



Armour  
*Bulletin*  
des Blindés



AUTUMN / AUTOMNE 1990

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**The Armour Bulletin des blindés**

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## Director of Armour's Foreword



Since my last foreword in the Summer 89 edition of the Armour Bulletin, there has been a great deal occurring in national and international politics, world affairs and the economy. All of these are coming together and creating a climate of change in many things that touch our daily lives. There is no doubt that these outside pressures will bring about change in our military forces. As society changes, so must the military. An efficient military force must stay attuned to these changes and must be prepared to make the necessary adjustments to meet new requirements and new challenges. What impact, if any, these changes will have is unknown at this time, because of the instability created by a constantly changing world situation. From an Armour perspective, I can tell you that armour, in one form or another, will continue to be a requirement in a modern and efficient Army. Until the future is clearer, there are two things which are important for all armour soldiers to bear in mind. First, we still have a role and, until we hear differently, we must continue to train and prepare for this role as professionally as we have in years past. Second, we have faced changes in the past which, at the time, looked insurmountable, but we have always come through them. I am confident that this is another one of those times and, if we continue to train hard and maintain our high professional standards, we will see better times ahead.

Good examples are the results of the recent Merritt Trophy competition and the Ram's Head Trophy competition; the first, a demonstration of recon skills and the second, a demonstration of armour gunnery skills. In both cases, from a quick analysis of the results it is obvious that these skills are being maintained at a high standard. I congratulate those who won trophies but, also, I congratulate all the participating troops for their excellent showing.

At about the time this edition of the Armour Bulletin is being published, I will be preparing to hand over my duties, as the Director of Armour, to my successor, Colonel N.B. Jeffries. Before moving on, I wish to take this opportunity to say that it has been both a privilege and an honour for me to have been the Director of Armour. To all of you serving in the regular force, the militia, and the RCAC Association, my heartfelt thanks for all of your support and help in making my task easier.

Best wishes and straight shooting.

A handwritten signature in dark ink, appearing to read 'D.G. Taylor'.

D.G. Taylor  
Colonel, Director of Armour

## Préface du directeur de l'arme blindée

Depuis mes derniers commentaires dans le bulletin de l'Arme blindée, édition été 89, plusieurs événements se sont produits sur la scène politique nationale et internationale, ainsi que dans le monde des affaires. Tous ces événements se rejoignent pour créer un atmosphère incertain, lequel affecte notre vie quotidienne. Il n'y a aucun doute que ces circonstances occasionneront des changements aux Forces armées. Nous ne pouvons pour le moment prévoir l'impact que tous ces changements apporteront. La société évolue rapidement et l'armée doit aussi se conformer à cette évolution. Les Forces armées doivent être constamment au courant des derniers développements mondiaux et doivent être prêtes à entreprendre les démarches nécessaires afin de rencontrer les exigences et les nouveaux défis que ces derniers apporteront. Quel rôle l'Arme blindée jouera t-elle dans l'avenir, je ne peux le dire. Cependant je vous assure que l'Arme blindée continuera à jouer un rôle primordial dans l'Armée moderne et sera capable d'affronter toute éventualité.

En attendant que la stabilité revienne sur la scène internationale, il y a deux objectifs que tout soldat de l'Arme blindée doit s'efforcer d'atteindre. En premier lieu, notre rôle au sein des Armes de combat demeure et doit être respecté. Nous devons continuer à nous entraîner avec vigueur et démontrer notre professionnalisme comme par les années passées. En second lieu, nous avons des défis à surmonter, lesquels comme par le passé semblent parfois infranchissables. Nous avons toujours répondu à la tâche dans ces situations et nous le ferons encore. Les excellents résultats de la compétition de reconnaissance Merritt ainsi que de la compétition de tir Rams's Head font preuve de notre excellence à l'entraînement. Je félicite tous les gagnants, mais de plus, j'aimerais féliciter tous les concurrents pour leur excellente participation aux compétitions.

Lors de la publication prochaine de cette édition du bulletin de l'Arme blindée, je serai à remettre mes consignes de poste de directeur de l'Arme blindée au nouveau directeur, le colonel N.B. Jeffries. Je tiens cependant à souligner que ce fut un privilège et un plaisir d'avoir servi dans ce poste. Je remercie tous les membres de la force régulière, de la Force de réserve, ainsi que tous les membres de l'association RCAC pour leur appui et la collaboration qu'ils m'ont accordés en tant que directeur.

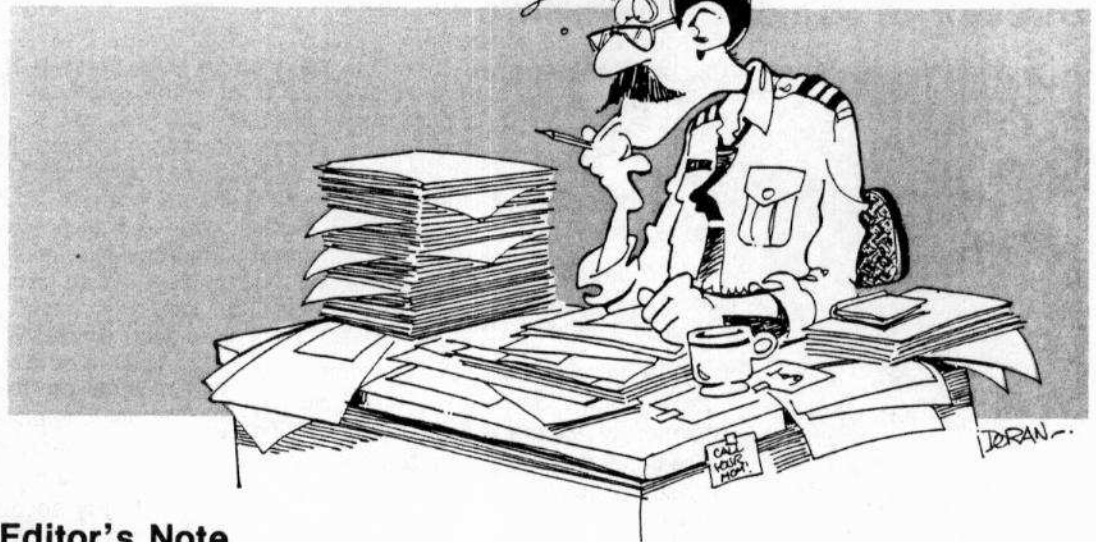
Tous mes meilleurs vœux et bon tir.

A handwritten signature in dark ink, appearing to read 'D.G. Taylor'.

D.G. Taylor  
Colonel, Directeur du Corps Blindé

## LETTERS TO THE EDITOR

## LETTRES À L'ÉDITEUR



### Editor's Note

Your comments on any article appearing in the Bulletin (or on any armour subject) are most welcome. Letters should be addressed to the editor and, of course, be to the point.

### Note du rédacteur en chef

Vos commentaires au sujet des articles qui apparaissent dans ce Bulletin (ou concernant n'importe quel sujet blindé) sont les bienvenus. Votre correspondance doit être adressée au rédacteur, et prière d'être bref et concis.

### Introduction

The letter which follows is an amusing story about one trooper's initiation to the Armour Corps at the beginning of World War II. The trooper, Mr. Michael L'Abbé Aylwin, works as a free-lance writer in Montreal.

It looked good in the movies. Heroic, Errol Flynn on horseback, with sword at the ready, leading his troops in a final cavalry charge. The roar of the guns and horses in the background. Like most animal lovers, I had a fondness for horses, however, my first encounter with horseflesh soon changed my feelings.

As a teenager, still enchanted with the beasts, I spent my leisure Sunday hours watching riders cheerfully galloping over the rolling hills of Mount Royal. I even took lumps of sugar to feed the horses while they were at their watering trough. "Oh, aren't they the sweetest things you ever saw!" exclaimed a passer-by one day. I thought so, too. In fact, then and there, I decided to enlist as a Trooper with the non-permanent 17th Duke of York's Royal Canadian Hussars just two blocks from my house. Fortunately, the

Honorary Colonel of The Regiment was a friend of the family and put in a good word on my behalf.

When I first reported for duty in my spanking new uniform, a burly Sergeant greeted me gruffly with "Welcome to the cavalry, Trooper - follow me!" and headed for the stables at the rear of the armoury.

Already I envisioned myself outfitted in my Sunday "church parade" black and gold uniform complete with busby, sitting erect in the saddle on a magnificent shiny, black stallion and cantering smoothly in a troop four abreast - just like in **The Charge of the Light Brigade** - all over Mount Royal. Young girls would wave and blow kisses as we flashed by.

"Here we are, Trooper, and keep your eyes open," warned the Sergeant "White Sox in number 17 is a kicker; put a man in the hospital just last week." I could hardly contain myself: stables! horses! riding! Forty stalls, twenty on each side, sheltered The Regiment's well-groomed mounts.

"Which one is mine, sir?" I asked, bubbling over with excitement.

**"They're all yours!"** barked the Sergeant as he handed me a heavy pitchfork and a shovel. "Starting right now, Trooper, for one week you're in charge of the finest manure pile in Eastern Canada."

"Bu-but, Sarge, my new uniform," I started to protest.

"Up one side and down the other, Trooper. Once around, and again, and again, follow me. Understand?"

"Bu-but, Sergeant, sir, you don't understand. I joined up to ride!" He had no mercy. "Horse manure, Trooper. To be a real cavalryman ya gotta smell the horseshit. Now, three times around – get going!"

That was only the beginning. True to the form of breaking in new recruits, they gave me the meanest, ugliest critter in the entire regiment. On my very first ride, the rotten creature, snapping at every horse in our section and bucking and kicking like a mud mule, grabbed the bit in his teeth and took off over Mount Royal with me, a total loss, in the saddle.



Circling the troop in a frenzied gallop my crazed monster, still snorting and puffing, had the good horse-sense to select just the right tree to throw me clear out of the saddle. Lying prostrate in a putrid, watery ditch, my ears managed to pick up my ultimatum.

"Get that horse back in line or else!" bellowed our Regimental Sergeant-Major, his voice reverberating over hill and dale.

Failing dismally to remount amidst the hooting and jeering from the entire unit of forty decorously mounted cavalryman, disheveled and covered in muck I shamefully shuffled back – a sorrowful sight and a sodden wretch of a soldier – to my section, leading Man O'War behind me.

At long last grasping the reins firmly in the left hand and with my left foot high in the stirrup and my right foot slithering on unfriendly ground, I clambered back into the saddle and, with disdainful side-glances from my fellow troopers – and barely in control – headed back to the stables. I was humiliated. Even more on the very next command.

"Back to the manure pile, Trooper!" snapped by Sergeant after we had dismounted. "Now, once around –..."

"I know! I know! And around and around!"

But wonder of wonders, my day of deliverance finally arrived: World War II broke out and we got rid of those brutes, the pitchfork and the shovel and were transferred to beautiful smooth-purring "motorized" cavalry requiring – thank God – only the occasional throw-away can of oil.

My kingdom for a horse? NOT ME  
THANK YOU VERY MUCH.

## CORPS UPDATE NOUVELLES DU CORPS



### Appointment of Colonel Commandant

On behalf of the Chief of the Defence Staff, the Director of Armour is pleased to announce that Brigadier-General G.G. Bell, OC, MBE, CD has been appointed by the Minister of National Defence to succeed Major-General W.A. Howard, CMM, CD, QC as Colonel Commandant of the Royal Canadian Armoured Corps on 1 October 1990.

Brigadier-General Bell enrolled in the Queen's York Rangers (1st American Regiment) and was commissioned in that Regiment in August, 1940. In March, 1941 he was posted to the 12th Canadian Army Tank Battalion (Three Rivers Regiment). Following World War II, he remained in the Canadian Army Regular, with the Royal Canadian Dragoons.

◀With over 32 years service, Brigadier-General Bell served in numerous senior staff appointments at Army HQ, FMCHQ and NDHQ. He served as the Second-in-Command of his Regiment, as a member

of the Directing Staff at the Canadian Army Staff College and as Chief Instructor of the Royal Canadian Armoured Corps School at Camp Borden. As well, he commanded the Canadian Contingent, United Nations Emergency Forces in the Middle East and was the Senior Canadian Military Officer serving with the International Control Commission in Indo-China.

He has also served as Honorary Lieutenant-Colonel of the Queen's York Rangers (1st American Regiment) for 10 years and as Colonel of the Regiment, the Royal Canadian Dragoons since July, 1984.

Brigadier-General Bell resides with his wife Jean at 206-225 Bamburgh Circle, Scarborough, Ontario, M1W 3X9.

### Nomination du Colonel Commandant

C'est avec plaisir que le Directeur de l'arme Blindée, au nom du Chef de l'État-Major de la défense, annonce la nomination du Brigadier-Général G.G. Bell, OC, MBE, CD, par le Ministre de la défense nationale comme successeur du Major-Général W.A. Howard, CMM, CD, QC, au poste de Colonel Commandant le Corps blindé royal canadien entrant en vigueur le 1<sup>er</sup> octobre 1990.

Le Brigadier-Général Bell s'enrôle dans le Queen's York Rangers (1st American Regiment) et y reçoit son brevet d'officier en août 1940. Il est muté au 12th Canadian Army Tank Battalion (Three Rivers Regiment) en mars 1941. Suivant la seconde guerre mondiale, il continue son service dans l'armée régulière canadienne au sein des Royal Canadian Dragoons.

Durant ses 32 années de service, le Brigadier-Général Bell occupe plusieurs postes d'état-major, notamment au QG de l'Armée, de la Force Mobile et à la défense nationale. Il sert comme

commandant adjoint de son Régiment et comme membre du personnel dirigeant au collège d'état-major de l'armée de terre.

Il est aussi Instructeur en chef à l'École du Corps blindé royal canadien à Borden. De plus, il commandé le Contingent Canadien, Forces d'urgences des Nations Unies au Moyen Orient et sert en tant qu'Officier supérieur Militaire Canadien avec la Commission de contrôle Internationale en Indo-Chine.

Finalement, il sert en tant que Lieutenant-Colonel honoraire du Queen's York Rangers (1st American Regiment) pendant 10 ans et comme Colonel du Régiment, au Royal Canadian Dragoons depuis juillet 1984.

Le Brigadier-Général Bell demeure avec sa femme Jean au 206-225 Bamburgh Circle, Scarborough, Ontario, M1W 3X9.



## RCAC 50th Anniversary Activities

During the year, in addition to the opening ceremonies for the armoured display at the Canadian War Museum on 6 June, there are a number of association and regimental activities to commemorate the 50th Anniversary of the Corps. These activities have been coordinated by region and are listed below in their regional groups, by date.

### Western Region

31 Mar	BCD	Regimental Reunion
12 May	SALH	Trooping of the Guidon, Freedom of the City parade (Medicine Hat), Currie Park dedication and Regimental Ball
19-20 May	LdSH (RC)	90th Anniversary Celebrations
3 Jun	FGH	D-Day Parade and Regimental Reunion
28 Jun	LdSH (RC) KOCR	Opening of the Museum of the Regiments by Her Majesty, Queen Elizabeth II
30 Jun	KOCR	Parade and roll past for Her Majesty, Queen Elizabeth II
11 Aug	BCR	Hill 140 parade and dinner
Sep	All	Mess dinner for outgoing Colonel Commandant
Oct	All	Western Warrior 90

### Central Region

28 Mar	QYR	Freedom of the City Parade (Aurora)
10-13 May	GGHG	Regimental Reunion
3 Jun	1 H	D-Day Parade and Regimental Reunion
26 Jun	1 H	Rededication of War Memorial at Courseulles-sur-Mer, Normandy, France
30 Jun	1 H	Attend Guidon presentation to Allied Regiment (Royal Hussars)
13 Jul	All	Black Beret function (end Ex On Guard)
18 Aug	RCD QYR GGHG Ont R	Warriors Day Parade at CNE
18 Aug	Windsor R	Warriors Day Parade in Windsor
7-9 Sep	Ont R	124th Regimental Birthday & RCAC 50th Anniversary Celebration
15 Sep	Elgin R	Freedom of the City Parade (St Thomas)
22 Sep	1 H	Warriors Day Parade (London)
30 Sep	All	50th Anniversary Parade and Memorial Service at CFB Borden. This activity will follow the RCAC Association Conference and all Black hats are welcome to attend and participate. Accommodation is an individual responsibility

**Secteur de l'Est**

16 Jun juin	12eRBC	Réunion régimentaire à Trois-Rivières. Les unités de la Force régulière et de Milice vont y participer
11 Aug oct	Sher H	Réunion régimentaire dédiée au char "BOMB"
24 Oct oct	All	Dîner régimentaire pour toutes les unités; tenu par le RCH

**Atlantic Region**

12-13 May	Halifax Rifles	Rededication of Memorial Tank and Association Reunion
2 Jun	8CH (M)	Change of Command and Freedom of the City Parade (Moncton)
22-23 Jun	PEIR	Regimental Reunion & Freedom of the City parade (Charlottetown)
11 Aug	RCD	Freedom of the City parade (Fredericton)
11-12 Aug	School RCD 8CH (M) PEIR	Warriors Day parade in Honour of the 50th Anniversary and associated anniversary activities at CFB Gaagetown. This will include dedication of the tank "Worthy"

**CFE (8CH)**

4 Apr	8CH	Liri Valley Day - parade and ceremony in honour of 50th Anniversary
Oct	8CH	Change of Colonel of the Regiment

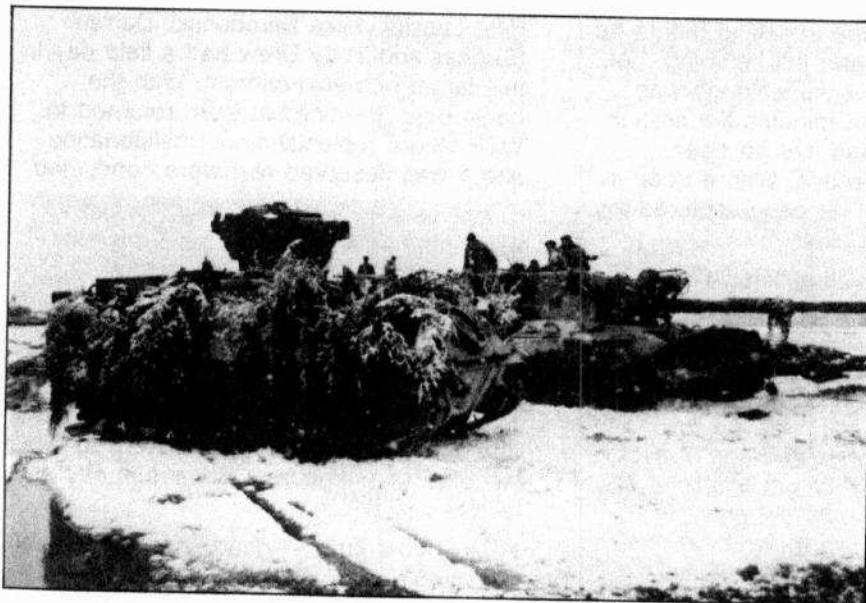




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## **C Squadron, The Royal Canadian Dragoons Conducts Exercise ROYAL SPRINGBOK 90**

"3 this is I2 SITREP: Objective secure, three prisoners of war taken, four minor casualties, ready to continue with task, out". Reports such as these were common as C Squadron, The Royal Canadian Dragoons and H Company, 2nd Battalion Royal Canadian Regiment (2RCR) conducted Exercise ROYAL SPRINGBOK 90, a two day, live fire combat team exercise. Other elements involved included an Armoured Vehicle Laying Bridge (AVLB) detachment from 22 Field Squadron, the Pioneers and four TOW Under Armour (TUA) vehicles from 2RCR. The safety staff consisted of Armour and Infantry officers and men from both the Armour School and 2RCR.



*Key elements of the combat team. Note the mineplough.*

The exercise was conducted over the period 3-8 April 1990, with the actual live fire portion occurring on the last two days. It began with the Squadron deploying to Worthington Tank Park (WTP) in the CFB Gagetown training area on 3 April. What was unique was the fact that C Squadron deployed via Highway 7, and judging by the looks on the faces of passing motorists, the sight of 19 Leopard tanks on this road was a rare and impressive site. After arriving at WTP and linking up with H Company, a "dog and pony" was conducted to allow the infantry soldiers to see the tanks close up.

Over the next three days, troop, platoon and combat team level exercises were conducted to allow each unit to work out the kinks. Corporal Mike Andrews for example, learned that if you don't hurry back in from the sentry post on a harbour exit, you may get left behind. 4 Troop practiced the "three tanks in a bog" drill so loved by Armour Corps soldiers using Gagetown's Lawfield corridor.

The AI echelon worked smoothly under the eagle eye of Master Warrant Officer Bruce Pendergast, who managed to "adequately" juggle ammunition, targeting, showers, tentage, transport and the hundred and one other points that kept the tanks functioning. Somehow he even coned the Administrative Officer, Captain Fernando Martins, to sling ammunition at a night replenishment.

With the "dry" work-ups complete the Squadron prepared for the live fire portion of the exercise. Early on Saturday morning, the combat team departed for the line of departure. Sergeant Carl Cox and his crew in 32B got the exercise off to a good start when he destroyed an anti-tank gun lying in ambush along a narrow road. With the first round fired, the combat team raced into their first assault with main guns and machine guns blazing. As the fire base engaged with pin point accuracy, the assault force closed with the objective. H Company provided close protection for the tanks in the assault and helped to quickly secure the objective. Exploitation found a few enemy tanks and anti-tank guns lying in depth, which were quickly destroyed by the gunners in the assault force tanks.



*Taking on ammo at a battle replenishment.*

With visibility reduced to 1000 metres, the combat team, supported by a "notional" tank squadron, cleared a long defile of enemy and launched through a minefield breach to capture the next objective. Using his mineplough, Sergeant James Cook managed to pull halfway through his side of the minefield before he was "knocked out" and left "burning". At that point, the reserve mineplough was committed and within minutes the assault force was through and had an open approach to the objective. With a troop in intimate support, H Company captured the day's last enemy position.

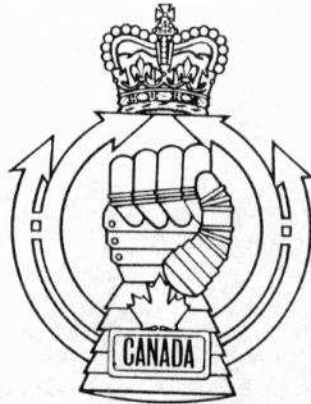
The next phase was a defensive scenario, H Company dug-in and was the anchor of the main defensive area. The tanks and TUA were responsible for the long range engagements into the kill zone. Again the echelon, with soldiers like Corporals Ron Johnson and Joe Hussey and Trooper Brad Trenholm, kept the F echelon supplied with fuel and ammunition, as well as the little "niceties" such as pop, gum, rations and water.

After destroying the enemy lead forces, the combat team conducted a deliberate delay operation. The pioneers blew craters to slow the enemy advance. The friendly

infantry took every opportunity to ambush the lead enemy vehicles, while the tanks and TUA concentrated on the enemy "main body". The grande finale saw the entire Squadron engage forty targets in a local counter attack by fire, which left the lead enemy formation decimated. Troopers Pete Lussier, Mike Bembenski, Darren Burgess and Tony Drew had a field day in this target rich environment. With the battle over, the combat team returned to WTP where replenishment, maintenance and a well deserved rest were conducted.

It is seldom that combat teams get to participate in live fire exercises anywhere in the Canadian Army. The lessons learned and confidence gained by new and old soldiers alike made Exercise ROYAL SPRINGBOK 90 a successful culmination to a busy training year. Exercise ON GUARD is around the corner and C Squadron is looking forward to working with its' parent Brigade in any and all tasks.

Until next time — good shooting. —



## Depot Squadron

In September 1987, the Armour School formed Depot Squadron to conduct the Qualification Level 3 (QL 3) course. This freed the regiments from the responsibility and allowed the training resources to be consolidated in one place and ensured a standardized level of training. The aim of the QL3 course is to train graduates of the Canadian Forces Recruit School at CFB Cornwallis to perform the general duties of a crewman in an Armoured Regiment. The course is divided into two parts. Part One is run by Depot Squadron and is designed to teach the skills common to all Armour Crewmen. Part Two is a Primary Combat Function (PCF) course taught by one of the other squadrons at the Armour School. A PCF prepares a soldier to perform a specific task once he arrives at the regiment, for example Leopard gunner or Cougar driver. Depot Squadron runs ten QL3 Part One serials per year and can have up to four courses in house at the same time.



Each QL3 Part One course consists of approximately 28 students, which are divided into four sections each commanded by a Master Corporal. An increment Troop Leader (from the sponsoring regiment), a course Warrant Officer (Sergeant) and a Corporal responsible for administration, make up the troop headquarters. The course will last 42 training days and is broken down into the following performance objectives:

- a. drive a 1-1/4 ton truck with a trailer;
- b. communicate using telecommunications equipment;
- c. fire the GPMG;
- d. fire service weapons;
- e. perform crewmen field duties; and
- f. achieve physical fitness.

### Drive a 1-1/4 Ton Truck with a Trailer

Training on the 1-1/4 ton truck emphasizes driver maintenance, documentation, recovery and actual driving. Students are given opportunities to drive on tracks, trails and hard surfaces both during the day and at night. The aim of driver training is not necessarily to produce a 1-1/4 ton truck driver but to produce a driver in general. The skills students develop on a simple vehicle, like the 1-1/4 ton truck, will be built upon later as they become exposed to more complex vehicles.

### Communicate Using Telecommunications Equipment

During this phase of training, students become versed in how to operate the radios, line equipment and generators common to the Armoured Corps. Particular emphasis is placed on the operation of the A and B radio sets and antennae. The most important aspect of this phase of training is radio telephone procedure. Currently, Depot Squadron is developing a day long radio telephone procedure exercise which will allow the students to practise the many voice procedure skills needed to effectively communicate with a radio. In the past, QL3 graduates were awarded the Basic Communicator Qualification however, this is no longer possible due to a reduction in training time and a change in emphasis toward only the radio equipment used by the Armoured Corps.



### Fire the GPMG

All students are given an opportunity to fire 440 rounds at stationary targets ranging from 100 m to trace burn out using the very old, yet reliable C5A1 General Purpose Machine Gun. This is a familiarization shoot only and is conducted from the ground mount.

### Fire service weapons

Definitely a favorite portion of the course. Students begin by throwing two fragmentation grenades. Later they fire the Short Range Anti-Armour Weapon (light) (SRAAW(L)-M72) at close range hard targets. Since all Canadian Forces personnel are exposed to pyrotechniques during their careers, QL3 students are also taught how to safely use smoke grenades, trip flares, thunder flashes, artillery simulators and para flares.

### Perform Crewman Field Duties

The most important aspects of this phase of training are the duties and responsibilities of a harbour guide and of a sentry. However, plenty of emphasis is placed on fieldcraft and field duties during the nine days spent in the field. Students are also exposed to the laws of armed



conflict, conduct after capture and handling prisoners of war. Vehicle and aircraft recognition are also included as well as detecting and reacting to mines and booby traps.

### Achieve Physical Fitness

All students complete the Force Mobile Command Battle Efficiency Test (2 x 16 km march), the combat swim test and the CF EXPRES test.

The emphasis is not to beat the student into shape but rather to gradually build a fitness base which can be further developed at the regiment.

At the end of Part One, there is a graduation parade and a badging ceremony where each student is presented their Regimental Cap Badge and welcomed into the Regimental family. Only one more step must be accomplished before the new trooper can join the regiment and that is completing a PCF course. Depending on which regiment and what positions need to be filled, the trooper can do one of the following PCF courses:

- a. Leopard Driving and Maintenance;
- b. Leopard Gunnery;
- c. Cougar Driving and Maintenance;
- d. Cougar Gunnery
- e. Reconnaissance Crewman

Over its short history, Depot Squadron has undergone a number of changes and continues to modify its training approach in order to ensure the Corps receives the best trained crewmen possible. The quality of graduates attests to the hard work and dedication of all those who have worked in Depot Squadron.

**Lieutenant Andrew Coxhead** is a Troop Leader with The Royal Canadian Dragoons at CFB Petawawa. He recently finished three months with Depot Squadron as a Troop Leader.

## FEATURES ARTICLES



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### **WATER: How Does the Crewman Get It? Is Enough Available?**

The soldier on the modern battlefield must have water to effectively carry-out his duties, be it the infantryman digging a slit trench or the Brigade Commander commanding his brigade. The key is how much each person requires? In past conflicts water consumption was not given ample attention. In the 1967 Egypt-Israeli Six Day War, the Egyptians suffered 20,000 deaths from heat stroke, while Israeli heat casualties were minimal. The Egyptians received advice on water requirements from their Soviet advisors, who at the time recommended 2.5 to 3.5 litres of water per soldier per day. After the Six Day War, the Soviets revised their individual water needs to eight to ten litres and subsequently increased this amount to 15 litres per day after the 1973 Yom Kippur War. Due to this increase of water requirements in Soviet doctrine, the Egyptians suffered fewer casualties from heat-related losses. The Israeli Defense Force's daily water requirement was and continues to be 11-18 litres per man per day.<sup>1</sup>

Water is one of the four combat supplies, the others being ammunition, rations and POL, and has been taken for granted for many years. The resupply of the three other combat supplies has been clearly defined in all Canadian Forces publications, but emphasis has not been given to the resupply of water. On the 1987 Qualification Level 7 (QL7) Course, 12 Warrant Officers with an average time in service of 28 years were asked to explain how water was resupplied. Interestingly, they did not realize a resupply problem existed and once identified they could not find a workable solution using the present equipment.

### United States Studies

The United States military has recognized the need to provide adequate water for their soldiers and have adopted a tactical water planning factor of 75 litres per soldier per day. This amount does not include the water required for decontamination. In order to achieve this daily amount the United States military has the capability to drill wells up to 1,500 feet anywhere in the world. As well they have water purification units which can pump 1,500 gallons of drinkable water per hour. The water is stored in either 3,000 gallon collapsible tanks or in water tankers.<sup>1,2</sup>



During a combined Navy and Marine Reservists exercise in 1980 a clinical study was conducted to determine the following:

- a. evaluate the role of the Botsball thermometer, a device to measure the wet bulb globe temperature (WBGT);
- b. assess the actual number of heat-related casualties during a military exercise in the desert; and
- c. determine the value of intensive education on the number of heat casualties.

The study was conducted in a desert in California. Some 6,000 Reservists participated in the exercise. The troops were provided with normal base camp facilities much like those established during the RENDEZ VOUS (RV) series of exercises in CFTA Wainwright. The temperature reached 120 to 130 degrees Fahrenheit daily. The WBGT index was Condition 4 (a state of voluntary to no activity).

To conduct the study two Marine Companies were selected. They were given detailed briefings on survival in extreme high temperatures and each company was given a Botsball thermometer which enabled them to monitor the environment, thus determining the amount of water and rest that would be required. The Botsball thermometer gave four condition levels which determined the water intake and work/rest cycle:

- a. **Conditions 1 and 2.** One litre of water with each of three meals and one litre (prehydration) before any sustained activity. Drink at least half a litre per hour for the remainder of the working day. Adjust the work-rest cycles to about 50 minutes work to ten minutes rest.
- b. **Conditions 3 and 4.** Same as above, but drink at least one litre of water per hour during the working day. Reduce the work-rest cycle to either 30 minutes work to 15 minutes rest or 15 minutes work to 15 minutes rest, depending upon the condition of the troops.

The remaining companies were given the normal pre-exercise medical briefing and were not denied access to water. The companies not involved in the experiment suffered up to 67 percent heat-related casualties, 46 percent were treated at battalion aid stations, the remainder were sent to the field hospital. The two companies which were studied received no heat-related casualties. This clearly demonstrated the need for education and training at all levels, to consider the effects of the environment when training.<sup>3</sup>

The results of this study are, to a certain extent, valid in Canada and Europe since temperatures do reach extremes, whether the soldier is on the ground working or in his Armoured Fighting Vehicle. Therefore, there is a need to ensure that our soldiers are properly educated and that they receive the rest and water required to function properly. Rest is always in short supply during operations, however, the lack of water should not compound this problem.

### **Soviet Water Resupply Doctrine**

The Soviet Army has recognized the need for an efficient method of water resupply. They feel that, if water is not provided to their troops, the offensive may stop. The Soviets have identified precise water-use norms. They are:

- a. combat personnel — 10 litres per day under normal conditions. 15 litres per day in high temperatures
- b. sanitation and bathing — 45 litres per day;
- c. contaminated conditions:
  - (1) cleaning an assault rifle — .5 litres, and
  - (2) cleaning a vehicle with jet hose — 600 to 1000 litres; and
- d. washing and vehicle supply — 75 litres to wash a wheeled vehicle and an estimated 1.5 litres per day to keep the radiator filled.

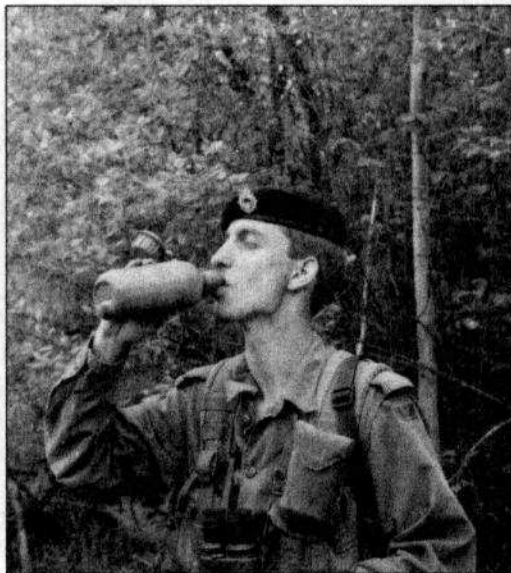
Like the United States, the Soviets have the capability to drill for water. At the division level, the engineer battalion has three two-man drills available. Each can be set-up in under two hours and can pump

from 1,300 to 2,000 litres per hour. As well, they can pump and purify water from rivers and lakes up to a capacity of 8,000 litres per hour. Of particular interest is their ability to purify radioactive contaminated water at a rate of 4,000 litres per hour. In addition to their ability to drill, pump and purify water a Soviet Division can store up to 5,000 litres in rubber bladders and transport up to 6,000 litres.<sup>4</sup>

### **A Soldier's Needs**

A soldiers' water requirements will vary depending on the type of operation or task and the climatic conditions in which these tasks are to be carried out. According to the Canadian Forces Health Manual a water allowance of 22 litres per man per day will fulfill all usage requirements. The absolute minimum is 4.5 litres, while the desirable minimum is nine litres in temperate climates.<sup>5</sup> This naturally is dependent on the activity and the temperature. The more strenuous the work, the more the individual will perspire, causing a greater desire to drink in order to replace lost fluids. In extremely hot conditions, the loss of body fluid by perspiration may total .75 litres per hour, depending on the severity of the work. The table below indicates the minimum water requirements for various activity levels:<sup>5</sup>

Activity	litres per man per day	
	less than 26°C	greater than 26°C
Light (clerical)	22	36
Moderate (route march)	27	40
Heavy (forced marches, entrenching, and route marching with heavy loads or wearing NBC clothing)	31	50



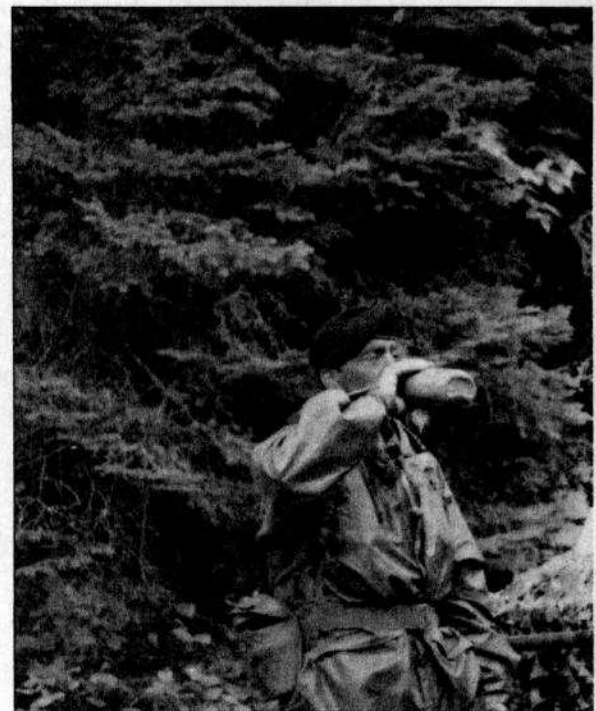
According to Canadian operational staff data, the water consumption per day for a soldier is up to 14 litres and five litres for vehicle maintenance, in temperate or cold climatic conditions. These amounts are far greater than the amounts carried onboard any Armoured Fighting Vehicle.<sup>6</sup>

The intake of water is the only way to prevent dehydration. Drinking fluids is how the human body replaces water lost through perspiration. According to a study conducted by a medical center in Israel, 15 litres of water per person is the optimum daily requirement. Each person working outdoors should consume at least one litre of water per hour.<sup>7</sup>

After perspiring, the body's built-in thirst mechanism tells the brain that the fluid level is low and water needs to be replaced by drinking. The amount of water which is to be consumed is directly related to the amount of fluid lost through perspiration. For example, if after three litres of fluid is lost through perspiration, three litres of fluid must be replaced. The problem in this case is getting an individual to drink three litres of water.

Most individuals cannot drink the amount of water lost as quickly as the body demands it. When this happens, a phenomenon known as "voluntary dehydration" occurs. Basically this means that even though water is available, the individual will still be dehydrated. In order to prevent voluntary dehydration fluids must be force-fed into the body. As a guide, the individual should drink enough water daily so that the colour of his urine will always be very light yellow to white or clear in colour.<sup>7</sup> During RV 87, the Division Surgeon directed all supervisors to monitor the amount of water consumed by soldiers and ensure that they urinated white at least once a day.

The type and temperature of the fluid was a key consideration during the Israeli medical centre study. They found that warm water was undesirable, cold water was consumed too slowly, and carbonated drinks gave a false sense of being full and consequently not enough was consumed. Cold, sweetened, fruit flavoured drinks were preferred by most soldiers, and were found to prevent voluntary dehydration almost completely.<sup>7</sup>





The availability of water is critical, soldiers should not have to go very far for a drink. The study also determined that drinking small amounts of water frequently was preferable to large quantities spaced over long intervals.<sup>7</sup>

### **The Basic Load**

Using the above data as a guide, each Armoured Corps soldier requires approximately 15 litres of drinking water per day. Add to this 15 litres for washing and cooking and approximately 5 litres per day for the tank, the total amount each tank must carry is 80 litres. Therefore, the F Echelon of an Armoured Squadron with 19 tanks would need approximately 1600 litres per day.

Currently a tank carries one 20 litre jerri-can externally mounted and four 5 litre plastic cans internally mounted. The internally mounted plastic cans are reserved for NBC purposes and will not be considered in detail, except that the 20 litres is not sufficient to replace fluids lost by the four crew members, when closed down over an extended period. The 20 litres externally mounted in a plastic jerri-can should, according to the table above only provide drinking water. The crew however, has to use this water for washing, cooking and maintenance.

The A1 echelon is responsible for carrying the second 24 hours of the basic load. Normally the Squadron Sergeant Major (SSM) only carries 10 to 15 plastic jerri-cans on the roof of his APC or in the back of a cargo truck. Regardless of where the water container is carried, the A1 echelon does not carry enough jerri-cans for a one-for-one replacement with the F echelon and sufficient jerri-cans to replenish itself.

The A2 echelon, like the A1 echelon, should carry the third day's basic load. This load is presently held in a 1200 litre water trailer pulled by a cargo truck under control of the Squadron Second-in-Command (2IC).

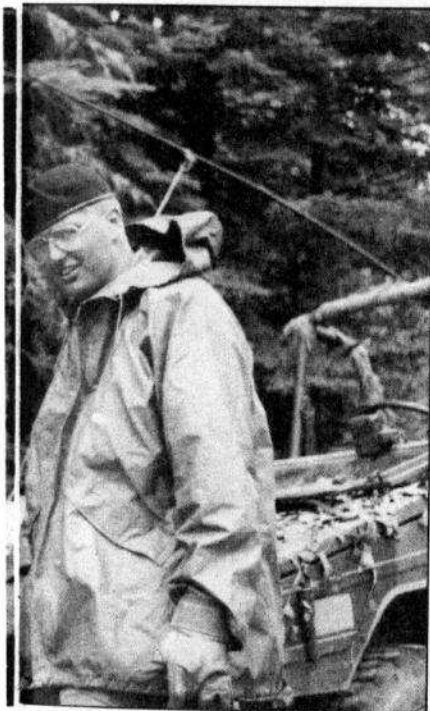
### **The Replenishment System**

Water is seldom demanded by the troop from the A1 echelon, since water is a normal commodity brought forward daily by the SSM when he is resupplying the F echelon. Only extreme amounts of water need be requested. At the replenishment point jerri-cans are exchanged one-for-one. When there is not enough water available (since the A1 echelon only carries 15 cans), water is cross-poured from the exchanged cans in an attempt to top-up the F echelon. Hopefully, when this replenishment is complete, each tank has been re-supplied with its' one can of water.

Next, the A1 echelon will meet with the Squadron 2IC and get resupplied with combat supplies held in the A2 echelon. The empty water jerri-cans which form the A1 echelon's basic load, as well as the jerri-cans from the vehicles in the A1 echelon, will have to be filled from the A2 echelon water trailer. Somewhere in the area of 30 jerri-cans may need to be filled or half the holding in the trailer. Filling 30 jerri-cans could take anywhere from 30 to 45 minutes. This amount of time is unacceptable since it provides the enemy with a lucrative target and the F echelon could be engaged in another operation and may require the A1 echelon. All other A1 echelon combat supplies are simply replenished by exchanging vehicles with the A2 echelon, making the whole process very quick except for the water.

Once the A2 echelon has completed resupplying the A1 echelon, it is replenished by the Regimental A2 echelon. However, the water trailer will not get re-filled because the Regimental A2 echelon does not provide bulk water resupply. Therefore, depending on when the unit has been allocated water point timings, the water trailer could remain empty for longer than is desirable.

If there was a need to get the trailer re-filled immediately, arrangements could be made for an emergency resupply of water at the brigade water point. Should the water point be too far back in the rear area, the normal practice would be,





according to Service Battalion doctrine, to transport bulk water forward to the units. The service battalion's present organization does not have the capability to transport water. The engineers, who have the responsibility to establish the brigade water point, similarly do not have an ability to carry water. Therefore, should potable water not be available, or establishing a water point prove to be difficult, the Brigade does not have any dedicated transport for water.

In Corps 86 the system is the same. The engineers are still responsible to establish the water point and the Service Battalion still does not possess the ability to transport bulk water forward.

#### **Solutions or More Problems?**

The following is one possible solution to the water re-supply dilemma. Each tank must have 80 litres of water per day. However, it cannot effectively carry the required four jerri-cans. Therefore, the tank should carry only two jerri-cans while the A1 echelon carries the remaining two. This will allow the SSM to re-supply the Squadron with the remainder of the F echelon's basic load of water throughout the day, using the normal battlefield replenishment cycle. The A1 echelon will now be transporting the squadron's second day basic load plus half of the F

echelon's first day basic load, for a total of 2400 litres or 120 jerri-cans. In order to provide some flexibility and reduce the number of jerri-cans (by 60) the A1 echelon will be given a 1200 litre water trailer which will be towed by the additional truck supplied to the A1 echelon. This truck will also be used to transport the 60 jerri-cans.

In order to speed up the resupply of the A1 echelon by the A2 echelon, the A2 echelon must be identically equipped with a truck transporting 60 jerri-cans plus towing a 1200 litre water trailer. This will streamline water resupply and would provide bulk water transporting capability as well as can-for-can exchanges.

**Major Paul Nielsen** is the Chief Standards Officer at the Armour School.

#### **Footnotes**

1. **Dardeau Elba A, Jr. Satisfying Soldiers' Water Needs.** *Military Engineer* V. 79, August 1987: p. 440-442.
2. **Carberry David O. Cpt/Malson Bruce A. LTC. Army Well Drillers in the Rapid Deployment Force.** *Engineer* V. 17, no. 1987: p. 23-24.
3. **Connelly John, MD/Hubbard Roger. Ph.D/Kerstein Morris, MD/Mager Milton. Ph.D. Heat-Related Problems in the Desert: The Environment Can Be An Enemy.** *Military Medicine*, Vol. 149, December 1984: p. 650-656.
4. **Nease Donald E, Dr. Water supply to Soviet ground forces.** *Engineer* No. 1, 1987: p. 18-19.
5. *CFP 213 Canadian Forces Health Manual.*
6. *CFP 303 (4) Operational Staff Data.*
7. **Epstein Yorman. MSc/Sohar Ezra. MD. Fluid balance in hot climates: Sweating, water intake, and prevention of dehydration.** *Public Health Rev* 1985: 13:115-37.

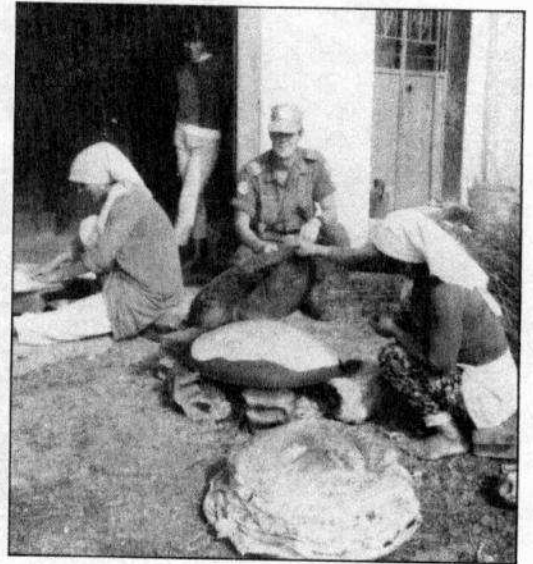


## South Lebanon January 1990

Browsing through some old papers not long ago I came across the report reprinted on the following pages. It was written while I was serving as an UNMO (United Nations Military Observer) with OGL (Observer Group Lebanon). OGL is a duty station of UNTSO (United Nations Truce Supervision Organization). UNTSO was formed in 1949 to monitor the borders of a then, newly created Israel and her neighbours. With a headquarters in Jerusalem and duty stations in Cairo (to man OPs in the Sinai), Tiberias and Damascus (for OPs on both sides of the Golan Heights), Beirut and a small detachment in Amman, Jordan, UNTSO is the longest serving UN mission. It is an unarmed mission of approximately 230 officers from seventeen nations.

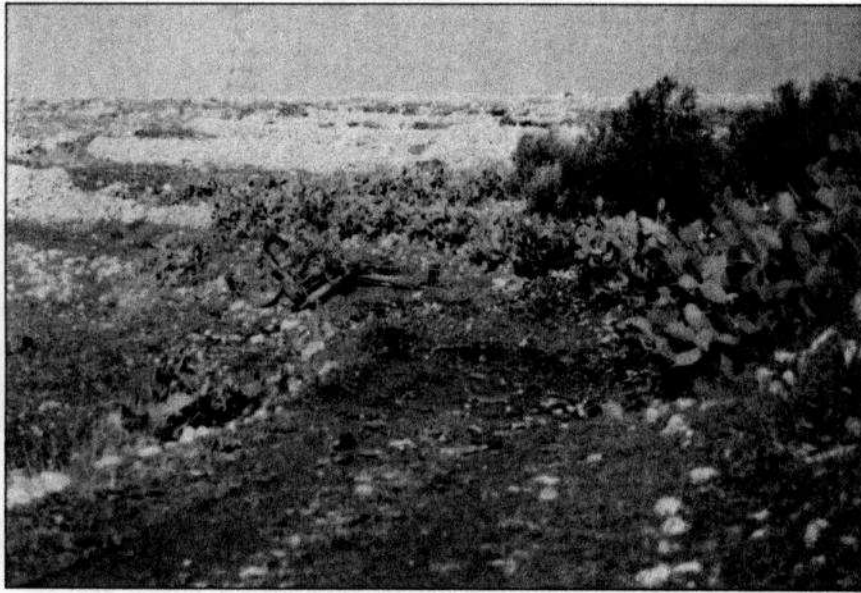


*Two SLA T55 tanks which broke down near Team X-Ray's compound. These tanks were captured by the IDF during one of their previous wars and given to the SLA. One tank had broken down late in the day while returning from a patrol. The other was sent to keep it company during the night when it also broke down. The crews were very glad to see the dawn.*



*Life goes on as best it can. Women making bread with Major Jackson hanging around the kitchen. Most middle eastern people do not like to be photographed, especially women.*

After re-reading the report, which summarized the activities in Team X-Ray's area of responsibility for January 1987, it occurred to me that it quite clearly depicts the life of an UNMO serving with OGL, or any other duty station in an active area. In January 1987, OGL was responsible for manning six OPs. Five of these were along the Israel/Lebanon border. Two UNMOs are on duty in each OP for one week at a time and they monitor and report any violation of the border by forces from either country. The sixth OP (OP Chateau) was located on a spectacular bluff on the north side of the LITANI River. It sat in the shadow of an old crusader castle (Chateau de Beaufort). The castle served as a PLO headquarters until 1982 when elements of the Israel Defence Forces (IDF) captured it after heavy fighting. It remains today a strong IDF position.

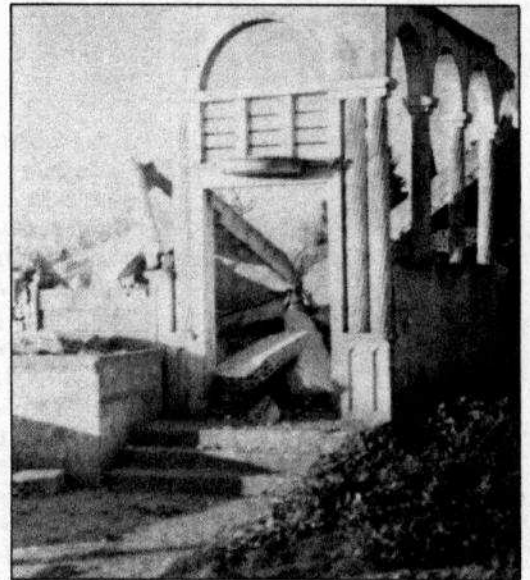


*This photo was taken shortly after five SLA soldiers died when a bomb exploded under the 1/2 track. This incident led to one old man being murdered and the village mucktar (chief or mayor) being wounded by a spray of Kalnisnakov fire.*

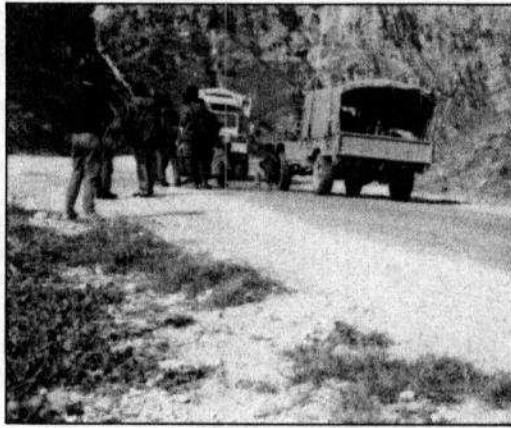
The other component of OGL were the Teams. Each Team (of four officers) was required to have two UNMOs on duty in Lebanon at all times. This meant a length of duty in Lebanon of four to ten days. Only one member would be relieved at a time. When off duty UNMOs lived in the town of Nahariya, a seaside resort town ten kilometres south of the border. Until February 1988 when the Chief of OGL (US Marine LCol Higgins) was kidnapped, there were seven Teams. Five of these worked and were quartered with various battalions of UNIFIL (United Nations Interim Force in Lebanon). Two (Team Victor and Team X-Ray), were tasked to patrol and monitor the area adjacent to the Israel/Lebanon border. This area coincides, for the most part, with the Israeli declared "Security Zone". Each area was 15-20 km deep (north to south). Team X-Ray was located on the eastern half of the Security Zone as it curves toward the north. A policy review following the kidnapping of LCol Higgins resulted in all but three teams being disbanded and the OP Chateau abandoned. The three remaining teams were Victor, X-Ray and Sierra (working with the Norwegian Battalion to the east of X-Ray).

The "Security Zone" provides the IDF with a buffer area through which AE (armed elements; terrorists or freedom fighters, depending upon your point of view) would have to pass in order to launch an attack or raid on northern Israeli settlements. It is garrisoned with a number of IDF strong points which are small forts of earth embankments sprouting MGs at the corners and firing positions for tanks and/or M113 vulcans. From these positions patrols (one APC and one tank) are dispatched nightly to ambush positions and troops are dispatched to as necessary for a multitude of tasks. Because any IDF presence in Lebanon is a violation of the 1949 Agreement, and these forts are permanent, those forts that are on Lebanese soil are known as PVs (permanent violations). Each PV is given a number, ie PV41.

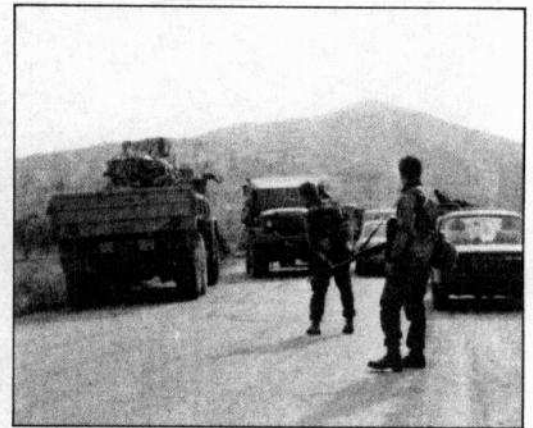
Also providing security to the area is the SLA (South Lebanese Army, also known as the Lhad Militia after their commander General Lhad). This force is trained, armed, paid and supported by the IDF. They are deployed in a series of "company" positions throughout the Security Zone and man a network of checkpoints. Both the IDF and SLA are the targets for ambushes, roadside bombs, and raids by all factions who come under the heading of AE.



*A house in the village of Markabe moments after it was destroyed by the IDF in retaliation for an ambush on an SLA patrol the day before. The removal of belongings or possessions was not permitted before the charges were detonated.*



*A roadside bomb discovered on the Litani Road is about to be destroyed by the IDF EOD team.*



*IDF soldiers direct traffic around a roadside bomb on the Litani Road.*



*An IDF APC on patrol in the village of Kaffir Keela.*

In the middle of all this are the people. Numerous small villages scattered through the hilly and scrub covered country. Most of the people are innocent victims caught in the struggle between the major parties wishing only to work the meagre land, run their shops and send their children to school in hopes that the future will be brighter. Others (especially the young men) are participants either as soldiers in the SLA or members of one faction or another. These young moslems, wearing plastic "keys to paradise" around their necks, plant the bombs at night and conduct the raids. If they die during an operation they have the key to enter paradise. Should they return they will be rewarded with US dollars for their efforts and encouraged to do it again.

Team X-Ray's patrol area was particularly interesting and active. The Team lived in an ATCO trailer located in an UNTSO OP compound. Called OP Mar because it was located close to the village of Markabe, it was dominated by IDF PV41 perched on a high piece of Lebanese ground about 1100 metres to the south. PV41 also commanded the village of Houle and an SLA company position/check point (called the Houle Company). The Security Zone narrowed here somewhat so that the Israel border is only a couple of kilometres from the area that was very active with AE. Markabe had a reputation as being somewhat sympathetic to various AE groups and two of the nearby villages (Bani Hayyan and Tuiusa) were known to have families with relatives who were members of one AE group or another (mostly Hizboulah). A steep, craggy wadi (valley) separated these three villages on the Security Zone side from several notorious AE villages on the "Other Side" (an SLA term).

With this situation in mind Team X-Ray summed up January 1987 (not too different from most other months in Team X-Ray's area of responsibility).

HEADQUARTERS  
OGL  
NAQOURA  
2 FEB 87

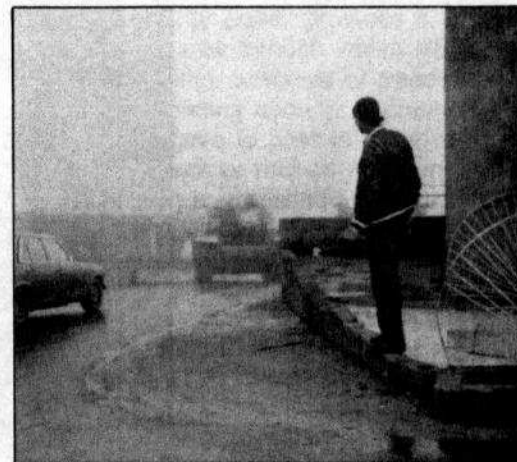
**TO:** COGL THROUGH TC  
**FROM:** TEAM X-RAY  
**SUBJECT:** TEAM MONTHLY REPORT —  
JANUARY 1987

**1. General.** January 1987 proved to be a very active time period in the area of the villages of Houle (AMRI194290), Bani Hayyan (AMRI196294), Tallusah (AMRI197292) and Markabe (AMRI198293). As well, road side bombs continue to be a normal aspect of life along the litani road. An increase of activities by all parties (IDF, SLA and AE) has resulted in gains and losses by all concerned. The IDF have initiated a major new policy of closer support to the SLA. The civilian population continue to suffer intrusions in their day-to-day lives. Irresponsible acts of indiscriminate firing and several atrocities committed by members of the SLA have led to a loss of faith in and respect for the LHAD militia. Lack of money and the continued devaluation of the livre remain to be problems as they affect all aspects of life from food to medical care. This has led to payment of the SLA members in US dollars and increased incentive for men to join the militia.

**2. Main incidents.** The following main incidents occurred:

**A. 4 Jan 87 — Ambush of SLA Jeep in Markabe**

1. Approx 1100 hr (LT),
2. Three AE fires SA at two SLA jeeps driving through the village,
3. One SLA soldier was slightly wounded,
4. The house used by the AE was destroyed by the IDF on 5 Jan 87, and
5. One family — parents and children — were arrested and are being held at Kiam prison;



*A SLA patrol that discovered a roadside bomb on the Litani Road. The bomb consisted of three 120mm mortar rounds taped together. The men are waiting for the IDF EOD team to arrive and are sharing their lunch with Team X-Ray. The officer second from the left is Major Erki Peltonen from Finland.*



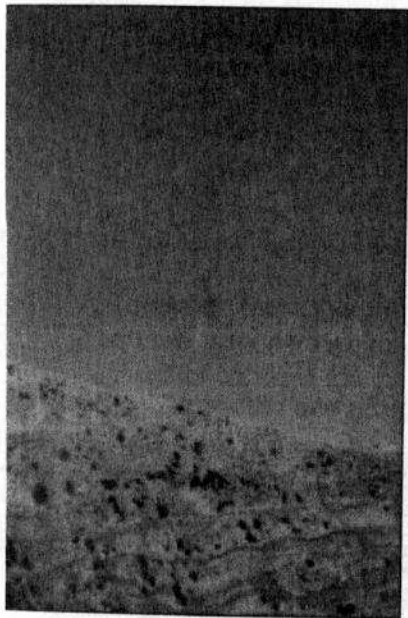
*Chateau de Beaufort overlooking the Litani River and the Litani Road. OP Chateau is just to the right of the castle along the ridgeline. This OP was destroyed and abandoned by OGL as the result of a policy review initiated by the kidnapping of LCol Higgins (US Marine Corps) who was (at that time) the Chief of OGL.*



A demonstration organized by the SLA to protest the shooting deaths, in the village of Markabe, of a woman and her daughter.



IDF artillery redeploy to their positions just inside Israel, following their support to an IDF incursion in Lebanon.



**B. 5 Jan 87 — SLA 1/2 Track Destroyed Near Bani Hayyan**

1. Approx 0745 hr (LT),
2. SLA 1/2 track was lured from the main road onto a little used track on which a bomb had been set,
3. Four SLA crew died immediately and another died later of this wounds,
4. Atrocities from this incident include:
  - a. Bani Hayyan — Father of Iman shot dead,
  - b. Bani Hayyan — Mucktar wounded from a burst of SA fire, and
  - c. Markabe — Shopkeeper wounded from burst of SA fire. Timely intervention by the SLA BN COMD prevented further bloodshed.

**C. 6 Jan 87 — Roadside bomb near Houle (AMRI19922907)**

1. Approx 1700 hr (LT),
2. Three SLA soldiers slightly wounded, and
3. Indiscriminate fire resulted in damage to a school;

**D. 1-16 Jan 87 — continuing arrests in Houle**

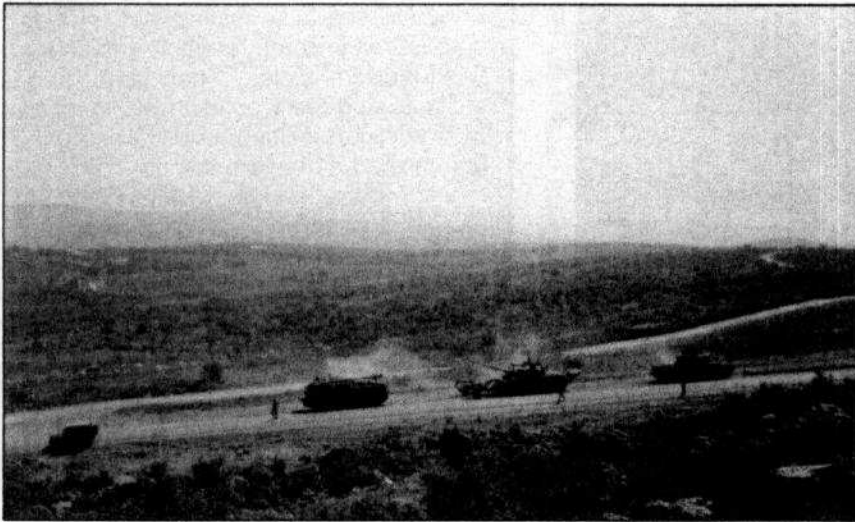
1. A total of 27 people arrested in Houle, mostly as a result of the attack on the Houle COY HQ ON 9 Dec 86, and
2. Movement restrictions have been placed on the residents of Houle;

**E. 9-27 Jan 87 — IDF Support to Houle COY.**

During this time an IDF MECH PL and one MBT operated from this position. The reason appeared to be an attempt to educate the SLA in night operations;

**F. 15/16 Jan 87 (approx) — Discovery of arms cache at Houle**

1. Exact date unknown,
2. Persons arrested for their supposed support of the 9 Dec 86 attack:
  - (A) 60 X Kalishnakoys,
  - (B) 13 X RPG,
  - (C) 1 X 81mm mortars with 72 bombs, and
  - (D) 500 KG of explosives;



*An IDF Centurion with mine rollers is recovered. The tank went out of control on a steep road (probably due to the rollers) and smashed its way across the country, badly damaging the rollers.*



*An SLA check point is resupplied.*

**G. 15 Jan 87 — Roadside bomb Litani road (AMR20103023)**

1. Approx 1700 hr (LT),
2. SLA APC from E15A hit two a/tank mines,
3. The crew sustained no injuries, however, the vehicle was destroyed;

**H. 16 Jan 87 — Roadside bomb — Houle (AMR1996t2910)**

1. Approx 1745 hr (LT),
2. Bomb exploded near IDF APC from Houle COY HQ,
3. No casualties were sustained;

**I. 19 Jan 87 — Three are killed near Markabe (AMR19762988)**

1. Approx 2330 hr (LT),
2. Four AE ambushed by IDF tank and infantry section while setting a roadside bomb,
3. Three were killed by tank fire at the spot while another was reported to have died of wounds later,
4. AE were reported to be part of group of 12 operating in the area. They may have been responsible for the 4 and 5 Jan 87 incidents,
5. The SLA state that one of the dead men was from Tallusah and the other two were originally from Markabe;

**J. 27 Jan 87 — Ambush in Kham (AMR207303)**

1. Approx 2300 hr (LT),
2. Target was, apparently, Ghazi Dawi (SLA COY COMD),
3. Two SLA soldiers using Dawi's car were stopped at an ambush site and shot; one dead; one wounded,
4. "Who and Why" are not known;

**K. 30 Jan 87 — Search operation Bani Hayyan (AMR196294)**

1. Approx 40 SLA soldiers searched houses,
2. Several persons were harassed,
3. Two young women were arrested,
4. One shop was reported to be looted of goods and robbed of money.

**3. IDF/GSS Activities.** The IDF have instigated a new policy of closer support to the SLA. The apparent intention is to make the SLA a more effective force. This is evidenced by: The tank and pl at the Houle COY HQ (9-27 Jan 87); increased night patrolling; and quick support (fire and troops) from PV41. The IDF also want to increase basic training from one month to two months for the SLA recruits. Better relations with the UN also appears to be a priority with the IDF. Senior IDF officers are now more willing to talk with members of team X-Ray.





*Members of Team X-Ray and Sierra conduct relief by a helicopter flown by Itai Air (an Italian Air Squadron which is part of UNIFIL). The UNMOs will return to Nahariya for a few days before returning to Lebanon for another four to ten days of patrolling.*

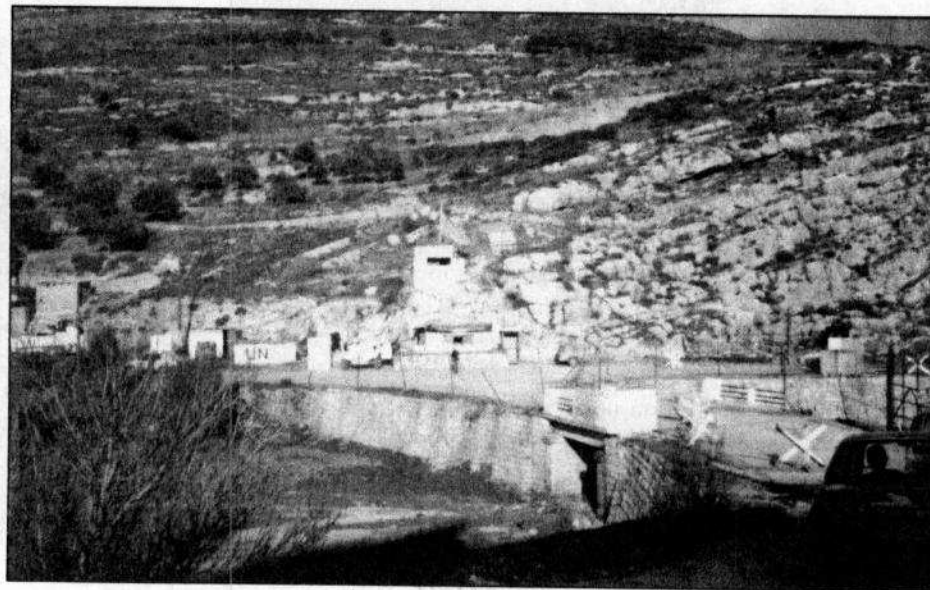
**4. SLA activities.** The SLA are slowly learning the value of night operations. As well, the value of good information sources in gaining importance. Prior knowledge of an AE operation led to the killing of three AE near Markabe on 19 Jan 87. Persons arrested from Houle on 30 Dec 86 have implicated 21 others, as well as disclosed an arms cache. Despite a seemingly improved military capability, the SLA remain to be a basically undisciplined and poorly controlled collection of armed men. This has not gone unnoticed by the civilian population.

They still see SLA soldiers run from an ambush only to return when it is safe, firing indiscriminately. The murder of one old man and the wounding of others by SLA soldiers seeking revenge has gone unpunished as have beatings, humiliations, looting and robberies. All these incidents are signs of an undisciplined force; Discipline being the bonding agent of an effective and respected army.

**5. Armed element activity.** The villages of Markabe, Bani Hayyan and Tallusah are considered, by the SLA/IDF to have strong sympathy for Hizbollah. The village of Houle also has a reputation of supporting other factions. Whether or not this is true is not very important since the SLA/IDF base their policies and activities on the belief that the local people are antagonistic. It is also believed that a group of 12 persons (mostly young men originally from Markabe, Tallusah and Bani Hayyan) have been responsible for most of the activity (in the area 9 except the roadside bombs near Houle). The killing of three (possibly four) of this group may dampen the enthusiasm of the others for a while. However, numerous arrests and movement restrictions on the residents of Houle have not stopped the planting of roadside bombs.



*Waiting at the Shaqra Gate. This is a SLA controlled crossing point between the Security Zone and the "Other Side". Long waits, detailed searches and a little "backshech" are the norm.*



*A typical UNIFIL checkpoint. This one is in the IrishBat area of operations.*

**6. Civilian sector.** The economic situations has not improved, however, the first hints of spring, the promise of electricity in the near future and general acceptance of the situation have kept the people going. The SLA are not trusted by most people, although they have respect for the IDF. Few people see any long term solutions to the problem of Lebanon, however they just want to be left in peace and go about their lives.

**7. Conclusions**

A. The IDF have made good with their promise to provide closer support to the SLA. The main thrust of this support is to instill a need for more active night patrolling and the provision of support;

B. The IDF appear to be smarting from the killing of an Irish soldier at 6-17. The CO of PV41 went to great pains to show that he knows where UN positions were located and was genuinely friendly. Other officers have similar attitudes;

C. The SLA are attempting to become a better fighting force, however, they lack basic military discipline and a sense of duty when under stress and under fire. The soldiers and officers do not consider themselves to be acting on behalf of the civilian population. Unpunished atrocities and breaches of basic accepted behaviour only ensure repetition of similar acts and public rejection;

D. Although one small cell of AE may reduce their operations, there are many others who will continue to operate against the SLA and IDF. Markabe, Tallusah, Bani Hayyan and Houle by nature of their populations and geographical location, combined with the SLA attitude, will continue to be unsettled and dangerous.

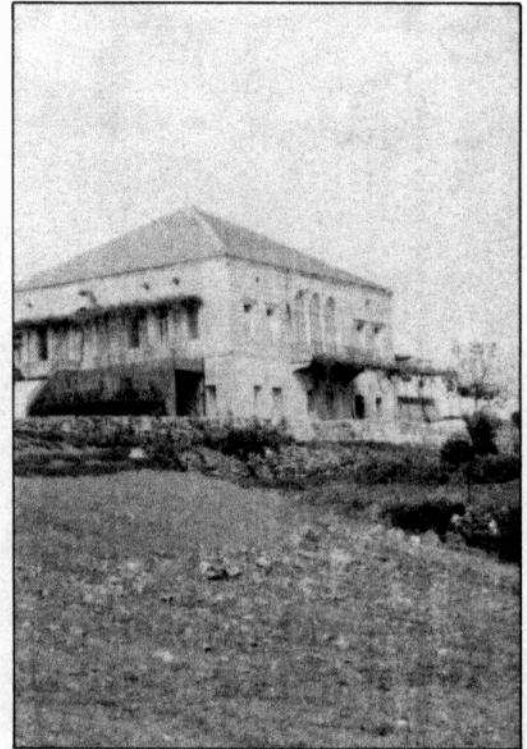
(SIGNED)

B.G. Jackson  
Major

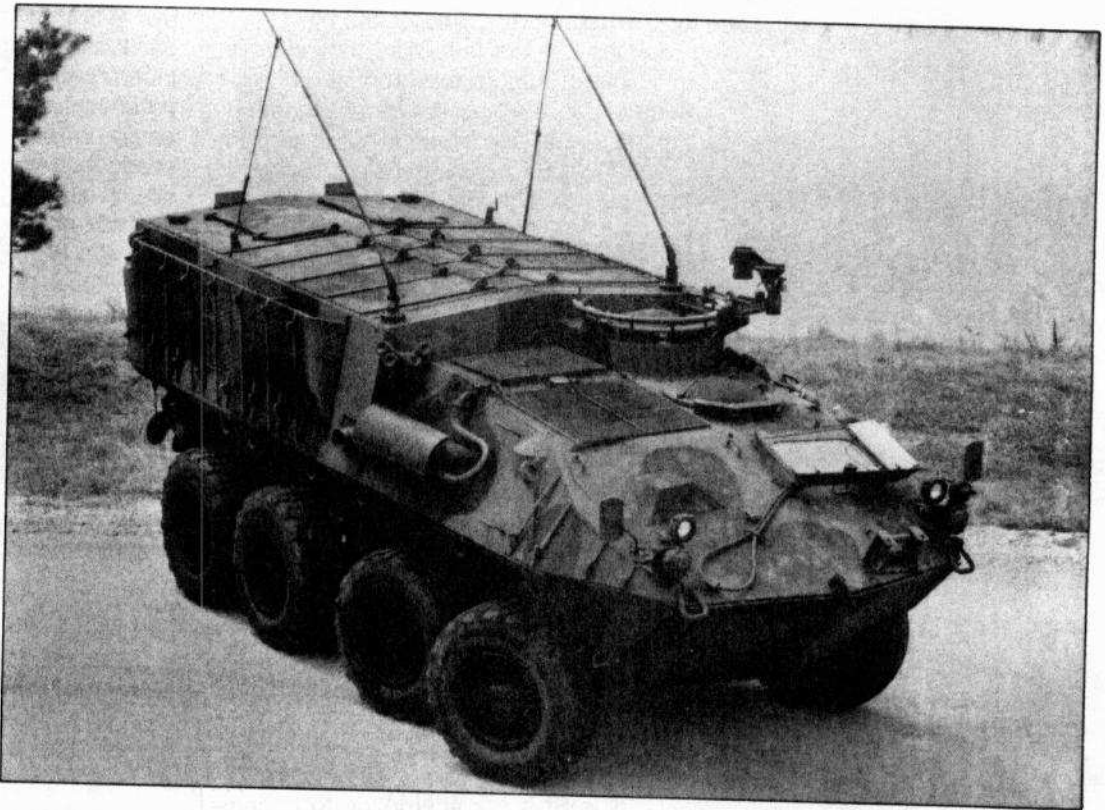
(SIGNED)

E. Peltonen  
Major

**Major Brian Jackson** is the OC Gunnery Squadron at The Armour School.



*The house of Bill and Pat Robinson, two American Christians (and their four young children) who took up residence in Marjayoun, South Lebanon. With no outside sponsor, they specialized in caring for disabled children. Team X-Ray paid them regular visits to chat over coffee and deliver mail. They owed no allegiance to any party or faction, wishing only to do (in their words) "God's work". Bill Robinson was murdered by three Armed Elements on 28 March 1990. Such a waste — as is the entire situation in South Lebanon.*



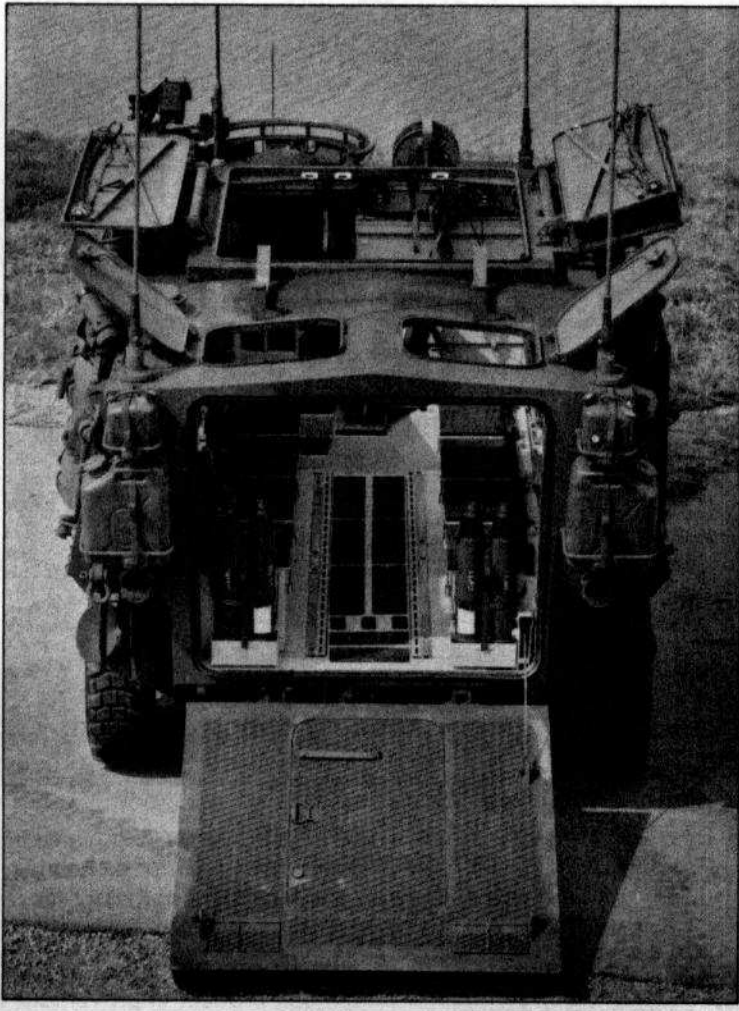
## The Canadian Forces New Bison

In July of 1989, the Canadian Forces signed a contract with General Motors of Canada's Diesel Division for the production of 199 8 x 8 wheeled armored vehicles. The vehicle is based on their very successful Light Armour Vehicle (LAV) family of vehicles sold to the United States Marine Corps (USMC).

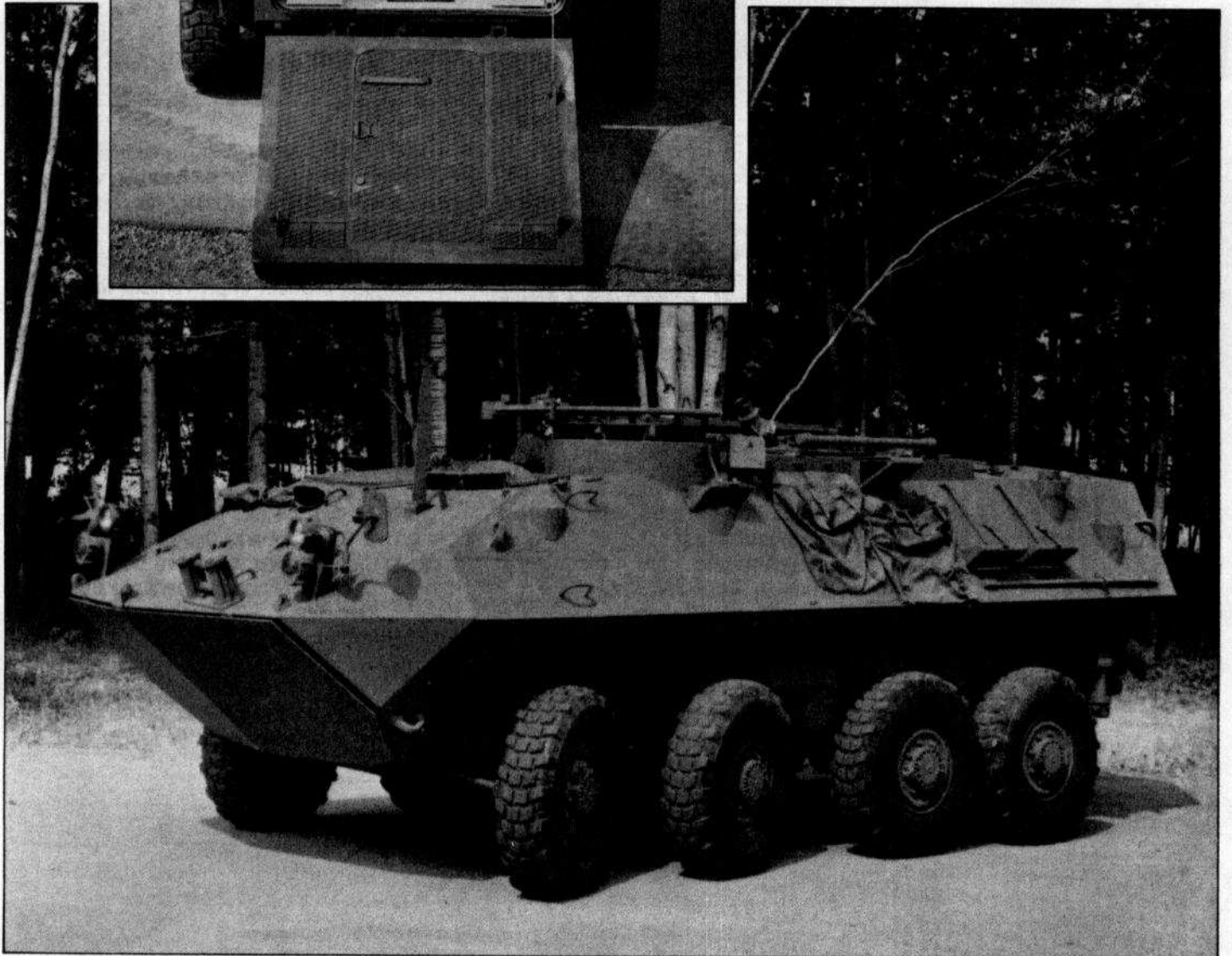
The 8 x 8 LAV is an improved version of the Canadian Forces Armour Vehicle General Purpose (AVGP). The USMC LAV program required changes to nearly all of the AVGP systems to more closely meet military specifications called for by the USMC contract. In addition, Diesel Division took over responsibility for the MOWAG suspension system and had it produced in North America by Rockwell. One major improvement which will soon be introduced into the AVGP is an improved front end suspension system. The internal shock absorber will be replaced by two external shocks which are easier to change and are common with the rear shocks. Once the Canadian fleet is retrofitted, the AVGP will have a common front suspension with the BISON and the

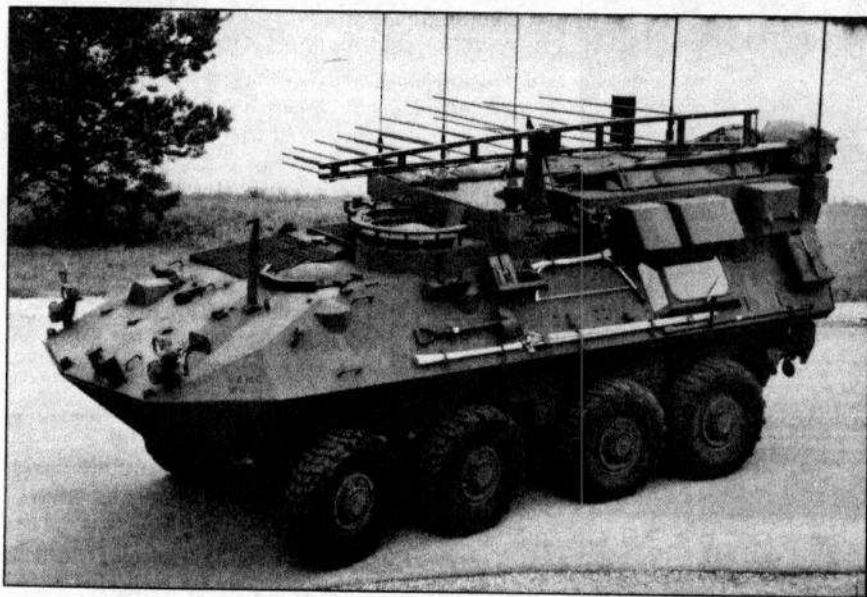
USMC fleet. A considerable reduction in operation and maintenance costs will result as well as improving the ride characteristics of the Cougar.

The USMC LAV 8 x 8 chassis will undergo a product improvement through the introduction of the BISON. Several improvements that could not be introduced in the LAV during production have been included in the BISON. The driver will now have a heads out display consisting of a speedometer and emergency warning system which will improve safety especially on highways. The LAV hydraulic system has been simplified to improve flexibility and drivability, and the lighting system was changed back to the more durable European headlight used on the AVGP. The BISON also incorporates fittings for the installation of air conditioning. The engine will still be the well proven 6V 53T Detroit Diesel, but it will be the improved Silver series engine which will have lower noise levels and better fuel economy.



Many of these changes are now under consideration by the USMC for incorporation into any future vehicle purchases. One product improvement that could not be incorporated at start of production was the introduction of a new tire. Trials have been conducted in Canada and the USA on a new 20 inch Michelin tire which improves soft soil mobility. A decision has been made to wait for a new wider 16 inch tire that is more easily retrofitted to the fielded vehicles. The USMC is also developing a tire with more side wall durability. These tires should be available some time in 1991. However, even with the current tires, the BISON is expected to have much



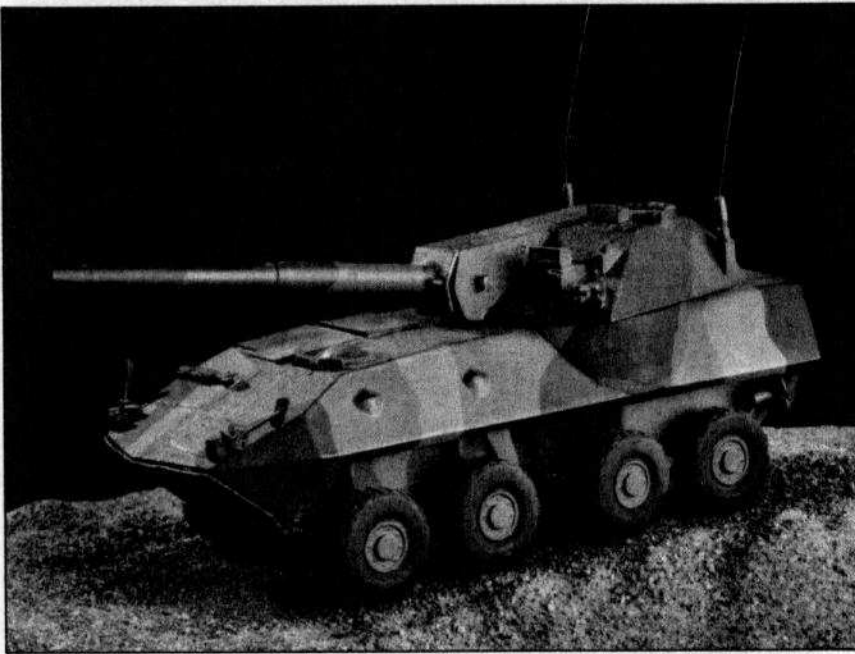


better cross country capability than the AVGP. Anyone who has driven a USMC LAV will attest to the better ride characteristics with less porpoising in rough terrain as well as better soft soil mobility due to the extra driving wheels and better support for the heavy front right mounted engine.

A few other improvements that fall in the survivability area include an armored fuel tank actually built into the walls of the vehicle at the left rear. This new tank will have an internal bladder filled with foam balls that act as a baffle and prevent explosion. The tank has a top blow-out plate in case of a catastrophic explosion. The BISON will be equipped with the larger armour smoke grenade system that is found on the Leopard tank. In addition, there will be fittings for the application of an engine exhaust smoke system. The vehicle is equipped for the installation of the ventilated face mask NBC filtration system although these two latter systems will not be applied in production. The steel armour hull meets the same requirements as AVGP. The high hardness steel was not selected due to concerns with cold weather durability and the fact that certain add-on armours perform better with RHA than with the high hardness steel. The BISON will be equipped with a pintle mount at the Commanders Station for the C6 machine gun. DND is studying a potential change from the ring mount to a cupola system mounting the C6 that can be fired from under armour.

## The Variants

The new Canadian family will be mostly made up of infantry section carriers (149) which feature a new hull designed to allow the internal stowage of the complete section kit as well as seating for up to 11 soldiers. It has a flat floor covering the torsion bar housings, and a rear ramp opening incorporating a single door. It also has a cargo hatch and two smaller hatches on the top. The section will be seated facing inwards similar to the M113 configuration. This vehicle forms the baseline for the remainder of the variants. Reconfiguration is further simplified by the installation of a rail system on the floors, walls and roof of the interior cargo compartment whereby, all the seats, stowage items, radios and even the lights are attached.



All of the section carriers are easily modified to become logistics vehicles by simply removing the rail mounted seats. Any section carrier can also be modified to become a Command Post (CP) since the baseline will be fitted for the CP kit. In production, 18 vehicles will be equipped with the CP kits.

The mortar carrier will have a similar configuration to the USMC carrier except for the walls and ramp door. The cargo hatch is used to fire the 81mm mortar from inside the vehicle. Seats are removed except for the one at the rear. The vehicle will internally stow the 81mm round and charges.

Further upgrades to this system mounting a 120mm mortar are under consideration for an international customer. This system may incorporate a turret allowing complete under armour protection for the carrier. Two contenders are being considered, one from Royal Ordnance and the other from Dhiel.

The Canadian family will also include a mobile repair team vehicle rather than the maintenance recovery vehicle such as the AVGP Husky or the LAV(R) of the USMC. The vehicle will mount the same crane system, but will have the cargo hatch moved to the rear of the vehicle to allow the internal stowage of a full power pack. All vehicles are equipped with front mounted self recovery winches which will provide a self recovery capability. The current Husky and the new HLVW recovery system will conduct the necessary recovery operations for the new vehicles. A procurement of systems is being considered.

Another Canadian variant under consideration at this time is a mobile electronic warfare system patterned after the USMC Mobile Electronic Warfare Support System (MEWSS). Development is expected in time for it to be added before production is completed.



#### **What of the Future?**

Development of this 8 x 8 family of vehicles is continuing in the United States. The USMC have two additional programs under Research and Development at this time that are of potential interest to Canada and other foreign customers.

The LAV-AD, or air defence, is currently undergoing prototype testing by the USMC. This system is modular in nature and has the capability of mounting and firing several different types of air defence missiles and guns. There are two competing systems. The one from General Electric mounts the GAU 12U five barrelled 25mm Gatling gun, Stinger missiles and a pod of 2.75 inch rockets. The FMC version mounts the M242 25mm cannon uprated to fire 650 rounds per minute rather than the 100 and 200 in the standard system. It also fires the Stinger and 2.75mm rocket pods. Both systems have thermal sights and automatic fire control. Diesel Division supplies the chassis for both systems and is teamed with General Electric for turret production. The USMC expects to procure 125 systems between 1993 and 1995.

The other USMC program that should be of considerable interest to the Armoured Corps is the LAV-AG Assault Gun System. After considerable testing and evaluation of guns ranging from the Israeli 60mm to the 90mm cannons from France and Belgium, the USMC has decided on the 105mm gun developed by BENET Laboratory as the weapon for their assault gun system. A request for proposal was issued in November 1989 and proposals from several competing turret manufacturers are now under consideration. The two winning competitors will then develop the turret system and modify the GM chassis to meet USMC requirements. The USMC plans to field between 150 - 225 systems between 1994 to 1996. There is considerable interest being shown in this system by the US Army who are looking for an assault gun system to replace the air droppable Sheridan light tank. Recently, the 82nd Airborne leased 16 LAV-25s from the USMC to evaluate that system to meet the Airborne requirements in the near term. Diesel Division will modify two of these systems for Low Altitude Parachute Extraction System (LAPES) and Paratroop for qualification trials. The 82nd Airborne require 55-70 systems to replace the Sheridan, but the total Army requirement may reach 200. The US Army has released a request for information to industry in January 1990. At least one international customer has expressed a requirement for approximately 150 systems based on the USMC LAV family of vehicles. The Armoured Corps would do well to consider joining this program to realize their Cougar replacement rather than spending more money to fix the current Cougar turret. The Cougar could then be considered for other roles. With the 25mm two man GM-Delco turret it could fill the role of reconnaissance vehicles for motorized brigades replacing some of the aging Lynx tracked vehicles that are unable to match the speed of the wheeled infantry units.



The US Air Force are just completing the development of an airfield reconnaissance and explosive ordnance disposal vehicle based on a modified USMC logistics vehicle. A decision had been expected in 1989 to proceed with the production of 20 systems against an eventual 277 system requirement, however, cuts in the USAF funding has resulted in a production postponement. At the time of this article, it was uncertain when, or if, the USAF will order any production units.

#### **Other Foreign Interest**

The USMC LAV family and indeed the Canadian BISON family have received considerable attention from the international community. It is highly likely that initial contracts will be let during 1990 with at least one Middle East country. In addition, Australia became a member of the LAV owners club with their purchase of 14 LAV-25s and 1 LAV Recovery vehicle directly from the USMC stocks in 1989. They will be replacing these systems to meet the 2nd Cavalry Regiment's requirement to replace their M113s which mount the Cougar turret.

The Australians require about 100 systems overall, some of which would be similar to the Canadian BISON. They have expressed interest in borrowing some BISON vehicles for their evaluation.

In the meantime, the Saudi Arabian National Guard have expressed their intention to the US government to replace their nearly 1200 V150 Commando vehicles with the USMC LAV family of vehicles. This program includes no less than nine different variants nearly half of which would be fitted with the LAV-25 two man turret. The program also includes a requirement for the 120mm mortar and the 105mm assault gun. There is no doubt that Canada has spawned a real winner with their initial purchase of the AVGP in 1977. Foreign purchases will ensure production until the year 2000, and will contribute product improvements and the development of new variants to the family. As this success continues, consideration is being given to the formation of an LAV club along the lines of the Leopard club, to ensure configuration control and supportability as well as interoperability. Planned improvements in the base vehicle to meet Canadian Forces future armoured vehicle requirements are planned. The Armoured Corps should consider how they can benefit from these programs to meet their needs for the Cougar and Lynx replacements.

**W.L. Claggett** is the Sales Manager, Defence Products, General Motors of Canada Ltd, Diesel Division



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## CTC Trials and Evaluation Section Armour Trials Update

The cycle of equipment procurement is never-ending. New kit is investigated, samples purchased, and numerous engineering trials are conducted. When most of the "bugs" are worked out, hands-on trials are done by the potential user.

While field units are often tasked directly by NDHQ to conduct the user trials, the responsibility for their planning and conduct as well as writing the final report is given to the Trials and Evaluation Section at CTCHQ, CFB Gagetown. The field units provide the Trials and Evaluation Section with physical data on the design, durability and operational value of the piece of equipment under consideration.

This update should provide an overview of the results of the many trials conducted by the Trials and Evaluation Section over the last year. Also, a brief description of current and upcoming Armour related trials is included.

### Recent Trials

**Respirators and Canisters.** The C4 mask is being reworked with a new, flatter eyepiece which will facilitate the use of optical instruments such as the Leopard gunner's sight. The filter canister recommended in the trial last year was the intermediate sized XC6 canister. As yet there is no official word as to when either the new filter or the C4 mask will be on general issue.

**Turret Identity Light System (TILS).** The prototype callsign boards tested in this trial proved to be of limited value due to the use of alphanumerics. Despite the large callsign figures, they could not be read at much over 200m. At the same time they were unacceptably bright. Coloured glowstick lights were also tested under the same conditions, to see if they were a feasible alternative to illuminated callsigns. The glowstick colours could be differentiated at distances up to 900m and they were very discrete in terms of light output. Only when used indiscriminately,

hung off antennae, etc, were they insecure. The recommendation in the TILS trial report was to design a new coloured light TILS system about 5 X 5 X 40 cm in size, with six coloured windows, each of which can be lit up individually by lightbulbs, light strips or mini glowsticks. Suggestions and encouragement for such night recognition systems are solicited.

**Track Components.** The Canadian made Leopard tank track pads, pins and bushings continue to undergo engineering trials at LETE and user trials are not expected for some time.

**Ventilated Respirator System.** This individual blower/filtration system was supposed to have been installed on the Leopard family of vehicles last fall but technical difficulties have delayed their arrival.

**Vehicle Stowage.** A Leopard stowage trial was conducted with C Squadron, The Royal Canadian Dragoons, during the fall of 1989 to account for vehicle modifications and equipment changes over the years. Cougar and Lynx stowage trials are expected to be carried out at CFB Valcartier during the summer of 1990. Based on the findings, units will be advised by FMC as to the authorized basic layout of the vehicles.

**AFV Crewman Vest.** The crewman vest was designed to allow crewmen to wear their survival gear (respirator, field dressing, water bottle) in the tank, flush against the body, so that in the case of evacuation during battle they can survive to return and fight. In the trial it was found that the respirator should be mounted on the web-belt rather than the hem of the vest. It was also determined that a normal size water bottle was required and that it too should be carried on the web-belt beside the respirator. A standard field dressing was recommended over the proposed first aid kit. The Armour School



*Two piece prototype crewsuit*

is promoting the carrying of two field dressings to deal with entry and exit wounds. In either case, the dressing could be carried in a shirt pocket. The remaining gear on the vest, including such articles as the field message pad, pencils, KFS set, etc, are very important for day to day use but they are **not** survival gear and could be carried elsewhere. There is therefore no need for a vest and the only webbing used should be that mentioned above.

**Crewsuit Part 1 — Pattern.** Testing of the three prototype patterns resulted in a recommendation to pursue the traditional one-piece crewsuit design with a longer trunk and a drop seat for defecation purposes. The alternative style of suit



*Helicopter flightsuit with crew jacket*

which was recommended was a two-piece uniform similar to the "pants-out" suit (see photograph). In either case, it was recommended that an AFV jacket for spring, summer and fall use be developed, based on the current winter AFV jacket and the helicopter crew jacket. The question of coveralls also needs to be addressed; will the fireproof materials in the crewsuit need to be protected by cotton coveralls, and if so, should all required pockets be put on the coveralls, allowing the crewsuit to be more simple in design? Also how do the Nuclear Biological Chemical Defence (NBCS) coveralls fit into the equation? A "system" approach to this matter must be taken.

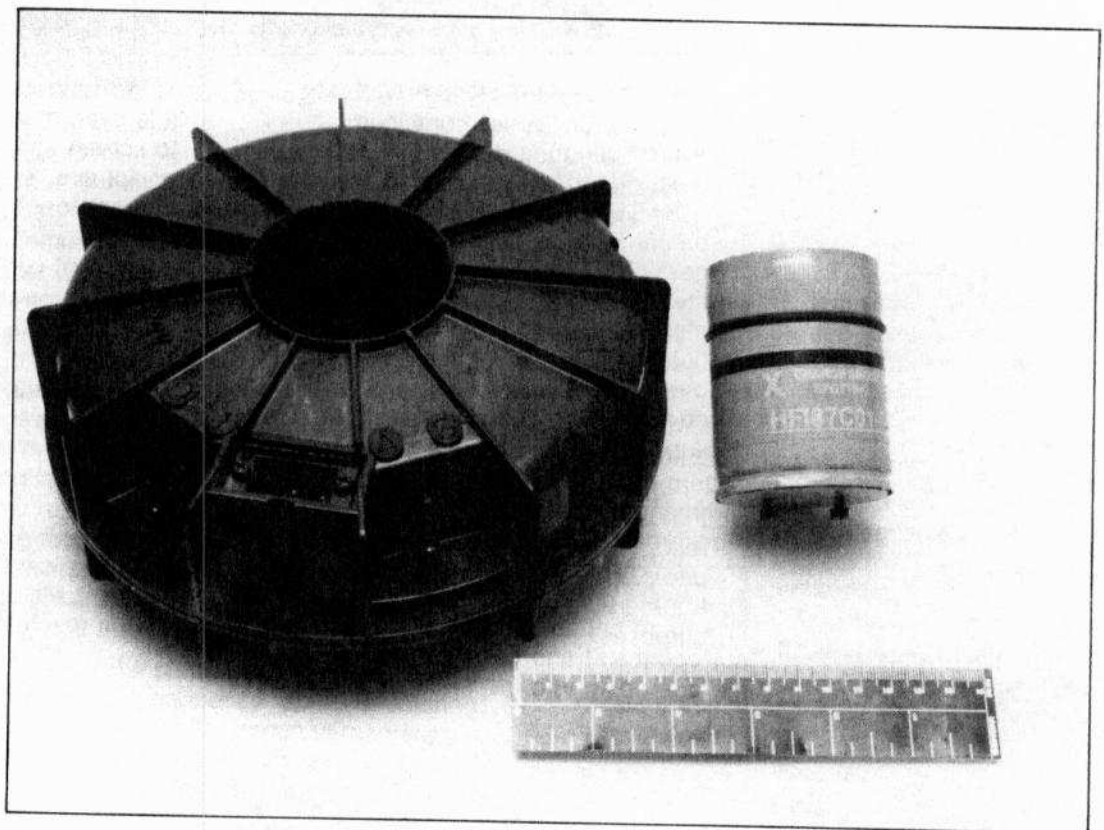
### Current and Upcoming Trials

**Crewsuit Part 2 — Material.** The Lord Strathcona's Horse (Royal Canadians) will assess the comfort and durability of 150 crewsuits of the current pattern made with five different flame-resistant materials. The trial will be done over a six month period. Once the best one or two materials are chosen they will be married up with the advanced development pattern of crewsuit and then a final trial will be conducted to decide the optimum crewsuit. Accessories to the final flameproof suit may well include a set of cotton longjohns and turtleneck sweater, fireproof gloves and even a flash hood to reduce the severity of burns.

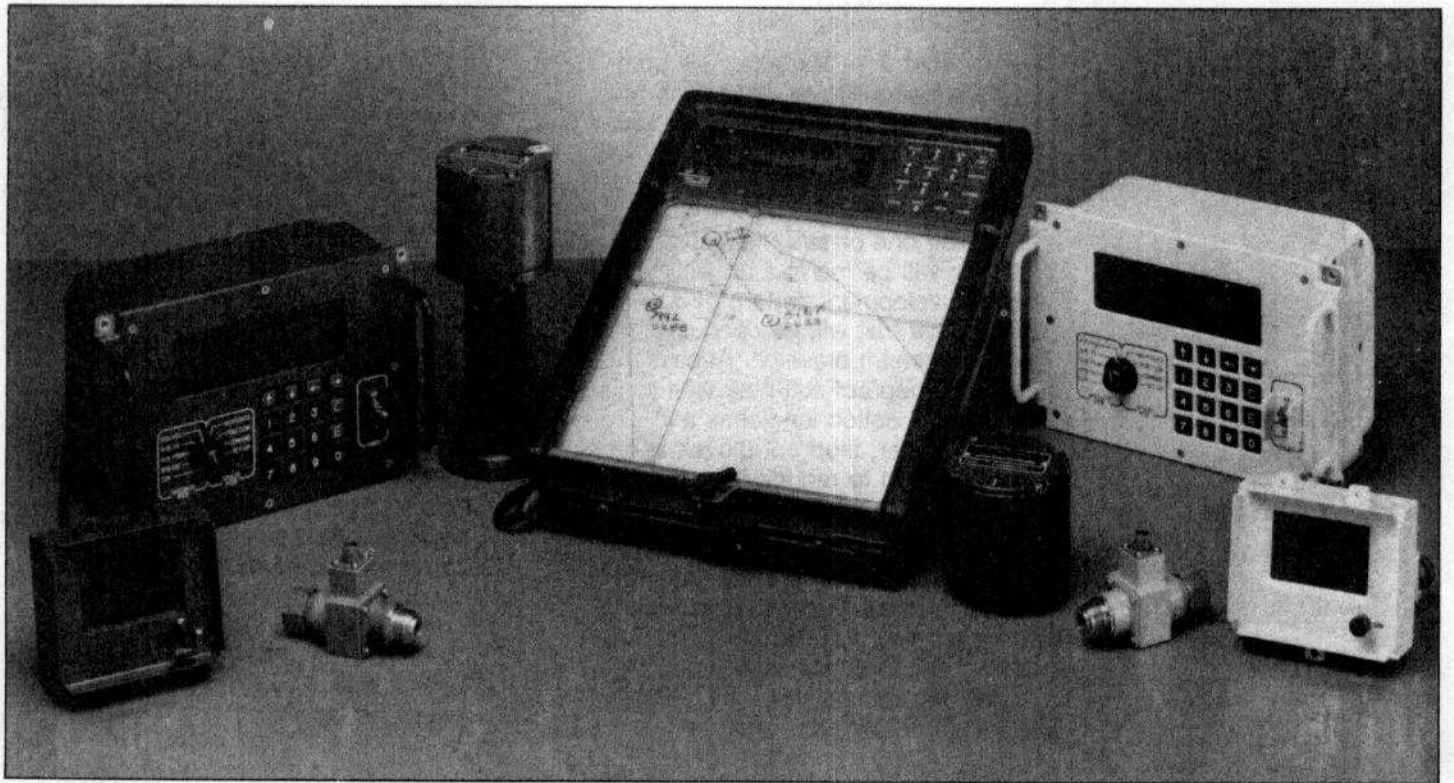
**Leopard Videodisk Interactive Gunnery Simulator (LVIGS).** This is a very realistic Leopard gunner training system which is undergoing testing by Gunnery Squadron, Armour School, in conjunction with the various Leopard gunnery courses. LVIGS is similar to the TOW simulator, called

TVIGS. The technology in both trainers will be used to develop a Cougar simulator called CVIGS. The benefits of such computerized trainers are obvious; better use of limited ammunition resources, better training through the use of realistic targetry and play-back functions, and generally a lot more shooting practice for units which do not have easy access to Indoor Miniature Ranges or the gunnery systems themselves.

**Mine Effects Simulator (MES).** This is a reusable, plastic, electronic training device which provides training not only for the Field Engineers but any army unit which moves about on the battlefield. The MES has a pyrotechnic canister which puffs smoke when you drive on or near the mine and hence lets you know you have been put out of action. Approximately 150 MES units will be tested this year during such activities as the Combat Team Commander's Course.



*Mine Effects Simulator (MES)*



*Land Navigation System, magnetic components (dark, left) and gyroscopic components (light, right)*

Vehicle Navigation System VNS Mk V(M). In this trial, a self-contained magnetic navigation device will be tested on light armoured and wheeled vehicles. The purpose of the trial is not only to determine the accuracy of this particular system but more importantly to determine, with the help and advice of all three combat arms users, what vehicles really need such a system. For instance, do reconnaissance vehicles require navigation aids when they move about. Should all the tanks in a squadron have a navigation system or will this degrade the crew commander's navigational skills? Is there a requirement for antillery forward observers and command post personnel to know their exact grid? Finally, should we not go to a more capable device which ties into our command and control system, such as the one going into the M1 Tank?

With the ever increasing fiscal restraint, it is even more important than ever before to screen and properly test new equipment. Trials and Evaluation Section appreciates the wholehearted support which has been provided by the equipment users in the past trials and look forward to working with them in the future. Comments or questions about these or other trials are welcome at any time. —

**Captain Michael Gagné** is the Armour Representative at the Trials and Evaluation Section



## Preparing Reconnaissance Units for the Modern Battlefield: An American Approach



*Scouts must dismount often. Remember, a Scout's most valuable weapons are his binoculars and his radio.*

On the tenth day of the war, NATO decided to counterattack. With boldness and speed, they gained ground and penetrated deep into enemy territory. Tank heavy combat teams led the breakthrough, with the infantry alongside. Reconnaissance units were placed "out front" of the advance and given the mission to find the enemy and report on his disposition. Characteristic of their forebearers, the squadrons moved with dash and purpose. As we would all like to believe, the enemy was located and the combat teams destroyed the aggressors.

When the picture unfolded as to what had actually happened, some interesting facts surfaced. One reconnaissance patrol came upon a Soviet tactical sign, pointing to the location of a battalion headquarters.

They did not report it since they did not know what it was or what it meant. A Leopard C1 was mistaken for a T-72 and engaged by American forces operating on the flank with 1 Canadian Division. One soldier who has his vehicle "shot out from under him" collapsed from fatigue while moving back toward his lines. He was simply not in shape. Two soldiers were killed by a sniper in a town during the advance. They were standing in the rear of their vehicle providing an excellent silhouette for the enemy sharpshooter. Another reconnaissance patrol lost its lead vehicle as it broke through a woodline. The unit never practiced dismounting and clearing open areas and therefore fell easy prey to an Anti-Tank Guided Missile (ATGM) team trained on a break in the woodline.

The reconnaissance units in the American Army can probably accomplish their missions if called to do so. Equipment, esprit and the calibre of the basic soldier has improved significantly over the last ten to fifteen years. However, training at the small unit level has not kept pace. There has never been a greater need to ensure that the training received by reconnaissance units be the best, since their information may determine how and where the rest of the unit will be deployed.

A careful look at the manner in which we train is required. Training must focus on the basic skills necessary for combat survival. These include reconnaissance and reporting, mounted and dismounted navigation, threat identification, fire distribution, and physical training.

### **Reconnaissance and Reporting**

Often unit training plans place too much emphasis on troop and squadron manoeuvre and neglect the importance of training crew commanders to employ their vehicle and crew within a larger grouping. Reconnaissance training must begin at the lowest level and only once this has been mastered should platoon and troop tactics be attempted.



*After shutting off the engine, the driver looks for mines and enemy activity along his route.*

There are several good methods for training a section. Instruction and initial practice of basic drills can be done in the classroom using chalk talks and sand table exercises. These drills should include movement and bounding, reports and returns, contact and held-up drills, and general techniques of reconnaissance and security operations.

Once the sections demonstrate proficiency, move to the local training area and practice the classroom basics on the ground, starting with vehicle movement. Action on contact should not start until this critical skill is mastered. Establish a good movement relationship between vehicles in the "team" under field conditions, including electronic warfare and radio silence. The drivers should know where to stop to clear open areas, how far to bound, and the sequence for adopting a position.

To add realism to the training, place minefields, enemy tactical signs, and vehicle silhouettes along the route or manoeuvre sector. This will allow all crew members to improve their observation techniques at both close and long range. The crew commanders must be taught to understand the importance of dismounting to clear open areas before exiting towns or woods.

When the sections are ready, use a live, controlled opposing force (OPFOR) to assist training. Ideas on length, type of enemy, and overall objectives are left to the leadership to decide, keeping in mind the skills and mission of the unit. This would also be a good time to rehearse action on encountering NBC contamination.

An effective training technique to test a section is to overload them with varying situations. For example, in a one kilometer area, the section can be required to call in a phase line, make a spot report, bypass a minefield, and react to a superior force. The more the section improves, the more they should be able to handle in a short period of time.

Soldiers must be trained to takeover command in the event of the commander being wounded or killed. This transition must be accomplished quickly without jeopardizing the mission. This can be done several times during the conduct of a training patrol.

Reconnaissance soldiers earn their pay by reporting in a quick and accurate manner. Oddly enough, one of the best examples of how not to report is demonstrated in the movie "Midway". This film depicts the decisive naval battle at Midway during early June, 1942, between the United States and Japanese navies. Prior to the actual attack, both forces sent out naval scouts to look for each other's carriers. During the film, the American pilots and observers sent terrible, incomplete reports which hampered the commander's decision making process.<sup>1</sup> Although the Americans were victorious at Midway, the reporting procedures left much to be desired. Scout platoons should view this film in order to understand the importance of proper voice procedure and accurate and timely reporting. As much detail about the contact must be included in the contact report. Things like vehicle type, nationality, new or special equipment, and direction of movement will add greatly to a commander's picture of the enemy.



*Make maximum tactical use of your vehicle. Here, a scout assists his crew commander in executing a "crest drill".*

### Land Navigation

The classroom environment is fine for learning some navigation techniques, but soldiers must get on the ground in order to become proficient at land navigation. Unfortunately, current training for reconnaissance soldiers at all ranks does not provide sufficient map using training. Navigation is a perishable skill. Once learned, it must constantly be reinforced and practiced.

Basic navigation skills such as pace and azimuth, compass work and map reading should be done initially during daylight. This will help build confidence. One of the biggest problems concerning dismounted navigation is trying to make the map fit the terrain, rather than allow the terrain features to help determine one's location on the map. At some point in time, everyone has become disoriented. Good navigators can re-orient themselves in a logical manner and still arrive at their objective with little loss of time.

Navigation training is not resource intensive. All that is required are some maps, compasses, a wooded training area, and a little imagination. Initially, courses should be short and incorporate many checkpoints so that soldiers can practice their skills. Difficulty should increase as the training period continues by introducing such things as night navigation, escape and evasion exercises, and timed "races".

Mounted navigation is also an acquired skill. The major problem in this area is the speed at which you must navigate. Practice on varied terrain is the only way to become fully proficient. This will be more difficult to achieve because of the lack of suitable training areas. However, every attempt must be made to perform this critical skill. The potential problems which could arise as a result of a lost reconnaissance vehicle could be devastating during a battle.

### Threat Identification

Another very important skill is enemy identification. It does little good to shoot well if you cannot identify the target. Similarly, commanders should understand how these vehicles relate to their parent organizations. Also, commanders should have a working knowledge of Soviet tactical writing. Learning the enemy's symbols and abbreviations can make reporting much more concise, especially if a soldier sees a Soviet tactical road sign or discovers an enemy map in a destroyed vehicle. Finally, learning enemy uniforms, ranks, small arms, and branch insignias will increase the depth of knowledge about the Warsaw Pact soldiers and make reports about enemy prisoners, dead or alive, that much more valuable to the commander. These are skills which need to be trained on a weekly basis.

There are many training methods which can be used for vehicle and aircraft recognition. Slides can be used for training and testing. More than one projector can be used to show different angles of the vehicle or aircraft. To increase the difficulty during testing, the exposure time should be shortened. A "threat city" can easily be made by placing scale models of enemy vehicles and aircraft in a mock built up area. A model can be a "mover" by simply tying a string to the front and pulling it. Aircraft can be airborne on string above the town. To add another dimension, vehicles and aircraft can also be illuminated from the rear so they cast a shadow forward onto a cloth sheet or piece of paper. Indoors, the vehicles can be illuminated, entirely or partially. There are many interesting and inexpensive ways to teach and test vehicle and aircraft recognition.

Understanding the enemy's order of battle can assist the soldier in determining how the information he sees on the battlefield fits into the larger tactical picture. It can also assist him in anticipating follow on forces or "keying" him as to what other vehicles may be in the area. Order of battle knowledge is gained by studying organization charts and how the enemy marches, deploys, and



Studying the uniforms and ranks of Warsaw Pact soldiers can further enhance the battlefield collection process. Soldiers should know USSR, DDR, Polish, and Czechoslovakian rank and branch insignia. If he captures or sees an enemy soldier, he should have the knowledge to know that the enemy, for example, was a Soviet Artillery Captain from a guards unit. If a commander has to wait for Military Intelligence to process this type of information it will often be too late to be of any tactical value.

### **Fire Distribution**

Reconnaissance soldiers must fire only in self-defense, but when they do engage the enemy, they must do so in a logical manner. The Army's marksmanship program enables the soldier to be trained twice a year on a standard range. He zeros, practices, and then fires for record. He cleans his weapon and fires again six months later. NATO will have to fight outnumbered, and therefore all soldiers must practice engaging and defeating superior forces, together as a team. The Warsaw Pact can be expected to mass at the decisive place and time. Shooting down a lane, in training, leaves much to be desired when on the battlefield your buddy on the right has ten targets to engage and you have none. The concept of fire distribution must be established and practiced now during peacetime.

We must transfer the technique of engaging and distributing small arms fire to engaging with crew served weapons and main guns. The mental drill must be consistent in the soldier's mind. The number of rounds fired during training can be directly related to the number of kills on the battlefield,<sup>2</sup> and therefore more time must be spent on the range.

A basic practice scenario is that of a combat outpost. This can be initially practiced by a section or vehicle crew and then "upgraded" to include crew served weapons and vehicles. The soldier must destroy the most threatening target in his sector first, usually the closest, and then systematically engage the remaining targets in his arc. When finished he must instinctively assist his left or right flank element using the same criteria as for his own sector.

Regardless of the type of distribution plan, the most important aspect is that it is understood by your soldiers and practiced.



*Familiarization with enemy weapons and equipment.*

fighters. There are a number of good videos showing Soviet and Warsaw Pact forces on exercise. These can be viewed to practice vehicle identification, relating vehicles to a given organization, or what type of operation is being conducted.

At a minimum, commanders need to have the capability to read and decode basic Soviet abbreviations and map marking symbols. To date, there are few resources available from which to train. However, this does not eliminate the need to become proficient. If we do not develop the capability to teach soldiers a little tactical Russian, we will be allowing more combat information to "slip by" unreported.



As we move into the 1990s, the Army will face the same budget cuts as other federal departments. We must use small arms to substitute for a cut in main gun and crew served rounds, caused by the budget problems. The most important aspect of this training is not what type of weapon you are using, but how you will fight as a team.

### Physical Conditioning

The United States Army has made a lot of progress in the last ten years with respect to physical training. We have stopped running in combat boots on concrete. This was the "hard-core" way to train and led to shin splints and bad knees. However, there is still a need to continue making improvements in the following areas: running, strength training, and swimming.

Formation running is great for esprit, but does not maximize the overall fitness of a unit. It prevents both fast and slow runners from reaching their full potential. Running in formation restricts natural stride and inhibits proper breathing. If you are the "man in the middle", you probably feel very constricted and bored.

Physical training must be varied and challenging, it should not be an event which is "muddled through". The intent is not to abolish formation running, rather to suggest alternatives for this type of fitness training.

In an ideal training environment, soldiers should run six days per week. Realistically, we should expect a unit to run between four and five days per week. This is why it is extremely important for the soldiers to have quality workouts.

Here are some common sense suggestions for running:

1. Stretch before and after runs. Five to ten minutes is not excessive.
2. Do not restrict PT to the morning hours. Morning PT tends to be shortened because of work details, inspections, and parades.
3. Design "road courses" on trails or paths.
4. Ensure that all soldiers have proper running shoes, not court or deck shoes.

Workouts must be interesting and vary from day to day emphasizing the three basic types of exercise:

- Anaerobic: an intense workout, high heart rate, i.e. sprints
- Aerobic: a moderate workout, build endurance, i.e. long, slow distance runs
- Fartlek: speedplay workout, i.e. jog-sprint-jog

### EXAMPLE TRAINING WEEK

#### MONDAY

Long slow distance 7-10 kms

#### TUESDAY

Sprints 10 × 400

#### WEDNESDAY

Obstacle course or Fartlek

#### THURSDAY

Long slow distance

#### FRIDAY

Sprints 20 × 200 OR Sprints 8 × 800

Long, slow distance (LSD) runs should be approximately 45 minutes long and anywhere between 7-11 kilometers in length. Select routes that vary with the terrain and do not always run the same route. Run in pairs but avoid running in step. Many critics will say "this does not look good", however, it looks even worse if soldiers are not in shape, and they will not be in the best shape possible if they always run in formation.

When running sprints, attempt to reach a target heart rate, which is defined as  $220 - \text{age} \times 75\%$ . Although this seems high, it provides a unit of measure to determine whether a soldier is working too hard or not hard enough. Sprints can be run once or twice per week. Common workouts are 10 × 400m or 20 × 200m. The rest time between sprints is double the time of the sprint. The rest consists of a light jog to keep the heart rate up and keep the legs from tightening. Half way through the set, a rest for four or five minutes can be done. Do not run too fast initially; the intent is to run the last lap at the same pace as the first. If the faster runners begin to exceed the established norms, increase their times, but hold them to the standard. Unlike formation runs,

sprints are an excellent method to improve fitness because they enable each man to develop his maximum fitness potential at his own pace.

Do not restrict your training imagination. You can line up a few combat vehicles and make an obstacle course if your base does not have one. If you do not want to run sprints on a particular day, run relays. Always be physically competitive and periodically hold races so everyone can see and monitor their progress. Keep the running aspect challenging and intense. The troops will gain nothing from easy physical training, especially slow boring runs.

The pool can bring welcome relief to the normally mundane PT schedule. The intent is not to develop olympic class swimmers, but rather to ensure that soldiers are familiar and relaxed in the water. If, for example, your unit is involved in a water crossing exercise and one of the vehicles sink, the soldiers should have been exposed to the water so that they will be able to swim to safety. A typical pool session should include a warm up, a workout to include a number of lengths using different strokes, and finally a warm down. You can augment this basic schedule by increasing distances, having relay races, playing water polo, or capture the flag. The main emphasis is to break up training monotony and teach soldiers the basic strokes so that they can survive in water.

Weight training is another aspect of physical conditioning that should not be ignored. In order to maintain upper body strength within the time constraints of a normally busy day, soldiers should utilize the gym every other day. Following the run, basic exercises can be performed in a half hour to 45 minutes, using free weights or a Universal Gym. Soldiers should start with 55-70% of their maximum lift, initially performing three sets of eight repetitions. Increase the repetitions until he can do twelve. Then increase the weight and drop the repetitions back to eight. This program can be augmented with situps, push-ups and dips.

Commanders must ensure that their soldiers are in shape. Physical fitness is vital to a soldier's survival on the battlefield by providing him with the

endurance to perform strenuous tasks over long periods with minimal food and rest.

These five training areas do not even begin to encompass all of the mission essential tasks which a reconnaissance soldier must perform. However, these areas can provide a solid foundation from which to build training. The key is in using a common sense approach, starting with basic vehicle movement. Reinforce dismounted land navigation and threat training. These are all perishable skills which must be practiced and tested on a regular basis. A high standard of physical fitness is important for all soldiers, but especially so for reconnaissance units. Finally, never forget that a properly trained and deployed reconnaissance unit can greatly contribute to battlefield success. —

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#### FOOTNOTES

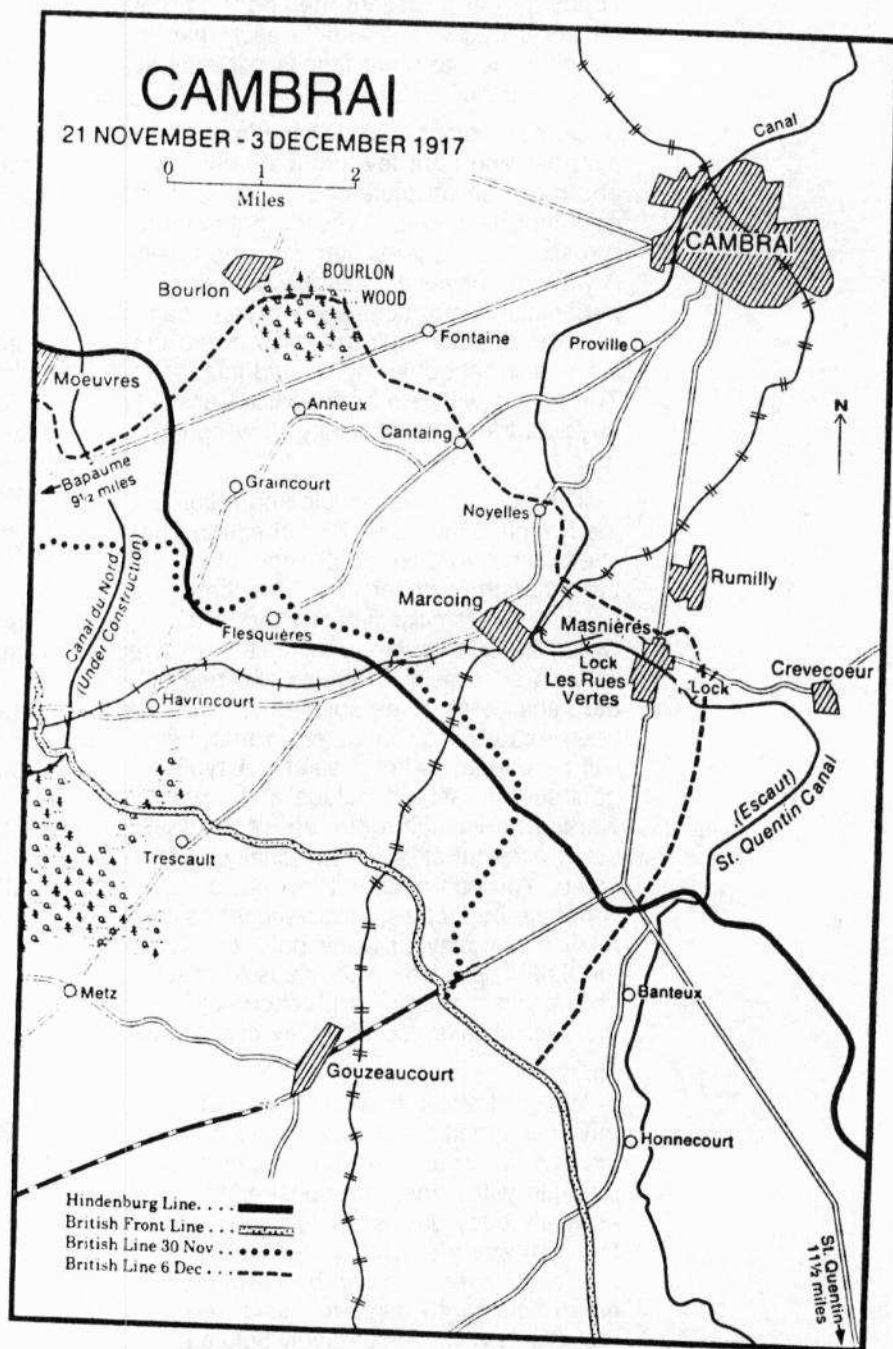
1. *Although this movie is historically accurate, the amount of reporting mistakes may have been condensed. The movie "Midway" should be viewed by the scout platoons.*
2. *Brigadier General Kahalani stated that the success of the Israeli Armored Corps in the Golan Heights, was largely due to the fact that they fired between 60 and 80 rounds per year, while the Syrians fired only four or six.*

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**HISTORICAL  
HISTORIQUE**

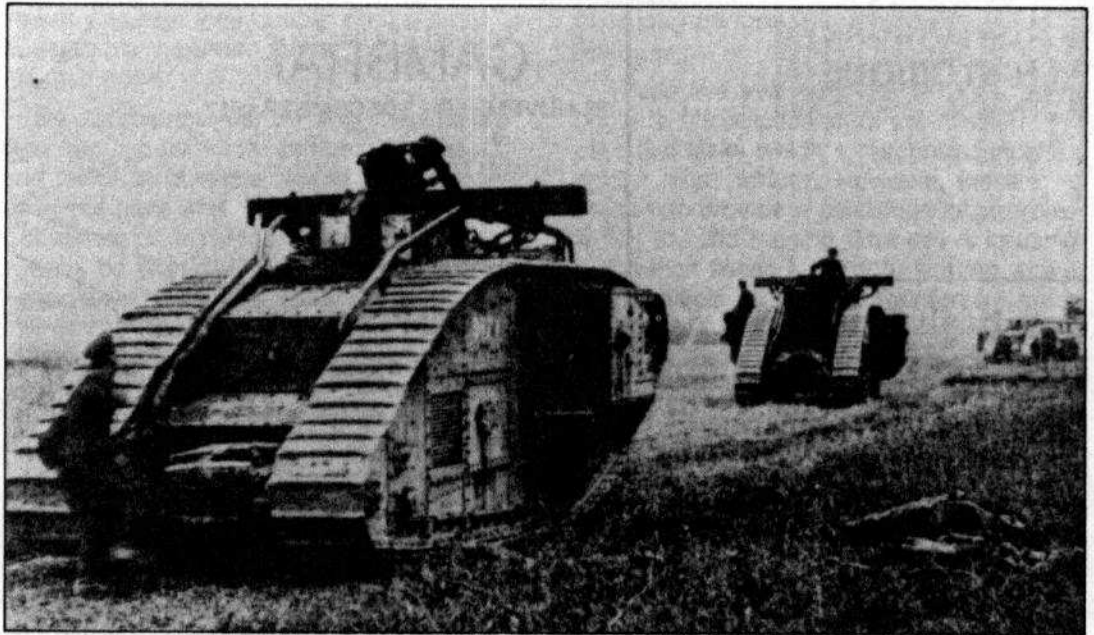
**Cambrai: The  
First Tank Battle  
A Success  
Despite  
Misgivings and  
Errors**



I think it's appropriate during the fiftieth anniversary of the Royal Canadian Armoured Corps to re-examine the first, successful use of tanks in warfare and to acknowledge the battle which essentially gave birth to armoured corps throughout the world.

**Pre-Cambrai Tank Employment**

It was a combination of tremendous casualties, the gaining of little ground, and the political pressures of a disillusioned homefront that forced Field-Marshal Sir Douglas Haig into hurling the untested Mark I (Big Willie) tanks and their hastily trained, ill-prepared crews into the Battle of the Somme at Flers-Courcelette on 15 September, 1916.<sup>1</sup> Thus the tank which has been so successfully kept a secret from the enemy, was quickly tossed into battle under all the wrong conditions and performed with predictable poor results.



The following summer of 1917 saw improved versions of the tank, Wilson & Tritton's Mark II and III, employed on occasion, in the Third Battle of Ypres (or Passchendaele as it was commonly referred to). Again, it was a combination of poorly prepared tank units and 'soggy' ground conditions which caused disastrous results for the tank.<sup>2</sup> In fact, there was talk of disbanding the newly-formed Tank Corps.<sup>3</sup> The Tank Corps desperately needed a major assault using a sufficient number of tanks as the main attack-weapon, on hard suitable ground to prove itself. The area opposite the city of Cambrai, bordered to the West by the Canal du Nord and to the East by the St. Quentin Canal, would prove to be just such a testing ground.

#### **The Planned Tank Raid**

The plans for a major tank operation had been under consideration for some time prior to the Battle of Cambrai. On 3 August 1917, Lieutenant-Colonel J.F.C. Fuller, the Tank Corps' Chief of Staff, submitted a plan for a great tank assault in the St. Quentin area. His intention was to distract popular attention from the recent slaughter at Passchendaele by conducting a "theatrical blow" with massed armour.<sup>4</sup> Upon conferring with his commander, Brigadier-General Hugh Elles, Fuller altered his plan to a large-scale tank raid to be conducted in the British Third Army's sector opposite Cambrai.

The proposed duration of Fuller's "raid" was between eight and twelve hours with the following objective: "to destroy the enemy's personnel and guns, to demoralize and disorganize him and **not** to capture ground." He suggested the use of three tank brigades of two battalions each, and two divisions of either infantry or cavalry. The idea was to advance, strike hard, and return to the original start lines.<sup>5</sup>

General Sir Julian Byng, who commanded the Third Army, liked the plan and proposed that it be expanded from a raid into an attempt to break through and capture Cambrai. He submitted his upgraded, tank-assault plan to General Headquarters (GHQ) which immediately rejected it, pointing out that all available troops were required at the Passchendaele offensive. Also, Field-Marshal Haig in particular still regarded the tank as a "minor factor."<sup>6</sup>

However, as the terrible failure at Ypres became increasingly obvious, British commanders looked more and more towards the suggested Cambrai attack as a possible means of recovering lost prestige. Haig had a change of mind and authorized a "limited" attack at Cambrai that was to last two days "unless the situation justified its continuation."<sup>7</sup> Finally,

on 30 October 1917, the operation was approved and detailed planning began with the attack set for 20 November.

General Byng's final plan called for a two Corps attack — IV Corps left forward and III Corps right forward — supported by three tank brigades consisting of three tank battalions each. A tank battalion consisted of approximately 36 tanks. In addition to the six divisions of infantry, there were 1,003 artillery guns in support and two divisions of cavalry (including the Canadian Cavalry Brigade) held in reserve.

The attack was to take place along a six-mile frontage running from Bullecourt south to Villers-Guislain, a region on the formidable Hidenburg Line which had three main lines of trenches supported by numerous outposts and communications trenches. On the positive side, the rolling terrain was generally high, dry and unscathed from previous fighting.

### Innovations

One of the major problems still facing the Tank Corps was the problem of crossing the very wide and deep enemy trenches; in fact, no method had been devised to aid the tank in crossing trenches. Fortunately, Colonel "Olly" Oliphant, commander of a tank salvage and workshop company, was given fourteen days to solve this problem and did so with great efficiency.<sup>8</sup>

With the aid of about a thousand Chinese labourers and some old tanks, Oliphant devised a method of binding approximately 450 large bundles of wood, or fascines as they were called. The fascines were tightened and compressed by the action of two tanks pulling cables in opposite directions.<sup>9</sup> Once completed, the fascines were transported to the tank assembly areas and mounted on the front of each tank in such a manner that they



could easily roll forward and off the front of the tank by releasing a lever inside of the tank. These compressed fascines could be dropped into the German entrenchments and used as a bridging device by tanks. The fascine, however simple in design, was an indication of the future struggle the tank would have with countering obstacles.

For the Battle of Cambrai, the tanks were brought as far forward as possible by rail, unlike previous battles where the tanks were forced to travel a great distance to the assembly area under their own power. The requirement for total secrecy restricted all tank movement to within one mile of the front and most movement was conducted at night.

On 19 November 1917, the eve of the attack, reconnaissance parties laid broad, white tape from the tank assembly areas — usually large woods — to the final forming-up points. That night, the tanks eased forward in low gear without lights following the tape. In the early hours of 20 November, the tanks crept forward under a protective morning mist to jumping-off positions as close as twenty-five yards away from German outpost trenches.<sup>10</sup>

#### **Tank Tactics**

As far as the pure tank tactics of the Battle of Cambrai are concerned, a highly successful drill was worked out to cross the three main lines of defence of the Hindenburg system. It was decided that the tanks would be spread out evenly across the front and would attack in three waves, with each tank working with the tank behind it.

In the first phase, the lead tank was to advance to the German line, turn to its left, and open fire at the enemy in the entrenchments with all the guns it could bring to bear.

While the first tank pinned down the enemy, the second tank was to follow, drop its fascine in the first trench, cross, advance to the second line, wheel left and repeat the tactics of the first tank. The third tank meanwhile would advance, cross the first line, drop its own fascine in the second trench and then attack the third German line in the described manner.

At this point, the first tank was to break off its attack on the first German line, leaving any mopping up for the infantry which was to follow in single file immediately behind the third tank in the assault. The first tank would then cross over the fascines of the other tanks, drop its fascine in the third German trench, completing a triple-bridging operation, while simultaneously keeping the enemy under heavy fire at all time.<sup>11</sup>

#### **Supporting Arms**

The supporting arms for the tank assault consisted of four main groups: the infantry in close support, the artillery, the Royal Flying Corps (RFC) as spotters, and approximately 100 specialty tanks in support of the 376 fighting tanks.

The artillery for the Battle of Cambrai was unique. The fire support was conceived by Brigadier-General H.H. Tudor, Commander of the Ninth (Scottish) Division's artillery, solely for the support of the tank assault. In short, it consisted of no warning artillery support until the moment of the attack, and the use of smoke in the bombardment. The guns were registered on known enemy targets as a result of the normal, occasional artillery fire along the Hindenburg front. No additional artillery nor air activity was to occur in the pre-battle stages.<sup>12</sup>

The air support for the battle consisted of fourteen squadrons from the First and Third Brigades of the RFC. For the first time ever, these aircraft were to support the armoured advance, flying at low level to spot, and if possible, destroy anti-tank and artillery guns.<sup>13</sup>

Although the RFC participated in the latter stages of the battle, the morning of the tank assault was too foggy for the planes to fly and air support on 20 November was virtually non-existent.<sup>14</sup>

Of the 100 supporting tanks involved in the Battle of Cambrai, many of them were equipped with large grappling hooks designed to clear wire and open routes wide enough for infantry or cavalry to exploit.



### The Results

At dawn, 20 November 1917, with seemingly complete surprise, Brigadier-General Elles personally led his Tank Corps from his tank, "Hilda", on a precise, masterful assault of the Hindenburg Line. The Germans, for their part, had been expecting some form of tank assault, but 20 November was far too early for an attack and the British had not given them the usual seven-day warning bombardment.<sup>15</sup>

Despite early success, the assault lacked any form of follow through and:

"by 4 pm at the end of the winter's day, an advance of 3 or 4 miles had been made on a 6 mile front. Instead of gathering momentum, the advance, inadequately reinforced, had come to a standstill, the proverbial 'diminishing power of attack' had taken its toll. A gap for the cavalry had not been made, and by 4 pm it was too dark to employ the masses of horsemen."<sup>16</sup>

While B.H. Liddell Hart argues that 'no gap had been made for the cavalry', many historians are of the opinion that the cavalry divisions were held back too long and did not take advantage of the holes which were so skillfully punched through the Hindenburg Line. The debate still goes on today.

At any rate, many of the tanks had gone as far as they could. Given their mileage limitations, they simply had to stop in open, unoccupied enemy territory to wait for the cavalry which, except for a lone squadron from The Fort Garry Horse, never came.<sup>17</sup>

From the earliest planning stages, Field-Marshal Haig had stipulated a forty-eight hour limit on the outcome of the battle. Coincidentally or not, this was also the tanker's battle-exhaustion limit as set down by Swinton and Elles.



The initial success of the tank assault was evident during the first ten days of the battle — more than six miles of enemy territory had been captured along a six mile front. This gain was shortlived, however, as the Germans, through a series of counter-attacks, were able to regain most of their lost ground and even some additional ground.

#### **Tank Assault Weaknesses**

Although the immediate results of the first successful tank assault were extremely favourable, there were three problems.

The first major problem with the assault was the lack of tank reserves. Much to Fuller's disgust, the divisional commanders did not keep any tanks in reserve as was originally planned. From the start of the battle, all fighting tanks were committed, regardless of what was down on paper.<sup>18</sup>

The second problem with the assault was that Major-General Harper, the Commander of the Fifty-First Highland Division, failed to adopt the new, single-file infantry-tactics when following tanks into battle. Instead, he resorted to the traditional, extended-line method of attacking. With an exposed front, his division's casualties were high.<sup>19</sup>

The third and final problem with the tank assault, was that the tanks were spread out too thinly along the entire six-mile front. Against such a formidable defensive position, a strong, concentrated punch, opening up a single gap, would have met with greater success.<sup>20</sup>

The Battle of Cambrai's tank assault proved that indeed the tank could be used as an effective weapon, given the following conditions:



- a. firm, dry and flat ground;
- b. proper bridging technique;
- c. sound tactics;
- d. effective co-operation with other supporting arms;
- e. recognition, at all levels, of the limitations of the tank; and
- f. where possible, the element of surprise.

As far as the final outcome of the battle is concerned, the follow through after the initial, successful tank assault needed to be much better defined.

From the outset, Fuller's plan had called for a raid, not a major attack. Based upon this premise, strategic planning was never fully realized. The raid had been transformed into a large-scale offensive in an effort to make political gain. Instead of securing a "pocket" by advancing up a "narrow lane", an offensive was conducted along a wide frontage with no immediate reserves to exploit local successes.<sup>21</sup> In addition to the lack of strategic planning was the sheer vagueness and lack of future direction given by British commanders. To create a broad, deep salient without any plans for following up seems rather careless on GHQ's part. I suppose, in their defence, they were not accustomed to an offensive being successful and may have been caught off guard.

By way of conclusion and as an example of the historical significance of the tank assault at Cambrai, B.H. Liddell Hart credits the assault as a "new cycle of warfare". Although the battle ended in disappointment, it foreshadowed the methods which would dominate the Second World War.

For the so-called "eccentrics" during the post-war years, such as Fuller and Liddell Hart, they religiously incorporated the lessons learned from Cambrai and furthered armoured theories of attacks en masse and lightning, blitzkrieg strikes in their writings; writings which would be read by such students of war as George S. Patton, Heinz Guderian,<sup>22</sup> and Major General F.F. Worthington.

**Captain Jeff Barr** is the 2IC of Recce Squadron, The Royal Canadian Dragoons.

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11. Carey, p. 52; Major-General J.F.C. Fuller, **Memoirs of an Unconventional Soldier** (London: Ivor Nicholson and Watson Ltd., 1936), p.p. 486, 487.
12. Woolcombe, p.p. 23, 24.
13. Greenhous, p. 208.
14. Cooper, p. 80.
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16. Liddell Hart, p. 348.
17. *Ibid.*, p. 353; Woolcombe, p. 86. It was B Squadron of The Fort Garry Horse, one of the only cavalry units to secure crossings in the Les Rues Vertes sector. The squadron advanced on its own as far as Fumilly taking heavy casualties. Lieutenant-H. Strachon was awarded one of the six Victoria Crosses given at Cambrai. He assumed control and rallied the squadron in the heat of battle.
18. Liddell Hart, p. 349.
19. Cary, p. 55; Cooper, p.p. 79, 80.
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21. *Ibid.*, p. 348.
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## The Corps V.C.s



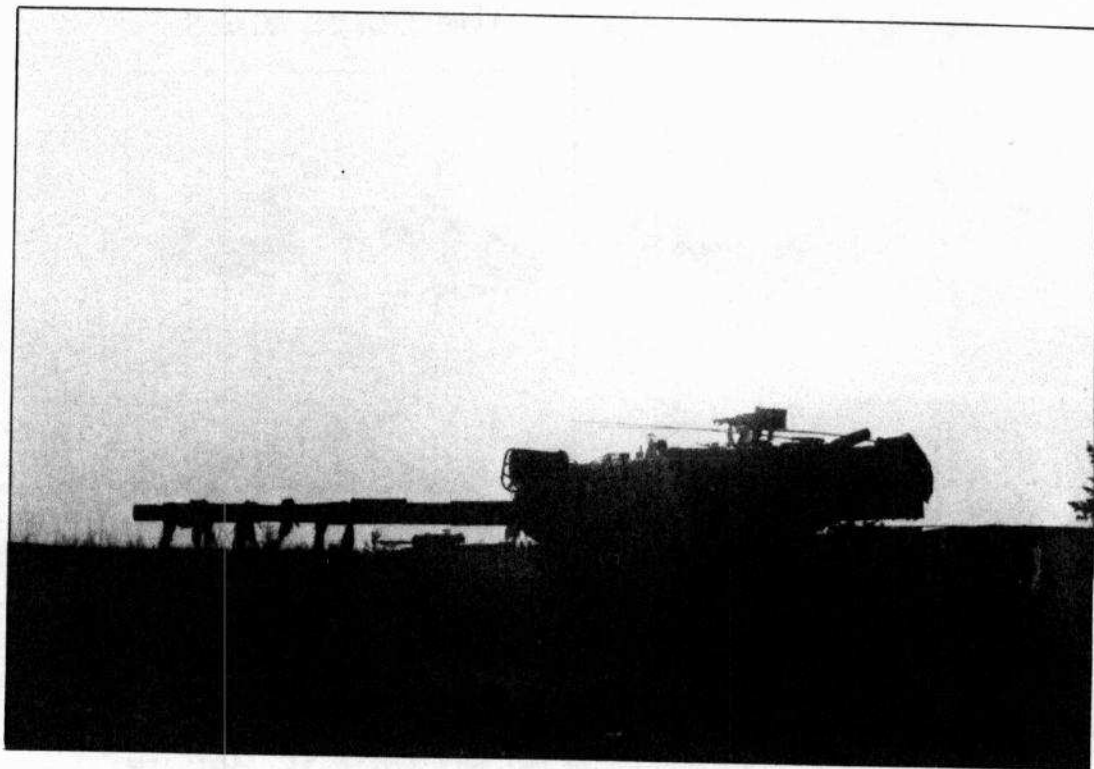
**Lieutenant E.D. Bellew**

Edward Donald Bellew was born in Bombay, India on October 28, 1882. Educated in England at Blundell's, Twerton; Clifton College, Bristol; and at Royal Military College, Sandhurst. He served with the Royal Irish Regiment in both England and India. Lieutenant Bellew emigrated to Canada and worked as an engineer with the Department of Public Works on harbour engineering projects in Vancouver and New Westminster.

On the morning of the 24th of April 1915, Lieutenant Bellew found himself the Battalion Machine Gun Officer of the 7th Battalion during a German assault on the Ypres salient. The main force of the attack fell on the Battalion which, partially owing to a gap on its right flank found itself surrounded. An effort to relieve the unit was also surrounded and destroyed. Finally orders were given for the remains of the Battalion to withdraw to a new line 300 yards back. That anyone made it back is due in large part to the last stand of Lieutenant Bellew and Sergeant H. Peerless, who was killed in the action.

As the Battalion withdrew, they each manned a machine gun. They waited until the enemy was within 100 yards before opening fire with devastating effect. Sergeant Peerless was killed and Lieutenant Bellew wounded. He nevertheless struggled back to his gun and fired until out of ammunition. As the enemy rushed his position he smashed the gun with a rifle and charged the enemy with fixed bayonet. He was finally overpowered and captured.

Lieutenant Bellew was awarded the V.C. on his return to Vancouver in 1919.



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In that a readable article is preferred, fit the style to the subject matter. Articles should be double spaced, typed on one side of the paper. Articles should normally not exceed 2,000 words. Only material of an unclassified nature should be submitted. Articles will be published in the official language in which they are received.

Nous préférons les articles qui se lisent facilement, et dont le style soit adapté au contenu. Tous les articles doivent être

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Tout travail artistique (croquis, photographies en noir et blanc ou couleur, cartes, dessins au trait, diagrammes, etc) rehausse la présentation et la compréhension d'un article. Le matériel utilisé doit être nettement découpé et faire contraste. Les photos délavées, grises, imprécises et très agrandies ne se reproduisent pas bien. N'envoyez pas de photocopies.

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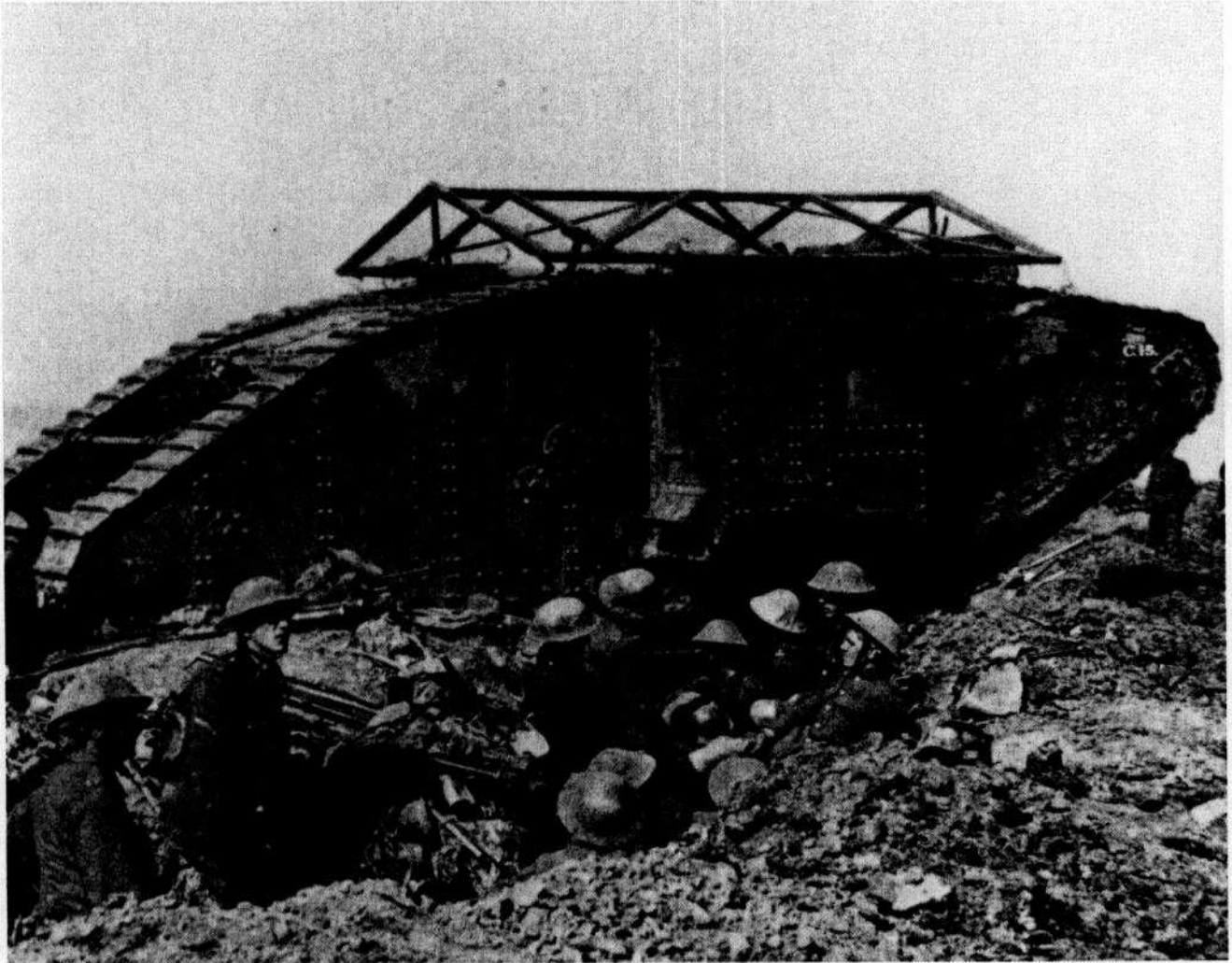
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