank's ammunition storage areas damaged the rounds, necessitating regular wipe downs and efforts to air dry the effected locations. (135)

Overall, though, the ammunition problems experienced by the CAT 1989 teams would not be repeated. For CAT 1991 teams would train with the same ammunition they would shoot in the competition. As early as January 1990 USAREUR requested 22,500 rounds to be shipped and placed under covered storage in Germany. This quantity addressed the expected CAT team requirements throughout their training program. It also included ammunition for zeroing the M1A1 Heavy Armor (HA). This version of the Abrams tank carried improved armor with depleted uranium. Fielding in Europe began in 1988, and it would make its CAT debut in 1991. (136) Indicative of the support for CAT, the quantity and cost of ammunition requested generated no queries or resistance. Department of Army headquarters envisioned little difficulty satisfying the request, merely noting "appreciate the importance of CAT and DA will provide ammunition essential to prepare our teams to win." (137)

**U.S. CAT 1991 Ammunition Requirement (138)**

<b>Event</b>	<b>Estimated Ammunition Requirement (Rounds)</b>
Gate I competition October 1990	4,000
Gate II competition March 1991	4,000
Kitty Kat competition April/May 1991	2,000
Pre-Competition week June 1991	1,500
CAT 1991 competition	2,000
Zeroing of M1A1 (HA) selected for CAT teams	384
Corrective training after Gates I & II, Kitty Kat	5,616
Testing & validation of fire distribution plan	3,000
<b>Total</b>	<b>22,500</b>

In preparation for CAT 1991, USAREUR sought a centralized training strategy to govern all CAT teams. This approach marked a significant departure from prior competitions in which each CAT team developed their own training program with material and command support from their respective formations. Now, all unit teams would follow the same program toward the same objective: hitting all main gun and machine gun targets. A five phased process marked the progress of each team from establishment to competition.

- Phase I: Crew member selection and individual training
- Phase II: Crew and platoon training
- Phase III: Gate I—Battle Run Training
- Phase IV: Gate II—Platoon Gunnery Training
- Phase V: Kitty Kat

Each phase included its own standards and measurement of success. A series of in-progress reviews were intended to supplement this basic schedule, providing opportunities for the teams to share best practices and experiences. (139)

As the USAREUR commander General Saint and his staff monitored and played an active role in CAT team preparations. His Assistant Deputy Chief of Staff for Operations and Training Brigadier General John H. Tilelli Jr. served as the USAREUR commander's representative for all CAT-related actions and coordinated the overall training effort. He worked with formation commanders to ensure the appropriate support for the competing teams, covered extraordinary funding requirements, and served as the U.S. representative to the Committee of Control. This last responsibility included ensuring U.S. interests were articulated and defended in addition to ensuring all competing units understood the rules and impact of any changes. He was assisted by a cell established in the USAREUR headquarters that tracked CAT activities and ensured all CAT team needs were met. The Grafenwoehr Training Area commander became responsible for appointing a central point of contact for Range 301 and preparing the range for Gate I, Gate II, the Kitty Kat, and the actual competition. (140)

Outside USAREUR, the Armor Center; Tank Main Armament System; Armament, Munitions, and Chemical Command; and Heavy Force Modernization Materiel Fielding Team also monitored and supported the CAT preparations. In this manner, the Army implemented a centralized, top-down approach to CAT that reflected the high profile of the competition and the personal commitment of the USAREUR commander and other senior leaders. (141)

In the wake of CAT 1989 Lieutenant General Gordon R. Sullivan sought an optimal training strategy for the CAT 1991. The Armor Center responded with a three phase plan applicable to all of the American CAT teams and responsive to a single point of contact. The first phase covered the period June to July 1990 and marked the initial establishment of the CAT teams. In the second phase from July to August training focused upon the competition range and targetry. From August to September teams emphasized platoon battle runs and actions related to the actual competition. The plan was not prescriptive, but it offered a clear path based upon lessons learned from prior CAT competitions. It also provided guidance and tips to build a unit SOP, select crew members, and ensure understanding of the CAT competition conditions and rules. It was submitted to USAREUR where it provided an effective supplement to that command's training strategy. The two plans collectively constituted the most comprehensive preparation for CAT undertaken to date by the U.S. Army, and they clearly reflected the event's stature and import. (142)

The import of CAT found further reflection in the desire to identify and disseminate applicable lessons learned throughout the American armored force. In August 1989, the Armor Center dispatched a team to USAREUR to "conduct a detailed postmortem to obtain additional information to benefit support for the CAT 91 effort and, most importantly, our tank force." (143) The Armor Center team received the authority from USAREUR to address those issues identified by the CAT 1989 teams. It also sought information related to training and equipment deficiencies to support both preparation for CAT 1991 and armor force readiness. USAREUR in turn sent a small team to visit the German armor school to interview their tank gunnery advisory cell and learn how their allies prepared for the Canadian Army Trophy. (144)

Despite this fact finding effort, it proved too early to determine broadly applicable lessons learned. By October, the Armor Center had yet to receive detailed after action reports from the CAT 1989 teams, possessing only anecdotal comments from observers. Without these reports Armor leaders proved reluctant to make premature conclusions with potentially long-term implications. Similarly, the Armor Center resisted efforts to draw parallels between shooting performance at CAT 1989 and perceived direct fire problems at the NTC. There observers noted difficulties experienced by rotating units in the live fire training phase in which they engaged a large target array designed to resemble the attack of a Soviet combat unit. Analysis suggested that units overemphasized maneuver skills at the expense of gunnery. Until this emphasis changed, live fire results would remain substandard. (145)

TRADOC overruled the Armor Center and directed the compilation of a lessons learned bulletin. Armor specific lessons were to be identified from the CAT 1989 experience. Those items found to have combined arms application were to be disseminated broadly. Consequently, in January 1990 the Armor School issued *Tank Gunnery Lessons Learned*. This bulletin provided a set of lessons that reflected analysis of the CAT 1989 experience, NTC rotations, and unit annual qualifications. The bulletin included a variety of articles and tips intended to improve readiness for all armored units. Contents included a recommendation for units to conduct classes on the tank fire control system, testing crew understanding of boresighting procedures at night or with induced failures that had first to be identified and corrected, fire distribution plans, and armament accuracy checks. Unit leaders were encouraged to implement "dirty" tank tables in place of sterile predictable ones, following the lead of the 24th Infantry Division (Mechanized). This formation introduced platoon battle runs that included smoke generators, attack helicopters, and a mandatory call for fire. The bulletin also addressed more mundane but crucial tanker tasks such as load plans, vehicle evacuation, and effective operation of the commander's station. (146)

A second bulletin emerged in November 1990. This one also provided gunnery tips, techniques, and procedures. Principal subjects included use of the coaxial machine gun against troop type targets, confirming the application of computer correction factors to ballistic solutions, and boresight procedures. The bulletin also outlined an accuracy improvement program for the M26A1/M27A1 Lenzar muzzle boresight device, which began to replace the M26/M27 Pye Watson device. However, the Lenzar model suffered from poor performance among the early production models and substandard operator manuals. The bulletin outlined the measures taken to improve these deficiencies. It also included boresighting procedures, special inputs for the computer, and more recommendations for preparation to fire checks. (147)

### **MRS: To Update or Not to Update?**

The American CAT 1989 teams experienced difficulties with zeroing and MRS usage. In preparation for CAT 1991 the Armor Center became responsible for generating a common zero procedure and muzzle reference system policy applicable not only to the competition teams but the entire tank fleet as well. In August 1989 four tank crews at Fort Knox fired a mix of HEAT and sabot rounds, after carefully boresighting in accordance with FM 17-12-1 guidance and following the zero procedures found in the operator's manual. The live fire results validated these procedures with one exception. The requirement to conduct an MRS update after each round fired during zeroing proved unnecessary. Instead, it seemed sufficient to conduct an update before firing the confirmation rounds. A corresponding change to the operator's manual was therefore scheduled for implementation by January 1990. Further testing and analysis, however, resulted in another change in May 1990. Instead of an MRS update, crews were instructed to perform a boresight check before firing confirmation rounds, re-boresighting if necessary. This change effectively eliminated the MRS from the zeroing process. (148)

Some confusion surrounded the best range at which to zero weapons, stemming in part from the different distances used by the CAT 1989 teams. Most technical agencies concurred in discouraging the 500 meter range, but no consensus existed whether 1,200 or 1,600 meters constituted a better distance. Further analysis within the Armor School resulted in a clear preference for 1,200 meters. This range facilitated use of the gunner's auxiliary sight, and many of the CAT engagements would occur at ranges closer to 1,200 rather than 1,600 meters. Moreover, 1,200 meters proved the most commonly used distance across the force, and gunners readily understood the corresponding aiming dot and circle found in the sight reticule. In April 1990 a CAT zero test was performed, during which tanks zeroed at 1,200 meters and then fired at both target sizes used in CAT 1989 and expected for CAT 1991. In both cases, the hit probability proved higher than that achieved by the American teams in the earlier competition. The zero debate ended with the adoption of a 1,200 meter range and the replacement of the MRS update with a boresight check. A single policy now existed for the Abrams fleet and ended the confusion that undermined preparations for CAT 1989. (149)



*Close-up shot of part of the Muzzle Reference System, in this case the muzzle reference sensor that helped the gunner to determine and adjust for gun tube bend and droop. (Author)*

Use of the muzzle reference system, however, continued to pose problems. Boresighting the tank's main gun established a relationship angle between the gunner's primary sight and the end of the gun tube. Subsequent temperature changes from atmospheric conditions or firing the weapon changed this angle by causing the gun tube to bend or droop. Without correction, these changes eroded the boresight and resulted in a loss of accuracy that increased with range. The MRS provided a means for the gunner to identify such deviation, realign the sight with the actual condition of the gun tube, and update the fire control system. The MRS update thereby enabled the gunner to adjust quickly for gun tube variation without losing accuracy—a considerable asset in combat conditions that prevented re-boresighting the tank. (150)

The greatest value derived from an MRS capable of consistent boresight retention within a narrow margin of error. (151) Unfortunately, initial production tests of the M1A1 MRS in 1986 found the rate of boresight retention within acceptable parameters to be just 71 percent. Worse the operation of the MRS suffered from hardware failures, including movement of the device on the gun tube, cracked or broken glass, and moisture accumulation. (152)

To address these problems a redesigned MRS underwent testing in June 1987. The boresight retention rate rose to 89 percent, a significant improvement but still less than optimal. The device also continued to experience hardware issues, including broken welds and a tendency to move on the gun tube until several rounds had been fired. In January 1989 the approval of another product improvement promised still further improvements to MRS durability, accuracy, and overall quality, but it would not be available to already fielded tanks until 1991. (153) Initial prototypes of the new MRS would become available in July 1989, followed by laboratory and fielding testing in early 1990. Army Materiel Systems Analysis Activity (AMSAA) expected the final product to be an improvement. Pending its availability, field units would rely upon the redesigned MRS that resulted from the initial production tests. (154)



The two year timeframe provided time to resolve outstanding issues and generate a product capable of sustaining boresight within a very narrow margin of acceptable performance — no more than .15 mils deviation in the vertical or horizontal axis. AMSAA considered this requirement unrealistic, noting that despite 10 years of testing and design changes it had never been met. Therefore, AMSAA desired the program manager and the Armor Center to reconsider the requirement. In AMSAA's view, "the effect of boresight being off .20 mil instead of .15 is negligible on the target, given all the other factors impacting: CCF [computer correction factor], Jump, Cant, dispersion, gunner lay error, etc." (155) The TRADOC commander echoed AMSAA's view, questioning the need for the tight tolerance, and suggesting a change to expedite development and fielding. (156)

The Armor Center represented the user and remained unwavering in its support for the original requirement. It accepted the interim MRS solution only to accommodate a longer term fix that satisfied the requirement. Armor Center personnel were concerned that relaxing the MRS performance parameters would reduce hit probability in combat. On the battlefield, tanks that lost their boresight would become entirely dependent upon the MRS to retain accuracy. This reality drove the Armor Center's emphasis upon a high boresight retention rate with only a very small margin of error. Some of its personnel considered the actions taken to date to improve MRS performance little more than quick fixes rather than a concerted resolution effort. Indeed they noted repeated efforts by the program manager to drop the performance issue in order to obtain a full materiel release for the MRS. The Armor Center understood that differences in the performance of the same ammunition, gun jump, gunner lay error, and the MRS constituted primary contributors to inaccuracy. Solving the MRS durability and performance problems thus eliminated one of these error sources. This position found support from the Armor and Engineer Board, long an organization that field tested concepts and materiel for the Armor Center. (157)



*The CAT 1991 team patch for 1-37 Armor.  
(Ron Mihalko)*

Some degree of tension always existed between the user of a piece of equipment and its developer. The latter struggled with technological complexities, tight schedules, and funding limitations unrelieved by the ever present pressure of a program manager eager to move the item closer to production and fielding. The MRS dispute exemplified this tension, but at the action officer level, sympathy among the contenders proved in short supply. Within the Armor Center, analysts feared that lowering the performance requirement would adversely impact the soldier and discourage future efforts to boost MRS performance and capability. They had little sympathy for individuals in the technical community seeking to lower the requirement and reduce costs, exemplified by the comment:

Remember there are those in AMC who believe their job is to provide the minimum required. Anything more is a waste of taxpayers' money. I personally think those people should be shot, but it sounds good to uninformed people. (158)

These disagreements between the user and development communities did not eliminate the MRS problem in the field. Many tanks possessed the original production MRS. Ongoing fielding of the improved interim version therefore resulted in combat units often possessing a mix of MRS devices. Crews therefore experienced wide variation in the performance and reliability of the MRS, and their confidence in the system suffered. The CAT teams were not immune from the resultant confusion and controversy surrounding its usage. (159)

Resolution of the MRS problem, however, constituted part of the CAT 1991 action plan adopted by the general officer steering committee. Acceptance of the interim MRS while improvements continued to satisfy the performance requirement did not address the need for a standard usage policy. The Armor Center sought a policy easy to understand and apply in combat conditions. By March 1990 the CAT teams were encouraged to eliminate MRS updates from the zero procedure. During the competition, while tanks waited in the quarantine area, they were to conduct periodic boresights with a muzzle boresight device. When directed to move to the first firing point, they were to make a final check of the gunner's primary sight and the MRS. Once the battle run began, they were to conduct MRS checks after each target array had been engaged and upon arrival at the second and third bounds. An actual MRS update was to be done only if a check showed boresight loss of greater than .15 mils. (160)

Two months later MRS usage procedures changed. CAT teams were instructed to omit MRS updates during zeroing and minimize the system's use during battle runs. They were to ensure the MRS was boresighted at the same time as the gunner's primary sight. The earlier guidance for actions while in quarantine remained, but upon arrival at the second and third bounds crews were to make MRS checks. If they found a boresight loss of more than .15 mil in azimuth or elevation, they should consider an MRS update. However, "past CAT experience and our own test results ... tell us that you should not perform an update if your tank is hitting targets even if the MRS check indicates the need for an update." The relatively short duration of a typical CAT battle run, normally 20-30 minutes, minimized the degree of boresight loss, further reducing the need for an MRS update. Obvious indicators of this need included a major shift in weather conditions or a delay due to target malfunction or range fire that allowed the gun tube to cool. Rounds that consistently fired short or overshot the target also signaled the need to conduct an MRS update. (161)

Policy guidance that both discouraged MRS usage and highlighted circumstances necessitating its use did little to dispel the confusion surrounding the device. In effect, the Armor School left the final judgment as to when to conduct an MRS update to each crew. The Armor School acknowledged this reality, noting:

Try as we might, we cannot make MRS usage an exact science. By using the USAARMS MRS procedures to build an understanding of the tank's gunnery

characteristics, throughout the CAT training year, crews will be able to determine the necessity of performing an MRS update. Ultimately, the tank commander must decide whether or not to perform an MRS update. His decision must be based upon his knowledge of his tank's characteristics gathered during training as outlined above.

At least the CAT teams would be briefed on the MRS usage when the Armor School mobile training teams provided gunnery instruction, but they would clearly need to determine their own best practices. (162)



*The patch worn by the 2-66 Armor CAT 1991 team. The First Gulf War diverted their gunnery talents to Southwest Asia instead of the competition range. (Ron Mihalko)*

## **CAT 1991**

Planning for the Canadian Army Trophy began in 1989. The first CAT Committee of Control meeting occurred in October. Chaired by Major General Richard B. Griffiths, the AFCENT Deputy Chief of Staff for Operations, it included representatives from NORTHAG, CENTAG, the United Kingdom, Canada, Belgium, the Netherlands, the Federal Republic of Germany, and the United States. Colonel John Mountcastle, commander of the 2nd Brigade, 1st Armored Division, also attended in his capacity as chief judge. The committee addressed equipment standards, reaffirming the prohibition against special equipment or vehicle modifications intended solely for competition use. To ensure compliance, competing units would provide the committee of control an equipment list for their teams. While platoons waited in the quarantine area before their battle runs, they would be inspected by the judges and incur a penalty if found with items not on this list. Such strictures contributed to the American abandonment of a commander's independent sight. (163)

The CAT 1991 rules would not be finalized and released until July 1990. In the meantime the CAT 1989 rules shaped training events and related simulator software development. Few significant changes were expected either in the scoring or in the nature of the battle runs. To avoid the penalties incurred during CAT 1989, American teams began their preparations with a detailed analysis of the rules, conditions, and outcomes of the earlier competition. They had plenty of time to do so, since

the three battalions that would provide the CAT teams had already been identified. They included 4th Battalion, 67th Armor Regiment (4-67 Armor), from 3rd Armored Division, 1st Battalion, 37th Armor Regiment (1-37 Armor), from the 1st Armored Division, and 2nd Battalion, 66th Armor Regiment (2-66 Armor), from the 2nd Armored Division (Forward). (164)

International developments, however, disrupted American plans to win CAT 1991. The Iraqi invasion of Kuwait on August 2, 1990 triggered an international response led by the United States. Before the month's end, the implementation of Operation DESERT SHIELD sent American combat forces to Saudi Arabia to protect the kingdom from a potential Iraqi invasion. The U.S. began to assemble a military coalition to liberate Kuwait while simultaneously seeking United Nations action to induce the Iraqis to withdraw or sanction the use of force. On November 29, 1990, the United Nations Security Council directed the Iraqis to withdraw from Kuwait by January 19, 1991 or be subjected to removal by military force.

In preparation for the application of military force to liberate Kuwait, much larger concentrations of forces began to arrive in Southwest Asia. U.S. forces stationed in Germany, poised to defend Central Europe from a Warsaw Pact invasion, began to deploy instead to fight Iraq. USAREUR combat forces constituted a significant portion of the American contribution to the international coalition. Planning, preparation, and deployment actions therefore precluded participation in CAT 1991. All three battalions charged with building and training CAT teams instead accompanied their parent formations to Southwest Asia and subsequently conducted combat operations during Operation DESERT STORM.

The British also participated in the liberation of Kuwait, deploying the 1st Armoured Division fight against Iraq. This action provided the justification for not participating in CAT 1991, although it is not likely such participation would have occurred in the absence of the Persian Gulf conflict. Still reliant upon the same Challenger tanks that had performed abysmally in CAT 1987, the British had little to gain and much to lose by entering the competition. (165)

Despite the absence of a U.S. team, CAT 1991 still reflected an American influence. The competition occurred on Grafenwoehr, one of the principal American training areas, and an American officer served as chief judge. Colonel Mountcastle received a new assignment, resulting in the January 1991 appointment of Colonel Glenn Snodgrass to the position. Snodgrass possessed familiarity with tank gunnery and Grafenwoehr, having repeatedly qualified the tanks under his command there while a cavalry squadron commander. He also brought knowledge of competitive international events, having led the winning squadron in the 1987 Boeselager Trophy competition. (166)

The chief judge bore responsibility for CAT preparation and execution. He oversaw the building of observation stands, secured spotting scopes for the official competition observers, and secured all equipment necessary to run the range and competition. The chief judge also housed and trained the national judges through live fire practice to ensure their mastery of the competition scoring system. In the execution of these actions for CAT 1991, Colonel Snodgrass led a team that included Grafenwoehr range personnel and soldiers from 4th Battalion, 69th Armor Regiment (4-69 Armor), a unit in the process of deactivation. He also benefited from the consistent support of the Committee of Control's chairman, and he received the opportunity to visit the armor school of each competing nation and fire each of their tanks. (167)

The chief judge's most important responsibility lay in the design of the target arrays each platoon would face during its battle run on Range 301. Colonel Snodgrass's team generated a different scenario for each platoon while keeping the complexity and challenge difficulty similar for each one. Realizing this goal meant long hours spent determining the details of each target engagement, overseeing the placement of targets, and ensuring that each target appeared at the correct time. He



*The all-powerful Committee of Control for CAT 1991. (Glenn Snodgrass)*

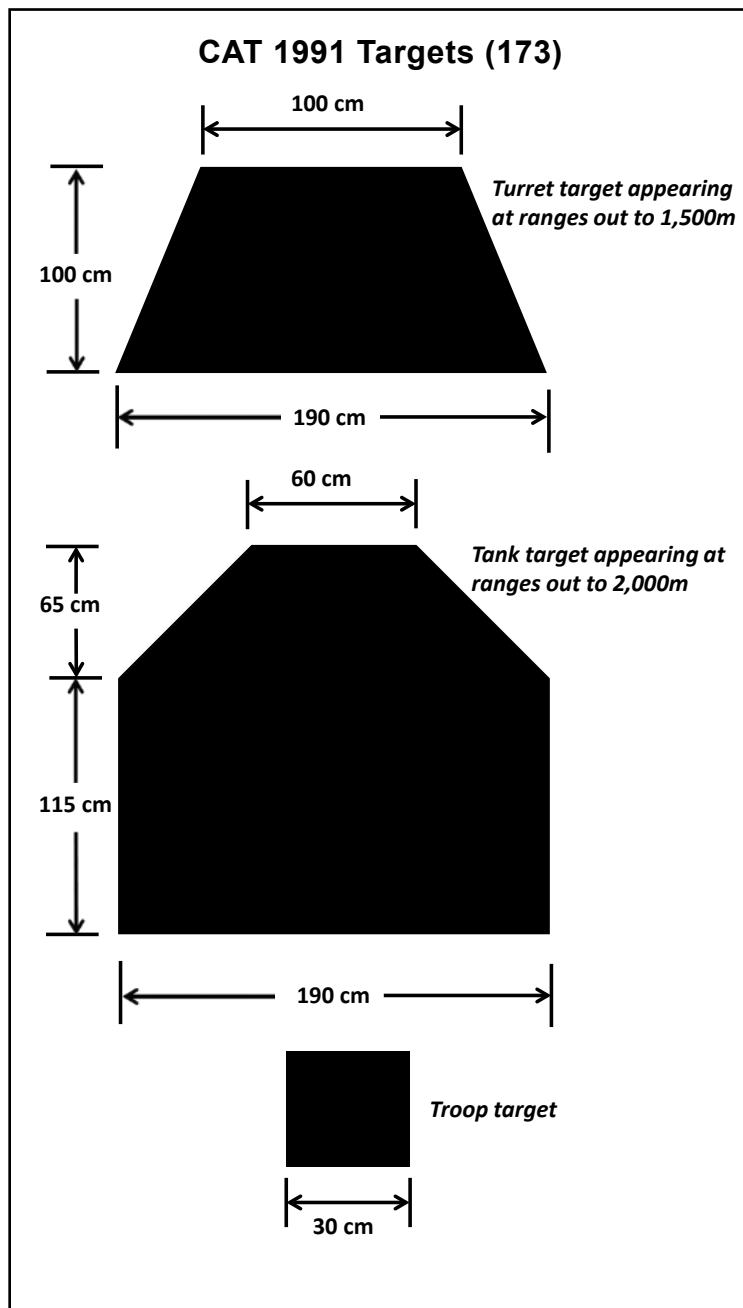
used his team to dry fire each target array repeatedly to check target placement and to minimize the chance of malfunctions. Continuous rehearsals became a trademark of the CAT 1991 preparation, but they also provided opportunities to see the range as competing platoons would see it. The posting of security guards served to prevent the premature disclosure of target locations by keeping onlookers away from the competition range. During the last month before the event only those personnel authorized by the chief judge had access to the range. (168)

The rules and conditions for CAT 1991 resembled those of prior competitions. Like CAT 1989, each battle run included a mix of stationary and moving engagements at ranges out to 2,000 meters. At least one engagement occurred under closed hatch conditions. Each platoon faced a total of 32 main gun targets and 80 falling plates representing hostile personnel. Main gun targets had only to be visible to all tanks in the platoon at the last bound. Otherwise targets might only be visible to a single section. Heated targets and decoys appeared as a group for 40 seconds. No points accrued for targets hit after this time. Each tank carried 12 main gun and 250 machine gun rounds. (169) CAT 1991 also included two different target sizes to represent both hull down tanks and fully exposed vehicles. Night battle runs were omitted following the withdrawal of the American teams and in deference to the inferior night firing capabilities of the Canadian and Belgian Leopard 1s. The smaller number of competing platoons also reduced the length of the competition from five days to less than three. (170)

Scoring remained similar to prior competitions with an emphasis upon speed and accuracy. The maximum platoon score remained unchanged at 22,600 points. Penalty points accrued for unauthorized use of reserve ammunition and failure to reach a bound within a specified time limit. Firing the main gun at machine gun targets resulted in the loss of points for all falling plates hit. Firing at targets in an open hatch configuration after being directed to close them resulted in a null score for that engagement. A new penalty included the failure to adhere to the chief judge's movement and control orders. The penalty proved stiff with the loss of 300 points per minute. The

competition remained one between NORTHAG and CENTAG, but the absence of American teams resulted in a lopsided contest between seven NORTHAG and five CENTAG platoons. Therefore the army group winner was determined by the highest average platoon score. (171)

The 1991 Canadian Army Trophy competition occurred on June 17-19 on Grafenwoehr's Range 301 hosted by CENTAG. The weather proved sunny and clear throughout the event, while battle runs experienced no target malfunctions. Nor were teams confused by the rules. None garnered any penalty points. In the absence of the Americans and British, only teams from the Netherlands, Canada, Belgium and Germany participated. Regular invitations to the French failed to result in their participation, despite the desire of commentators to witness the Leclerc tank in action. (172)



NORTHAG won CAT 1991 with an average platoon score of 16,076.3 versus 15,838.8 for CENTAG. In the absence of American and British teams, only Leopard 1 and 2 tanks competed. Not surprisingly the top scoring platoons fielded the Leopard 2. The NORTHAG team included five Leopard 2 platoons to just three in CENTAG. Nevertheless, it proved impossible to discount the Leopard 1, since a Canadian platoon place fifth. (174)

CAT 1991 Scores (175)								
Hit Score	Time Score	Ammo Bonus	Hit Bonus	MG Score	Penalty	Platoon Total	Rank	Targets Hit
<b>NORTHAG—Panzer Battalion 84 (Leopard 2)</b>								
8,750	5,525	0	0	2,000	0	16,275	8	28/32
10,000	7,225	500	500	2,000	0	20,225	1	32/32
9,062	5,865	0	0	2,000	0	16,927	4	29/32
<b>NORTHAG—43<sup>rd</sup> Tank Battalion (Leopard 2)</b>								
9,687	5,695	0	0	1,650	0	17,032	3	31/32
8,125	5,100	0	0	2,000	0	15,225	9	26/32
<b>NORTHAG—3<sup>rd</sup> Lancers (Leopard 1)</b>								
6,875	4,080	0	0	2,000	0	12,955	11	22/32
7,500	4,420	0	0	1,975	0	13,895	10	24/32
<b>NORTHAG Platoon Average Score: 16,076.3</b>								
<b>CENTAG—Panzer Battalion 153 (Leopard 2)</b>								
8,750	5,780	0	0	1,975	0	16,505	7	28/32
9,375	5,355	0	0	2,000	0	16,730	6	30/32
9,062	6,205	0	0	2,000	0	17,267	2	29/32
<b>CENTAG—8<sup>th</sup> Canadian Hussars (Leopard 1)</b>								
6,562	3,315	0	0	2,000	0	11,877	12	21/32
9,375	5,440	0	0	2,000	0	16,815	5	30/32
<b>CENTAG Platoon Average Score: 15,838.8</b>								

The 3<sup>rd</sup> Lancers represented Belgium in CAT 1991. Stationed in the Federal Republic of Germany since 1978, this unit still retained its Leopard 1A1 tanks. In the competition, its platoons placed 10th and 11th, achieving the lowest hit and time scores while hitting the least number of main gun targets. Symbolic of the generational gap in platforms, the Belgians only managed to outperform a Canadian platoon — also equipped with the Leopard 1. The low platoon scores tended to lower the overall NORTHAG average, since the other Dutch and German platoons all scored over 15,000 points. (176)



The distinctive patch worn by the Belgian 3<sup>rd</sup> Lancer's CAT 1991 team. (Ron Mihalko)

The 8th Canadian Hussars constituted the armored contingent of the 4th Canadian Mechanized Brigade Group. They had replaced the Royal Canadian Dragoons in 1987, and CAT 1991 was their second competition. An informal video of the Canadian CAT team showed crews in high spirits prior to the competition despite the impression of continuous maintenance activity. Whatever the state of their tanks, however, one of the maple leaf platoons placed fifth and hit 30 main gun targets — one of only four platoons to do so. Moreover, the time and hit scores for this unit compared favorably with those of other platoons equipped with the Leopard 2. Once again the Canadians had demonstrated the importance of crew rather than materiel quality. The other Canadian platoon may have felt differently, however, since they finished last with the lowest time and hit scores and the least number of main gun targets hit. (177)

The Dutch 43rd Tank Battalion received its Leopard 2 tanks in 1983, and it had participated in CAT 1985 and CAT 1987. In both cases, it earned the top score for the NORTHAG team. In CAT 1991, the top scoring platoon from this unit placed second, despite the lowest machine gun score of any competing platoon. It hit 31 of 32 main gun targets—one of just two platoons to hit over 30 and barely missing the hit bonus. The other platoon placed ninth with a low hit and time score and just 26 main gun targets hit. (178)



*The Dutch 43rd Tank Battalion's CAT 1991 team patch. (Ron Mihalko)*

The German Panzer Battalion 84 competed on NORTHAG's behalf. The unit was the first one to receive the Leopard 1, and it used this platform to win CAT 1975. Upgraded to the Leopard 2 in 1981, this unit became the first German tank battalion to conduct gunnery training on the Castlemartin training area in Wales. In CAT 1991 a platoon from this battalion placed first with a score of 20,225 points, beating its nearest competitor by nearly 3,000 points. The platoon was the only one to hit every target and earn the hit and ammunition bonuses, and it possessed the highest hit and time score of any competitor. The other platoons on this team placed fourth and eighth. (179)

Panzer Battalion 153 constituted a critical component of the CENTAG team, since it was the only unit equipped with the Leopard 2. The battalion was one of the German army's oldest tank units, and it had participated in CAT 1983. In 1991, its platoons ranked second, sixth, and seventh. The high scoring platoon hit 29 main gun targets and achieved the second highest time score. (180)

Although the U.S. could not win CAT 1991, the careful attention to detail evidenced by the chief judge and his team ensured the competition occurred without mishap. The execution of successive



battle runs occurred without incident, target malfunctions, or the distinctive range fires of CAT 1989. Protests proved noticeable by their absence due to the careful preparation and placement of targets. When a German platoon leader complained of being unable to see several targets, the chief judge was able to show the platoon leader where each target lay with the optics of his own tank. The combination of a well-executed competition and the absence of problems or incidents resulted in praise from the competitors as well as the CAT Committee of Control Chairman. Moreover, the immersion in range operations served to prepare Colonel Snodgrass for his next assignment as the Grafenwoehr Training Area commander. (181)

Despite the smaller size of the 1991 competition, the Canadian Army Trophy continued to attract international attention. The end of the Cold War, however, encouraged NATO members to start reducing force structure in the face of a diminished threat. The United States lost no time in doing so. In early 1990 the Armor Center commander expected to see the armored force shrink by 27 tank battalions and cavalry squadrons, or 19 percent, over a five year period. The personnel impacts of this reduction remained unclear, but “while we are one of the smallest branches, we man almost 30 percent of the Army’s weapons systems and 60 percent of the heavy maneuver battalions.” (182) These numbers marked only the beginning of a much larger Army-wide drawdown. Hence the Armor Center commander modified his original reduction notice just a few weeks later to address additional cuts forecasted. (183) Troop reductions would become a moving train that would accelerate dramatically as the decade unfolded. How such reductions across NATO would impact the Canadian Army Trophy remained uncertain as the dust of CAT 1991 settled.

### **A Different Sort of CAT: Tank Gunnery in the First Gulf War**

On January 16, 1991 an allied coalition of Western and Arab states began combat operations to liberate the Persian Gulf nation of Kuwait from its Iraqi invaders. Four weeks of sustained aerial bombardment served to erode Iraqi combat power and capabilities. Ground combat operations began on February 24 across a frontage stretching from the Persian Gulf to the western Iraq desert in an operation known as DESERT STORM. (184)

On the left the XVIII Airborne Corps served to protect the flank of those coalition formations charged with striking the main Iraqi resistance. The corps thrust across the desert of southwestern Iraq, gradually fanning out as it approached the Euphrates River. By the time hostilities ended, it spanned a frontage from Samawah to the outskirts of Basra. The principal combat formations of the XVIII Airborne Corps included the 101st Airborne Division (Air Assault), the 82<sup>nd</sup> Airborne Division, the 24<sup>th</sup> Infantry Division (Mechanized), the French 6th Light Armored Division, and the 3rd Armored Cavalry Regiment.

The VII Corps constituted the coalition main effort, and it therefore included a concentration of armored combat formations. Its task lay in enveloping and destroying the Iraqi forces, particularly Republican Guard formations, either in Kuwait or as they tried to escape. It also drove into the Iraqi desert before wheeling to the right to outflank Iraqi defense oriented toward the Saudi-Kuwaiti border. By war’s end advanced elements had reached Safwan, lying astride the main route from Kuwait to Basra. It possessed a concentration of armored combat power, including the 1st Armored Division, the 3<sup>rd</sup> Armored Division, the 1st Infantry Division (Mechanized), the 1st (UK) Armoured Division, the 1st Cavalry Division, and the 2<sup>nd</sup> Armored Cavalry Regiment.

On the coalition’s right flank Army, U.S. Marine Corps, and Arab assets attacked directly into Kuwait to fix the Iraqi defenders and prevent their escape. These forces made good progress and liberated Kuwait City. Principal elements included the I Marine Expeditionary Force with a brigade from the 2nd Armored Division attached, and the Arab Joint Force Command East with mechanized assets from Saudi Arabia, Kuwait, Bahrain, Morocco, and the United Arab Emirates. Joint Forces Command North included additional armored and mechanized formations from Egypt, Saudi Arabia, Kuwait, and Syria.

Ground combat operations proved fast paced and continuous, allowing the Iraqis little respite. Meeting engagements occurred frequently as the coalition troops advanced into and around defensive positions. The action of the 2nd Armored Cavalry Regiment at 73 Easting epitomized the type of sudden, sharp, and destructive actions that ensued when coalition forces contacted Iraqis. Similarly, when armored vehicles from the Iraqi Republican Guard Medina Division sought to block the advance of the 1st Armored Division's 2nd Brigade with reverse slope tactics, they were simply shot to pieces despite hazy and rainy conditions. The action highlighted the superior training and capabilities of American armor. In some instances, American commanders embraced night actions, rightly convinced that superior training and vehicle thermal sights would give them an edge. Nevertheless, night combat also introduced a degree of chaos, symbolized by the soldier characterization of the 1st Infantry Division (Mechanized) attack onto Objective Norfolk as "Fright Night." (185)

The rapid pace of operations strained vehicles, crews, and logistical support, but it also prevented an effective Iraqi response. Saddled with a sluggish command structure and postured against a coalition attack centered upon Kuwait, the enveloping efforts of the XVIII Airborne and VII Corps caught the Iraqis off guard, despite sometimes spirited defensive efforts. On February 28, a ceasefire went into effect. Sporadic combat continued as Iraqi forces sought to flee northward. Efforts to fight their way past coalition troops, however, generally ended in their destruction or capture. When the last resistance finally ceased, the Iraqi army had lost much of its combat power, particularly its armored and mechanized strength.



*U.S. armor arrives in Southwest Asia as part of the buildup of forces to defend Saudi Arabia and liberate Kuwait. (Defense Visual Information Center)*

The conclusion of DESERT STORM provided a treasure trove of data concerning the combat performance of tank crews, ammunition, and the Abrams tank. For years, the platform had been the subject of testing and analysis of its effectiveness at the National Training Center and training exercises. The Canadian Army Trophy also provided a venue for exploring the limits of crew and weapon performance in a competition environment. The Gulf War provided a much larger data set from an actual conflict against an enemy that shot back. Although the ground phase of combat operations spanned only a few days, armored units had conducted sustained maneuver and gunnery training in the desert during the weeks and months prior to the conflict. Moreover, not since the 1973

Arab-Israeli War had the Army been able to access such a mass of first hand data related to armored combat. It was an unprecedented opportunity to assess and learn — and the Army exploited this opportunity to study in detail every aspect of the war from predeployment training to post combat operations.

For the Armor community the effectiveness of the Abrams tank constituted a key focus, particularly with respect to its ability to hit accurately and destroy targets under varied conditions with service ammunition. How well the Abrams performed reflected directly upon training programs, doctrine, and materiel developments. Moreover, DESERT STORM tested the tank, crews, and combat organizations in a Middle Eastern rather than Central European environment.

In general the Abrams tank performed well. The M1A1 proved the most common model to see service in DESERT STORM, but several units still retained the M1 or M60A3 when they first arrived in Saudi Arabia. They upgraded to the M1A1 in theater, although crews and maintenance teams sometimes lacked familiarity with the newer tank. New Equipment Training Teams (NETT) provided assistance, often giving away their own technical manuals to crews receiving the M1A1 to offset a shortage of publications. The manuals became critical assets for units that received tanks taken from long term storage and in need of considerable maintenance to make them combat ready. (186)

Nevertheless, the M1A1 acquitted itself in combat with crew confidence in the tank justified. When ground operations began, tanks generally moved over 300 kilometers into combat. Nevertheless operational readiness rates remained over 90 percent, with some units reporting a 98 percent rate. Vehicles that did break down were repaired and returned to service. Dust and sand created headaches for crews struggling to keep their air filters clean, but most fire control systems remained fully operational throughout the period of combat operations. The 1st Armored Division ensured its weapons remained operable by conducting a “gas station” style maintenance service on its tanks focused upon the fire control system, turret, and hull. This process ensured early problem identification and correction. (187)

The American armor community had good reason to be proud of the combat debut of the Abrams tank. Indeed, a summation of its performance noted:

Training, focused on gunnery, paid off; concepts are sound; major fundamental changes are not needed. Proper boresight by the manual is still the basis for success. Crews shot well; they engaged and destroyed targets well beyond anticipated ranges. (188)

In Germany, USAREUR commander General Crosbie Saint noted “Even our German friends now have a better appreciation as to why we shoot late into the night and fly at low levels.” (189)

Tank gun accuracy proved effective out to 3,700 meters. Indeed, long range accuracy and the ability to engage hostile targets beyond the range at which effective return fire could be received exceeded performance expectations. Most units experienced long range engagements and reported kills at over 3,000 meters. Even in periods of low visibility, the M1A1 proved able to destroy enemy vehicles without being acquired through reliance upon the tank’s thermal sights. The few units that retained the M1, however, found the accuracy of the 105-mm main gun to drop significantly beyond 2,000 meters, though the problem was considered one of ammunition dispersion rather than a weapon or fire control system limitation. (190)

Long range engagements may have benefited from a lessons learned bulletin released by the Armor Center in January 1991. The bulletin shared the experiences of long range gunnery testing conducted in the desert environs of the NTC and Yuma Proving Grounds. At both locations, crews carefully prepared their vehicles, boresighted, and screened them. With no time pressure, good lots of ammunition, and without the clutter of a battlefield, crews made up of experienced gunnery



*An Iraqi tank burns in the desert—testimony to the precision and accuracy of coalition tank gunnery. (Defense Visual Information Center)*

instructors applied themselves to hitting targets repeatedly at ranges beyond 3,000 meters. The bulletin summarized the results, but also provided techniques to achieve long range accuracy and adjust fire. (191)

Achieving vehicle kills at extended ranges highlighted the accuracy of the M1A1, but many engagements occurred at shorter ranges. In the VII Corps, for example, the average engagement range proved to be 2,200 meters. Analysis of all American armored units similarly found that despite variation among individual organizations, 2,200 to 2,800 meters proved a more general average engagement range. Nevertheless, actual combat occurred at ranges that varied from 100 to 3,700 meters. (192)

The Iraqis found the result to be same at whatever range engaged, since “all Sabot (DU) ammunition (105-mm and 120-mm) penetrated all tank targets at 3000 meters or less to include the frontal 30 degree arc.” (193) Concerns about the armor protection of the Iraqi T72M1 proved unfounded. Both the 105-mm gun found on the M60A3 and the M1 and the M1A1’s 120-mm gun routinely achieved catastrophic hits. The depleted uranium sabot rounds dominated every hostile tank encountered, particularly the M829A1 APFSDS-T round. It made its combat debut during Operation DESERT STORM, where it received the moniker “The Silver Bullet.” Used against dug-in T72s, this round consistently punched through berms to strike vehicles and achieve a catastrophic kill. (194)

The effectiveness of American gunnery on the battlefield validated the calibration policy adopted in 1982. Tanks were not generally individually zeroed, but instead relied upon fleet zero settings assigned to each type of main gun ammunition. These computer correction factors were updated over time based upon firing data to further improve performance. Combat operations, particularly long range engagements, found the computer correction factors to be sound for each ammunition type. (195)

Crews proved less enthusiastic about air pressure and temperature information. This information was fed into the computer to provide a more accurate ballistic solution. It proved one of many factors whose influence upon accuracy increased with range, particularly beyond 3,000 meters. Yet lacking an onboard means of acquiring current air temperature and pressure readings, most gunners simply guessed, omitted, or applied the standard pressure reading, regardless of its relevance to their immediate location and atmospheric conditions. (196)

Reminiscent of the experience of American CAT teams, target sensing in combat proved somewhat problematic. The high velocity of sabot rounds made them difficult to sense, particularly beyond 3,000 meters. Crews unsure of a hit simply reengaged the target. Ironically, the older T55 tanks encountered on the battlefield posed a problem, since “the T-55 went catastrophic much less than did the T-72.” Postwar inspection of T55 wrecks showed many to have been hit multiple times, a clear indication of the uncertainty of crews as to whether they had hit and destroyed the tank or not. In general, however, the sabot rounds used proved effective. Crews noted that “Vehicles hit with SABOT either went high order [rapid, obvious destruction through explosions and fire] immediately or slowly caught fire. Smoke from the target was often the only indicator of a kill.” Vehicles hit with a HEAT round tended to catch fire immediately with the splash of the round visible under most visibility conditions. The easier sensing encouraged some crews to use HEAT when range permitted. Precisely the same considerations had led some CAT teams to favor routinely using HEAT in the competition. (197)

Combat operations ended the debate over MRS usage that had plagued American teams in preparation for CAT 1989 and 1991. By the time the war ended, the MRS was no longer the subject of curiosity and debate. Prior to the ground war, crews boresighted daily, but the onset of combat operations precluded this practice and forced reliance upon the MRS. (198) There were no other options to retaining boresight. As one postwar assessment noted:

The Muzzle Reference System (MRS) worked well to retain boresight. While units boresighted once or twice daily before initiation of the ground war, they did not boresight after crossing into Iraq and Kuwait due to time constraints. Instead, they relied only on MRS updates to keep their rounds hitting where they aimed. (199)

Boresighting constituted a unit priority before ground combat began. The high frequency helped crews identify problems otherwise overlooked, and it served to build confidence in the accuracy of the weapon system. Even after tanks had traveled great distances under combat conditions, significant boresight loss proved rare. As a result of the attention given to prewar boresighting and subsequent, exclusive reliance upon MRS updates, “the crews are now believers in the MRS.” (200)

Boresighting in the Saudi Arabian desert, however, posed different challenges than those faced by crews in Europe or the United States. When American units first deployed to Southwest Asia as part of Operation DESERT SHIELD, the Armor Center provided them with a small, simply written, booklet entitled *Tanking in the Desert*. This publication included tips and information to assist tankers in Saudi Arabia, including information about the weather, terrain, and the nature of the Iraqi threat. Safety tips and warnings related to the Iraqi potential to use chemical weapons complemented coverage of logistics concerns, communications, task organization, and desert maintenance. Crew reaction to the publication proved mixed, but the chapters related to gunnery proved valuable, particularly since the content could not be found in the latest field or technical manuals. (201)

*Tanking in the Desert* included tips for desert gunnery derived from testing of the Abrams tank in desert conditions. Formal evaluations had been conducted at White Sands Missile Range, Yuma Proving Grounds, the National Training Center, Fort Bliss, and Fort Hood. In addition, demonstrations of the tank had been conducted in Saudi Arabia, Egypt, and the United Arab Emirates. (202) The last nation hosted a month long event to showcase the desert capability of the M1A1 and Bradley Fighting Vehicle. Several vehicles were driven by UAE tankers over a 1,568 kilometer course. The tank's operational radius was tested by driving the tank cross country at the maximum speed the crew could endure. American crews demonstrated the tank's firepower by hitting targets at varied ranges out to 2,900 meters and firing accurately on the move at moving targets. Throughout the grueling demonstration, the tanks involved experienced no breakdowns or system failures — an impressive feat. (203)



*U.S. tank platoon during Operation DESERT STORM.  
(Defense Visual Information Center)*

Hence, by the time of Operations DESERT SHIELD and DESERT STORM a considerable body of data had been collected regarding the Abrams' performance in the desert with related user guidance to address special maintenance requirements to ensure operational readiness amid heat, dust, and sand. These tests and demonstrations also provided experience with refraction, or the bending of light rays in the desert, sometimes referred to as optical bend. Refraction impacted gunnery performance at ranges beyond 2,000 meters, with the greatest influence occurring during the daytime hours in the absence of wind or cloud cover. Heat shimmer often indicated the presence of refraction, which made targets appear lower than their actual elevation during the day and higher at night. (204)

Boresighting and zeroing did not eliminate refraction, but several techniques existed to minimize its effects. Since refraction proved less at dusk and dawn, crews were encouraged to boresight at these times. Moreover, basic information provided to tankers deployed to Saudi Arabia helped them to recognize the presence of refraction and adjust their aiming point accordingly to permit accurate firing beyond 2,000 meters. Tables provided detailed guidance on aim point adjustment based upon the time of day, cloud conditions, wind speed, and target range. Raising boresight targets ten feet off the ground also reduced refraction and heat shimmer. (205)

For crews left with no option but to boresight in the middle of the day when refraction effects were greatest, *Tanking in the Desert* provided an alternate boresight method using a 500 meter target. Abrams crews were advised that "If the situation arises that you must boresight during the middle of the day and refraction or space constraints prevent you from using a 1,200 meter target, the following procedures will give a 1,200 meter boresight using a 500 meter panel." (206) The shorter boresight range proved popular and effective with some crews painting boresight panel boxes on their tank skirts for quick use. (207)

The guidance and information provided to American tank units in Southwest Asia to ensure gunnery accuracy in the desert found validation when combat operations began. Indeed, many tankers already possessed desert experience beforehand, having completed at least one rotation at the NTC, located in the Mojave Desert. Nevertheless, the deployment of the M1 to Saudi Arabia occurred amid a storm of media criticism. In July 1990, *The Detroit News* ran an article entitled "Michigan-built Tank a Bad Deal for the Army, Report Says." The article attacked the tank's cost and overall quality, reliability, and performance with particular criticism aimed at its gas turbine engine. (208) *Defense News* followed up the same month with another article attacking the tank's high fuel consumption rate. In September, ABC's "World News Tonight" featured a story that questioned the

value of the M1, offering negative assessments of its weight, gas turbine engine, and fuel consumption. The Army and General Dynamics Land Systems countered these allegations with performance data, demonstrated capabilities, and an emphasis upon the tank's positive qualities. The press attacks continued. (209)

In October *Defense News* ran a story that attacked the choice of a gas turbine engine for the Abrams tank. This criticism added a new twist by citing a representative from Vickers Defence Systems, who extolled the efforts of his company to address fuel consumption concerns in the design of Challenger 2. *Armed Forces Journal International* also featured an article written by a Vickers spokesman highlighting the Challenger 2's engine efficiency in comparison with that of the Abrams tank. Throughout the 1980s Vickers played an active role in British tank design, and it had only recently delivered Challenger 2 prototypes to the British army for testing. Press attacks upon the Abrams tank and the publication of articles positively depicting British tank developments in the latter months of 1990 were probably not coincidental. The British government was scheduled to decide by December whether to establish a production line for a new, national tank design or upgrade its tank fleet via purchase of the Abrams tank. Given the United Kingdom's tendency to favor British-built vehicles when faced with similar choices in the past, Vickers' receipt of a government order to produce the Challenger 2 was unsurprising. (210)

In Saudi Arabia, American tankers were less concerned about bad press than preparing for combat. Despite the general success of boresighting, a few units struggled with the procedure. In these cases:

A lack of understanding of the tank fire control system contributed to the problem with crewmen incorrectly inputting data into the CCP [computer control panel]. Lack of confidence in their ability to boresight correctly caused crews to be reluctant to re-boresight their tanks once they had achieved a good boresight. (211)

Whatever time of the day conducted, boresight procedures mandated the use of a muzzle boresight device to provide greater precision than the rudimentary binoculars and string method once commonplace. By 1991 most Abrams crews were using the Lenzar M27A1 (or M26A1 for the M1). Since its fielding this device had incurred criticism, some of which stemmed from problems with early production models, inadequate manuals, and maintenance difficulties. Some deficiencies were addressed in the period 1988-1990, but Operation DESERT STORM still found tank units less than satisfied with the device. It had a reputation for unreliability that was not enhanced by the experience of 1-34 Armor. The unit received 58 devices when it received new M1A1 tanks, but 41 were out of tolerance and required adjustment. Within VII Corps overall, one of three such devices required additional calibration before use. (212)

More generally units found the muzzle boresight device too prone to being knocked out of calibration, necessitating its delivery to rear echelon maintenance for re-calibration. Upon completion and return to the unit, the device had still to be calibrated to a particular gun tube to ensure maximum boresight precision. Some units found the returned devices in worse shape than when submitted for maintenance. These crews would probably not have been reassured by the results of a user evaluation of muzzle boresight devices conducted in May 1991. Several devices were tested, including the M27A1, but none were found optimal. (213)

The Abrams tank proved a reliable and high performing platform in combat, but crews did experience challenges with some components. They found the tank's ability to acquire and destroy targets surpassed the range at which they could be clearly identified as friend or foe. Sight magnification proved insufficient at longer ranges, particularly beyond 2,000 meters. At ranges beyond 1,500 meters, targets appeared as hot spots in the thermals. Nevertheless, many gunners utilized their thermals extensively to see through dust, sand, and other obscuring factors, while some

platoons operated with one section reliant largely upon thermals and the other its daytime sights. (214)

Given the international mass of coalition vehicles maneuvering together, the ability to destroy targets beyond safe identification ranges increased the risk of fratricide. Indeed, some soldiers proved more afraid of shooting a friendly vehicle than they were the enemy. Consequently, some crews negated the M1A1's long range lethality by waiting until the range closed sufficiently to make positive identification possible before engaging. (215)

Rain, dust, and sand sometimes smeared the gunner's primary sight and interfered with the laser rangefinder's operation. Although the sight had some protection from small arms, it had no wiper to keep it clean. When it became too dirty, a crew member had to exit the vehicle to clear it. Doing so in battle sometimes resulted in soldiers inadvertently damaging the sight in their haste to complete their task and regain the protection of the tank's armor without being injured or killed. The laser rangefinder sometimes could not penetrate dust and sand to provide an accurate range reading, even when it was possible to see the target through the tank's sights. (216)

The Army Materiel Systems Analysis Agency (AMSAA) spearheaded a technical assessment of the M1 and M1A1 performance in Operation DESERT STORM. It sought to determine whether the probability of these tanks hitting their targets and that of destroying them if hit matched their actual combat performance. These probabilities were used in planning for future conflict. This study relied heavily upon the data collection efforts of the Army Materiel Command Weapons System Combat Performance Assessment Team, which surveyed a large number of M1A1 and M1 crewmen, tank commanders, platoon leaders, and company commanders. (217)



*An Abrams tank advances to contact in the First Gulf War—a conflict that vindicated the confidence of crews in this platform. (Defense Visual Information Center)*



The responses to the survey indicated that most tanks received hostile fire in the form of artillery, small arms, or mines. Iraqi forces proved limited in their ability to detect or acquire American tanks, leaving gunners plenty of time to lay their guns accurately on target. The study found that only about 10 percent of all engagements occurred versus the frontal arc of a hostile platform. This low number was “not surprising considering substantial evidence that the majority of Iraqi armored vehicles were unmanned when engaged.” Although most tankers who fought in the more highly visible engagements of the war would have disagreed that they shot empty tanks, the study also concluded that most crews did not achieve the popular standard of “one shot, one kill.” Instead the AMSAA analysis concluded: “It is clear that sizable numbers of tanks used more than one round per engagement. This differs from other reports which stated that only one main gun round was needed to kill each target.” (218)

Nor did AMSAA see evidence of large numbers of engagements conducted at ranges beyond 3,000 meters. Instead it found the median engagement range to be just 1,600 meters overall and 2,170 meters for sabot ammunition. AMSAA found that targets were in fact detected at longer ranges, but the inability to positively identify the target as hostile or determine conclusively its nature discouraged tankers from initiating engagements at the longer ranges, instead waiting until the distance closed. The study attributed the high hit probability reported by crews as the result of firing at the larger side profile of Iraqi vehicles rather than engaging tanks in hull down positions through their frontal arc. AMSAA concluded that the performance of the Abrams tank exceeded expectations due to the war’s short duration and favorable engagement conditions. It found no reason to alter existing probabilities of hit and target destruction since Southwest Asia “engagement and impact conditions are not considered representative of average combat.” (219)

The AMSAA study and a parallel analysis by the Ballistics Research Laboratory in some instances contradicted the views of the Armor Center and combat organizations that tracked their own performance. For soldiers and commanders rightfully proud of their wartime accomplishments, these studies seemed misinformed and out of touch with the ground war’s reality. Hence, “AMSAA accuracy estimates and BRL lethality estimates have no credibility with anyone in the field.” (220)

Combat operations did, however, result in a number of recommendations to improve gunnery training. In the aftermath of DESERT STORM, Tank Table VIII was considered insufficiently oriented toward the battlefield. It needed more engagements, fire control system failures, friendly targets, and a means to evaluate the use of abbreviated fire commands. Many master gunners desired crew qualification status to be indicated by green, amber, or red in lieu of a numerical score to encourage training for war rather than statistics. Crews also emphasized the importance of more challenging targets and no notice gunnery exercises. (221)

For all Tank Tables a desire existed for greater realism achieved through more degraded engagements, longer range targets, more realistic thermal engagements, and smaller targets. Similarly recommended improvements to Tank Table XII included target scenarios that challenged platoon command and control and tested the unit’s ability to react spontaneously to sudden developments. Advocates for change sought to make the platoon qualification a mix of tactical maneuver and collective gunnery skills. The war experience further suggested the need for more live fire exercises for platoon and larger organizations. (222)

Armor personnel received praise for their competency and effectiveness. Although lieutenants were considered to need more maintenance and gunnery training, “overall institutional instruction was very successful. Soldiers and leaders joining units upon the completion of courses were trained and ready to fight.” (223) Master gunners in particular played a critical role in pre-deployment training and preparations for combat once units arrived in theater. They helped unit commanders develop gunnery training programs and served as senior turret mechanics and troubleshooters. Their central role in preparing units for combat, participating in wartime operations, and in assisting the

postwar lessons learned process validated the resources and attention given to master gunner instruction. Their value proved hard to overstate. (224)

The combat operations in DESERT STORM bore little resemblance to the battle runs of the Canadian Army Trophy competition, but a linkage did exist. In general terms, the competition's emphasis upon maximizing gunnery performance and achieving rapid and precise results had direct application to the battlefield. The Armor Center conducted interviews of personnel from several armor and cavalry units, initially to determine how units intended to participate in CAT 1991 fared in battle. Later the project expanded to include the combat experience of a much broader range of USAREUR units. Among the results related to training and gunnery actions, the study found that "CAT training was effective. CAT crews acquired/identified quicker, engaged quicker, and sensed (and re-engaged) better (quicker)." This conclusion underscored the linkage between the NATO competition and combat conditions, and it highlighted the broader applicability of skills honed for the event to wartime readiness. CAT training did not win the First Gulf War, but the competition's influence upon materiel development, gunnery training and doctrine, and platoon action certainly were contributing factors. (225)

### Challenger's Vindication

In the wake of Iraq's invasion and occupation of Kuwait, the United Kingdom supported the United States in its efforts first to protect Saudi Arabia and then to liberate Kuwait. In August 1990, the British government decided to send the 7<sup>th</sup> Armoured Brigade to Saudi Arabia. The next month marked the formal, public announcement and the unit began its deployment. (226)

The 7<sup>th</sup> Armoured Brigade, however, was not designed for operations independent of its parent division. To enable its deployment, the brigade's logistical support had to be augmented and reorganized. It also needed additional personnel and vehicles to bring it up to full strength. This goal was achieved by transfers from other units. The 14<sup>th</sup>/20<sup>th</sup> King's Hussars, for example, lost all of its Challenger Mark 3 tanks, and its remaining vehicles were stripped of power packs, fire control computers, and other critical components to constitute a reserve stockage for the 7<sup>th</sup> Armoured Brigade. These actions left the King's Hussars with just one functional tank. (227)

Stripping armored units to support the Southwest Asia deployment reflected the resource constraints of the British army. However, it created significant complications when the British government later decided to expand its Saudi Arabian commitment to a full division. The 1<sup>st</sup> UK Armoured Division included the 7<sup>th</sup> Armoured Brigade augmented by a higher headquarters, artillery, aviation, engineers, combat support assets, and the 4<sup>th</sup> Armoured Brigade.



*The Challenger in the First Gulf War, a conflict that demonstrated the tank's combat capabilities and helped to overturn the stigma of CAT 1987. (Defense Visual Information Center)*

The decision to deploy a division increased the logistical complexities associated with Britain's Southwest Asia commitment. A total of 226 Challengers ultimately deployed, constituting nearly 50 percent of the tank fleet. 174 tanks equipped the two brigades with the remainder serving as a war reserve. It also posed a significant challenge to the 14<sup>th</sup>/20<sup>th</sup> King's Hussars, the armored component of the 4th Armoured Brigade, which had been stripped of vehicles and parts to support the earlier Saudi Arabian deployment. The unit now had to be returned to operational readiness. Parts began to flow into the King's Hussars home station straight from factories or from other nondeploying units. Soldiers organized into work parties overseen by Royal Electrical and Mechanical Engineers worked around the clock to make the tanks operational. The regiment then went to Bergen-Hohne to zero its weapons and conduct gunnery training. Crews worked to maximize the performance of their weapons and practiced troop battle runs and fire control in a manner not dissimilar to CAT training. (228)

The decision to deploy an armored division necessitated reliance upon the Challenger. This platform continued to suffer from its poor performance in CAT 1987, and it was the recipient of repeated attacks by the press and members of Parliament in 1988 and 1989. Mechanical reliability and the fire control system constituted key concerns, but the tank had become a political issue well. As Britain began to deploy combat assets abroad in the expectation of possible conflict, its government did not wish to be embarrassed by Challenger's combat debut. Hence Prime Minister Margaret Thatcher requested that the service chiefs, the Ministry of Defense procurement staff, and representatives from Vickers Defence Systems personally and in writing pledge that Challenger would perform to standard. (229)

Challenger's design focused upon operations in Europe. In preparation for its desert deployment, it required modifications. However, the British possessed considerable expertise in the use of tanks in desert environs through foreign tank sales to Middle Eastern nations. Hence a Challenger Improvement Kit was quickly developed and shipped to Saudi Arabia. It included modifications to the power pack, air cleaner, thermal sight, gun control equipment, and new maintenance free batteries. At the Saudi port of Al Jubail, the point of debarkation for the British tanks, dockside workshops were prepared. When the tanks arrived, they were offloaded from their transport ships and driven to the workshops. Each vehicle had its automotive and turret systems inspected and repaired as needed before the modification kit was installed. This work was accomplished in a production line setup in which REME personnel, Vickers Defence System civilians, and tank crews worked together. Upon completion the tanks moved inland to training areas. (230)

Other modifications addressed the Challenger's firepower and survivability. Initial plans for the employment of British armor anticipated its use to break through the fortified Kuwait-Saudi border and fight in the streets of Kuwait City. In preparation for urban combat, the Challengers received additional Chobham armor for the sides and explosive reactive armor for the lower front hull. The armor was delivered to the unit's location with instructions and tools for self-installation by crews in the field under REME oversight. The increased armor boosted the tank's overall weight by over three tons without any significant change in mobility. Indeed most crews believed the additional side armor reduced the amount of dust thrown up into the engine's air intake. Armored charge bins were also installed on those Challengers that were not the Mark 3 configuration. The new bins provided further protection for the propellant charges that were separately loaded. However, these bins proved difficult to install under field conditions, necessitating the removal of the commander's cupola. Insufficient time prevented all intended tanks from receiving them. (231)

Like the Americans, the British tanks received a new depleted uranium sabot round prior to the start of ground combat operations. It was provided to cope with the T72M1, and each Challenger received several rounds. The effectiveness of this round, however, remained unproven in combat. The British encountered no T72s, and officially none of the improved rounds were used in combat. Unofficially, one crew fired two of the rounds through a berm to destroy a T55. (232)

Other principal alterations included smoke generators and external fuel drums. The smoke generators were intended for mounting on a number of tanks to permit them to lay their own smokescreen. An early experimental version of this system sprayed diesel fuel into the tank's exhaust. It created a massive pillar of smoke visible for great distances, causing one nearby British unit to wonder why a Chieftain unit had arrived in the desert. This particular method of smoke generation was dropped. (233) To ensure sufficient fuel capacity:

External fuel tanks served to boost the Challenger's range in the desert. Therefore each tank had two 40-gallon drums mounted on the rear of the tank. This addition, however, created a problem for American crews, who often used the presence or absence of external fuel tanks at the rear of a tank as a means of distinguishing friendly from enemy tanks. (234)

The British utilized the weeks and months prior to the start of ground combat operations to train. However, shortages on replacement engines and other critical assemblies forced commanders to curtail training lest the consumption of spare parts impair combat operations. Between December 1990 and January 1991, for example, the 7th Armoured Brigade restricted its tanks to a daily mileage allowance of just 15 kilometers. From the perspective of the 1st Armoured Division command, this restraint permitted the 4th Armoured Brigade to conduct more intensive training, since this unit arrived later in theater. Nevertheless from the time of their arrival in Saudi Arabia until the ground campaign began, the tanks of 7th Armoured Brigade averaged 1,000 kilometers in training against the 850 kilometers of the 4th Armoured Brigade tanks. (235)



*Another view of the Challenger during the First Gulf War.  
(Defense Visual Information Center)*

Engine failures posed a more serious problem. The rate at which these failures occurred significantly exceeded the rates associated with usage in Europe. Commanders were forced to dip into their war stocks of engines and related assemblies to keep their tanks running. Since engine burnout occurred much faster than they could be repaired or replaced, the British established an engine repair facility in Saudi Arabia. This shop proved successful and helped to ensure sufficient engines and assemblies on hand to sustain combat operations when they began. (236)

The 1st UK Armoured Division constituted part of the American VII Corps when the ground campaign began. On February 24 it began its advance, conducting a forward passage of lines through

American forces the following day. It then drove northward, conducting a series of deliberate and hasty attacks into bunker complexes, while repulsing sporadic Iraqi counterattacks. The fast pace of operations and the destruction of Iraqi defenders in the British sector resulted in objectives being reached ahead of schedule. On February 27, the British turned right, moving into Kuwait. By war's end they lay astride the main road connecting Kuwait and the Iraqi city of Basra. (237)

When the ceasefire went into effect, the 1st UK Armoured Division had advanced 290 kilometers in 90 hours. It had destroyed three Iraqi divisions in the process, capturing 8,000 prisoners and large quantities of materiel. The division's Challengers destroyed over 300 Iraqi tanks and many other armored vehicles without loss to enemy fire or mines. These results proved a testimony to Challenger's performance, which exceeded expectations. Moreover, nearly 96 percent of all Challengers remained fully functional at war's end, while operational readiness rates were maintained at 95 percent overall throughout the period of combat operations. These results paralleled those of Abrams, although Challengers used only about one third the fuel consumed by the American tanks. (238)

British tank gunnery received considerable attention, partly due to lingering doubts about the Challenger's accuracy in the wake of CAT 1987. Such doubts were laid to rest. In the hands of well-trained crews, the platform proved highly accurate. Before combat operations began, crews routinely managed to place rounds within an 18-inch shot group at 1,200 meters. An assessment of British tank engagements found that 54 percent occurred against Iraqi tanks, 22 percent against other armored vehicles, and the rest against an array of personnel and soft targets. Further testimony to Challenger's accuracy occurred when a crew destroyed a T55 at 4,700 meters. Crews tended not to shoot while moving, instead relying upon the short halt technique that dated back to the days of the Centurion. (239)

Challenger never did encounter the T72s of the Republican Guard formations, preventing conclusions about the effectiveness of the new sabot round. HESH rounds, however, proved popular and highly effective. Their singular usage by the British reflected their restriction to a rifled gun. (240) Crews found hit sensing when firing HESH against lightly armored vehicles simple — “namely, total disintegration of the target.” (241) They also found TOGS one of the most effective thermal systems on the battlefield, capable of use day or night. Indeed, the system enabled crews to see “anything generating heat — from strings of camels to fornicating rabbits.” (242) The thermal system, however, outperformed the tank's laser rangefinder. Crews found themselves able to see targets in TOGS but unable to obtain a range to the target with the laser system. (243)

The biggest complaint surrounding Challenger's combat debut focused upon its poor ergonomic layout. The resultant discomfort increased crew fatigue, which became aggravated when forced to remain in a closed hatch configuration for long periods — precisely the conditions found in combat due to the threat of Iraqi chemical weapons. (244)

Still, Challenger's performance validated the British tank design emphasis upon survivability and firepower. The war accentuated Challenger's strengths and silenced much of the prewar criticism that stemmed from its poor showing in CAT 1987. In the words of the 7th Armoured Brigade commander, “I have always said that Challenger is a tank built for war and not competitions.” (245) Based upon the path of destruction carved through Iraqi forces by the 1st UK Armoured Division, he seemed to have a point.

## **Endgame**

The end of the first Gulf War, the cessation of the Cold War, and the dissolution of the Soviet Union marked the start of a new era in which superpower rivalry ceased to dominate world developments. NATO military prowess lay at its peak, but the absence of a major military threat to Central Europe triggered an avalanche of military spending reductions and downsizing among the member states. The new global landscape directly impacted the Canadian Army Trophy.

The Cold War's end and German reunification eliminated the need for a Canadian military presence in Germany. Hence, when the Canadian government presented its 1990 budget, it also announced the intended closure of its bases in Germany and the redeployment of its forces back to Canada. The 4th Canadian Mechanized Brigade Group proved the last of Canadian Forces to leave Germany in August 1993. Its home station at Canadian Forces Base Lahr decommissioned and closed the following year. These developments, coupled with the deployment of a squadron from the brigade to Yugoslavia, ended plans for CAT 1993. When the last Canadian troops left Germany they took the trophy with them. It gained a new home at the Canadian Armour School in Gagetown, New Brunswick. (246)

The departure of the sterling silver Centurion replica marked the end of nearly 30 years of a competition focused upon tank gunnery. Since the first event in 1963 the competition had evolved from a collection of individual tanks shooting at stationary targets on a range into hotly contested day and night platoon battle runs. In the process the visibility and importance of the competition grew. By the 1980s, CAT no longer constituted a low key event of little interest to anyone but the competitors. It had assumed international visibility and became a showcase for new platforms and gunnery expertise.

In the early years the competition proved a boon for British tank designs. The attention received promoted foreign sales vital to sustaining the nation's tank production. Over time, however, the competition became a potential threat with a poor CAT showing eroding confidence in British tank designs. The criticism heaped upon Challenger in the wake of CAT 1987 underscored this danger. It took war in the Persian Gulf to reverse the public perception of this tank. However, the high negative visibility that surrounded the British performance in 1987 also spurred efforts to build a better tank that finally emerged as Challenger 2.

CAT posed a different challenge for the Germans and Dutch. Both nations relied upon a conscript army. Preparation of a competition team necessitated both training new soldiers basic crew station duties and honing skills to a high level in a limited time. Neither nation possessed the luxury of simply hand picking the best tankers and placing them on a team, although this notion of a gladiator team remained a popular misconception. Both nations did, however, rely upon experienced officers and NCOs to oversee CAT training. For the Germans, the NATO competition allowed them to showcase the lethality capabilities of their Leopard 1 and Leopard 2 tanks. These platforms proved highly successful designs, exemplified by their widespread usage by other nations, including the Dutch and Canadians — also CAT participants.



*The last Canadian Army Trophy coin issued during CAT 1991. (Ron Mihalko)*

Canada initiated CAT, but over the years it struggled to remain competitive. The nation lacked the military resources to equip its forces with the most advanced equipment and training devices. Hence by 1991, the Canadians — together with the Belgians — remained the last of the competing nations to rely upon the Leopard 1, which by the 1980s had been outclassed by the Challenger, Leopard 2, and Abrams tanks. Nevertheless, the Canadians focused upon training and gunnery fundamentals, overcoming a technological handicap through skill and teamwork. Hence, the Canadian CAT teams remained competitive through the last competition, often beating better equipped teams even if they did not place first. Their performance — and that of the Belgians — proved a testimonial to the importance of crew development and teamwork.

The attitude of the United States toward CAT changed radically from passive indifference to aggressive, active engagement. This shift in attitude paralleled major improvements in armor training and readiness occurring in the 1980s. Tank gunnery in particular received much greater attention, spurred by the fielding of the M1, the influence of an expanding master gunner community, and higher training standards. Analysis of crew and platform performance at CAT served to further immerse the Armor community in all aspects of tank gunnery with much greater emphasis upon the related science. CAT provided an opportunity to test the boundaries of crew, tank, and unit performance and identify techniques applicable across the armored force. The discussions regarding boresight, zeroing, and MRS usage exemplified this relationship. By the end of the 1980s CAT attracted the attention of the Army chief of staff, and in preparation for the event significant resources and expertise were applied. The importance of the competition had transcended the simple public relations value of winning.

The Canadian Army Trophy also promoted the development and use of a variety of tank training aids. These items included sub-caliber devices, through the sight video, and computer simulators. The sophistication and reliability of these training aids steadily increased, but computer simulators constituted a major breakthrough in training technology. They provided a means of building and sustaining gunnery skills in varied environments at far less cost than live training. They helped to resolve problems associated with training area access and cost restraints. For the United States the UCOFT and later the PGT provided an invaluable means of training and sustaining gunnery skills. The application of SIMNET to gunnery training, encouraged by the CAT 1987 experience, complemented UCOFT and PGT by providing the means to develop unit rather than crew fire discipline and control. Similar virtual capabilities also became central to armor training among the other competing nations.

The goals of the Canadian Army Trophy lay in improving tank gunnery in the Central Region and promoting camaraderie among the participating teams. The competition accomplished both objectives. Between 1963 and 1991 the nature of the event reflected increased challenges and realism. Platoon battle runs, moving and stationary engagements against a mix of targets at varied ranges, complex target arrays, closed hatch engagements, night firing, and sensing difficulties marked the changing nature of CAT. It retained an emphasis upon rapid, accurate firing considered critical in combat and demonstrated during the first Gulf War. However, CAT encouraged interaction among the participating teams on multiple levels. The pre-competition negotiations constituted an exercise in diplomacy, while the CAT teams shared range time and training. These actions increased familiarization with the tanks, training methods, and doctrine among the NATO members, while corresponding social engagements established more personal bonds among soldiers — possibly the most important benefit for alliance members dependent upon one another in the event of war.

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# Epilogue

## The Canadian Army Trophy Legacy

The Canadian Army Trophy competition ended after 1991, but it remained an inspiration for similar events in the years that followed. In the late 1990s Canada and the United States implemented the Canadian-American Cup. Loosely modeled on CAT, it ran from 1997 until 2003 and the onset of Operation IRAQI FREEDOM. In 2012 the U.S. Army organized and executed a new competition, the Sullivan Cup, focused upon tank crew skills. The same year witnessed a revised Worthington Challenge by the Canadians. Overseas, the resurgence of Russian military power and the corresponding increased threat to European security triggered the emergence of the Nordic Tank Challenge in 2013 and the Strong Europe Tank Challenge in 2016. Not to be outdone, Russia implemented its own tank competition, the Tank Biathlon, in 2013. All of these events incorporated tank gunnery and promoted interaction among the participants.

### The Canadian-American Cup 1997-2003

In 1997 Canadian Forces initiated a new tank gunnery competition, the Canadian-American Cup. Like the Canadian Army Trophy from which it derived, this new competition encouraged rapid and accurate tank gunnery at the platoon level. It proved smaller in scope with participation limited to the American 116<sup>th</sup> Cavalry Brigade and the Canadian Lord Strathcona's Horse (Royal Canadians). The Canadian unit had participated regularly in the Canadian Army Trophy when stationed in Germany during the years 1966-1970. The American unit constituted part of the Idaho Army National Guard. Once again, a goal of this competition lay in promoting interaction and interoperability between the two nations through a unique and challenging training event.

The Strathconas were a regular armored regiment with a lineage and battle honors dating back to the Boer War. The 116<sup>th</sup> Cavalry Brigade traced its lineage to 1920, when its first elements were formed in Idaho's Snake River valley. The unit's headquarters lay at Gowen Field outside Boise, Idaho. The installation featured a multi-purpose range complex constructed in 1992. Its fully computerized ranges included a large mix of fixed and portable pop-up targets in addition to moving targets representing tanks and infantry. It constituted a state of the art range with open, rolling terrain suited to tank gunnery. A range control tower relied upon thermal imaging, radar, and high powered cameras to collect data on each engagement. (1)

Gowen Field's development as a ground maneuver and tank gunnery site reflected a host of actions in the aftermath of Operation DESERT STORM to increase readiness among Army National Guard tank units. Gunnery received particular attention. The Canadian-American Cup reinforced these efforts and provided a familiarization opportunity for the participating American and Canadian units. The high number of overseas deployments undertaken by the Army National Guard and Canadian Forces in support of humanitarian and peacekeeping operations underscored the importance of this interaction.

The first Canadian-American Cup competition occurred in 1997 on Gowen Field. The Strathconas were equipped with the Leopard 1, an aging platform that had struggled to remain competitive in the final years of the Canadian Army Trophy. The 116<sup>th</sup> Cavalry Brigade was equipped with the more modern M1A1. In order to make the new competition more challenging and offset the imbalance in platform capabilities, the Canadian and U.S. teams first trained on each

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other's tanks before participating in a field training exercise, culminating in an open range live fire event. (2)

These activities occurred between August 30 and September 1997. An American platoon from the 116<sup>th</sup> Cavalry Brigade deployed to Edmonton, Canada, for Leopard 1 conversion training on August 24-30 that ended with day and night firing. Upon completion the American crews were considered certified to operate the Canadian Leopard 1. On August 29, a Canadian platoon similarly departed for Gowen Field, where it began a nine-day course normally provided to ARNG M1A1 crewmen. This instruction included a mix of live and virtual training before qualification on Tank Table VIII. Simultaneously, a Canadian maintenance team completed training with the American M88 Armored Recovery Vehicle. (3)

On September 13-14 the U.S. crews employed the Canadian Leopards in exercises focused upon offensive operations and the execution of a hasty breach. The event provided an opportunity for the American and Canadian teams to share ideas on how their respective armies executed this type of missions. A maintenance day and simulator training ensued in preparation for the actual Canadian-American Cup competition, which began on September 16. (4)

Throughout the preparation phase, the Leopard 1 proved capable, but its age became evident in the form of several maintenance issues. Two of the four tanks intended for the competition suffered from fire control system problems. The need to replace several cables and components led Canadian soldiers to crawl "into the now scrapped M60s at Gowen Field to cannibalize parts (with US concurrence of course!)." Despite such efforts, two Leopards suffered from inoperable stabilization systems while the laser rangefinder of a third tank did not function. (5)

On the first day of the competition both teams used their own national tanks. The formation for the event derived from Tank Table XII platoon gunnery qualification. Both teams conducted day and night battle runs that entailed movement to firing positions and engaging a mix of moving and stationary targets at varied ranges. The engagements were assumed to occur in a nuclear, biological, and chemical (NBC) environment, necessitating protective measures by the crews. Both teams shot well, with the Canadians gaining a small lead in the daytime engagements offset by more accurate shooting by the Americans at night, assisted by the Abrams' thermal imaging system. (6)

The second day included similar day and night firing, but the crews exchanged tanks. In the daytime engagements, the Canadians mounted on the M1A1 outshot their American counterparts to gain a small lead. During the night engagements, the Canadians hit 14 of 16 targets to ensure victory in the competition. The Americans mounted on the Leopards struggled to identify and hit targets without thermal sights, a task complicated by a sudden storm that eliminated all ambient light. Nevertheless, they managed to hit more targets at night with the Leopard 1 than the Canadian crews had done. This worthy American performance proved insufficient to win the competition. When the Strathconas returned to Canada to continue their annual training, they took the Cup with them. (7)

The competition and its vehicle exchange provided an excellent opportunity for the two teams to gain insights into how each one functioned and the related materiel and doctrinal influences. For the Strathconas, the trip to Idaho allowed them to practice gunnery on a state-of-the-art range. The competition provided a unique training opportunity welcomed by the participants and supported by their respective chains of command.

The next Canadian-American Cup competition occurred in 1999. It followed the pattern of 1997, with both teams first receiving training on their competitor's tanks. The Canadian team traveled to Gowen Field to become qualified as M1A1 tankers, while the American crews similarly trained on the Leopard 1. The competition was held in Canada, but its platoon orientation with day and night engagements remained the same. Similarly, each team conducted competition battle runs with the Leopard and Abrams. In 1999, the Strathconas may have possessed the home field advantage, but when the dust settled, they no longer possessed the Cup, which found a new home in Idaho. (8)

In 2000 the competition returned to Gowen Field. The Strathconas traveled to Idaho where they conducted squadron gunnery in September that included round-the-clock live fire rotations. Upon conclusion, the results determined the competition team makeup. The gunnery training culminated with the Canadian-American Cup. The Strathconas won, but the event proved very close. They returned north with the Cup, fond memories of frozen Jimmy Dean lunches, and the knowledge that one of their soldiers possessed a special skill — the destruction of rental van tires. (9)

The competition also marked the debut of an upgraded Leopard 1. In 2000 the Canadian government modified its tank fleet through increased armor and NBC protection in addition to an automatic fire suppression system. Maple leaf tanks also received the Leopard 1A5 turret purchased from Germany that included an improved fire control system and thermal sight. These changes resulted in the Leopard 1 C2. (10) Its enhanced capabilities made it a better match for the M1A1 in a competition setting. Therefore the vehicle exchange training programs ended. Starting in the 2000 competition American and Canadian crews trained and competed only with their national platforms. The Strathconas used the time previously allocated for Abrams qualification to familiarize crews with the Leopard 1 C2. (11)

The 2002 Canadian-American Cup occurred on Canadian Forces Base Suffield. The actual competition followed a period of integrated gunnery training between the 116<sup>th</sup> Cavalry Brigade and the Strathconas. The nature of the event still centered upon a platoon battle run that included fire and movement, degraded sight engagements, and the use of both main gun and coaxial machine gun. Each team received an opportunity to conduct a live practice run over the five kilometer course before the competition. The elimination of the night engagements constituted a significant change. The Leopard C2 possessed a more modern thermal imaging system than that of the American M1A1s. Therefore the U.S. commander was given a demonstration of the Canadian thermals and permitted to decide whether or not to include night firing in the competition. He opted to omit the night shoot, but the American team still lost by a clear margin. (12)

In 2003 the Strathconas and 116<sup>th</sup> Cavalry Brigade again conducted internal competitions to determine which crews would participate in the year's Canadian-American Cup. In their crew identification, the Canadians utilized a mix of plywood targets and old combat vehicles. The latter helped to boost crew confidence in their ability to score a hit, since the shower of sparks and visible indicators simplified target sensing. For the American crews, preparation and participation in the competition necessitated an additional two-week training period for the part-time soldiers. (13)

Following crew selection, the Strathconas traveled to Gowen Field. They experienced for the first time difficulty crossing the border into the United States. Heightened security in the wake of the September 11, 2001 terrorist attack upon the U.S. made American customs officials immediately suspicious of a bus load of Canadian tankers carrying machine guns intended to be mounted on their tanks. After a 14-hour delay and U.S. State Department intervention, the Strathconas finally made it over the border. When they arrived at Gowen Field, they spent three days becoming familiar with the competition range during day and night conditions. (14) The American team conducted similar training, but they experienced fewer maintenance headaches. The Canadian Leopards, despite their upgrade, were not new tanks, and the basic design dated back to the 1960s. Fire control system issues surfaced on the eve of the competition. According to the team's platoon leader:

A lot of us have to aim half a target to a full target below the actual target in order to hit it. Otherwise the rounds go high, and we don't have the time or the resources to fix that before tomorrow morning when the competition kicks off. (15)

A Canadian film crew accompanying the Strathconas to make a documentary captured the maintenance issues and pre-competition training on tape. It also showcased capable American and Canadian tankers proud of their equipment and their respective armor branches. The pride

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contributed to a degree of healthy rivalry, noted by a Canadian warrant officer. Referring to the Strathcona tankers, he noted, “these guys enjoy knowing that they’re using an old piece of equipment and taking on the M1, which is a new piece of equipment and up to date, and kicking their ass.” Clearly, timing was a relative factor. By 2003 the Abrams tank was a 20-year-old platform with the Leopard 1 pushing 40 years. (16)

The actual competition spanned November 6-7. Each team conducted both a day and nighttime battle run. Performance was tracked electronically in the range tower and by master gunners physically confirming each target hit — a task simplified by the different ammunition fired by the American 120-mm and the Canadian 105-mm main guns. As in prior competitions, each team possessed limited ammunition with which to conduct the day and night runs. During the daytime battle runs, the Strathconas secured a lead, but the 116th Cavalry Brigade team outperformed them at night, despite the newer thermal sights of the upgraded Leopards. When the shooting stopped, the Americans had won their second Canadian-American Cup competition. (17)

The 2003 event, however, marked the end of this particular gunnery contest. Earlier in the year American combat forces invaded Iraq, fought their way to and into Baghdad, and overthrew the regime of Saddam Hussein. For much of the next decade the U.S. Army remained in Iraq, conducting a mix of combat, stability, and counterinsurgency actions as part of Operation IRAQI FREEDOM. The Iraq war paralleled a second conflict underway since late 2001 in Afghanistan. The continuous cycle of training, deployment, and reset that characterized the experience of many active and reserve component units effectively ended the Canadian-American Cup. In 2004 the 116<sup>th</sup> Cavalry Brigade deployed to Iraq. The armored squadrons of Lord Strathcona’s Horse similarly began deployments to Afghanistan in 2006, finally converting to much newer Leopard 2 tanks. (18)

## **Sullivan Cup**

In 2011 the last American combat brigades departed Iraq. The remaining advisory and support assets left by year’s end. America’s war in Iraq was over. For the Army, the departure coincided with major changes in training and doctrine designed to prepare for future conflicts that would not be limited to stability and counterinsurgency. Combined arms skills necessary for combat operations against foes possessing a full arsenal of modern capabilities, including armored forces, began to receive renewed attention. This shift in emphasis directly affected the Armor Branch, which underwent a major institutional upheaval in 2011 when the Armor School relocated to Fort Benning, Georgia, where it joined the Infantry School as part of the newly established Maneuver Center of Excellence.

In 2012 the Armor School announced the start of the Sullivan Cup. This biennial competition focused upon critical skills required of tank crewmen. In addition to tank gunnery, it also included small arms marksmanship, physical fitness, and maintenance. The event further encouraged competitiveness across the force and highlighted Armor’s presence on Fort Benning, the traditional home of Infantry. The competition was named in honor of retired General Gordon R. Sullivan, an Armor officer who rose from second lieutenant to Army Chief of Staff over a 36-year career, and who helped shape the Army’s transition into the post-Cold War era. (19)

The first Sullivan Cup competition occurred on Fort Benning during May 7-10, 2012. It featured 15 tank crews from the 1st Cavalry Division, 1st Armored Division, 2nd Infantry Division, 3rd Infantry Division, 4th Infantry Division, the 11th Armored Cavalry Regiment from the NTC, the Washington Army National Guard, and the Armor School’s 316<sup>th</sup> Cavalry and 194th Armor Brigades. When participants arrived, they received a welcome from the Armor School commandant and a rules briefing. The multi-day competition opened with an early morning standard Army physical fitness test. A maintenance test followed in which each crew was timed on how fast they could replace a section of tank track. From there, each team member was evaluated on how well they performed a select Gunnery Skills Test task. The gunner, for example, was required to load, unload, disassemble,



assemble, and perform a function check on the coaxial machine gun. The next event tested the ability of crews to identify vehicles and aircraft presented as daylight or thermal images. (20)

On the second day in the Harmony Church Simulations Center, loaders and drivers demonstrated driving ability and dismounted skills associated with checkpoint operations, building clearance, and defense of a forward operating base. At the same time team commanders and gunners conducted tank gunnery engagements randomly selected from Tank Table VI. Afterward each entire crew performed a simulated battle run, moving along a predesignated route, engaging hostile targets while seeking to avoid shooting friendly personnel also represented. (21)

As they entered the third day, crews had to evacuate their tanks and utilize their small arms to engage pop-up targets. Upon completion, they collected a stretcher with a representative casualty and raced it to a designated medical evacuation landing zone. The same day presented each crew with a mystery event unknown to them before the competition. The event chosen focused on the loader's use of the coaxial machine gun against troop and truck targets at ranges out to 800 meters. The day ended with a night live fire in which crews conducted both an offensive and a defensive engagement. (22)

The final day addressed precision live fire. Each crew fired three engagements against a mix of tank and troop-type targets at ranges out to a maximum of 2,000 meters. The final engagement necessitated firing on the move. Upon the conclusion of this event the judges determined the overall scores and standing of each crew. In the case of a tie, a sudden death shootout occurred in which crews fired one scored engagement after another until the tie was broken. (23)

When the event finished, the members of the top three crews received individual awards. In 2012 a crew from the 2<sup>nd</sup> Brigade Combat Team, 1st Armored Division won. Each crew member received an engraved M1911 .45 caliber pistol and induction into the Order of Saint George. The parent unit also received the Sullivan Cup Trophy, which it retained until the next competition. (24)

The first iteration of the Sullivan Cup proved popular. It garnered favorable publicity for the branch, which in the aftermath of the Iraq war, helped to highlight the complex skill set required of tankers — skills that could not be mastered on short notice. It also served to underscore the importance of crew development in training. Many tank units had found their primary capabilities underutilized in counterinsurgency operations, and the competition helped to revitalize training in fundamental skills.

In 2014 the Armor School again hosted the Sullivan Cup at Fort Benning. A total of 17 crews, including one U.S. Marine Corps, three Army National Guard, and two Canadian, competed. The competition events remained focused upon crew skills, particularly physical fitness, problem solving, and gunnery skills. It was also opened to the Marine Corps and international partners. It remained a voluntary event, but training prerequisites were established that included Conduct of Fire Trainer exercises, passage of the Gunnery Skills Test, and basic gunnery table qualification. In addition to American teams, interest was also manifest by Canada, Australia, Germany, and the United Kingdom. (25)

The competition events began on May 13. On the first day each crew conducted a main gun ammunition transfer, evacuated a wounded crewman from a tank, undertook vehicle identification, completed coaxial machine gun maintenance, and performed track replacement. The second day opened with some crews in the simulation center, developing tactical plans and implementing them. Other teams conducted boresight, live fire accuracy screening tests, and precision gunnery on the range. On day three those teams that conducted simulator training now moved to the range, while crews that had completed those events entered the simulation center. A mystery event required crews to conduct .9 mile run, carry a stretcher, traverse a wall obstacle, and high crawl before demonstrating their small arms skills. For all crews daytime precision gunnery marked the

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culminating event. In 2014 this live fire included degraded system engagement, use of multiple weapons, and extended range gunnery. When the event scores were tallied, the team from the 2<sup>nd</sup> Battalion, 69<sup>th</sup> Armor Regiment (2-69 Armor), placed first, taking the Sullivan Cup. (26)

The 2016 Sullivan Cup featured 16 teams, including one from the Marine Corps, two from the National Guard, and two from Canada. Participating tanks included the M1A2, the M1A1, and the Leopard 2A4. The crews were divided into two groups to permit simultaneous execution of different tasks by each one. In this manner, the competition flow was sustained without long periods of down time while teams awaited range or facility access. (27)

In preparation for the event, the U.S. Army Armor School focused upon basic crew skills necessary for operations on a complex battlefield, and it conducted a careful review of the 2014 competition. Consequently, the structure of the 2016 event differed from preceding years. In order to permit crews to become acclimated to their vehicles and conditions at Fort Benning, crews had five days before the competition to exercise and prepare their tanks, including the execution of boresighting and accuracy screening tests with support from the Abrams Master Gunner School. A deliberate effort was made to select event evaluators from across the Maneuver Center of Excellence and certify them to ensure their expertise matched the event they would be charged with overseeing. (28)

The multi-day competition included a variety of mounted and dismounted crew tasks. Physical fitness was assessed through a one mile run, a tow cable crawl, a road wheel roll, the track block shuffle, and lifting ammunition. These actions reflected the influence of the 1970s Armor Crewman Physical Proficiency Test, updated for current equipment. A situational training exercise lane required each crew to navigate through a series of waypoints without using digital aids. In the process, soldiers had to complete several tasks, including the preparation of the vehicle for combat, tank maintenance, vehicle identification, and combat casualty care. (29)

The live fire portion marked a deliberate effort to confront crews with challenging gunnery tasks, derived in part from feedback and assessments received from the combat training centers. Crews conducted multiple target engagements that necessitated using all of the tank weapons. They were assessed on accuracy and speed of engagement. Each one fired four daytime engagements and three at night before returning to fire another three day engagements. Each engagement required crews to fire at between two and four targets while changing weapons and ammunition. During the first daytime event each tank crew had also to request indirect fire without relying upon digital assistance, while the night engagement necessitated a call for illumination followed by shooting at two unheated vehicle targets. In all cases, crews had to demonstrate their mastery of degraded mode gunnery. Tanks did not carry a full ammunition load, increasing the importance of accurate shooting. Machine gun rounds had to be fired with their tracers removed to reduce the risk of igniting range fires, thereby making sensing more difficult. Live fire scoring relied upon both digital systems and visual confirmation by master gunners. (30)

When the live firing portion concluded, the score for each team was tabulated. Crews could earn a maximum of 2,000 points, including 400 for the physical fitness phase, 600 for the situational training exercise lane, and 1,000 for live fire. The top scoring four crews then advanced to a final shoot off in which they each conducted three live fire engagements against 22 targets, representing a mix of combat vehicles, personnel, and a helicopter. The commander's independent thermal viewer was expected to give M1A2 crews an advantage, since it enabled tank commanders to acquire new targets while the gunner fired at an already identified one. In actuality it was used to sense main gun rounds in the same manner as Leopard 2 commanders had once done during the Canadian Army Trophy. (31)

The top crew in 2016 proved to be from the 1<sup>st</sup> Battalion, 252<sup>nd</sup> Armor Regiment, from the North Carolina National Guard. The unit hit more targets during the final live fire gunnery than any

competitor. It marked the first time a Guard unit had won the Sullivan Cup, and it underscored the generally high state of readiness found among National Guard organizations in the wake of repeated deployments during the war in Iraq and ongoing operations in Afghanistan. (32)

### **Worthington Challenge**

Canada's sponsorship of armored competitions predated the Canadian Army Trophy. In 1954 the Canadian army began the Worthington Trophy, named for Major General Frederick Franklin Worthington, considered the father of the Canadian armored force for his central role in its establishment and development. The competition named in his honor changed over the years. At one point it focused upon reserve component reconnaissance units with the winner receiving the opportunity to train with a regular army organization. (33)

After 1996 the competition was not held again until 2012, when it was fundamentally restructured and renamed the Worthington Challenge. The three-day event focused upon Leopard 1 gunnery. It included a vehicle preparation day, boresighting and zeroing, and team battle runs that included stationary and moving engagements. The event's rules and nature derived from the Canadian Army Trophy, and the winning team also received a silver replica of a tank — in this case a Leopard 1. The competing teams came from Canadian Forces regular army units. The gunnery orientation of the Worthington Challenge remained unchanged in 2013, but the competition expanded to include both the Leopard 1 and LAV III as well as vehicle crews from across the Canadian Forces. (34)

In 2014 the competition underwent another major change. The Royal Canadian Armoured Corps School commandant redesigned it to focus upon crew, gunnery, and basic soldier skills, while encouraging interaction among the participating teams, particularly those from other nations. Hence the Worthington Challenge opened to all Canadian Forces divisions, while the light armored vehicle category broadened to permit participation by infantry and engineer vehicle crews. The four-day event required the competing teams, organized into groups, to rotate through a series of stands in a round robin fashion. Each stand featured a particular test and required demonstration of a particular skill set. (35)

The skills reflected four major categories: observation, driving and maintenance, march and shoot, and gunnery. Observation included tests of vehicle identification, range estimation using only binoculars while observing from a foxhole, and requesting indirect fire. The driving and maintenance phase required crews to sprint to their vehicles, change a road wheel or tire, run to a first aid station and demonstrate basic medical skills before carrying a weighted stretcher to a destination point. Then each vehicle had to navigate a closed circuit driving course with a variety of terrain hazards and obstacles, including steep drop-offs. The march and shoot phase addressed dismounted skills, including navigation of an obstacle course, light machine gun operation, and a timed foot march to a small arms range. There, each team ran from one firing position to another to engage targets with both pistol and rifle. Upon completion, they had to carry a representative casualty to safety. The live fire gunnery phase now included 120-mm and 25-mm categories, reflecting Canada's replacement of the Leopard 1 with the Leopard 2 and the continued use of the LAV III. Each vehicle ran two battle runs, engaging a variety of targets representing moving and stationary hostile vehicles and personnel. The scenarios forced crews to engage multiple, unheated targets and use more than one weapon system. Rapid, precision firing secured the highest point totals. (36)

The Canadians invited other nations to attend, but in 2014 only the U.S. Army sent teams. The United Kingdom, Australia, and the U.S. Marine Corps all sent observers. The principal vehicles represented were the LAV III, the newly debuted Canadian Leopard 2, the M1A2, and the Bradley Fighting Vehicle. The American 3rd Armored Brigade Combat Team, 3rd Infantry Division sent two M1A2 tanks from 2-69 Armor and M2A3 Bradley Fighting Vehicle crews from 3-1 Cavalry and 1-15 Infantry. In preparation the U.S. units conducted their own training and shoot off competition to

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determine the participating crews. The final tank team members included Sergeant First Class James Grider, who commanded the winning Sullivan Cup crew the same year. (37)

The 2014 Worthington Challenge occurred at Gagetown, New Brunswick, between September 29 and October 2. Canadian crews won each category with one exception. An American Bradley crew placed first out of 14 contestants in the 25-mm division. 2-69 Armor, however, only placed third among five teams in the tank division. Nevertheless, the goals of promoting interaction and interoperability among the participants became clear during a live fire demonstration before the awards ceremony that included integrated battle runs by a Leopard 2 paired with an M1A2 and parallel teaming of a Bradley and Light Armored Vehicle. A detailed after action review and a conference hosted by the Royal Canadian Armoured Corps School focused on materiel developments and simulations provided an opportunity for the exchange of information and ideas between the Canadians and Americans. This interaction and competition supported the 3rd Armored Brigade Combat Team's regional alignment with the U.S. Northern Command that entailed cooperation with Canadian Forces. (38)

The nature of the Worthington Challenge crafted in 2014 continued to define the annual competition through 2017. It remained a challenging event that required participants to undertake a rigorous training program in preparation. In 2016, for example, the Royal Canadian Dragoons sent two Leopard 2 crews to participate only after completing a grueling, month-long training program complicated by the need to both prepare for the event and train soldiers new to the tank in their primary responsibilities. The four-day competition opened with the march and shoot phase focused on dismounted and small arms skills. Day two featured direct fire gunnery, the most weighted component of the event. The third day tested driving skills, routine maintenance functions, and first aid. The final day featured vehicle navigation through the Canadian Forces Base Gagetown training area without digital aids while encountering a series of tactical challenges. (39)

The most significant change to the competition lay in the expansion of international participation. A Danish team participated in the 2015 competition, and the following year's event included teams from Chile, Denmark, and New Zealand in addition to those provided by the United States and Canada. Observers from Australia, Poland, and the United Kingdom also attended. The Danes made an immediate impression, winning the tank category with the Royal Canadian Dragoons in second place. (40)

In 2017 the field of participants included Canada, the United States, Denmark, Chile, and Poland. The principal events remained mounted direct fire, mounted navigation, platform-specific technical skills, and the march and shoot phase. In this year's events, the 2nd Canadian Division won the cup, its soldiers winning in most categories except one. Once again the Danes placed first in tank gunnery. (41)

## **Nordic Tank Challenge**

Across the Atlantic interest in competitions focused upon tank crew skills also increased. The Danish army implemented the Danish Tank Challenge in 2013, an event open only to the armored units of the Royal Danish Army. The competition then expanded to include participants from other European nations and the United States. It offered an opportunity for teams to assess their own skills against those of other partner nations and interact with allied armies. (42)

The Nordic Tank Challenge spanned four days, and it focused upon tank crew skills. On the first day, the competitors maneuvered their tanks in confined areas, uploaded and downloaded ammunition, conducted simulator tasks, and changed road wheels. The second day featured small arms firing from vehicles and dismounted engagements. The third day tested dismounted skills. Crews demonstrated navigation ability, target observation, provided medical aid, tossed grenades, and negotiated an obstacle course. They ran from one event to the other, seeking to complete all tasks safely, effectively, and in the shortest time. The final day focused upon tank gunnery,

necessitating fire and maneuver on a range, including firing while moving in reverse. Overall the competition assessed crew problem solving abilities, physical fitness, individual crew member capability, and dismounted drills. The winner received a trophy in the likeness of a Leopard 2, which equipped the Danish armored force and many other European nations. (43)

In 2016 the Nordic Tank Challenge included seven competing teams from Canada, Poland, Norway, Sweden, Germany, Denmark, and the United States. It marked the debut of the Americans, who sent a team from the 3<sup>rd</sup> Battalion, 69<sup>th</sup> Armor Regiment (3-69 Armor), a part of the 3<sup>rd</sup> Infantry Division's 1<sup>st</sup> Armored Brigade Combat Team. With its M1A2, the American team proved distinctive, since every other competitor fielded a variant of the Leopard 2. A crew from the Danish 1st Armor Brigade won the competition, but the event proved an important training event for the American team. With a resurgent Russian threat and more U.S. armor units being deployed to Europe as part of Operation ATLANTIC RESOLVE to demonstrate America's commitment to regional security, the Nordic Tank Challenge permitted American tankers to interact with their European partners and exchange information about their respective tanks and tactics. (44)

In 2017 teams from Norway, Canada, Germany, Sweden, Denmark, and the United States competed. The competition's nature remained similar to the previous year and emphasized mastery of crew skills. Cohesion among the individual crew members proved a key factor in success or failure in the competition — just as it would in a combat setting. The American team came from 1<sup>st</sup> Battalion, 66<sup>th</sup> Armor Regiment, but the Danes once again claimed first place and the trophy. (45)

### **Russian Tank Biathlon**

Amid the resurgence of tank competitions, the Russian Tank Biathlon ranked among the most unique. It derived from the winter sport, substituting tank driving and gunnery for cross country skiing and rifle shooting. The format of the event evolved over time, but in essence it required competing tanks to run laps around a closed circuit, negotiating a variety of obstacles and engaging targets representing enemy tanks, helicopters, and RPG or ATGM teams. The contest resembled an Olympic sporting event in its nature and in the broad international participation it attracted. It featured teams from Asia, Africa, Europe, and the Americas. The Tank Biathlon focused upon crew skills in a competitive environment, but it lacked the emphasis on tactical skills found in the Canadian Army Trophy or more recent Canadian and European tank competitions. Nevertheless, it provided a platform to showcase armored vehicles and crew performance, and its entertainment value proved hard to beat, underscored by the throngs of civilian spectators of all ages in routine attendance.

By 2017 the contest involved three stages. The first was an individual race in which each tank completed three laps, each three to five kilometers in length. At the end of each lap, the tank moved into a fixed firing position, uploaded ammunition, and engaged a stationary target with its coaxial machine gun, antiaircraft machine gun, or main gun. Each lap required tanks to ford a water obstacle, cross a pontoon bridge, pass over a small hill, move through a narrow cutting, drive over rocky ground, carefully navigate a lane through a representative minefield, climb a small wall, cross a stretch of washboard road, and negotiate a series of S-curves amid poles. Each crew sought to complete the lap and engage the presented targets in the shortest time. Up to four tanks entered the track at one- to two-minute intervals. (46)

The scores from stage one determined the top 12 teams who advanced to the second stage, a relay race. In this phase three crews from each team took turns running four laps apiece using just one tank. One lap required the tanks to compete in a speed race. Each of the other three laps provided a single gunnery opportunity that collectively included the engagement of two targets with a the anti-aircraft machine gun, firing at three representative RPG teams, and shooting the main gun over the side at tank targets while moving. A total of four tanks competed simultaneously. The four teams with the highest scores then conducted a second relay race to determine the biathlon's winners and final placement. The top three positions received medals. (47)

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Each participating nation sent a team to Russia that included a team leader, three tank crews, a reserve crew, a coaching group, and a maintenance unit for a total of 21 personnel. The Russians provided each team a T72B, later upgraded to a T72B3, for use, although there was no prohibition against each nation competing with their own national platforms. The T72B3 constituted the latest upgrade to the basic platform. For the competition the tanks were color coded, sometimes in a single, distinctive color (red, blue, green, etc.) to denote each team. Each vehicle also sported national insignia. (48)

Placement in the Tank Biathlon derived from the time to complete each lap and the related firing tasks. However, the accumulation of penalty points added to the final time score. Hitting any of the poles used to mark obstacles earned points. Missing a target, avoiding an obstacle, running over a simulated mine, stopping, violating safety procedures, or hitting the sides of the cutting all necessitated the completion of a penalty lap on a shorter circuit. More egregious offenses including a false start, firing without the chief judge's authorization, disobeying the chief judge, driving when crew members were not in their seats, or disregarding safety limits during firing, all incurred two penalty laps. Each penalty lap increased the overall time score. Extreme infractions included aiming weapons at the judges and causing vehicle collisions. These actions resulted in automatic disqualification from the competition. (49)

The first Tank Biathlon occurred in August 2013 at the Alabino Proving Ground near Moscow. In this first iteration only teams from Russia, Armenia, Belarus, and Kazakhstan competed. The Russian team won with the fastest time and no penalties. Other nations, including China and members of NATO, were invited to participate, but none did so. (50)

For 2014 Russia held a preliminary competition that pitted crews from the various military districts against one another to determine the top three finalists, who then constituted the Tank Biathlon team. The winning crews received gold plated miniatures of a T72B. Other competing nations conducted similar events to determine final team composition. Symbolic of the growing stature and international nature of the event, the 2014 Tank Biathlon featured 12 teams from Angola, Armenia, Belarus, China, India, Kazakhstan, Kuwait, Kyrgyzstan, Mongolia, Russia, Serbia, and Venezuela. To provide an atmosphere similar to the Olympic games, the contest began with a display of Russian tank driving ability and an opening ceremony that featured waltzing tanks firing colored smoke. A parade of Soviet combat vehicles from World War II, and a display of surface-to-air missile systems offered more tangible indicators of Russian military capability. (51)

China's participation captured headlines, particularly since the People's Liberation Army opted not to rely on the issuance of a Russian tank. Instead, the Chinese team brought their own Type 96A tanks. This vehicle resembled the T72B in weight and armament, and it, too, possessed an autoloader. Although the T72 proved a commonplace vehicle in much of the world, the Chinese lacked familiarity with it. The Russians offered six weeks of T72 training to all teams before the competition, but the Chinese preferred their own national tank. However, during the competition, one of these tanks threw a track, and it had to be replaced with the team's spare vehicle. The Tank Biathlon ended with Russia in first place, followed by Armenia, China, and Kazakhstan. (52)

In 2015 the Tank Biathlon became part of a broader set of military competitions hosted by Russia, known as the International Army Games. This event encompassed multiple, different locations and included 13 different contests for nearly every branch of service, including reconnaissance, airborne, combat engineering, artillery, air defense, and aerial events. China used its own equipment in the Army Games, resulting in a large collection of Chinese combat platforms and materiel arriving in Russia. For the Tank Biathlon, the Chinese again opted to use the Type 96A, although they found it underpowered in comparison with the Russian issued T72B3. The Tank Biathlon featured 12 other teams from Nicaragua, Tajikistan, Russia, Venezuela, Armenia, Kyrgyzstan, Angola, Mongolia, Kazakhstan, India, Serbia, and Kuwait. Belarus abstained from this

event, instead focusing its efforts on other contests that it believed it had a better chance of winning. (53)

The Tank Biathlon occurred in August. A ceremony that featured an air show and waltzing tanks marked the start of the competition. The Indian team blessed their tanks in the hopes of superior performance. RT News provided the broadcast services, while some 100 cameras ensured maximum high resolution video coverage and playback. Some participants might have preferred less spotlighting of the action, particularly the Kuwaiti crew that flipped its tank and the Venezuelan team that stalled in the water obstacle. The Russian team, however, likely benefited from such coverage. It set a speed record for completing all laps and gunnery in 74 minutes. Not only did the Russians win the biathlon, the winning crew also received a new T90 main battle tank in addition to medals. China placed second, followed by Serbia and Kazakhstan. (54)

In 2014 and 2015 the Russians extended invitations to the Western powers to participate. However, whatever chance might have existed for participation by NATO teams ended with Russia's seizure of the Crimea and the provision of military support, including tanks and heavy weapons, to East Ukrainian separatists to assist them in their effort to break away from the rest of the Ukrainian state. This conflict occurred amid a general increase in threatening Russian military activity worldwide reminiscent of the Cold War. It increased tensions with the Western Powers, and the United States began to increase its military footprint in Europe while conducting exercises with Eastern Europe nations fearful of Russian intentions. The international political backdrop found expression at the Tank Biathlon, where large crowds of Russian spectators repeatedly chanted "Russia! Russia!" in support of their national team. Some of them wore T-shirts emblazoned with the slogan "Polite green men" in reference to the soldiers who initially occupied the Crimea. They were distinctive by their green uniforms and lack of any identifying insignia, but they were generally believed to be Russian Special Forces. (55)

The 2016 Tank Biathlon occurred between July 30 and August 13, 2016. It featured teams from Russia, Kazakhstan, China, Belarus, Azerbaijan, Serbia, Iran, Mongolia, Venezuela, Armenia, Kyrgyzstan, Angola, and India. The opening ceremony included the now commonplace waltzing tanks, ballet dancers performing to the sound of moving tanks, and self-propelled howitzers firing over the heads of taiko drummers. Most teams again received a Russian issue T72B3, a platform that by 2016 had seen combat service in Eastern Ukraine. For this year's event the Belarus team brought their own T72s, and the Chinese opted to debut their new Type 96B tank. This platform was a lighter version of the Type 96A intended for more mountainous terrain. It entered service in the 1990s, and in comparison with the earlier model it featured a modernized 125-mm gun, new fire control system, and a more effective transmission. Its engine boosted horsepower from the Type 96A's 780 to 1,200. The tank's principal drawback lay in the relatively poor production quality. In 2013, for example, one battalion lost half of its vehicles to mechanical failure during a single nine-day training event in Inner Mongolia. During its Tank Biathlon debut in 2016 the Type 96B gained instant media coverage when it lost a road wheel in the midst of a lap. Russia once again won the contest. (56)

The 2017 Tank Biathlon included 12 competing teams from Russia, Kazakhstan, China, Belarus, Azerbaijan, Serbia, India, Iran, Mongolia, Venezuela, Armenia, and Kyrgyzstan. India joined China in bringing its own national tank. India considered its teams at a disadvantage using the Russian issue T72B3. Therefore it selected its best crews and sent them to the Tank Biathlon equipped with two T90 Bhishmas. This tank constituted India's replacement for its aging T55s and older variants of the T72. The army fielded over 1,000 T90s. Despite the high expectations before the competition and a strong performance made once it began, disaster struck in the form of mechanical failures. One vehicle suffered a broken fan belt, while the spare tank suffered an oil leak and ceased to function. Neither tank could be repaired. Unable to complete the contest, the Indian team was disqualified. However, the failure to place caused considerable concern for the Indian army, since the degraded engine performance of the T90 had long been a cause for concern. Indeed, the platform had proven

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unable to operate for long periods in high temperatures due to a radiator problem. The Tank Biathlon failure encouraged the Indian government to invest in an upgrade program for the T90's engine in addition to boosting armor protection. The failure of the T90 in its Tank Biathlon debut bore a strong similarity to the British Challenger experience in the 1987 Canadian Army Trophy. With India out of the running, the Russians again won the contest, followed by Kazakhstan, China, and Belarus. (57)

The Tank Biathlon possessed outward similarities with tank competitions held in Western nations. Judges could be seen in a special box with spotting scopes and access to varied communication devices. Cameras placed at strategic locations helped to capture the action and facilitate target sensing. Participating tank crews needed to be proficient in their duties to navigate quickly the obstacles and challenges. However, the Russian event left the clear impression of a racing circuit rather than a tactical environment. Large numbers of civilian spectators suggested a family day rather than one of military prowess on a simulated battlefield environment. A commentator announced the action as it occurred, while large screens displayed close-up shots and instant replays of particularly noteworthy events. Russia's RT News provided coverage and ensured online access and videos, while the sheer entertainment value of watching T72s racing, drifting, flipping, jumping, and shooting at targets while moving proved hard to ignore. (58)

### **Strong Europe Tank Challenge**

The Tank Biathlon could not disguise the nature of Russian aggression and the threat it posed to Europe. Russia's seizure of the Crimea, its military support to East Ukrainian separatists, its intervention in Syria on behalf of Bashar al-Assad's regime, and its military posturing in general created unease. Eastern European nations in particular began to assess how best to resist a possible Russian invasion and sought partnerships and support from NATO and Western European powers. NATO members began to improve their military readiness. Through Operation ATLANTIC RESOLVE, the United States undertook to reinforce its military presence throughout Europe and demonstrate its commitment to regional security. International military exercises and high profile U.S. troop movements served as a warning to Russia and an assurance of American support, exemplified by the 2015 road march of the 2nd Cavalry Regiment through Poland, Latvia, Lithuania, Estonia, the Czech Republic, and Germany.

Behind the Russian threat lay a set of military capabilities that demonstrated significant improvements since the collapse of the Soviet Union and the debacle of the First Chechen War in 1994-1996. By 2016, the Russian military included a strong, combined arms mechanized component. Moreover, the Russians continued to improve their tank fleet. The T72B3 on display at the Tank Biathlon represented a major upgrade over the T72B first fielded in 1985. The newer model included improved protection, a new fire control system with a more powerful computer, thermal imaging, a digital radio, and a hunter-killer capability. New tracks and a more powerful engine provided the mechanical gusto to perform the feats highlighted at the Tank Biathlon. The Russian army began to field the T72B3 in 2013, and the vehicle saw combat service in the Ukraine over the following two years. (59)

While upgrades to the venerable T72 kept this platform combat capable, the T90 provided a more up-to-date tank and the first main battle tank built in post-Soviet Russia. It marked an effort to merge the best features of the T80 and T72. The T80 mounted a maintenance intensive gas turbine engine with a limited range and a high fuel demand. The platform suffered heavy losses during the First Chechen War, and it proved unpopular. The T90 mated a T80U turret with the reliable T72 chassis. The resultant tank's original diesel engine was quickly upgraded to boost horsepower from 840 to 1,000 for a 48-ton vehicle, giving it a high power-to-weight ratio. The T90 carried a 125-mm smoothbore main gun capable of firing ATGM missiles or conventional rounds. Secondary armament included an externally mounted machine gun for the tank commander and a coaxial machine gun. Its fire control system also benefited from the incorporation of a French-built sighting system that



enabled target detection beyond the range of its weapons. The T90's survivability derived from the combination of composite armor, explosive reactive armor, laser warning receivers, and optical dazzlers to interfere with hostile target acquisition efforts. Signature reduction and a system intended to disable mines before the tank ran over them completed its defensive suite. The T90 entered production in 1994, and it underwent continuous, subsequent upgrades. It saw combat service in the Ukraine and Syria. (60)

The development of the Armata Universal Combat Platform, however, offered the Russian army a new family of armored fighting vehicles. Variants included the T14 tank, the T15 heavy infantry fighting vehicle, and the T16 armored recovery vehicle. Still another variant included the so-called "Tank Killer," a system bristling with weapons. The Armata marked a sharp departure from earlier tank designs that derived from the T54/55 and T62 platforms. It featured high levels of ballistic protection, supplemented with an active protection system and devices to disrupt laser guidance systems. The Armata also carried the latest generation of NBC protection and fire suppression systems. The T14 tank carried a 125-mm smoothbore gun capable of firing missiles and conventional ammunition in an unmanned turret and a remotely operated 7.62-mm machine gun. The three-man crew remained in an armored capsule in the forward hull of the tank. With a reputed range of at least 5,000 meters, it posed a significant threat to hostile tanks on the battlefield. The T-14 included a digital battlefield management system for command and control, while its mobility derived from a new 1,200 horsepower turbocharged diesel engine. An auxiliary power unit enabled a silent watch capability. By 2017 the T14 tank remained in an advanced stage of development with full production expected to begin in 2020 or 2021. Fielding plans called for the gradual replacement of the existing fleet of T72s, T80s, and T90s with the T14. (61)

Russian bellicosity buttressed by a capable tank fleet forced the European powers to refocus military readiness upon conventional warfighting capabilities. Light, rapidly deployable forces suited to counterinsurgency operations had dominated developments in the major Western powers. The return of an old threat with its armored muscle posed an unwelcome danger, necessitating revitalization of tank fleets and related combined arms maneuver skills. In the Cold War a similar threat posed by the Soviet Union and the Warsaw Pact inspired the Canadian Army Trophy, which cast a spotlight upon armored prowess and capability through emphasis upon precision gunnery. In the face of the resurgent Russian threat, the German army and USAREUR established the Strong Europe Tank Challenge.

This competition continued the Canadian Army Trophy's emphasis upon platoon gunnery. Out of a total possible score of 1,000 points, offensive and defensive engagements necessitating rapid, precision firing and maneuver accounted for 700. The competition required each platoon to engage moving and stationary targets at varied ranges using tank main guns and coaxial machine guns. The targets represented a mix of tanks, troops, and aerial platforms. Moreover, platoons had to demonstrate the ability to hit targets from stationary firing points and while moving. (62)

However, the Strong Europe Tank Challenge addressed individual crew skills and dismounted actions. It effectively merged the Canadian Army Trophy's precision gunnery emphasis with the attention to crew actions found in the Sullivan Cup, Worthington Challenge, and the Nordic Tank Challenge. Crew skill and dismounted events accounted for roughly one third of the total possible points. Unlike the Tank Biathlon, the Strong Europe Tank Challenge focused upon tactical skills — it was neither designed nor intended for entertainment. Instead it served to promote the capabilities associated with armored operations, build interoperability among allied and partner nations, and boost confidence in the effectiveness of multinational operations. These goals were achieved in part by assessing how each national platoon performed using its own equipment rather than reliance upon a standard issue platform. In addition the competition also featured a Friendship Shoot on the final day and an Interoperability Day in which participants received a chance to inspect the competing tanks and share tactical information. (63)

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Collectively, the Strong Europe Tank Challenge required participating platoons to perform tasks indicative of combat operations in the 21<sup>st</sup> century. Unlike the bright colors characteristic of the Tank Biathlon that served to track the actions of a particular team, each crew in the Strong Europe Tank Challenge had to conceal their vehicle with a camouflage net. Platforms had to navigate an obstacle course without using vehicle optics and overcome 13 different challenges, each one reflective of a crew or platoon skill. Driving over an automobile constituted one of the events and doubtless provided drivers a degree of destructive satisfaction. Crews had to react to indirect fire, call for support from friendly artillery or aircraft, correctly identify a mix of 25-30 enemy and friendly vehicles, and determine the range to a target without use of a laser rangefinder. Each team also underwent a test of their ability to provide accurate reporting of a tactical situation during a patrol through an urban area. Under a simulated chemical attack, crews had to recover a disabled tank by hooking up a tow cable and then haul the vehicle to safety. This action required mounted and dismounted action while wearing chemical protective suits. Battle damage assessment and completing hasty repairs complemented the attention given to crew welfare during an event requiring the provision of medical treatment and evacuation of a wounded soldier. Two teams, however, resolved their medical challenge in a more brutal manner when they accidentally ran over the dummies used to represent casualties. (64)

A special event required crews from different teams to work together in response to an improvised explosive device attack. The soldiers had to perform a battle drill, followed by the assessment and treatment of a casualty before arranging for a medical evacuation. Dismounted activities required crews to demonstrate their mastery of small arms skills in a combat pistol shooting event, racing to and from the range on foot. Crews also competed in a physical fitness test and a relay race in which the competitors carried various pieces of tank equipment. Soldiers tested their stamina in a contest based on walking the greatest number of laps along a hillside track while carrying a 44-pound tank main gun training round. (65)

The first Strong Europe Tank Challenge occurred at the Grafenwoehr Training Area between May 10 and 12, 2016. The German army and USAREUR jointly sponsored the event, which was hosted by the Seventh Army Joint Multinational Training Command. Denmark, Germany, Italy, Poland, Slovenia, and the United States participated. Each nation sent a single four-tank platoon to compete, except the United States, which sent two platoons. The Czech Republic planned to attend, but proved unable to participate. (66)

All of the represented nations were NATO members, reflecting the alliance's expansion since the Cold War and exemplified by the Polish and Slovenian teams. The tanks used by each nation similarly varied. The Danes and Polish competed with the Leopard 2A5, the Germans with the more modern Leopard 2A6, and the Americans with the M1A2 SEP v. 2. All of these platforms reflected upgrades over the Leopard 2s and M1s that once competed for the Canadian Army Trophy. The Italians brought their own nationally built Ariete tank. It entered service in the 1990s, and it reflected a mix of Challenger, Leopard 2, and Abrams influences. The Ariete carried composite armor, a 120-mm main gun, a thermal sight, a hunter-killer sight for the tank commander, and a digital fire control system. Slovenia brought its M84, a Yugoslavian derivative of the T72. (67)

The German platoon won the competition, followed by the Danish and Polish units in second and third places. The German team also proved the best in terms of overall physical fitness, exemplified by carrying main gun ammunition for 64 laps. It also earned the highest score for recovering a tank under a simulated chemical attack. During gunnery the Germans may have benefited from their use of training targets smaller than those used in the competition. (68)

The Polish platoon hit more than 75 percent of the targets during the offensive engagement phase, scoring 285 out of a possible 350 points. In the defensive phase the Poles hit 17 of 23 targets, earning 277.5 points out of a possible 350, making it one of the highest scores for this category. In

contrast, the Slovenians struggled through the competition with the oldest tank and the least capable fire control system, ammunition, and weapon stabilization. The Italian Ariete platoon experienced initial difficulties, but its performance steadily improved thereafter, although the unit's gunnery scores proved among the lowest of participants. Nevertheless, the Italians managed to place fourth, placing them ahead of the Americans and the last place Slovenians. (69)

Post competition analysis and media coverage focused upon national performance. The Germans received considerable praise for their victory, and the Leopard 2 once more garnered attention, since the top three scoring platoons used a version of this tank. (70) Conversely, the Americans became subjected to media attacks in a manner reminiscent of the CAT years. Headlines such as "US Army Completely Fails NATO Tank Competition," "Stopped in Their Tracks: US Army Fails to Make Top 3 in NATO Challenge," or "U.S. Crews Fail to Place in NATO Tank Competition" once again illustrated how some news outlets used the event outcome as a vehicle to attack U.S. Army readiness. One of the more virulent attacks suggested that "the only thing the US military managed to showcase was its own incompetence." (71)

For American tankers, the long years of counterinsurgency operations did result in a skill decline that ongoing training changes addressed. Some of the criticism clearly reflected ulterior motives, particularly when it emanated from Russia Today, or RT, the Russian government-funded broadcast agency that covered world affairs from a distinctly pro-Russian perspective. (72) Another article sought to attack the U.S. Armor Branch's active component, contrasting its low placement in the Strong Europe Tank Challenge with the first place Sullivan Cup finish of an Army National Guard tank crew "consisting of an insurance adjuster, Pepsi truck driver, college student, and aspiring police officer." (73) The author failed to note that National Guard readiness had reached an all-time high through continuous deployments and combat rotations since 2001 or that the Armor School oversaw the training of its Guard component. The 21<sup>st</sup> century National Guard was a far cry from the unflattering stereotypes of the 1980s found in movies such as *Southern Comfort* and *First Blood*.

In 2017 the Strong Europe Tank Challenge again occurred in May at Grafenwoehr Training Area. It featured four-tank platoons from Austria, France, Germany, Poland, the Ukraine, and the United States. The personnel strength of each platoon, however, varied with the vehicle crew size. While the Leopard 2 variants used by Austria, Germany, and Poland, and the American M1A2 SEP v.2 all relied upon four-man crews, the French and Ukrainian tanks included autoloaders that reduced crew size to three. Sweden expressed interest in the competition, but opted to participate in 2018. Despite its second place finish in 2016, Denmark did not participate. Cost considerations forced it to limit its competition presence. Therefore, it opted to participate in the Nordic Tank Challenge held in Denmark and Canada's Worthington Challenge, both crew rather than platoon competitions. (74)

Austria won the 2017 Strong Europe Tank Challenge. It did so despite its use of the older Leopard 2A4. For years Austria relied upon the American M60-series, but it undertook a modernization program in the 1990s. When the Royal Netherlands Army began to reduce its tank fleet, Austria purchased the now excess Dutch tanks, striking a deal before the Norwegians, who also desired a tank upgrade from the same source. In 1998 the "new" Leopards entered service with the Austrian army. They lacked the upgraded armor protection, more powerful main gun with newer kinetic energy ammunition, and other features found on the German Leopard 2A6 or Polish Leopard 2A5 models. Nevertheless, the Austrians made the most of their tanks and the related training opportunities. In addition to their first place finish, they also earned the highest score in the call for fire event. (75)

The Germans proved a strong competitor, finishing in second place. However, Leopard 2s ceased to dominate the top three high scores. The American platoon with its M1A2 SEP v.2 finished third. This placement marked an improvement over the 2016 performance, but the U.S. platoon suffered

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from inferior precision driving and offensive gunnery engagements in comparison with the Austrians and Germans. The Poles slipped from third to last place in 2017. Their Leopard 2A5 platoon experienced difficulty during vehicle recovery, precision driving, vehicle identification, range determination, and calling for fire — a broad range of crew skill deficiencies possibly the result of an ineffective training program and not helped by a fire control system failure during the competition. (76)

The French participation marked the nation's debut in a European tank competition, since the nation never sent a team to the Canadian Army Trophy. In 2017 a French platoon equipped with the Leclerc tank placed fourth. The Leclerc tank entered service in the 1990s. It featured modular, composite armor, a 120-mm smoothbore main gun, an electrical aiming system, fully stabilized weapon system, and a commander's panoramic sight to facilitate rapid target acquisition and engagement. The vehicle became one of the first digital platforms to be fielded, automatically reporting fuel and ammunition status to a command tank. The combination of autoloader, electrical aiming system, and full stabilization in a modern fire control system enabled rapid engagement of multiple targets whether moving or stationary. Its turbocharged diesel engine generated 1,500 horsepower, but it proved smaller than other tank engines, allowing for a smaller hull design. The combination of a powerful engine and lighter overall weight gave the Leclerc an excellent power-to-weight ratio and good cross country mobility. These qualities may have contributed to it achieving one of the fastest precision driving times. The Austrian Leopard 2A4 achieved a comparable time, and both tanks lacked the increased weight that accompanied the latest upgrades to the American M1A2 and German Leopard 2. (77)

The Ukrainians also represented a first for a European tank competition. Still fighting in the Donbas region against separatists supported by Russia, the Ukrainian presence underscored the importance of events that boosted armored force readiness. In the 2017 Strong Europe Tank Challenge, the competing Ukrainian platoon had first to win a national contest against other Ukrainian units that also sought to represent the nation in the tank competition. The Ukrainian platoon employed a T64BM, upgraded through the addition of new radios, a global positioning system, and night vision optics. However, while the Ukrainians attracted considerable attention for their platform and their ongoing resistance to a resurgent Russian threat, they finished in fifth place behind France. Still, the simple presence of the team symbolized Ukrainian solidarity with other European and NATO states. The soldiers in the platoon also provided firsthand experience of the ongoing fighting in the Ukraine. (78)

The Strong Europe Tank Challenge constituted a clear manifestation of the Canadian Army Trophy's legacy. Both events emerged to promote armored force readiness in response to the external threat represented by Russia. They also served as training activities that encouraged interoperability and interaction among partner nations. Moreover, both competitions focused upon platoon operations. However, all of the tank competitions noted above, including the Russian Tank Biathlon, served to encourage skill mastery and forge bonds between the soldiers of the competing nations. All of these events reflected the original objectives of the Canadian Army Trophy which inspired them.

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## Note on Sources

This work derived from many different sources. The absence of a central repository of Canadian Army Trophy (CAT) documentation and the international nature of the competition necessitated a broad brush approach in the collection of information. The scope and breadth of source material is indicated throughout the text in the form of endnotes. However, there are several items and organizations that proved of exceptional value.

In this digital age most research projects begin with a simple internet search to determine what type of readily accessible data exists. In this case, the Mihalko family website proved of great value. This site contains a wealth of information related to CAT from 1963 to 1991, including team placement, scores, vehicles, major rules changes, and imagery. Select competitions also feature more detailed documentation and photographs. Ron Mihalko, a retired Armor First Sergeant with firsthand CAT experience, built the website. It continues to feature new material, particularly related to the more recent Strong Europe Tank Challenge.

The Tank Museum at Bovington Camp in England provided the materials that enabled a much more nuanced depiction of the British CAT experience. Access to select archival files provided the source material related to Challenger development, negotiation of the CAT rules, public relations efforts, training, and competition performance. The Tank Museum also provided the rules and conditions for the climactic CAT 1987. Indeed, the museum constitutes a prime source of information for any work related to European tank development. For the British experience in the deployment and sustainment of an armored division to Southwest Asia during the First Gulf War, *Gulf Logistics: Blackadder's War* provided the perspectives of several different officers associated with these efforts.

Information on the Canadian CAT experience drew heavily upon the Royal Canadian Armoured Corps School's *Armour Bulletin*. This publication provided insights into the state of the Armoured Corps during the 1970s and 1980s as well as the unique training challenges facing this force. Back issues dating back to the 1970s are available on the Royal Canadian Armoured Corps website. This publication made it possible to place Canadian CAT training in the broader context of developments affecting the army as a whole and the Armoured Corps in particular. Other significant Canadian sources include the Canadian Forces Network documentary of CAT 1987 and a similar documentary of the 2003 Canadian-American Cup, both of which can be found on YouTube. Regimental histories and publications are also readily available, including *The Strathconian*, which ran several articles on the latter event.

The information regarding the Dutch and Belgians was taken largely from online articles and from references located in American and United Kingdom documents. The sources for the German CAT experience included memoranda from American liaison officers to the German armor school, articles written by German liaison officers serving at the U.S. Army Armor School, and third party references found in other reports and documentation. English language sources for the Leopard 2 development and use are limited, but the best to date are the books written by Frank Lobitz. The volume devoted to German army usage details the design, development, and characteristics of this ubiquitous platform, while the volume devoted to the international variants addresses the modifications

### *Note on Sources*

and usage by other nations that have purchased the Leopard 2. Numerous online videos and articles further showcase the unique features of this tank.

A significant portion of this book's content focuses upon the U.S. Army, particularly the training, doctrine, and major developments of the Armor Branch during the CAT years. This information provides context for understanding the American approach to the competition and underscores the growing linkage between it and changes in gunnery training. The Maneuver Center of Excellence Donovan Research Library holdings include older gunnery manuals that chronicle this evolution. Technical studies related to platform development, assessments of CAT performance, and major training actions can be found in the online archives of the Defense Technical Information Center (DTIC). The mission of this organization lies in making research, development, and testing materials related to defense systems available. Many of these documents have been fully digitized over the years, and older, less sensitive items are available to the general public. They include items used in this work related to gunnery, studies of Armor training, platform issues, and a few focused specifically upon CAT.

***ARMOR***, the journal of the Armor Branch, proved the source of many articles used throughout this book related to platforms, training issues, gunnery developments, and the general state of the branch. This publication provided a wealth of information based upon the firsthand experiences of American tankers of all ranks during the years of CAT. The issues covering the 1970s-1990s were unashamedly plundered, since they address nearly every facet of the U.S. Armor experience during this phase of the Cold War. Given the large number of articles referenced throughout this book, it is hard to overestimate the value of this publication to any serious study involving the Armor Branch. Many of its earlier issues can be accessed online, and a current initiative focused upon making every issue since its inception in the 1880s similarly available is ongoing.

The Armor Branch archives maintained by the U.S. Army Armor School provided the rest of the primary source material for the American CAT experience. Its holdings addressed the background development and capabilities of the U.S. tanks used in CAT, technical studies related to tank gunnery, and the assessments of armor performance in the First Gulf War. More recent acquisitions pertinent to this study include the after action reports of select American units that participated in CAT, particularly in 1987 and 1989. These items were discovered in a room full of materials slated for destruction. At the bottom of a stack of discarded papers and manuals lay worn black binders featuring a faded CAT logo. They immediately went into the archives for preservation and future digitization. They are invaluable for their detailed depictions of CAT team preparation, training, and competition performance. Hopefully, more such after action reports will find their way into these archives.

YouTube videos offered another dimension of research and, admittedly, entertainment. There are a few videos focused upon CAT that provided some sense of the range, atmosphere, and participants. However, for the more recent armor competitions referenced in the epilogue, there are many good quality selections. RT provides the most entertainment with their coverage of the Russian Tank Biathlon, but the more informative videos showing the Strong Europe Tank Challenge and Nordic Tank Challenge provide a clear sense of the enduring influence of the original Canadian Army Trophy.

## About the Author

Robert S. Cameron holds baccalaureate degrees in economics and history from Binghamton University, New York. In 1994 he received his doctorate degree in modern military history from Temple University, Pennsylvania. He taught undergraduate history at several colleges in the Philadelphia area, including Temple University, Camden County College, and Manor Junior College. Dr. Cameron began to work for the U.S. Army in 1996, serving as the Armor Branch historian. He continues to work in this capacity, providing historical support to the Army in general and the Armor community in particular. His publications include several articles related to armor and cavalry developments that have appeared in *ARMOR* and *Military Review*. His published books include *Staff Ride Handbook for the Battle of Perryville, 8 October 1862* (2005); *Mobility, Shock, and Firepower: The Emergence of the U.S. Army's Armor Branch, 1917-1945* (2008); *To Fight or Not to Fight? Organizational and Doctrinal Trends in Mounted Maneuver Reconnaissance from the Interwar Years to Operation IRAQI FREEDOM* (2010); and *Armor in Battle: Special Edition for the Armored Force 75<sup>th</sup> Anniversary* (2016).





