THE ROYAL

THE ROYAL ENGINEERS JOURNAL

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Guidelines for Authors

The Editor is always pleased to consider articles for publication in the *Journal.*

Guidelines for prospective authors are:

Subject. Articles should have some military engineering connection but this can be fairly tenuous, especially if an article is well written and interesting.

Length. Approximately 4500 words plus illustrations.

Copy. Ideally one copy of the text should be submitted, together with a head and shoulders photograph of the author plus a short pen picture.

Clearance. Articles must be cleared by an author's CO where applicable.

Computers. Articles submitted on 3½in discs are very welcome. Please ensure that text is typed with no formatting, ie LH justified only, and please **NO** caps-only headings – all upper and lower case.

Copyright. If an article has been published elsewhere before being submitted to the Institution, copyright clearance must be sought by the author; where necessary copyright clearance on photographs, maps or illustrations must also be obtained prior to submission.

Photographs should be of good quality with sharp definition, and don't forget to add appropriate captions. Please do not submit laser/photo copies of photographs for publication.

Rewards can be generous. The Publications Committee has about £350 in prize money to allot for each issue plus valuable annual prizes. All authors receive £10 to help cover costs.

Pseudonyms will not be revealed by the Editor under any circumstances.

Contributions should reach the Editor by:

9 June for the August 1997 issue
Early October for the December 1997 issue
Early February for the April 1998 issue

Submissions before the deadline are particularly welcome.

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Editorial

This issue of the *Journal* maintains the wide range and diversity of articles we have come to enjoy from authors within the serving and retired sections of the Corps. It is pleasing to see some of the younger members, in rank if not in age, making their contribution to the exchange of information and ideas. That some of the articles have proved both thought-provoking and interesting is evidenced by the letters in the correspondence section.

We lead off with *Wadi Akarit*, a marvellous account of a sapper officer's experience of the day he first came under fire. It captures the stark reality of battle and the sheer intensity of life in the day of a troop commander. No wonder many grew up so very quickly and went on to take responsibility for commanding squadrons and regiments in war at such a young age. For a good adventure story from the Second World War, go on to read *Escape from Singapore, 15 February 1942*.

With the focus of the Corps' effort now in Bosnia, there are several articles which reflect the shift since 1995 from fighting for peace with the Allied Command Europe Rapid Reaction Corps, through peace enforcement with IFOR (Implementation Force), and now to building the peace with SFOR (Stabilization Force). One of the first things to be achieved to meet the terms of the Dayton Accord was to repair the communications infrastructure of the country, and that meant building bridges. *Bosnia Bridge Gallop* is a great insight into the capability of sappers from other nations as well as an appreciation of the talents of the author, who as a retired warrant officer of the Corps, directed, if not commanded, some of the bridge builds. For a professional engineering view of one of them, go on to read *Repair of Slavonski Brod Fixed Bridge*.

Still on the bridging theme, *The M3 Amphibian Has Arrived!* is a timely reminder of the introduction into service of the successor to M2. Together with BR90, the close support and general support bridging system also recently introduced into service, it ensures that the bridging capability of British forces remains second to none.

It was said to the present troop commanders course, at a recent joint professional meeting held in Chatham, that there was one certainty in life: some of them would be serving in Bosnia within the nex six months. They would be wise to read *Quarryin Operations in Bosnia Herzegovina* and *Operations in FRY – a Resources Troop Commander's Perspective*. And so of course should others.

"British officers in general have little geological knowledge", to quote from *Geological Training for British Army Officers: A Long-Lost Cause?* Digging a heel into the ground to assess, from the imprint, the CBR (Californian Bearing Ratio) value might come to some readers minds. This well researched article tells the story about the rise and fall of geology as an educational subject in the British army.

If geology is a long-lost cause, the various disciplines which contribute to Military Survey's capability are most certainly not. *Geographic Field Support to IFOR* highlights the high-tech nature of some of the equipment now employed, notably the Global Positioning System for centimetre-accurate surveys and computers to generate terrain and other geographic information.

In the Gallipoli campaign 80 or so years ago, not even a field survey section was deployed and the only reliable map was obtained from a captured Turkish officer. Few may know, since accounts are scattered and sparse, of the otherwise significant sapper contribution to the campaign. *Engineers in Gallipoli* makes amends and brings together some little known or forgotten facts.

Sadly, the employment of sapper officers with the Railway Inspectorate, in the early days as serving officers and later as retired officers, has come to an end after an unbroken period of 156 years. The doyen of the Royal Engineers Transportation Club, Major General John Woollett, attended a farewell dinner for the last two incumbents, Majors King and Holden, in September of last year. *Royal Engineers and Railway Safety – 1840 to 1996* relates an interesting and little known chapter in the history of the Corps.

To conclude, we say farewell to our President, Major General John Drewienkiewicz, who last November was appointed Chief of Staff to SFOR and has been incarcerated in Sarajevo ever since. He hands over to Major General Tony Pigott on 1 May 1997.

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Contents

New President of The Institution of Royal Engineers

MAJOR GENERAL A D PIGOTT CBE MA

Major General Pigott will be appointed President of The Institution of Royal Engineers on 1 May 1997. He was commissioned from the Royal Military Academy Sandhurst into the Royal Engineers in December 1964. He graduated from Trinity College Cambridge in 1968. His regimental appointments have included service in the Far East, USA, Australia, Hong Kong, Belize, Northern Ireland, Germany and the UK. He attended Division 3 of the Army Staff College, Camberley in 1976.

Following appointments on the Staff, at Grade 2 level in the Ministry of Defence (ASD2), a short tour on the Directing Staff at Camberley, as Military Assistant to the Vice Chief of the General Staff, and as Assistant Chief of Staff G2/G3 at Headquarters 1st British Corps, he attended the 1989 course at the Royal College of Defence Studies. He was promoted to Brigadier in 1989 and appointed Commandant of the Royal School of Military Engineering until October 1991. He then became Chairman of the Allied Command Europe Rapid Reaction Corps Working Group in Bielefeld and assumed the appointment of COSARRC in the rank of Major General in November 1992. In September 1994 he returned to the UK to take up the appointment of Commandant of the Staff College and in January 1997 assumed the appointment of Director General Development and Doctrine. He was appointed MBE in 1978, and promoted OBE in 1984 and CBE in 1993.

General Pigott is married to Felicity and they have three children.

Major General A D Pigott CBE MA
New President of The Institution of Royal Engineers p4

Wadi Akarit

MAJOR C A LYALL BSc

The following is an edited version of part of a memoir written by the author, now deceased, in about 1990. The memoirs include additional material written by the author's wife, Lynda McCallum Lyall LRAM ARCM, who has kindly given permission for this extract to be published. Lynda hopes to have the complete version published at a later date.

Wadi Akarit

This is a personal account of the events of a day nearly 45 years ago, when I first came under enemy fire. Even after all these years it remains vivid in my memory: a new and very frightening experience – nothing like the battle training we had undergone in the UK when live rounds were fired over our heads. Perhaps the worst thing about it all was the noise.

The Germans and Italians in North Africa had decided to make a stand on the last natural barrier before the harbours of Sfax or Sousse. They had dug in along a line of hills behind a dry wadi and were further protected by a minefield in front of their position and a deep antitank ditch. The forward positions were held by the Italians, with the German 90th Light Division in reserve behind. The 90th Light were well known to the 8th Army and respected for their fighting qualities.

I joined 274 (Highland) Field Company as a very raw second lieutenant about 31 March 1942 and was given command of 3 Section. In a harbour area which was flat and sandy, with a few scattered olive trees and a small patch of thorny scrub brushes giving a little green shady corner, I can recall the smell of the sandy soil in my slit trench to this day, and the Nivea cream that I applied to my painful sunburnt knees and arms.

We were busy preparing for the forthcoming battle. Stores had to be sorted for the minefield gapping operation, and fascines made for laying in the dry bed of the wadi to allow tanks to cross without breaking through the thin crust of firm ground which covered the underlying soft salty marsh. Drills for the gapping operation had to be practised, though most of my section were only too familiar with this routine. To me, it was a period of frantic rush: learning the names of my men, the different methods adopted by 8th Army, finding out what stores we had, familiarizing myself with the different types of mines likely to be met, and being strafed by an ME 109.

Others in the company were carrying out night patrols to discover the depth and composition of the minefield (as a new boy I was spared this particular job). They found antipersonnel and antitank mines; they also found an entirely new wooden Italian antitank mine virtually undetectable by our mine detectors because even the fuzes were made of chemical bakelite.

Major "Bing" Benzies, the OC, was to be LOB (left out of battle) as he had run over a teller mine in his jeep a few days before and was lucky to have escaped with only a perforated ear drum. Captain Angus Patullo, the 2IC would command the company during the action. There were also three subalterns including myself who were the section commanders, Don Finlay, 1 Section, another, whose name I cannot remember, commanding 2 Section, and myself. My section sergeant was a tough little Scotsman called Ken Cummings, from Aberdeen, and with my complete lack of experience I relied very heavily on him for help and advice.

The overall plan was that the Gurkha battalions of the 4th Indian Division were to carry out a silent night infiltration of enemy positions using their kukris to the terror and discomfiture of the Italians. 51st Highland Division and 4th Indian Division on our left flank would attack before first light on 6 April. 51st Division was to attack on a two-brigade front with 152 Brigade in reserve. It would be difficult. Ammunition for the divisional artillery was limited. The 5th Camerons and the 5th Seaforths on the left and the 7th Argylls on the right were to cross the minefield and establish a bridgehead beyond. Then the 2nd Seaforths and the 7th Black Watch were to pass through and swing respectively right and left and take the high ground beyond.

Three lanes were to be cleared through the minefield using "Scorpions", each lane-gapping operation supported by a section from our company. Scorpions were obsolescent Matilda tanks fitted with a revolving drive, driven from the tank engine, to which

weighted chains were attached. As the tanks advanced, with drums revolving, the chains beat the ground and exploded any mines in their path. Or such was the theory. In addition, the Scorpions churned up a clearly discernable path and created vast clouds of dust in the process. The sappers' job was to mark the edges of the safe lane with pickets, tapes and lights or, in the event of the tanks not succeeding, to clear the minefield manually. A further section from 276 (H) Fd Coy, under Dan Gallagher, was to blow three gaps in the walls of the antitank ditch on the far side of the minefield, coinciding with the ends of the three gaps in the minefield, to let the tanks through.

At last light on 5 April we moved up to the wadi. Our first job was to lay the fascines; only tracked vehicles were to be used in the first phase of the attack. All our stores: detectors, tape, angle-iron pickets, barbed wire, torches, wire for pulling mines which might be booby trapped, etc, etc, were loaded onto bren-gun carriers which were seconded from the infantry battalions not committed to the initial assault.

The fascines were successfully laid across the wadi as soon as it was dark enough, and a crossing was established. It was essential that noise from vehicle engines was kept to a minimum at this stage, to maintain surprise. The crossing completed, my section withdrew about 200yds from the wadi and dug in for the night. Digging my slit trench warmed me up, for the temperature fell abruptly in the desert after dark. We were wearing tropical kit and had only our pullovers in our small packs. The night was bitterly cold and the slit trench very cramped, just deep enough to get below ground level.

The time must have been sometime after midnight. The cold, along with the discomfort of my slit trench and the anticipation of the coming battle, made sleep impossible. I discussed details of the arrangements for the morning with Sgt Cummings and my sub-section commanders.Then I went to visit the two bren-gun detachments which had been posted a little ahead to guard against the possibility of being bumped into by an enemy patrol. All was quiet. The darkness of the night was lightened by artificial moonlight produced by searchlights shining up into the clouds. Time seemed to pass slowly. At last, at about 0300hrs our cooks, led by the CSM, arrived with a large container of tea, and wads. Each man had been issued with iron rations for the following day; mine consisted of a tin of sardines and some hard army biscuits, and of course we all had our water bottles.

Zero hour had been set for 0415hrs, and right on time the skyline was lit by gun flashes and we soon heard the sound of shells passing overhead to explode in the enemy positions. The 4th Indian Division's attack had started earlier and we had been able to follow some of its progress by the thump of exploding hand grenades and bursts of tracer fire over on our left. Then beyond us, the Bofors light antiaircraft guns opened up, firing tracer shells over our heads to indicate the axis of advance for the infantry who had to march from their start line on a compass bearing and by counting paces to their objective. Soon, out of the darkness, came the sound of a piper of the Argylls playing the leading companies into battle. They passed through our position, mostly silent but the odd one making some wisecrack and inviting us to get up and join them. Now the Vickers machine guns of the Middlesex Regiment opened up laying a curtain of fire to isolate the flanks of the Argylls' objective and adding to the general noise.

The Scorpions were due to start their gapping operation at 0445hrs and as soon as the three tanks had formed up, we began to move forward with our stores into the bed of the wadi. The tanks moved, but after about a hundred yards they halted, started again, and to our dismay finally began to withdraw. Eventually we found that the engine of one was not running properly, on another the drive of its drumhead had broken and the third one's steering brakes had burnt out. So there we were, no gap through the minefield, dawn breaking and the churned up track leading towards the minefield clearly indicating our intentions to the enemy observation posts in the hills ahead.

All was still quiet as far as incoming fire was concerned. After a rapid readjustment of plan, I got together a gapping party and we started to move forward slowly sweeping for mines. Suddenly there was the whip crack of bullets. A sapper with one of the detectors fell over, hit, and another bullet went through the leg of my trousers. Everyone in the gapping party fell flat. After a while Sgt Cummings managed to locate the sniper who was by a little mound of earth to our right front about 300yds away. I crawled back to the wadi and contacted the 3in mortar platoon of the Argylls, dug in some short distance behind the wadi; the fourth round appeared to score a direct hit and we heard no more from that sniper.

By the time I returned, Sgt Cummings had got the gapping party on its feet again and we started sweeping forward. By now however it was bright

daylight and the enemy guns and mortars opened up. Once again we had to take cover. Luckily there were a number of what appeared to have been old gun pits in the area which gave some protection. While the shelling and mortaring continued it was impossible to clear the gap. Any movement brought renewed shelling. We could hear the *nebelwerfers* – multi-barrelled mortars called "moaning minnies" because of their characteristic noise – and waited for their cluster of six bombs to arrive, and the rising shriek which heralded the arrival of the 105mm shells while we tried to grovel further into the earth. Then, during a lull, I decided to go and see whether Dan Gallagher had managed to blow a gap in the antitank ditch so that we could align the minefield gap on it when we were able to start sweeping again. It had been blown sufficiently to allow tanks to climb out of the ditch which at this point was a very formidable obstacle over 20ft deep. Going further forward to the battalion HQ of the Argylls I started to explain our difficulties to the CO, Lt Col Campbell. Things were pretty hairy, and an enemy counterattack seemed to be developing with considerable mortar fire arriving. Given half a chance I would have dived for the nearest hole, but Lorne Campbell just stood there ignoring everything, listening attentively to what I was saying. He then said it was imperative to get the tanks and antitank guns up as soon as possible and that the gap must be cleared at all costs. At this moment the 7th Black Watch leading companies began to pass through the Argylls to swing left and take the higher ground beyond the antitank ditch. I went back and decided that I would go along the antitank ditch and see what had happened to 2 Section's gap and the blowing of the antitank ditch in their sector. I made my way along the bottom of the antitank ditch. I had not gone very far when I heard shouts from the top and saw two Italian soldiers pointing their rifles at me. With my hands up I obeyed their signals to climb up to them. They must have been in a pocket that was bypassed when the Argylls went through and had not been mopped up yet by the Black Watch. Pushing me down into their slit trench, they seemed very jittery and demoralized and jabbered away to each other. Suddenly there was the most appaling crash of bursting mortar bombs which went on for what seemed an eternity. I learned later that it was the 4.2in mortars of our own Light Regiment RA, supporting the attack of the 7th Black Watch. We all cowered terrified in the bottom of our trench. Nearly the last bomb of the barrage hit the top edge of the trench burying us and injuring at least one of the Italians. I took advantage of the confusion as soon as I had recovered my senses and dived out of the trench back into the antitank ditch from where I made my way back to the area of our gapping operation.

I started to recross the minefield, but an outbreak of shelling drove me into a nearby gun pit, where I found a sapper corporal from Dan Gallagher's section who was in a bad way. He had apparently stood on an antipersonnel mine which had shattered his foot and had dragged himself into the pit. I put a tourniquet onto his leg, gave him some water, then took an ampoule of morphia from the pouch of my belt and injected it into his arm. After waiting a while to let the morphia take effect I somehow managed to get him onto my back in a fireman's lift and staggered back across the rest of the minefield to the wadi where the MO of the Argylls had established his Regimental Aid Post (RAP). Somehow, in the stress of all that was happening one does not stop to think about the mine danger, but afterwards I remember feeling quite horrified about what might have happened to me.

I then went to find Angus Patullo who had taken up his position in the Scorpion command tank in the wadi. How safe it felt crowded in the turret with him surrounded by several inches of armoured plate. I gathered that the other sections' gapping operations were not going well. 1 Section had met a dense antipersonnel minefield. Don Finlay had been severely wounded by an exploding mine and there were several other casualties. They had not progressed very far, though a gap had been blown in the wall of the antitank ditch. The gapping operation in 2 Section's sector by the Scorpions had been more successful than elsewhere. The tanks had got partly into the minefield before withdrawing, but no gap had been blown in the antitank ditch; when 2 Section had started to clear the minefield by hand they had been severely mortared. Their section commander had been killed and no further progress had been possible.

The radio in the command tank was on the brigade command net. The brigade commander was insisting to Angus Patullo very vehemently that it was essential to get a gap cleared. The tanks and antitank guns were desperately required by the infantry to help defeat the counterattacks which the Germans were mounting. I remember Angus Patullo taking off his headphones as he turned to me, saying "Well, you heard all that! Now I think

the only real prospect of clearing a gap quickly is to get on with yours." I felt a sinking feeling in my stomach, realizing what he meant but also very reluctantly having to agree. I said I would try to do something about it and very slowly climbed out of the tank. There was still a lot of shelling going on and I dived into the gun pit where Sgt Cummings and some others were hiding. He told me that there were four or five more in the next gun pit and that he had sent the rest of the section further back to some shelter near the stores dump.

I organized a working party of Sgt Cummings, a corporal who was one of the sub-section commanders, a sapper and myself. Two other sappers with coils of white tape were detailed to mark the edges of the gap. The four of us in the working party armed with bayonets were each to clear a 2yd wide lane. I think that had I not been an officer with a duty to get something done, nothing would have got me out of that hole in the ground. As we waited for the shelling to ease, I lit a cigarette. My mouth tasted foul, the cigarette tasted even more so. It was a "Pirate". These were the weekly, free issue cigarettes which were made in India. They tasted pretty disgusting at the best of times, and this was not one of the best of times.

Finally I decided we could not put it off any longer. Angus Patullo arrived in the pit, all of a heap, having been encouraged on his way by a large bang. He cajoled us to get on with it! I think that each one of us was very apprehensive: I know that I felt very frightened, but knew I had no choice. We drew strength from each other and climbed out of the pit, doubled to the forward edge of the Scorpion track and spread out. We worked our way rapidly forward prodding the earth with our bayonets at any suspicious spots. We had about 300yds to go and had to fall flat on the ground on several occasions as more mortaring and shelling took place. We found some mines which we quickly disarmed and carried out of the gap, dumping them carefully in a safe place. We took quite a risk just lifting the mines which might have been booby-trapped. The normal drill was to attach a length of wire to a mine and pull it clear whilst under cover, but we did not have time for such refinements on this occasion. At last we reached what we took to be the far edge of the minefield, having lifted and cleared about ten anti-tank mines, German teller mines and the new Italian wooden box mines. There were also some German antipersonnel "S" mines. Just before we got to the end Sgt Cummings was hit by a shell fragment just above his knee and Spr Rice, who was on the tape reel, was hit in the head by a splinter. Sgt Cummings said his leg was numb but he could still walk, but Spr Rice was unconscious. I left Sgt Cummings to get the party back under cover and got Rice back to the RAP in the wadi. I then told Capt Patullo that the gap was clear for the tanks.

The first phase of our job was done but the gap was only marked very temporarily by tapes laid out on the ground. It still had to be fenced off properly with angle-iron pickets and barbed wire. However, we all realized what would happen when the enemy observers on the hills saw the tanks starting to cross the minefield. I arranged for one sub-section of a corporal and ten men to stay in the vicinity of the gap to start marking it if and when this became possible. They were ready to carry out any emergency clearing of the lane if any vehicles obstructed it. The remainder of the section I sent further back to the vicinity of the stores dump.

We soon heard the noise of 23rd Armoured Brigade's Valentine tanks as they drove up to the gap and went through flat out. Sgt Cummings said that he hoped we had got all the mines, and I thought about the very confined access from the antitank ditch; any obstruction there would be a major disaster. The first troop got through safely, but the second tank in the next troop received a direct hit from a shell and burst into flames. The following tanks did not stop but swerved round the burning tank, going into the uncleared minefield in the process. But they were lucky. The enemy guns and mortars kept up a constant fire on the gap, 105mm guns being joined by some 88mm. The very high muzzle velocity made their sound quite distinctive, but also meant that you had much less time to take cover than with the slower 105s.

Sgt Cummings' leg was becoming very painful and had stiffened up so that he was unable to walk. I sent him back to the RAP from where he was evacuated. Spr Rice too had been evacuated, though fortunately his condition was not as bad as we had first feared.

The time was by now mid-afternoon. We were all very tired, hot and dusty, and had had nothing to eat since the early hours. The thought of a tin of sardines and hard biscuits revolted me. Someone had opened a tin of bully beef but in the heat its contents were liquid and very far from appetizing. For the time being there was nothing to do except

keep our heads down. Most of the tanks and bren carriers had gone forward. Some ambulances had also used the gap. Two had been hit and were burning fiercely. I understood from hearing messages on the brigade command net radio that heavy counterattacks were being launched especially against the sector held by the Argylls.

At last, as dark began to fall the shelling and mortaring stopped and comparative quiet reigned. Military police lit the minefield with torches and controlled traffic. My section along with the rest of the company were withdrawn. It was a great relief to march along the dusty track to the rendezvous where our transport waited with the CSM. We were driven back to the company harbour area. There the cooks had a meal ready, but I could not face any food. After two large mugs of hot sweet tea, I went off round the sub-section areas to hear what the sub-section commanders had to report. Then I detailed off No 2 sub-section to be ready to move off to the minefield area at 0630hrs to clear up. A work party was also detailed to assist in digging graves in the area of the wadi. Having checked that my LSgt had taken over Sgt Cummings' duties and that the guards for the night had been detailed, I arranged for the kits of the killed and wounded to be collected and sent to the CQMS. The last thing I had to do was censor a large batch of letters which I had found in the section post box. By the time I had finished, everyone except myself, the cooks and sentries had settled down. I, too, felt it was high time for bed, so I climbed into my slit trench to rest.

I remember tossing and turning, thinking over the traumatic events of the day. Eventually I must have dropped off, for I remember waking with a start to find my batman shaking me and saying that he had managed to scrounge a mess tin full of hot water for me to wash and shave with. I quickly shaved, dressed and had a hurried breakfast.

I gave orders to the LSgt to check the weapons and equipment of the rest of the section and have them ready to move at 30 minutes' notice in case we were called on to join in the pursuit, and to check road verges for enemy mines. I then dashed off to the company office vehicle, left the batch of censored mail, and had a brief word with Maj Benzies who said Capt Patullo would see me later at the wadi. We soon left the coast road with its reasonable tarmac surface and bumped along the three or four miles of dusty track to the wadi. Today all was peaceful and quiet; gone were the apprehensions of yesterday.

When we arrived, the sub-section was set to work to check the area for engineer stores which had been left on the dump and around the edges of the wadi. A small working party was also detailed to help the pioneers who were digging graves on top of the wadi bank. We buried No 2 Section commander, (the padre of the 7th Argylls officiating), and marked his grave with a wooden cross.

Our gap in the minefield was derelict and abandoned. 276 Fd Coy was completing the clearance of the gap which had been started yesterday by 1 Section. This had a better alignment and would serve as the divisional axis of advance.

Capt Patullo and I were about to leave the area when the divisional commander, "Long Tom", Gen Wimberley, drove up in his jeep and stopped to speak. Capt Patullo introduced me to him, remarking that I had just joined the company and that yesterday had been my first encounter. The general looked at me and said wryly that I had chosen a good occasion for he reckoned that it had been the most vicious battle the division had fought so far.

That evening sitting by the company mess truck was a sad occasion with just the three of us left. We wondered how Don Finlay and the others were getting on and when we would get reinforcements posted in. We had heard that the Argylls had lost four officers and about 100 men and that the Black Watch had suffered heavy casualties in taking the high ground.

Some weeks later we heard that Lt Col Lorne Campbell had won the VC for his bravery and coolness during the battle. Capt Patullo was awarded the MC for the company's work during the battle.

Bosnia Bridge Gallop

WARRANT OFFICER CLASS 2 A D PEARSON BEM

WO2 Pearson left the Corps in December 1995 after 25 years mainly in the Royal Engineers. His time in the Corps was divided between 21 Engineer Regiment (1 and 4 Field Squadrons) and 59 Independent Commando Squadron where he served his last six years as troop staff sergeant and quartermaster sergeant instructor. He saw service in many countries, including the Falklands, the Gulf, Norway, Belize and others. As you will see, he now works for Mabey and Johnson.

I HAD worked for Mabey and Johnson for five months and built three bridges, when Brigadier Garth Hewish said that the company was anticipating a little business in the former Yugoslavia. I immediately said that I was the man for that job. Little did I realize that my initial trip to build three bridges over a six-week period would actually become eight months of occasionally very hard and not a little bit stressful work.

I was briefed by Mabey's chief engineer, Colin Harvey, on the details of the first three bridges, all of which were to be Mabey Compact 200 (MC200). They were:

- a two-span bridge of 20 bays triple single reinforced and eight bays of single reinforced at Stara Gradiska, 87.4m,
- 23 bays of double double reinforced at Aleksin Han, 70.15m, and
- 21 bays of triple single reinforced at Visoko, 64.05m.

MC200 is similar in appearance to the Bailey bridge, from which it derives, the panels being the same length (3.048m), but a little higher at 2.236m. Individually, components are heavier and stronger than Bailey but there are fewer parts, for instance: only one transom per bay regardless of class load, and spans which would require triple truss, triple storey Bailey, can be bridged in double single or triple single construction with Compact 200. MC200 components form the majority of parts for the Mabey Military Bridge.

I arrived at Zagreb airport on 19 February 1996 to be met by Hungarian army engineers; rather foolishly I had imagined that I would be working with the British sapper I knew and loved. The only contact I was to have with British horny-handed sons of toil would be when on a site recce with 20 Squadron and the occasional chance meeting when I invariably tried to scrounge some good old NAAFI tea.

The Hungarians were ready and willing to begin work. The bridge equipment for Stara Gradiska was already in their camp. The Hungarians had not yet been hooked up to the military satelite telephone system and they and 62 CRE (Works) were living in blissful ignorance of each other's intentions and responsibilities. Eventually Major Tony Wakeman was contacted and after a site meeting a plan was devised.

Meanwhile, having never held panel bridging equipment, the Hungarians had to be taught how to assemble it, from scratch. They were very enthusiastic and didn't allow the fact that no one spoke English to interfere with progress.

Work on the bridge began with setting out, the fitting of reinforcing chords to bridge panels and moving the bridge to site. Construction started on 7 March and within two days 17 bays of triple truss single storey were on the rollers.

WO2 A D Pearson
Bosnia Bridge Gallop (p10)

At this stage the pier had not been constructed due to flooding and, as no further work was possible, a party of Hungarians and I moved to Slavonski Brod in Croatia to prepare for the construction of two bridges to join the two towns of Gunja, Croatia, and Brcko in Serb Bosnia. The bridges were to be built by a combined force of Hungarians and US army engineers, something unthinkable only a few years ago.

The first bridge was a 23-bay, three-span, continuous, double single, and took two and half days from setting out to open for traffic. Unfortunately this time included an extra day whilst work was held up by the US army safety officer to discuss the method of decking down, which then remained unchanged.

The second bridge was a double single reinforced, over a drop of 30m. Setting out was critical since the inner truss line would rest on an "I" beam on the road, and the outer truss on the kerb. The build went well and was completed in three days despite mechanical breakdowns and a serious thick attack by an engineer storeman who did not realize that when Tirfor is required, the strops, shackle and handle should also, ideally, accompany it. The main reason for the speed of the builds, by the way, was the element of competition that built up between the US and Hungarian engineers.

A big problem was that of visiting dignitaries, the Hungarian commander would arrive with an interpreter and driver and ask the equivalent of "How's it going?", whereas a general (and there were many of them) would arrive with a fleet of helicopters and a staff the size of the Adjutant Generals Corps (AGC), descend on the bridge and ask questions like "Why aren't these men wearing gloves?" Despite these visits the task was completed quickly and efficiently with only one minor injury – fingers and bridge rollers just do not go together!

So! Back to Stara Gradiska where the pier area was still under water.

Having spoken to Captain Tony Glasgow at HQ ARRC in Sarajevo I was told that the next task would be the double-storey bridge at Aleksin Han on the road between Sarajevo and Mostar. This bridge would be built by the 6th Regiment of the French Foreign Legion and had to be completed within 48 hours. I travelled to Kiseljac and met Majors Phil Stanton RE and Hugh Hennessy RE(V) the engineer logistic staff officers, who combined the energy of a Tasmanian devil on benzedrine with the patience of Job. They had the responsibility for moving and recovering all bridging equipment, and a very efficient job they did, despite the best efforts of numerous other staff officers of various nationalities who were obviously in serious training for the NATO insanity competition!

The end of the bridge at Brcko – note "I" beams on inner panel line and outer line resting on the kerb.

I travelled to Mostar airport and met up with members of 6eme REG (*Sixieme Regiment Etranger du Genie*. The 6th Regiment Foreign Legion, Engineers). This was to be an all-nation effort; not only was almost every nationality present in the regiment (except British) we also had a Romanian crane and driver working with us.

Four days training in shocking weather was followed by two days for preparation and transporting of the equipment to site. During this time I carried out a site recce and was appalled to see a 10-bay triple single extra wide Bailey bridge (EWBB), which our bridge was to replace, being trafficked simultaneously by two articulated vehicles which must have had a combined weight well in excess of 120 tons. The Bailey (Military Load Class 30) exhibited all the signs of collapse without actually collapsing, a sight that would have Sir Donald (may he feast at the right hand of Allah!) turning in his grave.

The bridge build began at 0600hrs on Saturday 6 April. As our 23-bay double double reinforced Compact 200 was built, the EWBB was stripped out to one side by the *Bundeswehr* engineer battalion. Everything proceeded well for the first two hours until a German sapper was crushed by a collapsing Bailey truss. (Pearson's top ten tips: the panels are held onto the transoms with transom clamps, therefore DO NOT remove those

Bosnia Bridge Gallop (p11)

The 21-bay triple single reinforced bridge at Visoko just before launch – note the wire gabion pyramid on the far bank.

transom clamps until you arrive at the bay being stripped out.)

This delay was fortunate for the Legionnaires; they hadn't had a drink since breakfast and managed to see off a bottle of wine apiece! whilst the casualty was evacuated with what transpired to be only minor injuries. The work was carried out by sections of 16 men under the command of a lieutenant or adjutant working in four-hour shifts. The officer in charge was Lieutenant Gac, an extremely energetic young man who intended to stay on site throughout the build. The French army is similar to the British in organization, except that the officers are in technical command of tasks. Every RE NCO knows that troop commanders are there for Command (capital C), recce and last, but definitely not least, to keep the CO away from the site. The French are different. By 2000hrs Sunday 7 April, Lieutenant Gac was exhibiting the symptoms of a young officer on his first visit to the sergeants mess, ie, completely incoherent and staggering all over the place. He continued to stagger manfully until 0200hrs when he asked if I could speak French (ooh, aah Cantona?) and his OC ordered him to sleep. At 0600hrs the bridge was complete and the first vehicles crossed, the signal for the Legionnaires to have another drink and for me to go for a shave (British, old chap!). It was another good effort that no one could have bettered, (apart from any Royal Engineers' field troop) on a vitally important route.

I then travelled back to Stara Gradiska; the ground was still under 2m of water.

The next bridge was a 20-bay triple single reinforced at Visoko. The task was the responsibility of the *Bundeswehr* and was on a difficult site which presented many problems, not least that the gap was too big for a single storey bridge making it necessary for the home bank to be extended. 62 CRE had planned for the construction of a gabion abutment which was not popular with our German colleagues: they did not consider filling gabions suitable work for soldiers. Absolutely! The Romans and everyone else since, must have got it wrong then. Major Wakeman used his diplomatic skills to their limit and told them to get on with it. They were allocated some assistance from the Romanians who were very impressive; the gabion pyramid was built, mainly by hand, with plant assistance for backfilling, in less than six working days. Bridge erection began on Monday 15 April and the bridge was launched on Thursday 18th. The launch was delayed by the late arrival of one of the 11 film crews and eventually launched at 1100hrs amidst a blaze of flash bulbs and the whirr of video cameras; we then got on with removing the nose and jacking down. The bridge was opened with suitable ceremony on Sunday 21 April.

On my return to Stara Gradiska I was pleasantly surprised to find that the pier was almost ready. It was constructed from Compact 200 panels left over from the UN involvement in FRY, and discovered in the Material Management Unit at Split. 62 CRE had designed the pier, bracing and pier cap. The bridge had to be built and launched from the Croatian side, across the pier, into the demolished bridge, which was of the steel truss through-bridge type with overhead bracing, and onto the existing bridge pier. The existing bridge required a bit of surgery in that the overhead bracing had to be removed and placed on top of the top chord, to allow the passage of 16-ton DROPS vehicles. The bridge was completed and launched into the existing structure, the far end resting on a steel grillage 670mm high to give sufficient clearance between the bottom chord and the existing road surface.

This bridge was officially opened on 2 May in true Hungarian fashion; the CO told the Padre to keep it short, a barrel of beer was rolled across the bridge and then everyone had a well deserved drink.

My next task was at Donji Bratinja, east of Gorazde. It involved the construction of two bridges over gaps blown in an existing bridge, which were to be built by the 2nd *Bundeswehr* contingent, the majority of whom came from the former German Democratic Republic. The

Bosnia Bridge Gallop (p12)

bridges were simple enough to build, 17 bays of double single reinforced and ten bays of double single. The only problem was that the biggest bridge was built from a curved road section with a 130mm crossfall, the second bridge was built from the other direction and the two sets of ramps had to meet. 62 CRE had designed the join, which worked, but the setting out was critical and took most of the first day on site. The German engineer battalion was heavily tasked at the time and only 18 men were available for bridge erection. Working hours were 0530 to 2030hrs. Reveille was signalled each morning at 0430hrs by *Der Spiess* (slang for sergeant) with a long whistle blast and a shout of "*Kompanie Erwache!*" (company awake). This little ceremony must have set him up for the day because he was a very cheerful individual. The 17-bay bridge was completed in four working days (what days!) and the ten-bay was completed in one day with a working party of one officer and eight soldiers, a very good effort indeed.

Whilst the above bridge builds were in progress one minor job came up with a Belgian engineer company. The bridge in question was a five-bay single single reinforced overbridge. After a recce and in a moment of insanity (NATO insanity competition here I come), I said that it could be done overnight, in about six hours, by a works party drawn from the AGC. Ah! what optimism. Can this estimate really have been based on years of experience in the Corps? I arrived on site at 2000hrs, after a day on the Donji Bratinja site, to meet the Belgian engineer troops. The bridge build progressed (after the first three bays were built) excruciatingly slowly, due mainly to the ancient crane and an unbelievably pedantic banksman. Consequently, after 11 hours when I left to return to the Donji Bratinja site, the ramps were still being fitted. What a night!

The next bridge, to be built by the Hungarians, was on Route *Python* between Sarajevo and Tuzla, to replace one the Bosnians had demolished; it was in a devilishly difficult position, having to be built across a gap in a loop road at the head of a re-entrant. The problem was exacerbated by the cliff sides in the bridging area: there was not enough room to build the bridge in this position. The solution was to build the bridge diagonally across the gap and lift the home bank end into position with a crane. The bridge had a launch weight of 56 tonnes and the home bank end had to be moved approximately 20m into position. After

The completed bridge at Stara Gradiska. Note the position of the end of bridge over the existing bridge pier.

carrying out a recce with Captain Dave Pardy, it was decided that Route *Python* must be closed whilst work was in progress since the tail end of the bridge would block the road.

All preparation was complete and the bridge on site by Friday 24 May. We learned at this stage that certain staff officers had decided that it was not necessary to close the road during the erection of the bridge. A visit to HQ ARRC was necessary. After a conversation with Colonel Carbijn of the Netherlands engineers the decision was taken to close the road. Captain Tony Vosper was tasked to ensure that the information was included in the daily conference, which it duly was.

Works began at 0800hrs the following day. The road was due to close at 1000hrs – why can you never find a military policeman when you need one? The road had to be blocked by the Hungarians, who are far too polite for that sort of thing. Of 16 soldiers on site, nine were involved in controlling traffic, so it is to their credit that 17 bays of double single were built during the day. The Chief Engineer ARRC, Brigadier Moore-Bick OBE arrived at 1700hrs, bearing the antidote to all soldiers' problems, which was consumed that evening.

The following day the bridge superstructure was completed and launched. We then had to wait for a 90-tonne capacity crane which was booked for 29 May. The crane arrived together with various spectators and reporters expecting, no doubt, a grand spectacle. Unfortunately for the thrill seekers, the movement of the bridge was carried out in 150mm increments with the end of the bridge never going higher than 50mm. The main reason for the snail-like progress was that the far bank end of the bridge was on 2m-high wooden packs and after each increment it was necessary to adjust

Bosnia Bridge Gallop (p13)

the position of the packs using hydraulic jacks. Eventually the bridge was in position, and was jacked down onto its bearings. This took from 1000 to 1630hrs.

The most surprising thing about the whole task was the manifestation of something which all who have served in the former Yugoslavia believe does not exist – gratitude; a baker from Sarajevo stopped and gave us a gateau. Another good job from the Hungarian engineer contingent.

At this point I was granted a week's leave. Prior to leaving, a recce to the next site at Lukavac in Bosnia was made. A US engineer four-span Bailey was to be replaced by a two-span Compact 200. The Bailey was an American M2 (single lane) and had suffered badly whilst in use. The plan was to strip out the Bailey and build the MC200 from the same side.

On my return from leave I met up with the Romanian engineers who were responsible for my next two bridges. We travelled to site and found that after the US engineers had delaunched their bridge a site survey was carried out. This presented a couple of problems:

- the launch and erection scheme from Mabey and Johnson had the bridge being built from the same side that the Bailey was being stripped onto. It was not impossible to build it backwards but it would be more difficult (a bit like a medium girder bridge reverse strip, in reverse), and
- the launching rollers would be on 2m of packing and the first set of construction rollers would be on 2.5m of packing.

After much wringing of hands (mine), the decision was taken to load the bridge onto vehicles and move it to the other side. This decision was not popular with HQ ARRC but to construct it the other way would have involved a major logistic effort to supply timber for the necessary trestles to support the rollers.

The author with a group of Hungarian sappers on Route *Python*. The bridge is about to be launched. The restricted nature of the site is illustrated by the proximity of the bank to the rear of the bridge.

Bridge erection began at 0001hrs Monday 17 June. The US Army 38th Engineer Company assisted during daylight; the Romanians worked in three shifts around the clock. The bridge was eight bays of double single reinforced and 19 bays of triple single reinforced and was complete at 0200hrs Friday 21st. The Romanian sappers demonstrated a capacity for work which I have seldom seen equalled. Additionally their recovery vehicle crew was extremely flexible. During the launch of this bridge the strop broke no less than seven times but was repaired each time within 30 minutes.

The next most noteworthy thing was the amount of theft perpetrated by the locals, followed by the lack of success of the Bosnian police in recovering anything, even after thieves had been identified. A particularly irritating example of this occurred during the night of 17 June; after the night shift had completed their work and secured the tools in a vehicle. Two soldiers were left on site to manufacture road signs, and they disturbed four men who disappeared on bicycles but not before one of the men left his bike and ran off into a known minefield. The police were summoned and the owner of the bike was identified. The police recovered nothing, not surprising since four 30-ton hydraulic jacks and 55mm ratchets are so easy to conceal! Another example of Bosnian gratitude was shown when a Bosnian youth placed a Russian antitank mine on the bridge site and demanded money before he would remove it. The 38th Engineer Company first sergeant responded by threatening, in a very convincing manner, to shoot him if he didn't move it. A very successful and salutary act of diplomacy, I thought. The bridge was opened by Brigadier Moore-Bick. The Romanian idea of an opening ceremony is similar to the Hungarian: keep it short and sweet, bring on the beer.

The following day we had to return to the bridge site to repair the kerbs. This was due to Bosnian drivers attempting to use an extra wide roadway as two lanes and climbing up onto the mild steel kerbs to pass other vehicles. Sixty per cent of the kerbs fitted had to be thus repaired, whilst this was happening vehicles were still attempting to execute this unusual manoeuvre.

Bosnia Bridge Gallop (p14)

Our next task was a 99.6m two-span bridge at Doboj. Prior to the bridge build certain works had to be undertaken on the piers and approaches. Unfortunately, the Romanian soldiers' capacity for work was not matched by their battalion staffs' planning ability. Concurrent activity is not in their vocabulary and consequently, while 21 soldiers were working at Lukavac, the remainder of the battalion's 400 men were kicking their heels in barracks. The bridge platoon was given four days off after their effort at Lukavac. Luckily the bridging officer, the excellent Major Costache, was made of sterner stuff and a lot of progress was made but it was not until Saturday 29 June that work began on this bridge. Once gain the Romanian capacity for work was demonstrated. Work began at 0600hrs and the bridge was complete by 1200hrs Monday 1 July, working daylight hours only.

During the erection of this bridge an incident occurred which demonstrates the difference between British Royal Engineers and engineers of other nationalities, but which is especially true of the former Warsaw Pact armies. 20 Field Squadron was about to construct a bridge of their own and paid us a visit. The squadron 2IC, SSM, a SSgt and a number of JNCOs made up the party. The Romanian CO asked why they were here and when I explained, he asked if the captain was to be IC the bridge; he was very surprised when I told him that the SSgt would be in charge of the bridge erection (the Romanians had a lieutenant colonel) and the JNCOs would have a considerable amount of responsibility during the build. He was a little sceptical; in the former Warsaw Pact, WOs and NCOs have little status and all responsibility is taken by officers.

It's normal for old soldiers to denigrate the quality and effort of younger soldiers still at the bottom of the food chain, but having worked with almost every nationality in the Implementation Force, with the exception of the French, no army has officers, NCOs or soldiers of the standard and quality of the British. I experienced a flush of jingoistic pleasure when the Romanian officers told me that, in their opinion the British were the most professional in NATO – I already knew it!

After this I had two bridges to build with the French army engineers, which due to their straightforward nature, and the professionalism of the French sappers, was a piece of cake. I left Zagreb on 1 October, no more FRY work pending, and on my arrival at company headquarters near Reading was told to prepare to go to Ethiopia in five days' time, but that is another story.

The completed bridge on Route *Python*. The photograph has been taken along the direction of launch showing the distance the bridge had to be moved into its final position.

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Bosnia Bridge Gallop (p15)

Geographic Field Support To IFOR

MAJOR J D KEDAR BSc(ENG) FRGS

Major John Kedar was commissioned into the Corps in 1983 following graduation from Southampton University. Tours with 39 Engineer Regiment, Junior Leaders Regiment and on-loan service with the Sultan's Armed Forces Engineers in Oman, preceded survey training. In 1993 he attended Staff College, and was subsequently rewarded against his will with a tour as a SO2 in HQ British Forces Cyprus.

Major Kedar assumed command of 14 Independent Topographic Squadron in March 1996 at the Kiseljak Brick Factory, Bosnia, taking over from Major Jim Mitchell who had deployed the Squadron 2½ months earlier.

FOUR days before Christmas 1995, as 14 Independent Topographic Squadron was heading off for a few days leave prior to deploying to Bosnia, the call came through that the squadron had four hours to get to RAF Bruggen and GO. It was the start of 14 Squadron's second major operational deployment in six years, and of a massive commitment by Military Survey to support the first deployment of the Allied Command Europe Rapid Reaction Corps (ARRC).

This article outlines the geographic **field** support provided to the Peace Implementation Force, concentrating primarily on that given to the ground forces in Bosnia Herzegovina by the Geographic Support Group (GSG). The contribution of other areas of Military Survey, and particularly those based at Feltham, is not considered. It is not intended as an analysis of the support, nor an attempt to draw detailed lessons, but simply to inform the reader of the modern capability of Military Survey's field deployable assets using Operation *Joint Endeavour* as a vehicle.

BACKGROUND

IT is important to recognize several key factors which contributed to shaping the provision of geographic (geo) support in theatre:

Internationality: some 27 nations served under command of ARRC. All, as well as the United Nations, other agencies, and the Bosnian factions and people themselves, received support from the geo community. This support was unique in many respects, with no other Corps asset reaching as far.

The Dayton Accord and changes thus instigated continually led geo support. The agreed cease fire line became ineffective at D+90, resulting in areas of transfer between factions as the Inter Entity Boundary Line (IEBL) took full effect. Subsequent negotiated IEBL changes required dissemination. The former warring factions had agreed at Dayton to co-ordinate the IEBL, but this was clearly beyond their capability and so the Implementation Force (IFOR) commenced this operation whilst training local surveyors. Later, as elections approached, support to the Organisation for Security and Cooperation in Europe became more important. The centre of gravity of geo support therefore moved progressively from G3[1] to G5[2] as the operation matured.

The Nature of Geographic Work. The role of the geo support organization in theatre is to obtain, process and disseminate geo information to commanders, staff and units within theatre. Basic data (paper maps, digital maps, reference books and other geo data) comprises information, but when assessed and processed by trained technicians, for example during terrain analysis, the result is, or equates to, intelligence. This must then be disseminated in a

[1]G3 – Operations.
[2]G5 – Civil affairs.

Maj J D Kedar
Geographic field support to IFOR (p16).

suitable format and time-frame to those requiring it. This role has long been recognized in the British Army, but other nations are not so focused, with widely spread geo responsibilities reducing the coherence of this their support.

Theatre Geographic Support

Before considering the role and work of the ARRC GSG, it is important to understand how the GSG fitted into the overall geo organization. Naturally this mirrored IFOR's organization, and is shown right. As ARRC lead-geo nation, it was no surprise that the bulk of geo support in theatre (as much as 83 per cent of geo manpower) was that from Military Survey. Some 70 per cent of Military Survey's soldiers spent a six-month tour in theatre during 1996, in many cases having completed tours on Operation *Grapple*. A number have returned after six-month tour intervals to Operation *Lodestar* in 1997. The geo organization in which GSG operated was:

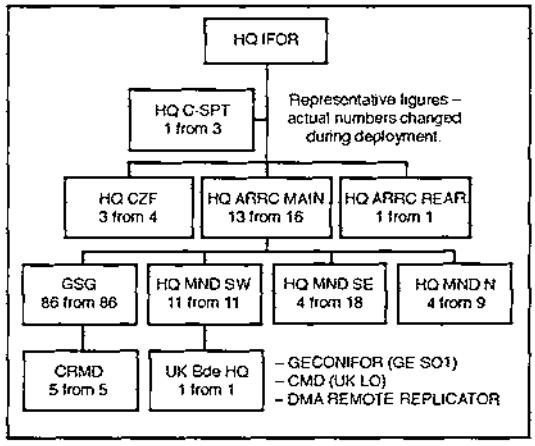
HQ IFOR set the overall Force geo policy, and co-ordinated support provided outside IFOR by IFOR geo elements, for example to the United Nations forces still operating in Croatia and Macedonia.

HQ Commander for Support (C-SPT) had a small map store located in Zagreb, supporting both C-SPT and the United Nations. A Military Survey JNCO provided the expertise in this multinational store. The need for map supply understanding was illustrated here by the JNCO, on taking over responsibility, having to remove much superseded and out of date mapping.

HQ ARRC Main. ARRC's chief geographic officer (CGO), Lt Col R N Rigby, and his staff at HQ ARRC gave geo advice and support to Commander ARRC and his staff, and controlled and tasked the GSG. They undertook much terrain analysis such as flood and earthquake predictions, determined map supply policy, and produced graphics and limited run geo products for HQ ARRC. Much of their work was, however, dedicated to supporting the negotiations on changes to the IEBL which diverted them from many routine geo responsibilities. There is no doubt that the branch was one of the busiest in the HQ.

HQ ARRC Rear. Down the road in the Dalmatia hotel in Kiseljak, a single post provided map supply, geo advice and graphics to HQ ARRC Rear.

HQ Communication Zone Forward (CZF). Supporting ARRC, but based in Split, HQ CZF had a small geo cell providing a range of geo services and, most importantly, a link with national support elements essential in ensuring map planning packs were distributed to units ahead of their deployment.



Military survey representation amongst ARRC geo personnel.

Corps Reserve Map Depot (CRMD) was based in Split. This depot came under GSG command on behalf of HQ ARRC. It was collocated and lived with the logistics regiment in Dalma Warehouse. The depot's role in map supply is considered later.

HQ Multinational Division South West. Each division had a divisional geo support detachment, two of which were under the operational command of the GSG, and the third, at HQ Multinational Division South West, was under the operational command of that HQ. At this HQ the detachment was equipped with TACICAM[1], TACISYS[2] and TACIPRINT[3] (giving a capability to print colour products up to 655 by 464mm in size) and two MAPSPs (map supply points) (each holding up to 60,000 maps comprising divisional planning, second line maintenance and reserve stocks). Work varied on the one hand from map issues through graphics to mines maps production – these 1:50,000 scale monochrome maps being overprinted in green to show reported locations of mined areas. The HQ led on mines map production in Bosnia, eventually plotting the mines overlays for these maps direct from Arc View, a computer programme (geographic information system).

UK Brigade HQ. The only brigade level HQ in Bosnia with dedicated geo support was the UK brigade based at Sipovo, where a brigade geo sergeant provided map supply advice, graphics and terrain analysis support. Later equipped with a Drawland terrain visualization system this post was reinforced with a JNCO, giving an excellent brigade support package.

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[1]TACICAM, (tactical information camera).
[2]TACISYS (tactical information system).
[3]TACIPRINT (tactical information printing).

Corporal McGahon in TACISYS, designing a basic overlay to assist helicopter flight planning.

HQ Multinational Division North. The US in Tuzla had a very different outlook on geo support. Terrain analysis is very much a G2[1] function, topographic survey an engineer function and map supply a G4[2] function, resulting in a lack of a geo focus, which at times proved frustrating. However, their terrain analysis effort was advanced, and had commenced approximately a year prior to the division's deployment to Bosnia. There is a valuable lesson here; terrain analysis takes time and research, and should be commenced way in advance of any potential deployment, thereby assisting the pre-deployment decision-making process. One of the more interesting terrain analysis tasks undertaken by the HQ involved identifying potential mass grave site locations, using criteria such as soil type, gradient, and accessibility. Our support to the HQ comprised a MAPSP and a TACIPRINT, with the vast majority of this work again based on mine map production and map supply. Although not constrained by US force protection rules, the surveyors there lived in tents and ate appalling food largely produced by British chefs working under contract.

HQ Multinational Division South East, based outside Mostar at the airfield, it had a cohesive divisional geo cell comprising French topographic surveyors and cartographers, Canadian terrain analysts and the Military Survey detachment of a TACIPRINT and MAPSP. Work centred around mines map production and map supply. The soldiers here were once again accommodated in tents, ate even less appetising food than the Americans, and had to overcome the language barrier. Military survey will often be working alongside foreign forces in the field; language skills in its officers and soldiers should therefore be encouraged.

Central Map Depot, located at Zweibrucken in Germany, held the out-of-theatre reserve. At the end of 1995 we deployed a section to this depot for two weeks to help ensure initial map supply success, and a SNCO was then seconded there for the remainder of ARRC's deployment, providing assistance and liaison to ensure that maps moved forward to theatre as required. It should be noted here that the British Forces Germany Map Depot, part of 14 Indep Topo Sqn in Mönchengladbach, could equally have undertaken Zweibrucken's role and may well be called upon to do so in future operations.

German Contingent Implement Force, was not part of ARRC. Based in Split the force had a single staff officer grade 1 geo post, running a map store and giving geo advice.

Defence Mapping Agency Remote Replicator. The US moved a remote replicator facility to Hungary to support the geo effort. Effectively a computer system with very fast and impressive plotters, it was capable of reproducing a large coloured map in six minutes from disk. To an extent this was seen as competition to the GSG's more conventional print systems, but on balance they were complimentary. The remote replicator's main advantage lay in its data transfer links with the HQ it was supporting. In other words a map overlay could be designed and drawn on computers in Tuzla, transmitted down the telephone line to Hungary, 100 copies printed off overnight and flown back to Tuzla in the morning. Larger print runs were more efficiently produced by the GSG's presses.

The Geographic Support Group

The GSG concept aims to concentrate geo resources to best effect, meeting the fundamental principles of concentration of force, economy of effort, flexibility and administration. The mission given to the GSG in Bosnia was to provide direct geo support to the ARRC to assist the ARRC in the conduct of unrestricted operations within the Former Republic.

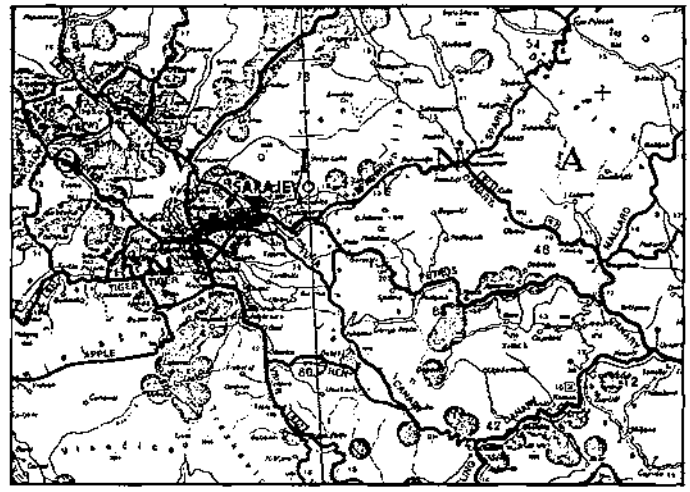
Essentially the GSG was based on 14 Indep Topo Sqn, and for 2½ months, 19 STRE. 13 Topo Sqn took over from the end of June 1996 until the transfer of authority in November. These units were also supported by reinforcements from 16 Survey Support Sqn, the School of Military Survey, TA personnel and reservists. Total manpower allocated to the GSG

[1]G2 – Intelligence.
[2]G4 – Quartering/logistics.

Geographic field support to IFOR (p18).

was approximately 90, sufficient to work long days but not to maintain 24-hour operations.

Deploying before HQ ARRC Main, without formal command and control links, the squadron relied heavily on peacetime training contacts with units deployed from the Rheindahlen area. Eventually, in April, operational control of the group was vested in ARRC's Chief Engineer, Brigadier Moore-Bick OBE, who took great pleasure in adding the GSG to his wiring diagram. Administrative control took longer to resolve. Eventually, and just before roulement in June, it was vested in Commander 1 Signal Brigade, who had visibility on both the UK and ARRC nets.



Detail from mines contamination map produced by the squadron. Every known mined area is included to give users a clear indication of known danger areas.

The work undertaken by the GSG was grouped into six areas, namely: map supply, topographic survey, terrain analysis, production, support to geo assets in theatre and administration. Each is examined in turn.

Map Supply

Map supply was, without any doubt, the single most important aspect of geo support to the operation. It is not simply a G4 function (frequently users failed to understand what, exactly, they required, "I want a map of Bosnia"!). Information is being passed, not simply paper. For example, one area of contention was the choice of 1:50,000 scale mapping. The UN1002 series used on Operation *Grapple* was replaced by a seemingly less detailed M709 series for IFOR, but many units continued to use the UN1002 mapping despite HQ ARRC direction. The M709 series was, however, far more up to date, containing correspondingly less potential for error.

Approximately 1000 line items were available through the map supply system in Bosnia and Croatia, varying from town plans to planning charts, both on paper and CD. Many were overprinted with the IEBL and agreed cease-fire line, and were called the Golden maps. Golden 1 was the initial issue, Golden 2 had the agreed cease-fire line removed at D+90, and Golden 3 showed the many minor changes to the IEBL negotiated since the D+90.

The map supply system must be, and was, simple. Bulk mapping moved forward from the producing nation (generally US and UK) to the Central Map Depot at Zweibrucken or in many cases directly to the Corps Reserve Map Depot in Split, which held third line bulk stocks, varying between half and one million sheets; it was also responsible for supplying ARRC and other agencies in the theatre, and for preparing map packs for incoming units. Should IFOR have comprised two or more Corps, this depot would probably have supplied all of them.

Where a major reissue was required, for example when Golden 2 replaced Golden 1, one million new maps were packed into unit loads at the depot in Split, and dispatched, to brigades, using multinational logistic assets, for unit collection. This removed double handling, but required the reinforcement of the depot by GSG personnel, to the detriment of other geo tasks, thus making full use of the inherent flexibility of the support group system.

Routine map supply was carried out through the Corps Map Distribution Point, part of the GSG at Kiseljak, to MAPSPs at each divisional HQ. Units seeking second line resupply obtained them directly from the relevant MAPSP.

Stock levels were not dictated by days of supply, but by a regularly monitored assessment of usage. Stock levels at each line are calculated according to the requirement for planning stocks covering the relevant area of interest, and maintenance and reserve stocks covering the area of operations.

Old maps were disposed of by overprinting for use by schools as scrap paper (giving IFOR a

Electronic theodolite station in use on Gorazde road survey.

useful asset with which to support local communities), using a salvage contract in Zagreb, or returning to the UK for exercise use.

Military Survey proved once again, as in the Gulf, that map supply requires specialist expertise in order to ensure a timely and effective response. Over six million maps were handled during the first six months of the operation, with few, if any, problems.

Topographic Survey

19 STRE deployed in January 1996, and although their original task failed to materialize, much useful support was provided to the artillery in Multinational Division South West, by carrying out provisional IEBL marking, and in the establishment of a first order survey network in Bosnia, requiring the deployment of all 12 Global Positioning System teams throughout Bosnia and Croatia in February to establish a centimetre-accurate control network.

Once 19 STRE had departed, the GSG retained four two-man topographic survey teams in Bosnia, effectively 14 Sqn's "topo" section. They joined forces with 523 STRE to survey the detailed alignment of a major new route through the mountains linking Sarajevo and Gorazde. At 70km length, this is claimed to be the biggest survey of its type carried out in the world this century.

As with much work undertaken by topographic surveyors in FRY, the risk of mines was ever present, with additional training and precautions being taken to ensure their safety. They watched with great interest some Bosnian mine clearance techniques at a ford: as digging with pickaxes revealed nothing, a vehicle was driven back and forth through the water to check all was clear.

Under the Dayton Accord, the Bosnians agreed to mark the IEBL, but in June they approached IFOR for assistance, being unable to execute the task themselves. IFOR agreed to undertake the task for three months whilst Bosnian surveyors were re-equipped with the global positioning system and trained. International teams of surveyors from Military Survey, the US, France and Canada worked directly for the multinational divisional HQs, being technically controlled by the GSG. They found the task slow work, but in October handed over to the Bosnians. It remains a massive task with over 1000km of boundary (much of it mined) left to mark, still requiring local agreement on its exact location as it passes through fields and around houses. The work done by 19 STRE on the first order network provides the framework for the survey.

Terrain Analysis

Terrain analysis fell into two areas: analysis such as flood and earthquake prediction, and visualization, which gives a computer-generated, 3-D perspective view of the ground. Using TACISYS, a 14ft box body containing two powerful computer systems (Sun Spark workstation with Arc View and Arc Info, and a Silicon Graphics workstation with Erdas Imagine and Drawland), for the first time with largely untrained personnel, proved a real challenge.

Terrain visualization using Drawland, enabled French special forces to assess options whilst on task and computer generated height overlays assisted helicopter flight planning. Drawland generates a 3-D perspective of the ground by draping imagery or a map over height information. Line of sight, dead ground, weapons ranges etc can all be added to the view, which the operator can then "fly" round as he wishes. The linking of Drawland to a video monitor now enables videos of computer generated fly-throughs to be produced, saving the tasking commander, or staff officer,

Geographic field support to IFOR (p20)

travelling to the computer screen. Provision of Drawland to HQ 1 Mechanized Brigade in Sipovo proved a considerable success, with the Brigade staff finding numerous uses for this terrain visualization package.

TACISYS was also developed as a tool to support the production process. Simple graphics, such as road safety posters, proved quick and easy to produce, but map overlays, such as additional flight information for joint operations graphics air charts were a little more time-consuming. Computer generated products have benefits which will increase as operators become more proficient, but often pen and ink cartography remains quicker. Multinational Division South West utilized Arc View for their mines database, allowing computer generated plots to be printed.

Ground recce was often required, a skill terrain analysts are always, understandably, keen to practice. One example concerned the requirement to determine the extent of railway tracks in the Tuzla area (essentially to confirm map information). Ground truthing tasks were also undertaken to support the production of Bosnian town plans in UK by obtaining street names, key civil locations and such like.

Geo Production

The new interim geographic support system was fully tested for the first time during this operation, and found to be an excellent addition to Military Survey's capability. The system core comprises six air-conditioned 20ft containers, mounted on 14-ton flatbeds, and allows production of medium format products (essentially twice the size of the familiar TACIPRINT products). The six containers are:

- Pre-press, containing two A0 paper-sized light tables and a computer graphics workstation, in which products are designed and drawn.
- Helio, containing two print-down frames, a film processor and developing facilities, in which printing plates are made. Failure of the air conditioning system within this container resulted in temperatures of 56 degrees centigrade being recorded, slightly over recommended levels!
- Two press containers, each containing single colour Heidelberg presses (giving a maximum print size of 890 by 620mm). These were eventually ground dumped to improve productivity.
- A print finish container housing a guillotine.
- A conditioned paper store. (Paper is not a stable material, and can shrink and expand with humidity and temperature. Without air conditioning, errors in map scale will be significant.)

Other vehicles are fitted in as required. In the GSG a TACICAM (containing screen camera and film processor) enabled photographic development and enlargement. This facility was much used by the intelligence community who appreciated the "one hour" service.

Tasking, although formally through HQ ARRC, was invariably through a number of sources. Standard tasks included the production of frequently updated routes and dispositions maps: essentially monochrome maps with colour overlays depicting information. Similar products included survey control point and communications coverage maps. Colour production was tested by successfully proving the capability of the GSG to take on base plant production work by running three seven-colour Golden 2 sheets through the presses. Colour work increased in demand during the deployment, and by June 1996 multi-colour products such as the 1:600,000 mines contamination map and Multinational Division North's fire control map were routinely being designed and printed.

One of the largest production tasks initiated, using computer generated graphics, was the *Bosnia Helicopter Landing Site Directory*. With approximately 160 pages, each comprising text, graphics and photographs, the task proved fairly time consuming, especially during compilation. However, future amendments will be relatively simple, especially utilizing digital photography.

Some work was of a psyops (psychological operations) nature, especially when informing the civil populace during the build-up to the D+90 transfer-of-responsibility date. The US had a psyops printing facility in theatre, reducing the GSG's total workload considerably.

During 14 Indep Topo Sqn's tour, some 300 different products were produced in eight languages with the new larger size medium format interim geographic support system proving a great success.

Liaison

The multinational environment, together with the large range of new Military Survey equipment now in use, led to some lack of understanding of the GSG's capability. HQ ARRC and GSG rose to the challenge of "spreading the word" with the result that the GSG quickly became established as a truly "international" unit. Captain V J Bealby, became the GSG liaison officer in addition to commanding the topographic survey section, visiting formations down to brigade level, including the Russian brigade HQ, to state the in-theatre geo

capability and to ensure people were getting the geo support they required. Hundreds of visitors to the GSG were also welcomed, ranging from Commander ARRC to Services Sound and Vision Corporation, and from other nations' geo officers to Italian pilots; all were very impressed with our equipment and capability.

G1/G4 Support

A less glamorous but absolutely vital aspect of the GSG's work was in its provision of support to all geo detachments in theatre. GSG fitters and electricians were almost constantly on the move, keeping equipment running throughout Bosnia, and GSG Q staff co-ordinated the ordering and movement of all geo specialist equipment and consumable stores. The field support office (part of the Directorate of Geographic Field Support at Hermitage) deployed personnel to support our IT (information technology) systems. In addition to this routine support, the GSG provided reinforcement, both vehicles and manpower, to detachments when required.

To Conclude

The success of the GSG's support to Operation *Joint Endeavour* was considerable. 14 Indep Topo Sqn deployed into a theatre with no formal command and control links, set up the first ever operational geographic support group, initiated a wide range of geo support to a multinational force of some 27 nations and established an excellent working relationship with HQ ARRC.

Military Survey as a whole made a significant contribution during 1996, a demanding year on resources and manpower. Several personnel opted to serve in Bosnia for the full year, and others are returning again in 1997. Throughout, 42 Survey Engineer Group was dedicated to supporting the operation. Its Commander, Colonel A P Walker OBE, visited the theatre three times to search for ways to increase his support.

New equipment has proven a great success, giving the field army a capability not seen before. In short, Military Survey has demonstrated that, although small, its equipment, procedures and soldiers are second to none.

Geological Training for British Army Officers: A Long-Lost Cause?

COLONEL E P F ROSE TD MA DPHIL. MCIWEM CGEOL. FGS

Ted Rose has contributed 15 previous articles to the RE Journal. *Pen pictures in volumes 94, 103, 104, 107 and 110 document his Territorial Army service and academic career. A university teacher of geology for 30 years, and currently in the Regular Army Reserve of Officers, he now additionally serves on the Military Education Committee of the University of London. He here describes the rise and fall of geology as an educational subject in the British army. During the 19th century there were great expectations of its practical usefulness – only partly fulfilled. Significant military applications of earth science became evident only in the 20th century, through world war.*

SOLDIERS and geologists share a common interest – in ground. In battle, infantry must take and/or hold ground, armour and artillery traverse and dominate ground, and sappers change the face of ground to suit the tactical commander's aim. Geologists learn basically to distinguish different types of ground, their characteristic features, and the processes by which they form.

Soldiers with geological knowledge should thus have a better understanding of ground conditions than those without. They should be able to make better use of ground for military purposes.

So why does the British army not teach geology to its officers? Well, it tried. It was arguably the first army in the world to try. But it largely gave up – despite the lesson learnt in world war that "A certain knowledge is desirable for staff officers in order that they may use their specialists to best advantage" (Brigadier-General J E Edmunds, in King, 1919, p217). This article describes how it tried – at Woolwich, Addiscombe, Sandhurst, Camberley, and Chatham – and indicates how it coped after it gave up.

THE ROYAL MILITARY ACADEMY, WOOLWICH

AT Woolwich, an early opportunity was missed. From 1804 to 1826, John MacCulloch *(Photo 1)* held appointment as chemist and assayist to the Board of Ordnance, and consequently as a lecturer at the then Royal Military Academy – which at that time trained potential officers for the Artillery and the Royal Engineers. Whilst in receipt of military pay, MacCulloch became increasingly distinguished as a geologist – but the British army as such made use of his practical rather than his teaching abilities in this subject.

There was early peer group recognition of MacCulloch's geological skills. He was the author of the first paper (and eighteen others) to be published by the Geological Society of London, the world's oldest geological society. For the early years 1810-1812, also 1813-22, he served as a member of the Society's council, and from 1816 to 1818 as its fourth president. Moreover, the military applications of his geological ability were soon apparent, for he was deployed by the Master General and Board of Ordnance on two successive military geological projects:

- From 1809 to 1814 he was tasked with fieldwork to find in Britain a source of limestone suitable for millstones used in gunpowder manufacture. (The Napoleonic War then in progress had stopped importation of "Namur Stone" from Belgium for the grinding of gunpowder and its constituents. Use of an inferior stone from Ireland was credited as the cause of an explosion at the powder manufactory, from sparks generated by quartz impurities within the limestone).
- From 1814 to 1826 he was tasked with a detailed geological and mineralogical survey in support of the Ordnance's Trigonometrical Survey of Scotland (to test the hypothesis that nearby hills or mountains, or inequalities of densities of rocks beneath the surface,

Photo 1, right. John MacCulloch, MD FRS (1773-1835), an early president of the Geological Society of London, Ordnance geologist, and lecturer on geology at the East India Company's military seminary, Addiscombe, 1819-1835. (Bust in possession of the Geological Society, London.)

Geographic Training For British Army Officers (p23)

might cause deflection of the plumb line used in astronomical calculation of fixes of stations used in the primary triangulation).

Lack of detailed instructions allowed MacCulloch to deviate from the specific requirements of the Trigonometrical Survey into preparation of a geological map for Scotland as a whole, but the military necessity of such a map was not apparent. After much controversy, the office of Ordnance chemist was finally abolished. MacCulloch was made militarily redundant on 13 January 1826, with a pension of £248 per year and the recommendation that he could "transfer his undivided attention and services to the geological survey under the Treasury." The Treasury did indeed pay for his fieldwork until the map was completed, about 1832.

In 1835 MacCulloch married, at the age of 62 – but did not survive the honeymoon. He died, sadly, not with a smile on his face but from a tragic carriage accident. His geological map of Scotland was published posthumously (MacCulloch, 1836) – the first geological map of any country to be based on an official survey and to be published by a government.

It may be that cadets at Woolwich did receive some early geological inspiration, but not from MacCulloch. Between March 1829 and August 1831 Captain J W Pringle RE was posted to the Academy. (Named as John William Pringle in 1811 to 1836 editions of *The Army List*, he is shown as John Watson Pringle in 1837 to 1861 editions). Pringle was a veteran of the Peninsular War – wounded in action at Nives, and awarded the War Medal with clasps for service at Nivelle, Nives, and Orthes (Hancock, 1995). He was also a veteran of Waterloo – the only RE officer wounded in action (*London Gazette Supplement* 3 July 1815). But he was also a geologist. Trained in Saxony at the distinguished Freiberg school of mines, between 1826 and 1829 he was employed under sapper command as the first Superintendent of the Geological Survey of Ireland, and therefore became in effect the founder of the world's second oldest national geological survey. His task was to supplement the work of the Trigonometrical Survey, under the auspices of the Master General and Board of Ordnance – the Master General at the time of his appointment being none other than his Waterloo field commander, the Duke of Wellington. Pringle served only briefly at Woolwich, as Public Examiner for Commissions (Anon, 1892), before retiring in March 1832, after extended leave, on account of war wounds and ill health.

Photo 2, left. David Thomas Ansted, MA, FRS (1814-1880), an early professor of geology at King's College London, consulting geologist and mining engineer, and lecturer on geology at the East India Company's military seminary, Addiscombe, 1845-1861. (Drawing dated 1850, courtesy of the Geological Society, London.)

Whether he was able to exert any geological influence whilst in post is not known – but from 15 September 1848 to 1 January 1868, Professor James Tennant of King's College London was appointed "Lecturer on Chemistry and Geology" (Anon, 1892; Boase, 1965), at an annual salary of £200. By that time the course was divided into two parts, the first "theoretical" and lasting four years, the second "practical" and lasting one year. The practical year included 40 lectures on geology and mineralogy (Yolland, Smyth & Lake, 1857).

The East India Company's Military College, Addiscombe

It was the Honourable East India Company that used MacCulloch's geological expertise in the training of army officers. Whilst lecturing at Woolwich, from 1814 he additionally became lecturer in chemistry at Addiscombe, the Company's military seminary, and from 1819 until his death also lecturer in geology.

MacCulloch thus became one of the earliest teachers of geology in Britain, for the only other courses entirely devoted to systematic geology in 1819 were being given by William Buckland at Oxford and Adam Sedgwick at Cambridge. (Robert Jameson at Edinburgh taught "geognosy" merely as part of a natural history course).

MacCulloch wrote two books: *A geological classification of rocks* (MacCulloch, 1821) and *A system of geology* (MacCulloch, 1831). These were intended to be course books for the military seminary at Addiscombe, and were published with the financial support of the East India Company. In style they were designed to be practical reference books for engineering officers active in India – and so the military thus generated the first British textbooks to provide "geology for engineers".

Geographic Training For British Army Officers

The separate teaching of geology at Addiscombe was discontinued after MacCulloch's death, but resumed in 1845 when David Thomas Ansted (*Photo 2*) was appointed to the lectureship. Ansted, a graduate of Jesus College Cambridge (BA 1836, MA 1839), and its Ley Fellow 1840-1851, was professor of geology at King's College London 1840-1853, secretary to the Geological Society of London 1844-1847, and from 1845 professor at the College of Civil Engineers, Putney – but he also practised as a consulting geologist and mining engineer from 1850 until his death in 1880. Although "he was whole or part author of a considerable number of volumes; the majority of these were of a somewhat popular character" (Anon, 1881). He retained his post at Addiscombe until 1861, when the East India Company lost its sovereign powers, the Company armies were merged with the British army, and the Addiscombe seminary closed as its teaching functions were transferred to Woolwich and Sandhurst.

The teaching of geology at Addiscombe did bear some fruit. As early as 1849 Richard Baird Smith, of the East India Company's Engineers, authored an "Essay on Geology, as a branch of study especially meriting the attention of the Corps of Engineers". He enthusiastically advocated a place for geology in military education on the grounds that the subject is inherently fascinating and potentially able to excite an interest in the applied sciences as such (Smith, 1849, p28); also, that it has very practical military use in the siting of boreholes for water supply, in road alignment and construction, and in bridge building. His paper is to be found in the very first volume of "Corps Papers" published jointly by the Royal and the East India Company's Engineers.

The Royal Military College, Sandhurst

On 26 March 1858, following publication of the *Report of the Commissioners appointed to consider the best mode of re-organising the system for training officers for the scientific corps* (Yolland *et al*, 1857) a lecturer on (sic) geology was appointed to the then Royal Military College, Sandhurst. The commissioners had taken advice from Major General J E Portlock late RE, invited whilst he served as Inspector of Studies at the Royal Military Academy. However, Portlock was a sapper who had pioneered geological surveys in Ireland between 1834 and 1843 "under the authority of the Master General and Board of Ordnance" (Portlock, 1843). From May 1857 until 1862 he served on the newly-formed council of military education (Vetch, 1909). At that time, 1857-1858, Portlock was also President of the Geological Society of London. Perhaps unsurprisingly, the lecturer appointed at Sandhurst was the Society's Assistant Secretary – T Rupert Jones (*Photo 3*).

Thomas Rupert Jones had been apprenticed as a surgeon from 1835 to 1842, and worked as a medical assistant from 1842 to 1850 (Anon, 1893; Woodward, 1911). But he was an enthusiastic amateur geologist and palaeontologist, and so had been employed as Assistant Secretary to the Geological Society from 1851.

Rupert Jones was promoted at Sandhurst to the post of "Resident lecturer" and professor of geology in May 1862, and resigned his Geological Society secretaryship on moving residence to be nearer Sandhurst. He taught the relations of geology to topography, to questions of sanitation, and to water supply (Woodward, 1907) to cadets aspiring to commissions in the infantry and cavalry (candidates for the artillery and the engineers being at that time trained at Woolwich). However, a *Report of the Royal Commission appointed to inquire into the present state of military education and into the training of candidates for commissions in the army* (Dufferin and Clandeboye *et al*, 1869, p21) recommended, amongst much else, that Sandhurst "exclude the study of chemistry and geology". In 1871 the purchase system for commissions was abolished. The policy of optional attendance at the College for gentlemen cadets was consequently changed, the College reduced – and Rupert Jones retired, with effect from 31 December 1870.

The Staff College, Camberley

However, Rupert Jones also taught at the Staff College (*Photo 4, over the page*), and continued to do so until 1882.

The Staff College from 1858 was open to officers of at least three years' service from "all arms of the Service" who were

Photo 3, right. Thomas Rupert Jones, FRS (1819-1911), lecturer/professor of geology at the Royal Military College, Sandhurst from 1858 to 1870 and at the Staff College, Camberley until 1882. (Photo courtesy of the Geological Society, London.)

Geographic Training For British Army Officers

Photo 4. The Professors, 1874. The professor of geology, T Rupert Jones, is standing bareheaded at the left rear. Others are, from the left: (rear row) Lieutenant-Colonels Parsons, Farrell, Schaw, Barker; (front row) Professors Dowson, Charante, Colonel Hamley, Dr Atkinson, Revd J F Twisden, Dr Overbeck. (Photo courtesy of the Staff College, Camberley.)

eligible for command of at least a troop or company (Godwin-Austen, 1927). Entrance was by way of an examination, initially with compulsory subjects in mathematics (1200 possible marks) and French (300 marks) and optional subjects in military history and geography (900), German (300), fortification (300) military drawing (300), chemistry (150) – and geology (150 possible marks).

On admission, mathematics had pride of place in the early syllabus, with more time spent on this subject than any other. Of military subjects, fortification and artillery were given pre-eminence, followed by military topography and reconnaissance, and military history. There were three language periods per week, each of one and a half hours, for French, German, and Hindustani. The sciences (geology, chemistry and physics) were voluntary subjects that in the hunt for marks became almost compulsory.

The teaching seems to have generated at least one geological enthusiast: Frederick Wollaston Hutton, according to *The Army List* an experienced infantry officer who had purchased his commission as an Ensign in the 23rd (Royal Welsh Fusiliers) Regiment of Foot on 18 May 1855, been promoted lieutenant on 27 March 1857 and served in the Indian campaign of 1857-8, including the relief of Lucknow by Lord Clyde, defeat of the Gwalior contingent at Cawnpore, capture of Lucknow, and operations north of the Goomtee – for which he received a medal and two clasps. He entered the Staff College, Camberley, in 1860, prior to promotion to captain on 2 March 1962, so must have been influenced by Rupert Jones – for he wrote an article whose "object is to show ... how Geology ... is, to military men, by far the most important of all the sciences, and therefore the one to which their attention should be principally directed" (Hutton, 1862, p343). The article drew attention to the value of geology in predicting sources of fuel (coal); potable water (through borehole site selection); site selection for military encampments; development of building stone and aggregates; foundations for major engineering works, road and tunnel alignment; diggability of ground for tactical earthworks; factors influencing cross-country movement; fordability of rivers and stability of bridge abutments – and terrain assessment for military purposes. All these applications were thus apparent by the year in which Rupert Jones became resident as a professor.

In the following years, geology grew – "under the self-justification of its professor", according to Godwin-Austen (1927, p136) – although it "remained an optional subject" (Bond, 1972, p88). But the end came: "The useless subject of geology at length disappeared in 1882, with the retirement of Professor Jones, whose reduction had been recommended in 1868, but the terms of whose engagement had enabled him to linger on for fourteen years" (Godwin-Austen, 1927, p204). Indeed, Lord Dufferin and Clandeboye *et al* (1869, p24) had recommended "reducing the amount of mathematical and scientific subjects taught at the College to proportions more suitable for what is required by an officer destined for the Staff, rather than to that needed for the Engineers". The view was endorsed by a later *Report ... on the working of the Staff College* (Walker, Alison & Wood, 1880, p3), but with a qualification: "The Committee are of the opinion that the study of geology and experimental sciences should be limited to a course of lectures illustrative of the practical application of these sciences to military purposes; *and to that extent should be made obligatory on*

Geographic Training For British Army

all students instead of being left optional as now" (my italics).

Godwin-Austen's scathing condemnation of the teaching of geology at Camberley *at length* (my emphasis!) to potential field and staff officers must be treated with respect. *The Army List* records that the Major Godwin-Austen of 1927 retired in 1947 as General Sir Alfred Godwin-Austen KCSI CB OBE MC, after a military career of distinction and influence. However, what is not so well known amongst military circles is that his grandfather, R A C Godwin-Austen, and his father's elder brother, H H Godwin-Austen, were geologists of very considerable distinction (Boase, 1908; Mason 1937). His antipathy to too much geology may well have been influenced by his exposure to the subject within the family: its teaching had long ceased at the Staff College before he attended it, between 1923 and 1925.

From 1882 the teaching of geology at Camberley was indeed limited strictly to its practical use for military purposes and linked to "Experimental Sciences" under the more embracing heading of "Applied Sciences", to which a relatively minor place was accorded in the curriculum. Teaching was conducted first by a Major Mitchell, then from 1886 to 1898 by Lieutenant-Colonel Charles Cooper-King, Royal Marine Artillery (Jones, 1898; Boase, 1965). Cooper-King was a professional serviceman who became instructor in tactics, administration and law at Sandhurst in 1872, and was appointed professor of these subjects from 1878 to 1885. He retired in 1886, and thereupon took up the geology lectures. A friend and former colleague of Rupert Jones, he had been elected a Fellow of the Geological Society of London in 1872, and developed an interest in geology through their friendship. On his death in 1898, geological teaching at Camberley ceased, for "he had no successor" (Edmonds, in King, 1919, p218).

The School of Military Engineering, Chatham

Some geological teaching was given about this time at Chatham. Brigadier General J E Edmonds (in King, 1919, p218) records that when he was a young officer at the (then) School of Military Engineering, Chatham, "Prof. Green of Oxford came every year and gave a course of lectures, and took us on a geological tour for ten days" but that "This custom must have ceased soon afterwards".

Alexander Henry Green (*Photo 5*) was a graduate and subsequently Fellow of Caius College Cambridge who had been appointed to the Geological Survey of Great Britain in 1861, but resigned in 1874 on appointment as Professor of Geology at the Yorkshire College at Leeds (which later became the University of Leeds). He was appointed Professor of Geology in the University of Oxford in 1888, and appears to have held a visiting Lectureship on Geology at the School of Military Engineering for several years at about this time (Anon, 1896; Hicks, 1897; Vincent, 1994, p8). "Professor Green's geological teaching in his lectures, though not perhaps calculated to move to enthusiasm, was exact and thorough" (C L, 1898, pix), but "as a teacher of practical field geology he had few equals".

Green died on 19 August 1896, after a year of ill-health. Thus by the late 1890s it seems "that the study of geology in the Army appears to have gradually dropped out" (Edmonds, in King, 1919, p217).

Military Textbooks on Geology

As noted above, MacCulloch (1821, 1831) had written two geological textbooks specifically for use as course books at the East India Company's military seminary, Addiscombe.

Whilst a serving sapper Lieutenant-Colonel, Portlock (1849, p14) had noted in a later elementary geological textbook that "the Soldier ... may find in Geology a most valuable guide in tracing his lines both of attack and defence". He had some practical experience of this: in 1814 he had charge of constructing the fortified lines at Chippewa in Canada which halted the progress of advancing enemy forces – those of the United States. Not surprisingly, he contributed an extensive 116-page section on "Geognosy and geology" (Portlock, 1850) to the massive three-volume *Aide-Mémoire to the Military Sciences*

Photo 5, right. Alexander Henry Green, MA, FRS (1832-1896), British Geological Survey geologist, later professor of geology in the University of Oxford and lecturer in geology at the School of Military Engineering, Chatham. (Photo courtesy of the Department of Earth Sciences, University of Oxford.)

Geographic Training For British Army Officers

(Lewis, Jones, Nelson, Larcom, De Moleyns & Williams, 1846-52) compiled by a committee of Royal Engineer officers from contributions by officers of various services. Portlock's section on geology was slimmed to a mere 100 pages in an otherwise enlarged second edition (Lewis, Jones, Larcom, Williams & Binney, 1853-62), but provided enough reading to indicate that geology was still considered important at this time.

The Corps had to wait a long time before one of its members produced a textbook as such on geology for engineers (Lieutenant-Colonel R F Sorsbie, 1911; second edition by Brigadier-General R F Sorsbie, 1938), even longer before it was to produce its own geological textbook (Anon, 1949; 1976).

Conclusion

It thus appears that:

- the British army made use of geologist expertise as early as 1809;
- the East India Company provided geological training for its (British) army officers from 1819 to 1835, and 1845 to 1861, and was amongst the first three organizations in the United Kingdom to institute geological teaching;
- lectures on geology and mineralogy were provided as part of a practical course for potential engineer and artillery officers at the Royal Military Academy, Woolwich, for at least the 20 years 1848 to 1868;
- teaching in geology was provided for gentlemen cadets of the infantry and cavalry at Sandhurst from 1858 to 1870, but discontinued thereafter;
- training in geology as such was provided for officers of all arms at the Staff College for the 20 years 1862 to 1882, and on a much reduced scale for 16 years thereafter;
- prior to 1896, a short course of geological lectures and field studies was given annually for some years to junior sapper officers on courses at the School of Military Engineering, Chatham.

Since that time there has been no significant teaching of systematic geology to members of the British armed forces. Only very small amounts have occasionally been introduced, for example into civil engineering courses at the Royal Military College of Science, Shrivenham, and even less frequently into the Construction Materials Technician 2-1 course at the Royal School of Military Engineering, Chatham.

From 1915 onwards the British army developed a new approach. Instead of trying to educate large numbers of officers to a low level in geology, it used small numbers of very highly trained and experienced geologists in specialist appointments – with the success evident in both world wars (Rose & Hughes, 1993a; Rose & Rosenbaum, 1993a, 1993b). From 1949 it has maintained a "pool" of half a dozen geologists in the reserve army (Rose & Hughes, 1993b, 1993c), currently within the Royal Engineers Specialist Advisory Team (V) (Rose, 1988), to contribute specialist expertise in peace and war.

But since the demise of T Rupert Jones, whose distinction as a geologist and palaeontologist is still revered in many branches of those disciplines even if his military associations are largely unknown, British officers in general have little geological knowledge. The subject has been crowded from an intensive military educational curriculum – and some potential loss in understanding of ground conditions must be accepted. To mitigate this, specialist military geotechnical maps have been developed – such as those indicating engineering characteristics ("diggability"), off-road trafficability ("going"), and hydrogeology/water supply – at appropriate scales for field or planning use, to convey relevant information quickly and easily to the non-specialist. But specialist map development is another story ...!

Acknowledgements

Factual data in the text are summarized from an article recently published by the Geologists' Association (Rose, 1996), in which fuller acknowledgements are made, but are presented here with new emphasis, illustration, amplification and discussion. I am grateful to librarians at the RE Corps Library (R T Arnold, M Magnuson), the Staff College (P E Bendall) and the Department of Earth Sciences in the University of Oxford (D J Haigh), and to the Honorary Archivist (J C Thackray) at the Geological Society for assistance; to copyright holders for permission to publish illustrations, as indicated in individual captions; and to Keith Denyer and Jane Pickard of the Department of Geology, Royal Holloway, University of London, for respectively printing photographs and typing the first draft of the manuscript.

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Flying Dustbins

BRIGADIER R A S RICKETS

MAJOR Gladen's article (*Sapper*, July 1996) on the retirement of the 165mm demolition gun, brought back memories which might amuse of happy days in Perham Down in 1953, with 26 Squadron (then 26 Assault Squadron). The squadron was equipped with Churchill AVRE, mounting the wartime Petard – or "flying dustbin", the single ARK (Amoured Ramp Carrier) and the Sherman flail, which could do a terrifying 45mph with the governor removed!

We got the new 6.5 inch (as it then was) demolition gun, and took it down to Bovingdon for the range exercise that summer, to try it out against hard targets. The Cavalry watched with amused interest as a Mk VII Churchill lumbered onto the firing point, elevated this strange stove-pipe thing, and fired at a target tank some 1200yds down the range. Away went the canister-like shell at some 880ft per second muzzle velocity, arcing high and slow. For such a low velocity, it was surprisingly stable in flight and incredibly accurate but, even so, it took a lot of luck to hit first time which, in this case, it did. Sixty pounds of squash-head shell, 30lb of HE or thereabouts, on a Churchill tank target. Whoosh! When the smoke cleared, the turret (of the target tank that is!) was 20ft away. Cavalry mouths were open in astonishment and no little dismay.

"What the hell is that thing?"

"Didn't you know? It's the new tactical nuclear weapon." And they believed us.

Back at Tidworth, where in those days 32 Assault Regiment put on the annual RE demonstration in front of the grandstand at Sidbury Hill, the "6.5" was to be seen in action – this time against a concrete pillbox, firing from right to left across the front of the assembled hierarchy. Since all the "bangs" were my job, I had to arrange this and it had to look good but, for understandable reasons, no shell was to be fired.

We made the "pillbox" out of CGI and timber, and planted some 40lb of explosives beneath, to be fired electrically from a safe trench off to one side. The firing party would hear the gun go off, count a few seconds and fire the charge. So far so good, but the spectators had to watch and see the gun fire, which meant simulating the noise and the smoke.

We welded up a sort of inverted paint-pot with a hole in the bottom and a lip at the top, to fit into the top inch or two of the barrel. It was filled with a mixture of oily soot and a couple of gun-cotton primers on sticks, to be fired electrically by a cable running back down the barrel and through the open breech. I climbed into the turret to try firing it from the spotlight switch box; I suppose I have always led a charmed life! The spotlight, somehow, was already switched on, and the primers fired as I connected the wires. My inverted paint-pot became a shaped charge, the cone of which shot down the barrel, through the steel flame-guard at the back of the breech, missed my leg by an inch, and buried itself in the engine! A lesson never forgotten – but the outside effects had been superb!

Back in the tank hangar at Perham Down, a corporal gunnery instructor was teaching loading and firing drill, using a practice round of course – except that, though marked as such in the right colours, it wasn't. It was "inert", ie the propellant was there but the charge (thank goodness) wasn't. It went off, ricocheted off a girder, went out through the wall, crossed the tank park, went through Bill Slattery's MT office a few feet above his head, and buried itself beyond!

Some years later, I rejoined 26 Armoured Engineer Squadron – as it had become – at Hohne in Germany, to find that the demolition gun had a fume extractor fitted to the barrel. I had also been involved, back at Perham Down in those early days, in a "toxicity trial". The boffins had wanted to know how an AVRE crew would fare if they had to fire all 30 rounds closed down – not an unrealistic possibility. One didn't often get the chance to fire off 30 rounds rapid, and we came out alive, but only just, and certainly could not have hit anything after the first few rounds.

It is sad that the gun never had the chance to prove itself. Designed specifically for the demolition of mass concrete, such as a bunker (the squash-head charge demanded a hard, flat surface with not much slope, or it would glance off), in its role nothing else could touch it. And the accuracy, with such a slow velocity and no tail fins, was quite astonishing; it blew great chunks out of the "Hitlerhof" bunker on Soltau ranges, which nothing else could do.

Perhaps someone will now write an article about the Giant Viper or the Churchill flail: I have a lot of memories of both – equally hair-raising!

Engineers at Gallipoli – 1915

GLC

GLC is a retired officer who occasionally reviews books for the Journal. *He recently reviewed Colonel Michael Hickey's book "Gallipoli" and was surprised to find that little or no mention, let alone credit, was given to the part played by engineers in the campaign. He decided to do some research and, as readers will see, Sappers were kept extremely busy, with precious few resources and, as so often in previous campaigns, improvisation was the key to their success.*

Introduction

When reading accounts of the Gallipoli campaign, one could be forgiven for thinking that the only Services or Arms involved were the Navy and the Infantry. There is little about the Gunners, hardly surprising perhaps when one considers the shortage of ammunition, sometimes restricted to two rounds per gun per day, and precious little about Sappers. Yet there were over fifty engineer units involved, so what were they all doing?

The land campaign at Gallipoli only lasted nine months and was considered by many to have been a costly diversion from the main war effort on the Western Front, but this is to ignore the circumstances in which it took place. By the end of November 1914, little more than three months after the war had started, the Allies had suffered nearly a million casualties and the trenches stretched for 350 miles from the North Sea to the Alps. The War Council had begun to debate whether the impasse might not be broken by some broad flanking movement either through the Baltic or through Turkey and the Balkans when, towards the end of the year, word came that the Russians were in difficulties. A demonstration against Turkey would not only threaten Constantinople but would also force the Turks to withdraw forces in the Caucasus and thus help our Allies.

It was known that there was barely a division of Turkish soldiers on the Gallipoli peninsula, widely scattered, poorly equipped and poorly led and it was somewhat naively thought in London that a naval expedition could bombard and take the peninsula, with Constantinople as its objective. A fleet was assembled and dispatched to the Mediterranean but, by 18 March 1915, the attempt to force the Dardanelles had failed. Thus was set the scene for the land campaign.

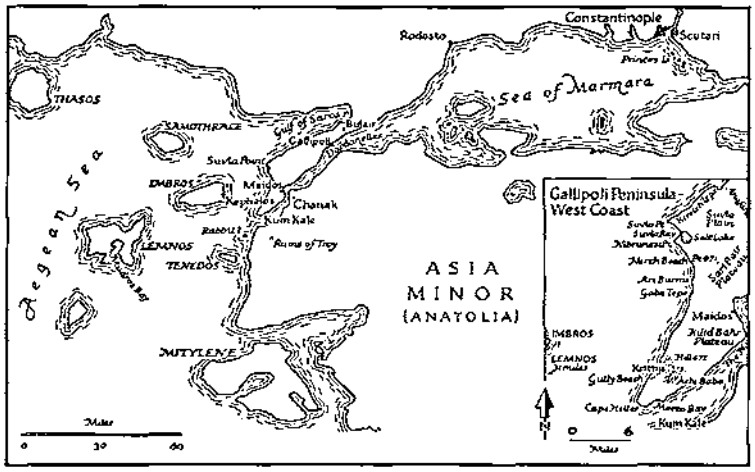
Preparations for Land Operations

Though there were some people in London who thought that the Dardanelles could be forced by sea alone, the War Council began to make preparations for land operations and Kitchener, the Secretary of State for War, agreed in principle on 16 February to make available the 29th Division. He then dithered and did not finally release the division until 10 March. Two days later, he appointed General Sir Ian Hamilton to be the Commander-in-Chief, the military force to include the 29th Division, the Royal Naval Division, units from the Indian Army, the Australian and New Zealand divisions then in Egypt, and a French division.

Hamilton departed next day, with a hastily assembled staff of some thirteen officers, all from the General Staff. It had been suggested that the expedition should be mounted from Mudros but, though it was only seven hours from Gallipoli, he found it had no water supply, no piers or jetties and an unsheltered harbour, hardly an auspicious place from which to start. Furthermore, Hamilton had left London without any administrative or quartering staff and no Sappers. These followed a fortnight later but it was a drawback from which the force never really recovered. Astonishingly, though, the Allies landed on the Gallipoli peninsula only five weeks later.

It was evident that Alexandria, over two days steaming away, would have to be the main base, initially at least, and Hamilton ordered his first troop transports to go there. This turned out to be fortuitous as, in the hurry to load back in England, there had been no coherent plan and every ship had to be unloaded and re-sorted. Even so, the reloading left much to be desired especially from the sapper point of view and many essential stores were left in Egypt.

In the meanwhile, the Turkish defences were improved out of all recognition, an example being at Sedd el Bahr where on 25 February a Naval party had been able to land unopposed to demolish some guns, yet on 25 April, barely two months later, 29th Division suffered 3000 casualties.



Map of area covered by article.

Extraordinary as it may seem, when Brigadier-General Roper was appointed as "Technical Adviser" to the CinC (ie his senior Sapper officer), he was given no executive power and his whole staff consisted of one clerk! General Roper knew nothing of the likely engineer requirements or of any material available; in fact he was told in London that the Turks were expected to retire as soon as we landed so nothing very elaborate would be needed. How often had one heard this sort of thing before, or indeed since?! On arrival in Alexandria, he met the Chief Engineer of the Australian and New Zealand Corps (Brigadier-General de Lotbinière) who told him he was arranging for several 60ft barrel piers to be carried on the transports, together with six 100ton lighters which were to be towed. These lighters were fitted with gangways, anchors and piles for holding them in place, and they contained galvanized iron tanks, pumps, hose etc for water supply. Unfortunately they were difficult to tow and several were sunk in rough weather. A 500ft run of trestle bridging was also ordered and 20,000 4gal tins were filled with water in Alexandria.

Mudros and Imbros

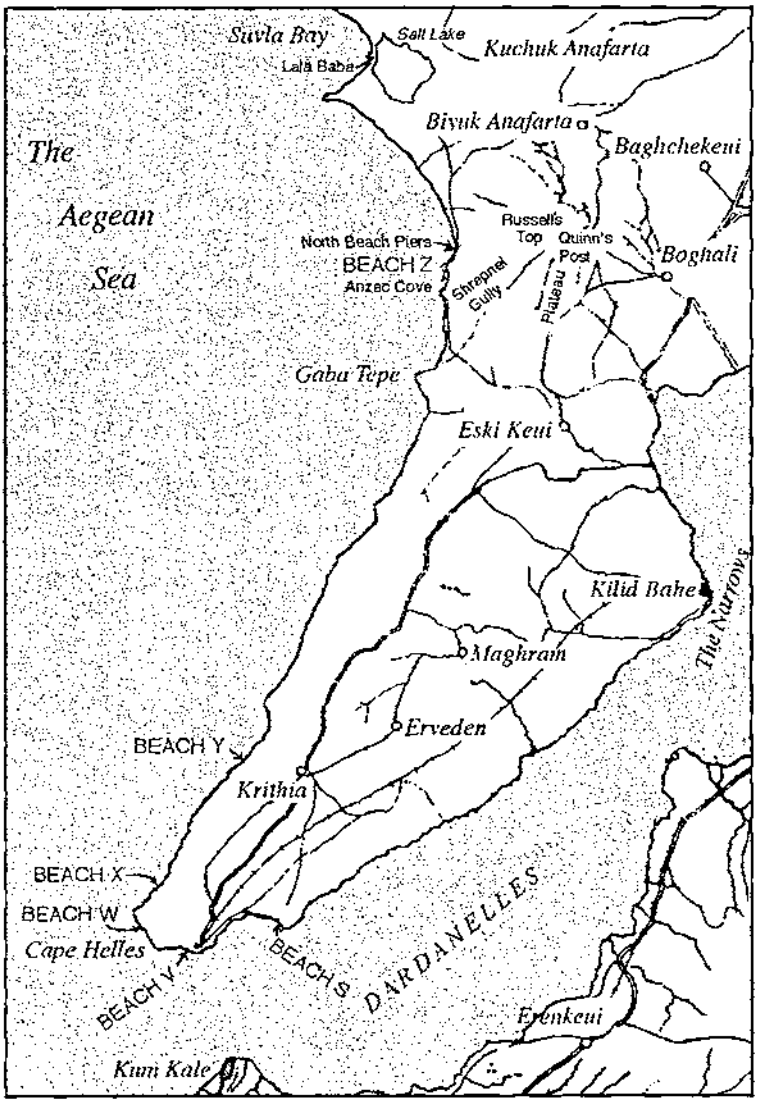
Mudros is actually a village on the shores of a large bay on the south side of the island of Lemnos, but during the campaign the name was used indiscriminately for the bay and the island itself. When General Roper reached the island, he was told that it was not intended to use it as a forward base due to its lack of facilities and that nothing elaborate in the way of piers or water supply was required.

The Gallipoli landings took place on 25 April and, though Mudros Bay had been used for assembling and launching the attack, it was intended to maintain the force by direct shipments from Alexandria, the cargoes being discharged by lighters onto temporary piers at the beaches. Towards the end of the month though, it was decided that no ocean-going ship should proceed beyond Lemnos where cargoes would be transferred to smaller ships in Mudros Bay which could be protected against the burgeoning submarine threat. The complete tonnage of maintenance stores and supplies thus had to be handled at least twice in a harbour without any adequate facilities. Massive congestion ensued but, at the beginning of May it still seemed quite possible that further advances could be made, leading to the capture of Constantinople, so there still seemed no need to build up a large organization at Mudros. It was not until July that a longer-term policy was adopted, after which determined and successful efforts were made to develop the island.

Imbros, an island only fifteen miles from Gallipoli, was the site of GHQ from 21 May and was also the centre for distributing water to the peninsula. It offered a rest camp for troops and possessed a small advanced workshop for the beaches, run by a detachment from 1/3 Lancashire Workshop Company, based at Mudros. It also provided stone from its quarries for roads on the peninsula and erected a stone-crusher to supply road-metal for the beaches. A disinfector and a bathing establishment were built for troops arriving from the peninsula and an Egyptian works battalion was largely engaged on piers, breakwater and water supply under sapper supervision. Huts were also provided, as at Mudros, for semi-permanent services such as bakeries.

The chief drawback to Imbros was that its harbour was just a bay which faced north and even a light breeze from that direction made landing virtually impossible. The navy sank two small stone-filled steamers, under the lee of which two piers were

built, but the November storms wrecked everything. A large ship was then sunk as a breakwater and this stood fast. Water supply was a constant problem on both islands and from the start most of it was shipped from Egypt being pumped to reservoirs ashore or, in the case of Imbros, afloat in the shape of a 6000ton ship, the *Mercedes*. It took until autumn to locate and develop adequate local supplies.



Map showing the Gallipoli Peninsula in more detail.

The Gallipoli Landings

Much has been written about the actual landings on the Gallipoli peninsula on 25 April 1915 and it is not proposed to go into any detail here. Suffice to say that the principal British landings were made by 29th Division, under Major General Aylmer Hunter-Weston, a Sapper, at Cape Helles on the toe of the peninsula (Beaches V, W, X and S), while the Anzac Corps landed on the western side. It was at W Beach that the Lancashire Fusiliers won their famous "six VCs before breakfast", while V Beach saw the dreadful slaughter of the Dublin Fusiliers and the Munsters trying to land from the *River Clyde* in the face of withering fire from the Turkish defenders.

At W beach, sappers, under heavy fire, tackled the Turkish wire entanglements and made a causeway for the guns. At nightfall they began to assemble the barrel piers from Alexandria while a light trestle bridge was started, as well as two roads. Tube wells could not be sunk on the beach but a well was dug and lined and water tanks, erected by the Lowland Field Company, were filled from a lighter. A spring under the cliff was also found and cleared. The West Riding Field Company disembarked from the *River Clyde* and was sent forward in support of the infantry.

When the Anzac landing took place north of Gaba Tepe, some of 1st (Australian) Field Company dashed forward with the leading infantry in a fit of enthusiasm and it was some time before they could be reassembled on the beach where they were divided into three parties, one to make roads, another to search for water and the third to construct piers for landing stores. Paths to the top of Plugge's Plateau and a track for 18-pounder guns were constructed during the day; communications up Shrapnel Gully were also greatly improved and a certain amount of water

was found there, two tube wells being sunk by nightfall. A water-tank boat, provided with eleven galvanized tanks and pumps was towed ashore, and by early evening there was enough water to supply the whole force, kerosene tins being used to take water to the forward troops. A barrel pier had arrived by noon and pontoon equipment a little later so, despite enemy shrapnel fire, an excellent landing stage had been erected in Anzac Cove by nightfall enabling some 1500 wounded men to be evacuated before midnight.

Earlier in the year, a field survey section had been got ready for the expedition but was not taken in the end, with the result that the only map of Gallipoli available for use during the attack was a one-inch compilation made by the geographical section. This was unreliable and its inaccuracies caused many difficulties, not least for the gunners. Fortunately, a moderately good and fairly recent map was found on a captured Turkish officer and this was promptly reproduced and distributed by the very efficient Survey of Egypt.

The Helles Front

The supply of engineer stores, material and plant to units on the peninsula was totally inadequate and sappers were driven to every kind of improvisation. Work on the building of piers, and their repair after bad weather, went on continuously. The first pier was lengthened by means of a breakwater composed of sunken ships filled with sand by a dredger and this, combined with the second pier formed a small harbour. Further south was another, far smaller, sheltered area formed by an L-shaped pier. The construction of further piled piers continued and, during July, a stone breakwater and pier was built, running out to a depth of 17ft of water. The final state of W Beach harbour with its piers and sunken ships being used as breakwaters, resembled the Mulberry Harbour at Arromanches in June 1944.

Dugouts were constructed for people working on the beaches and a certain amount of protection was also provided for dumps of stores and supplies. Causeways were built and decauville track was laid across the beaches and also laterally across the front. Water supply was a never-ending headache and the ration varied between a half and one gallon per day. Road work was limited owing to the comparatively small area in our possession, the front line never being more than four miles from the beachhead and only three in width, but there were miles of mule tracks that had to be maintained. Another sapper task was the improvisation of bombs, in the absence of any grenades at that stage of the war, and up to 250 a day were manufactured from empty jam tins, filled with ammonal and with very primitive and dangerous fuzes. Periscopes were another trench store produced in considerable quantities.

There is no doubt that a lot of RE energy was wasted in the early days by employing sappers on work which should have been undertaken by the infantry, such as wiring, digging and revetting, but the British army had had very little training in trench warfare prior to the war. For the first three months after the landing, sappers were engaged in helping infantry units to acquire the necessary skills. Sappers were however legitimately employed on consolidating key points and in the construction of redoubts, often extremely close to the Turkish trenches. This soon developed into a considerable period of mining. At first, shallow galleries were run out and small charges were blown; this was followed by defensive mining and, in July, 254 Tunnelling Company was formed, mainly by transferring miners from other units. Both at Helles and at Anzac, mining was under the direct orders of the General Staff, a system much criticized by the Corps and unlike that operating in France where the staff dealt only with policy and left the execution entirely in sapper hands.

In charge of digging was a 31-year old officer called Frank Sutton, one of those eccentric sappers who undoubtedly helped to confirm the Army's view that sappers are all "Mad, Married or Methodist", the first at any rate. He arrived at Helles in command of a party of 30 sappers and with a bag of golf clubs, carefully wrapped in hessian and prominently labelled "Theodolite, Legs of". This delighted everyone, particularly the Anzacs, always ready to appreciate an unconventional "Limey." On 22 May, about to explode a large mine, the Turks launched a vigorous assault and Sutton's party was pinned down by a Turkish grenade attack. With none of his own, Sutton was reduced to catching the enemy bombs and throwing them back until one exploded in his hand, blowing it off. The grenade was followed by a huge Turk with whom the disabled Sutton fought, killing his man. He was then carried down to the beach where his golf clubs were found and restored to him after the shredded remains of his hand had been cut away. As he lay on his stretcher awaiting evacuation, General Hunter-Weston, the Divisional Commander, visited him

and awarded him an immediate MC. He was soon playing golf again, albeit single-handed.

Shortly after this, sappers were involved in what became known as the third battle of Krithia when field companies were allotted to brigade commanders and accompanied the infantry in the assault, converting to our use the captured Turkish trenches and constructing bridges over trenches to carry guns. Considerable sapper casualties led to the later practice that engineers should not accompany the first assault waves but should be used only when a definite task could be identified. This eased the sapper load but, even so, it was found to be impossible to withdraw any sapper units for a rest and it was only later in the year that a few units were able to have a short period on the island of Imbros.

Anzac Operations

Fourteen miles to the north, the Australian and New Zealand Army Corps occupied an entrenched line less than two miles long and little over a thousand yards deep. At the most it was some 400ft above sea level and was dominated by heights rising over 950ft. Into this tiny bridgehead were crammed some 40,000 men and the narrow beach was under observation from Turkish positions two miles to the south.

Eight piers were constructed on the beaches in the Anzac area, the first being started immediately after the landing. It was 210ft long, the first nine bays being trestles, the remaining ten being piled, with a depth of water at the end of twelve to thirteen feet. It was under constant artillery observation and was one of the most dangerous spots in the whole area. A few weeks later, a rather stronger pier on piles was begun and completed in three weeks, using an 8in unexploded Turkish shell (emptied of explosive!) as a drop hammer, surely ranking as one of the more unusual examples of sapper improvisation. On 18 June, following completion of one of the piers, Lt Col Foot, an Australian Engineer, drew attention to the fact that it was the centenary of the Battle of Waterloo and suggested a dinner in his dugout that evening which was attended by six Australian and six British Sapper officers. This first Waterloo Dinner has since become a purely Australian event, stemming from the recognized birthplace of Australian military tradition: Gallipoli.

The beach itself was just as dangerous as the front line and contained the RE dump, which made the drawing of stores rather unpopular. Other engineer activity included building a mule shelter and a bomb-proof casualty clearing station on the beach and corps and divisional headquarters were dug into the narrow gullies leading off it. Valleys, partly under enemy observation, led up to the trenches and a great deal of rough road or track had to be constructed and maintained.

As at Helles, water supply was a constant problem and the supply to forward positions was often a nightmare. The daily ration was one gallon per head for cooking and drinking, with nothing for washing, the garrison at Quinn's Post receiving only a third of a gallon for much of the time. The first wells to be dug were close to the sea and the water, though just drinkable, was brackish and unpleasant. Before long, they began to dry up but wells dug higher up, though producing sweeter water, lasted an even shorter time. It soon became necessary to build a piped supply from a central reservoir with a 49,000-gallon capacity which drew water from lighters and was pumped up from the beach using two old Worthington steam pumps brought over from Egypt.

Trench warfare at Anzac was described as "immensely interesting to the sapper"! It was certainly hazardous and consisted mainly of tunnelling. Anzac provided a classic ground for developing the art of sapping and mining as the conditions were suitable and the opposing lines were close. The soil was easy to work, artillery fire was not heavy during the first six months so the galleries did not need to be deep and timber was only needed at the openings. It was not long before a vast tunnelling system had been developed, including mine counter-measures against the Turks.

In addition to this work, machine-gun positions, artillery gun-pits and communications had to be executed or supervised by sappers, and tracks in enemy view had to be traversed or blinded with sacking on wire. Crossings over communication trenches had to be made for guns and, as at Helles, the manufacture of jam-tin bombs was an every day chore. The manufacture of periscopes and periscopic rifles became a big undertaking, the glass being "obtained" mainly from mirrors on the sea transports.

The Suvla Landing

By June a stalemate had been reached and an entirely new strategic concept was needed which resulted in the decision to send five extra divisions

A remarkable view of V Beach, taken from SS River Clyde.

to the Mediterranean. These divisions were the first fruits of the rapid expansion of the British Army to a total of seventy divisions. There was no lack of gallantry on the part of the troops, but there was a complete lack of "know how" in the art of battle, in administration and in the organization of staff work. Against this background, or perhaps despite it, it was decided to effect a new landing, further up the western coast at Suvla. This assault was to be coordinated with attacks, first on the Helles front to pin down the Turkish reserves, and then at Anzac, coinciding with a surprise landing in Suvla Bay.

The plan was for the 11th Division to land on the night of 6/7 August, to be followed by the 10th Division next day. Had the assaulting troops but known it, the Turks had only four battalions, spread over a wide front, to oppose them, with no machine guns or even barbed wire. They were under command of Major Willmer, a German officer, who aimed to prevent any assaulting troops gaining the Anafarta ridge, some five miles inland, before he could be reinforced which could not be for at least 36 hours. The first two British brigades landed unopposed but the landing of the third was completely disorganized and delayed by unexpected reefs and shoals, with some troops wading as much as 1000yds and then finding they had not landed where expected. Next morning, 10th Division started to land, again not always in the expected places, with increasing disorganization and delay. No artillery, vehicles or animals had been put ashore and trouble was being experienced at Mudros with their loading. Only a few stores had been landed by the evening of 7 August and the landing of seaborne water was also seriously in arrears. Poor communications resulted in a series of orders and counter-orders resulting in further chaos and, as the day wore on, the confused mass of men became completely exhausted.

The 8 August was not much better and by the early hours of the 9th, when the first British troops were assembling to seize the ridge line facing them, they found Turkish reinforcements coming down the slopes to attack them. The Turkish battalions had marched 35 miles to the front, whereas the British had been within two to four miles, opposed by only four battalions and nineteen guns! Conditions had by now become chaotic, the infantry was without artillery support

Engineers at Gallipoli - 1915 (p36)

and the supply of ammunition, rations and water had broken down. There was no transport and the men were exhausted, dispirited and mad with thirst. The Suvla landing had been a complete fiasco and it was decided to spend the 11th August in reorganization. British and dominion casualties at Suvla and the supporting fronts of Anzac and Helles had totalled 25,000. It was in one of the Anzac attacks, conducted with much heroism, that Corporal Bassett, a signaller with the Royal New Zealand Engineers, won the VC, the only one awarded to the Sappers in the campaign.

Through all this chaos, Sappers were extremely busy. By the 9th, two piers were in working order, one of steel lighters with barrel-pier gangways and the other of pontoons. The bulk of this work was carried out by the very efficient and well equipped Royal Australian Naval Bridging Train (RANBT) which had just arrived in the theatre with its own vehicles and equipment and was working under the Chief Engineer. They subsequently moved on to build most of the other Suvla piers, leaving the divisional sappers free to support the rest of IX Corps. Water supply was the most important need and, to cover the first two critical days after landing, plans had been made to bring water in by sea while sappers would develop supplies on shore and install pumps. Water was to be distributed under staff arrangements by mule or carrying party, but no mules were put ashore on the first day. Four wooden lighters, each carrying 62tons of water and associated equipment, had been obtained by the Director of Works and handed over to the Navy at Imbros which arranged for them to be towed across to Suvla. Unfortunately the first lighter hit a sandbank some way out but by building trestles the hose was got ashore and water delivered. The second lighter was brought in on a line, but one of her tanks was missing. Troops in the neighbourhood got out of hand, seized the lighter and started to pump into bottles direct, some even cutting the hoses and helping themselves. The third arrived two days later and the fourth never even started. The irony of it all was that if only the infantry had been able to reach their initial objectives, there was abundant water in the hills. The sapper field companies were also frustrated in their efforts to provide water on shore by the lack of any tools or stores other than those they had been able to carry ashore with them.There was a store-ship specially loaded with engineer equipment, including pumps and water-supply plant, but she had to wait her turn in the landing programme and in the confusion received no priority. Brigade field companies, apart from trying to improve the very inadequate water supply, were strengthening positions on the divisional front, improving tracks, constructing shelters and headquarters, and were also employed as infantry.

After the fiasco at Suvla, and the failure of the supporting offensives at Helles and Anzac, a "night of the long knives" was long overdue. In fact there were several such nights and the first took place on 15 August when General Stopford was relieved of the command of IX Corps at Suvla. General de Lisle was appointed to succeed him and General Mahon commanding the 10th Division then refused to serve under him "for personal reasons" so was also relieved. Lindley, commanding the 53rd (Welsh) Division was the next to go. These changes followed the relief of Egerton commanding the 52nd Division at Helles the previous month and the departure of Hunter-Weston, commanding VIII Corps, with exhaustion. Hamilton, the CinC, was to be relieved on 16 October.

Autumn in Gallipoli

Meanwhile, General Hamilton was determined to break the stalemate on all three fronts by mounting further offensives and, though VIII Corps at Helles failed to put in much effort, the IX Corps at Suvla and the Anzac Corps did launch one further offensive on 21 August. After much fierce fighting, and mounting casualties, the attacks petered out without any significant progress by the end of the month. The Sappers in IX Corps were fully employed in the preparations for the offensive and in 65 Field Company alone sixty men were lost out of the hundred engaged.

The Suvla terrain presented its own special difficulties. The soil on the front line was so rocky that blasting was always necessary, but everywhere else the ground was low and often waterlogged, requiring an immense amount of drainage. The whole area was carefully mapped and as it was overlooked by the enemy, miles of communication trenches had to be dug. Drainage required long collector drains, very carefully levelled and excavated, and, when trenches had to be deepened to give added protection against artillery fire, drainage problems were exacerbated, with pumping from sumps being necessary. Not surprisingly, mine warfare (ie the digging of mine shafts and galleries) did not play such a leading part as it did in the Anzac area. Much work was done on fire trenches but, owing to lack of cement, joists, rails

and timber, no protection against heavy bombardment was ever practicable. Considerable areas of land mines (ie buried high-explosive charges) were laid in no-man's-land and wiring in front of trenches was greatly thickened. Brushwood mats for roofs and floors of dugouts were made and bricks of sorts were manufactured for fireplaces.

By the end of September, the eleven piers in the Suvla area were all in various stages of completion or use. They were mostly pretty flimsy, part pontoon and part trestle, reinforced with boulders; the little cement available being used to grout the stone piers and quays. Railway lines, driven by improvised pile-drivers, were particularly useful as they were less liable to storm damage. Similar work was carried out at Anzac but the protection of piers began to be a cause of anxiety and three ships requisitioned by the Navy were sunk to protect the new pier at Lala Baba. Three more ships were sunk at Helles, with two more at Imbros and one at Mudros. No labour being available to fill the ships with sand or ballast, a big dredger was obtained from the Suez Canal Company which could handle 4000cu yds per day.

Due to the differing nature of the terrain, engineer work at Anzac entailed considerable effort on the storage of water. Pipe connections were made to pump water from lighters direct to tanks on the beach and thence by 2in pipelines to canvas tanks in the valleys and 220-gallon cylindrical tanks with the divisions. Road work was never-ending with major effort being directed to ensuring that all roads and tracks were clear of the expected winter torrents. Terraces were also dug under cover of the steep hillsides for living and hospital huts as well as stables for mules and for ammunition.

In anticipation of winter, orders had been placed in August for hutting, timber, corrugated iron, stoves and trench-pumps, but lack of shipping caused delays leading to much suffering among the troops. Engineer work was continually hampered by lack of stores and equipment and a notable example was caused by the torpedoing of *Orange Prince*, entirely loaded with engineer stores, including 3000tons of hutting. Timber was also required to provide stronger protection against the heavier artillery beginning to become available to the Turkish army. Seasonal gales frequently interrupted the movement of shipping from Mudros and high seas and damage from lighters caused continuous work for sappers. A three-day blizzard towards the end of November caused further havoc with thousands of cases of frostbite and hundreds dying of exhaustion or swept away in the flood water. Roads were almost impassable and there was not nearly sufficient cover for the troops.

Evacuation

By 30 November, the gales had abated and three weeks of almost perfect weather followed which enabled piers and jetties to be repaired and a start to be made with the re-embarkation of stores in anticipation of an order to evacuate the peninsula. The number of troops at Suvla and Anzac was gradually reduced to 83,000 and a number of guns was also sent away. On 7 December, the Cabinet at last confirmed the decision to evacuate Suvla and Anzac, but to remain at Helles. It was vital to keep up the appearance of normality without alerting the Turks – thus the number of embarkation points was increased by using trestle piers but they remained hidden until the last moment. Gradually, the garrisons in each area were reduced to 20,000, with the minimum of guns, animals, vehicles and stores, the final withdrawal being planned to take place over the nights of 18 and 19 December. Fortunately the weather remained fine and the programme for the first night was completed without a hitch, with the remaining garrison simulating normal activity. On the last night, the garrison at Russell's Top, which commanded a view of the embarkation areas, was quietly withdrawn under cover of the firing of the last two mines, each consisting of three quarters of a ton of ammonal, placed 30ft below ground. Vast heaps of valuable stores, unable to be recovered, were prepared for burning on the final night, but practically all the gun ammunition was saved. Incredibly, the whole evacuation was completed without loss of life, only two men being wounded at Anzac on the last night.

Engineer work during the evacuation phase included the building of defences in reserve areas and 85 Field Company constructed a "keep" for the rearguard at Suvla during the final stage. This consisted of four groups of fully wired fire positions. Other important tasks were wiring and the laying of mines, both in front of our positions and between the front line and the reserve areas; 3000 mines were laid at Suvla, using up all surplus explosives. Much work was also done on roads leading to the embarkation beaches and, using up surplus rations, lines of flour were put down on the last two nights to guide the retiring troops. Sappers were the last to leave, having closed the gaps in the defences, and three officers were left behind to set on fire two huge dumps of supplies

on the Suvla beach. Paraffin-soaked dumps further inland were automatically fired at the same time by means of candles burning an inch an hour – more sapper improvisation?!

Last Days at Helles

By 21 December Anzac and Suvla had been evacuated, but "Helles was to be held for the present." Three days later a signal arrived from London saying "Make all preparations for immediate evacuation of Helles without, however, prejudicing a contrary policy of remaining there."! How often one has heard this sort of instruction, covering the sender's back so that no subsequent blame can be attributed to him! And then, only four days later, before any work can be done, and with ministers (and generals) no doubt at home for the Christmas break, "The Government has decided that the Cape Helles position may now be evacuated." A flurry of activity took place as it was clear that the only way to deceive the Turks a second time would be to complete the final stage of evacuation in a single night. Forward trenches would have to be held in strength until the last possible moment and the last troops would have to withdraw in one bound from the front line to the boats. The deception plan would have to be carefully coordinated and engineers would have a major part to play.

Right up to the last day, work continued on communications, improving main routes, erecting bridges across streams and constructing redoubts, strong points and entanglements. For the last night bonfires and mines with automatic timing devices were prepared, together with trip wires for bombs, and plans were laid for the closing of barricades and entanglements as the last parties passed through to the beaches. Tunnelling had continued right up to the last moment when six large mines were fired.

Much has been made of work on the various piers but they were the lifeline for the whole expeditionary force, whether they were at Anzac, Suvla, Helles or even at Mudros. It was vital to keep them in operation and the battle of the piers was, in its way, as gallant an affair as that of the tunnels and trenches further forward. The final evacuation was ordered for the night 8/9 January and parties of engineers were to stay to the end in case of damage to the piers. They were badly needed as, by 9pm the wind was blowing at 35mph and steadily increasing. Angry seas pounded the frail piers and two lighters broke adrift causing further damage, and sappers, working in pitch darkness with waves dashing over them, were hard put to make the necessary repairs. By 3.30am the sea was running so high that further embarkation would soon be impossible, but by 3.45am the last of 17,000 men, together with all 37 guns, had left, the evacuation was complete and the main magazine blew up with a thunderous roar. This second, almost miraculous, withdrawal was completed without a single casualty.

Conclusion

Looking back, the most surprising thing about the Gallipoli campaign is that it ever took place at all. Planning was almost totally non-existent, troops were not properly trained and they were led by elderly and out of date generals, yet great heroism was shown and dreadful conditions were stoically accepted by soldiers on the ground. As in every other campaign, sappers proved their worth, often working under intolerable conditions and with inadequate stores and equipment. Improvisation and resourcefulness were the order of the day and the Corps can be justly proud of their contribution, together with that of their Australian and New Zealand comrades.

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The M3 Amphibian Has Arrived!

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The author has recently taken over the post of Colonel Defence Studies attached to the Joint Services Command and Staff College. Commissioned into the Corps in 1975, he served with 26 Engineer Regiment prior to completing an in-service degree at Cambridge, which was followed by tours in 39 Engineer Regiment, 21 Engineer Regiment and on the engineer staff of HQ 1st (British) Corps. He then attended the German Armed Forces Staff College in Hamburg and assumed the post of SO2 G3 (Operations/Organisation & Deployment) on the staff of HQ 1st Armoured Division in late 1988. He remained on the Divisional general staff to see service as SO2 G3 (Plans) during the Gulf War. After commanding 39 Field Squadron he became a member of the Directing Staff at Camberley where he was closely involved in the writing of doctrine, for his sins! before commanding 28 Engineer Regiment.

Mungo Melvin is married with two daughters and a son, and his principal interests now involve reading and writing military history and inspecting battlefields, ancient and modern.

Introduction

An undeniable requirement of an army is an ability to cross obstacles. When Julius Caesar bridged the Rhine near Koblenz in 55BC and then dismantled the structure 18 days later he displayed not only an impressive military engineering capability but also demonstrated to the "barbarians" the power of Rome to intervene at will.[1] More recently, in January 1995, the US Army bridged the river Sava in the former Republic of Yugoslavia in order to project significant combat power into northern Bosnia. If the British Army wishes to remain a world class army then it must retain such an ability, and the introduction into service of the M3 is therefore a key milestone in the equipment programme.

28 Engineer Regiment has now received its first production M3s and so the long-awaited replacement programme for the ageing M2 fleet has begun. First impressions of the M3 are very positive: the crews are proud to receive such a modern and effective piece of equipment, on time and to the right specification after nearly ten years of trials and procurement.

Along with our sister unit of the *Bundeswehr, schweres Pionierbataillon 130,* based in Minden, we have trained on the new equipment since September 1996. A formal handover ceremony took place in October last year in Minden when, together with our German colleagues, we demonstrated the M3 on land and on water in the presence of a couple of hundred of military and civilian guests, including many from overseas.

The results of the UK M3 User Trials were described by Colonel Tom Foulkes in the April 1992 edition of the *Journal.*[2] This article continues the M3 "story" so far, describes the preparations made in 28 Engineer Regiment during the period 1995/1996 for the introduction of the M3, outlines the 1997 training plans and offers some tentative thoughts on possible future developments.

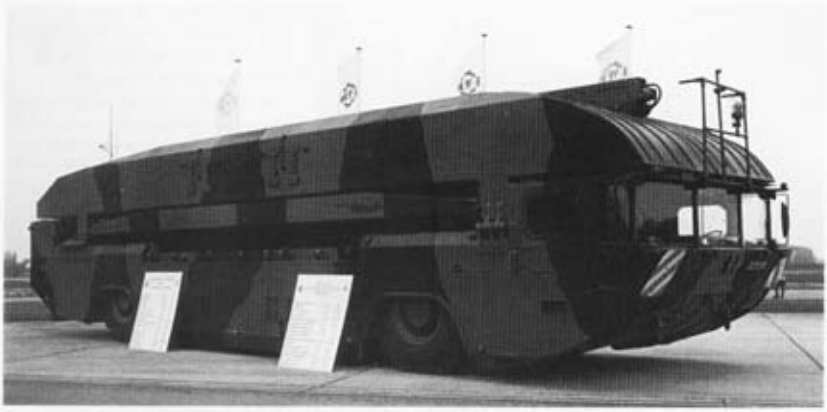
Technical Description

The M3 Amphibian is a left-hand drive 4 x 4 wheeled Military Load Class (MLC) 26 vehicle powered by a single 338-brake horsepower diesel engine. The main hull and side pontoons are constructed of aluminium alloy. There is no protection for the three-man crew, consisting of a commander, driver and pilot, either for NBC or from direct or indirect fire – in this respect the M3, like the M2, is

[1] See J F C Fuller, *Julius Caesar,* (1965; reprinted by De Capo Press, New York), p121.

[2] Lieutenant Colonel T H E Foulkes, *The New M3 Amphibian UK User Trails by 28 Amphibious Engineer Regiment,* RE *Journal,* Volume 106, Number 1 (April 1992), pp.5-11.

Col R A M S Melvin MBE
The M3 Amphibian has arrived! p40



The M3 Amphibian Prototype.

a B vehicle. On the road it can sustain 80kph, 30kph faster than its predecessor. It has the option of four wheel steering and the facility to adjust tyre pressures whilst on the move giving it an excellent cross-country capability.

The M3 is large: 12.82m long, 3.93m high and 3.35m wide. This increases to a width of 6.57m when the side pontoons are opened out in water or in a hide to allow for routine maintenance. Its size and distinctive shape make it easy to identify as a combat indicator equipment. On the water it is powered by bow and stern-mounted water pump jets that can operate through 360 degrees which make the M3 extremely manoeuvrable on both still and fast flowing water. The M3's long ramps make it adaptable to a very wide range of river profiles.

M3s are linked together to form a bridge or to form ferries. The side pontoons carried on the top of the hull in the land mode are hydraulically opened on hinges and locked to convert the M3 for water operation. Amphibians can be linked together side to side pontoon (close coupled) or joined by means of the three ramps carried on each vehicle (open coupled). Additional ramps required for certain bridge and ferry configurations are carried on support vehicles. The M3 can carry tracked vehicles up to MLC 70 and wheeled loads up to MLC 100.

The water jet propulsion system, in contrast to the M2's propeller method of propulsion, gives the M3 an exceptional ferrying capability, thus allowing it to be employed from dispersed sites. Another distinct tactical advantage over M2 is that the M3 is substantially quieter on both land and water. The ferry option, usually consisting of two ferries operating at the same site, is probably the most economic way of crossing substantial water obstacles, such as rivers over 100m wide or larger bodies of water such as lakes. The most effective configuration is a four-rig close coupled combination which can carry two main battle tanks or a wide range of other vehicles. This configuration does not require any additional ramps and combines excellent manoeuvrability with a large deck area; additionally there is an element of redundancy with four engines.

A total of eight amphibians is required for a 100m long bridge. The design of M3 allows armour and wheeled vehicles to cross the bridge at higher speeds than before, up to 25kph for MLC 30 traffic, for example. An M3 bridge is only wide enough to allow one-way traffic. Whilst it can be sustained for a number of days at one crossing site, an M3 bridge is not well suited for a longer-term lines of communication logistic bridging task.

Preparing for the M3: Preliminary Steps

In the two-year interval between the last M3 trial conducted in the Spring of 1993[3], and the return of 28 Engineer Regiment, including 23 Amphibious Engineer Squadron, from Operation *Grapple 5* in the Spring of 1995, little attention had been placed

[3] Termed the Reliability Qualification Test, it confirmed certain aspects of the 1990 UK trails.

The first British production M3.

on M3 at unit level. In view of *Drawdown*, including the reduction of the regiment to its Option *Whisky* organization of just under 500 all ranks by April 1995, and other major operational commitments including two separate squadron deployments to Northern Ireland in 1993/1994, this is not at all surprising. However, the price of this focus on reorganization and peace-support operations was soon apparent: the regiment had not exercised in a war fighting role at unit level, let alone at formation level, for nearly three years. Indeed, it had never exercised fully in its new operational role as 1st (UK) Armoured Division's General Support Engineer Regiment. Much experience had gone in the meantime: amphibious skills had become rusty, and, equally seriously, many procedures for the command and control of water crossing operations had simply been forgotten through the turnover of key personnel.

Thus before M3 could be introduced with any chance of success, the most pressing imperative in the early summer of 1995 was to re-establish crew, troop, squadron and regimental amphibious skills and to revise and to rewrite standing operating procedures (SOPs). With no M3s available until November 1996, then 18 months away, the only course of action available was to train as hard and realistically as possible on the M2, and to start thereby considering the implications of M3, including its tactical employment. This objective was to prove easier said than done.

In the late summer of 1995, we got hold of one of the three M3 prototypes left in Hameln but our first attempts to get it running were not particularly promising. It was very temperamental and appeared to have a mind of its own at times. Undeterred, a band of enthusiasts involving both RE and REME capbadges, kept on working on it, dedicating much of their own time in the process.

After three months of troop and squadron-level training on the M2 and a series of doctrine-based unit study days, and armed with brand-new SOPs, the regiment was well poised to deploy on two closely linked exercises in October 1995.

Following a "warm-up" exercise in southern Germany on the rivers Rhine and Neckar, Exercise *Neptune's Revenge*, the regiment redeployed back to northern Germany on Exercise *Neptune's Endeavour*. This exercise provided a challenging opportunity for us to develop and demonstrate our field and amphibious skills within a combined arms context. It also involved our *Bundeswehr* partners operating their ribbon bridge equipment. The exercise culminated in the CRE's TESTEX, after which the CRE declared us operationally ready, thus meeting the mission he had set us on our return from Bosnia, six months earlier.

The M3 Project Gathers Momentum

Despite the relative success of both exercises, certain deficiencies in both the M2 equipment and the state of crew training were nonetheless shown up.

Procedures at all levels were at times too slow and valuable opportunities to streamline procedures were missed. A thorough after-action review process led to the re-appointment of a chief instructor (amphibious) – a position lost under *Options For Change* – who was now held against the newly established post of Troop Commander, 412 Amphibious Engineer Troop (Volunteer).[4] The chief instructor's task was to re-examine every aspect of amphibious engineer training, to recommend changes where necessary and to validate training standards thereafter. In the three-month period from January to March 1996, the chief instructor conducted weekly crew validation periods by day and night, echoing the good practice of the 1970s and 1980s. Standards improved significantly.

[4] Recruiting for 412 Amphibious Engineer Troop (Volunteer) was well underway by September 1996. Plans have been made for a formation parade in May 1997.

The M3 Amphibian has arrived! p42

It also became clear by early 1996 that planning, meanwhile, for the introduction of M3 was taking an increasing amount of time and effort in 23 Amphibious Engineer Squadron, an unwelcome distraction in view of the forthcoming tour to Northern Ireland (September 1996 to March 1997). Already steps were in hand to establish a full-time M3 Unit Project Team to plan in detail the introduction of the M3 into service and to provide a central focus both internally and externally. Eventually, after considerable wrangling about who should fund the team, HQ 1st (UK) Armoured Division kindly agreed to fund three posts: project officer (captain); project WO (QMSI) and project artificer (REME SSgt). The Procurement Executive funded a large proportion of office support whilst travel and subsistence remained the responsibility of 28 Engineer Regiment. By the beginning of September 1996 the team was fully operational; its members had already been in post for many months before, however, working on M3 in addition to their normal duties.

M3 with side pontoons deployed.

Other concerns remained over the establishments of 23 Amphibious Engineer Squadron and the regimental workshop, and the works services needed to house the new equipment and its associated equipment support. Much was to be resolved by the summer of 1996, including bringing forward the rebuild of Gundolph Park in Hameln to provide extended technical accommodation for M3. This was a major achievement in view of the fact that we had not exactly received much sympathy from the G4 quartering staff having let part of the officers' mess in Bindon Barracks burn down the year before! Not surprisingly, in view of current constraints, we did not make as much progress in getting additional manpower established in order to crew the full fleet of M3s and to provide sufficient manpower for bank support. These matters remain to be addressed in the British Army 2000 force structure work.

On the conceptual side, matters fortunately were more in our own hands. A first draft of the M3 Tactical Doctrine Note was prepared, and we discussed it with our German colleagues to ensure interoperability. Despite many other commitments, we also had a chance to consider some of the implications of M3 on a regimental command field exercise (CFX), Exercise *Neptune's Vision* in March 1996. Although almost all the regimental headquarters squadron was involved, both 23 Amphibious Engineer Squadron and 42 Field Squadron were deployed only in CFX mode with an amphibious troop of eight M2Ds and a field troop respectively. In addition, we were supported by elements of 12 Regiment RA, an air defence unit equipped with the new high velocity missile system, and divisional logistic troops. The M2 troop was divided into two sections of four amphibians, each providing a four-rig ferry to mimic our proposed drill for the employment of M3. Our prototype M3, now running more reliably, took part in a demonstration of crossing site drills at the hitherto under-used amphibious training area at Sennelager and was subsequently shown to the Deputy CinC of Land Command, Lieutenant General Sir Hew Pike, on the Weser. He clearly enjoyed his trip piloting the M3 down the river by the picturesque Schloss Corvey, near Höxter.

The most important results of Exercise *Neptune's Vision* were largely procedural: either an amphibious or field squadron can support a combined arms crossing site headquarters in an assault river crossing operation with a mix of amphibious and field engineers under command. If the crossing is unopposed, such as in the lines of communication, then a squadron headquarters can form the crossing site headquarters in their own right.[5] This general support grouping is analogous to the mix of armoured and field engineers in

[5] For further details on current British army doctrine see "The Army Field Manual" Volume 1, Combined Arms Operations, Part 1, *Formation Tactics*, Annex A to Chapter 4.

forming an ad hoc close support squadron. Amphibious troops can be split for limited periods into two sections although there are command, logistic and equipment support penalties in so doing. Most significantly, however, we were able to demonstrate an increased tempo of amphibious and field engineer operations: troops deployed swiftly off the line of march to task sites with limited time for reconnaissance and subsequent planning. At crew level, the chief instructor's weekly validation periods had shown their worth. Overall, we had made the step-change from conducting "deliberate" to running "hasty" operations, both physically and conceptually.

Training With The Bundeswehr

28 Engineer Regiment's formal affiliation with the *Bundeswehr* in Minden goes back to 1977 when an official *Patenschaft* (Partnership) was concluded with *Amphibisches Pionierbataillon 130*, the amphibious engineer unit of I (German) Corps. Over the last 20 years the strength of this association has waxed and waned, but when "130" lost its M2s in 1992 on the reorganization of the German Army, contacts lessened. When the German Army decided to purchase a limited number of M3 (a total of 30 only), the decision as to where to base them was by no means straightforward. Apart from Minden, Speyer and Ingolstadt were other contenders. As the last unit remaining in the *Bundeswehr* to operate M2 was in Ingolstadt, and linked to the German Army Engineer School based in Munich, a "southern" option seemed the most likely. However, we were reliably informed that the eventual decision in favour of Minden was made on grounds of proximity to 28 Engineer Regiment and anticipated benefits in interoperability. This was to prove a far-sighted decision.

28 Engineer Regiment's first major involvement with *Pionierbataillon 130* for at least three years, on Exercise *Neptune's Endeavour*, marked the start of a very fruitful period of co-operation. We were able to call on *Bundeswehr* liaison teams for all of our subsequent exercises, to play flanking or in-place formations, adding considerably to their realism. It was not all one-way; for example, the *Pionierbataillon's* 2IC was posted at short notice to join the ACE Rapid Reaction Corps' engineer staff in Sarajevo and commented on his return how much the time on exercise with 28 Engineer Regiment had helped him. Yet we had to face the fact that the Germans were due to receive their first M3s before us and that the planned official handover ceremony, for political and economic reasons one suspects, had to be hosted principally by the Germans. Thus the onus was on us to get alongside.

In the event, the joint handover ceremony held in Minden on 31 October 1996 was a great success, reflecting a great deal of prior liaison and subsequent cooperation at staff level, but more particularly goodwill and comradeship at crew level. For nearly three months before the ceremony at least two British crews at any one time joined the German "Training the Trainers" package, which took in training at the EWK factory in Kaiserslautern, on the Rhine at Speyer and on the Weser at Minden.[6] Our crews were drawn from the M3 Cadre of 23 Amphibious Engineer Squadron which was manned in addition to a normal rear party. In total, four crews were trained and the cadre now forms the nucleus of M3-trained personnel in 28 Engineer Regiment.

Following the Minden demonstration, the Germans offered to demonstrate M3 with us in Hameln in early December 1996. Exercise *Neptune's Frost* provided an opportunity for us to display our first production vehicle in action together with three German M3s within the context of a combined arms assault river crossing. The demonstration, which was classed as a divisional training event, proved to be quite an impressive show with armoured infantry and air defence in support, and plenty of battle simulation. It served as a fitting and a final training highlight for 28 Engineer Regiment in 1996, ably supported by 35 Engineer Regiment and other units.

Plans For 1997

The first major milestone for 1997, the declaration of "Q" readiness, was achieved on 31 January. By the time of the publication of this article 28 Engineer Regiment should have received eight M3s and the unit "Training the Trainers" package should have been completed. After that, the first major milestone is the In-Service Reliability Demonstration (ISRD). This will involve four M3s completing a demanding series of tank crossings on the river Danube to confirm that M3 fully meets the required levels of reliability. Once the ISRD is completed, as the main body of 23 Amphibious Engineer Squadron returns from

[6] See Corporal Leer's article "Off to a Good Start", *The Sapper*, Volume 27, Number 12 (January 1997), p. 532

its post Northern Ireland leave, the first M3 courses will be run, followed by squadron and regimental level training. Thereafter, the planned formation exercise programme includes support to a divisional combat support exercise, *Rhino Replen*, in September 1997 and a brigade field training exercise in Poland, Exercise *Ulan Eagle 1997*, in October 1997.

Looking Ahead

THE currently funded fleet of 38 M3s will provide 23 Amphibious Engineer Squadron with 28 M3s at first line, enough to equip three troops, including the TA troop, with eight M3s each and the training troop with four M3s. The remainder of ten equipments will be split between War Establishment Increment, War Maintenance Reserve and Repair Pool. At present, there is no funding available to replace 227 Amphibious Engineer Squadron's M2s, and the prospects for new money being made available do not look good. If this aspiration were to be endorsed within existing financial constraints, compensating reductions from other parts of the programme would have to be found. It is beyond the scope of this article to suggest where they should be made, except to say that there is very real danger that any reductions would be accepted as savings only and we would not be able, at the end of the day, to procure any more M3s. This might seem a defeatist outlook but, that said, there may yet prove to be an achievable middle ground to balance a slightly enlarged fleet between the regular and TA squadrons. This proposal is being staffed at present. I believe that our long term aim should be to equip both amphibious squadrons with common equipment in order to provide both 1 and 3 Divisions with the crossing capability they need.[7]

Preliminary Conclusions

WITH so many important M3 milestones remaining to be met in 1997, this article can only be regarded as an interim report. In particular, the ISRD and Exercise *Ulan Eagle 1997* remain crucial events against which the ultimate success of the M3's introduction into service must be gauged. That said, I consider it appropriate to offer now some preliminary conclusions:

- In short, M3 is an outstanding piece of equipment. It can be employed as much as a ferry as a bridge. With its high operational and tactical mobility on road, cross-country and on the water, low logistic and equipment support overheads and flexibility in employment, M3 will serve the army well on both war fighting operations and on operations other than war. Active consideration should be given to extending the fleet in order to allow sufficient M3 to be deployed to 227 Amphibious Engineer Squadron (Volunteer) of 78 Engineer Regiment.
- Meanwhile, without the tremendous hard work and tireless support over many years from DDOR (Engr and NBC), PE GEE, ES 42, EWK and the *Bundeswehr*, 28 Engineer Regiment would not have achieved so much with M3 in so short a time.
- The close links re-established with *schweres Pionierbataillon 130* during the 1995/1996 training season, including Exercise *Neptune's Endeavour* in October 1995, set the basis for the initial joint training which culminated in the two major demonstrations in October and December 1996. These proved fundamental in introducing the M3 so quickly into service and the close co-operation achieved between the two units must be maintained.
- The use of the M3 prototype allowed valuable familiarization training during 1996, including its first field deployment on Exercise *Neptune's Vision* five months before the arrival of the first production M3s in Minden. In particular, it allowed us to demonstrate the M3 – albeit in prototype form – to our German colleagues and to build up early on our credibility with the new equipment, which extended to consideration of the tactical doctrine. This professional edge was never lost subsequently.
- Finally, and not least, the skill and enthusiasm of the regimental M3 project team and of the 16-man strong M3 cadre of 23 Amphibious Engineer Squadron were first-class, attracting widespread and fully-deserved praise from our many visitors and guests. That so much was done by the regiment and squadron rear party whilst the main body of 23 Amphibious Engineer Squadron was deployed in Northern Ireland for a six-month period, says much for the quality and dedication of those individuals who remained behind to look after both M2D and M3. If you add the fact that 412 Amphibious Engineer Troop (V) was also raised from scratch in the autumn of 1996, having overcome many bureaucratic hurdles in the process, then you can get some impression of what was achieved.

[7] This is Corps policy, after all, despite some recent debate on the matter; see "The Annual Report to the Corps by the Engineer in Chief", RE *Journal*, Volume 109, Number 2 (August 1995), p. 126.

Royal Engineers and Railway Safety – 1840 to 1996

MAJOR C F ROSE CBE (CIVIL) MBE CENG FICE MCIT

Charles (Freddie) Rose was commissioned into the Corps in 1947, following three years as a trainee civil engineer with the Southern Railway Company. His initial service was with military railways in Palestine, Egypt and Libya. Thereafter he divided his time between transportation work and more general soldiering. He served in Germany (Officer Commanding 39 Field Squadron), Korea, Kuwait and Thailand where he was the Project Officer for Operation Post Crown, *a major road construction project. He was selected for promotion in 1968 but elected to leave the army to join the Railway Inspectorate. He became Chief Inspecting Officer in 1982 and from 1986 combined this with chairmanship of the Channel Tunnel Safety Authority and membership of the Intergovernmental Commission for the tunnel. Since 1989 he has acted as a consultant for the Chunnel and the new high-speed railway between London and Folkestone.*

IN late autumn 1996 an event occurred, largely unnoticed, which marked the end of an unbroken 156-year association between the Corps and the government in the field of railway safety. The event was the retirement from Her Majesty's Railway Inspectorate of the last two former RE officers to serve as Inspecting Officers of Railways. The nature of this long association is probably not widely known, even within the Corps, and this short article may be of general interest as well as commemorating a small landmark in the Corps' history.

By 1840, railways had been spreading through the land for over ten years, with little or no regulation of their safety by the government despite a growing number of accidents. These accidents had led to the appointment, in 1839, of a parliamentary select committee to consider whether some control over the construction and operation of the railways was necessary in the public interest. The committee's conclusion was that some additional form of control was needed but that it should be kept to a minimum and should not detract from the prime responsibility for safety placed on railway management. The report led to the passing of the Regulation of Railways Acts of 1840 and 1842. These, inter alia, authorized the appointment, by the Board of Trade, of Inspecting Officers of Railways who were charged with inspecting new railways before they were opened to the public. The government was authorized to delay the opening of any new line that the inspecting officers considered unsafe.

The 1840 Act led to the formation, within the Board of Trade, of the Railway Inspectorate. The first inspectors, as well as inspecting new lines, collected accident data and, although not specifically empowered to do so by the Acts, began at once to conduct inquiries, in public, into the more serious accidents and to publish reports on them. These inquiries were formalized, over 30 years later, by the 1871 Regulation of Railways Act. The three main functions, of inspection, accident data collection (and analysis), and inquiry, have formed the basic work of the Inspectorate ever since.

In appointing the first inspectors, the government needed people with broad engineering experience and preferably no professional or financial connection with the railways. Most engineers at this time were engaged in canal, road or railway construction and the Board of Trade therefore came to an arrangement whereby Royal Engineers' officers

Major C F Rose CBE
Royal Engineers and railway safety (p46)

would be seconded to the Inspectorate for limited periods before returning to active duty. The first head of the Inspectorate, given the title of "Inspector General of Railways", was Lt Col Sir Frederic Smith. He was joined by two inspectors, Lt Col R Thomson and Capt S C Melhuish. Sir Frederic lasted only a year, leaving to take over as Commandant of the School of Military Engineering at Chatham and being replaced by Major-General Sir Charles Pasley, who had been Commandant of the School since its opening in 1812. Smith went on to become a general and later MP for Chatham.

The first accident to be investigated by the Inspectorate occurred on 7 August 1840, three days before the Inspectorate was officially formed. Sir Frederic Smith conducted the inquiry, which was into the derailment of a train on the Hull and Selby Railway near Howden. A heavy casting fell from a goods wagon and derailed the following passenger coaches; four passengers were killed. In those days, trains of mixed goods and passenger stock were commonplace.

Many of the early inspections led to delays in the opening of new lines when the inspectors decided that improvements were needed. One interesting by-product of an inspection by Capt Melhuish was the first adoption of a standard time throughout the UK. When inspecting the new Birmingham and Gloucester Railway he discovered that the clocks of Birmingham and Cheltenham varied by between 10 and 15 minutes. This was not helpful when, in the absence of proper signalling, trains followed each other at timed intervals. He recommended that London time should be adopted on all railways and this quickly became standard throughout the land and became known as "railway time."

A consequence of the emphasis on the basic responsibility for safety placed on railway management was that recommendations made following formal inquiries by the inspectors were not enforceable, even though most were adopted by the railways. The Inspectorate's aim was to encourage all railways to achieve the standards of the best, and to encourage innovation in safety procedures and equipment. Through the middle years of the 19th century, the inspectors campaigned for the universal adoption of "Lock, Block, and Brake" – that is, proper interlocking of points and signals; the absolute block system by which lines were divided into sections or "blocks", the signalling being designed to ensure that only one train at a time occupied a "block"; and the provision of continuous automatic brakes on passenger trains, designed to bring both parts of a train to a halt if the train divided accidentally – something that happened quite frequently! These three vital safety measures were not universally adopted until 1889.

Throughout the 19th century the Inspectorate continued its work, coping with the huge expansion of the railway network and continuous technical advance. Towards the end of the century it became the practice for officers selected to join the Inspectorate to leave active service and to spend the remainder of their careers in the Inspectorate.

Many of the Victorian inspecting officers were remarkable characters. In 1847 a young officer named John Simmons was appointed an inspecting officer at the age of 26. In 1853 he was on leave in Eastern Europe when war broke out between Russia and Turkey. He was first asked to report on the condition of the Turkish defences and, one thing leading to another, found himself in command of a Turkish force fighting the Russians. By this time he had outstayed his leave and his absence from Whitehall had been noticed. A signal was sent which required him to return immediately or resign from the Inspectorate. He resigned, a move which did him little harm since he went on to become a field marshal.

Another great character was Henry Tyler, who married General Pasley's daughter in 1852 and joined the Inspectorate a year later. In 1868 he spent his leave constructing the first railway in Greece, hiring six local brigands to police the works. In 1875-76 he was chairman of the English Channel Tunnel Commission, and so far from regarding such a tunnel as a menace to our security, he held that if only we could induce a hostile army to enter a 30ft diameter tube 30 miles long, it would be worth spending three million on its construction for this purpose alone! He was chief inspecting officer from 1871 to 1877 and, as Sir Henry Tyler, became MP for Harwich and then for Great Yarmouth after leaving the Inspectorate.

One of his successors as chief inspecting officer was Col Sir Francis Marindin, who combined a distinguished career in the Inspectorate with being president of the Football Association. Although himself a keen footballer, he was not a member of the Corps team which won the FA Cup in 1875, but one young officer who did play in that team, Pelham von Donop, later joined the Inspectorate and was chief inspecting officer from 1913 to

1916. An all-round sportsman, he scored a century in a remarkable cricket match against I Zingari in which the Corps side scored 726 for 8 wickets, and was a champion tennis player.

Although inspection of railways, leading to ministerial approval for their use by the public, was the main function of the inspecting officers, it was inevitably the public inquiries which brought the inspectorate to public notice. Published reports into the more serious accidents, and the inspectors' recommendations, form a continuous record from 1840 to the present day and chart the long search for improvement in railway safety. The question of worker safety was not ignored either. Work on or near the track was always hazardous and the number of men killed or injured was high. In 1900, an Act brought in measures for the improved safety of railway staff and the inspectorate recruited a small number of additional inspectors who became known as Railway Employment Inspectors. Over the years a number of these inspectors had served in the Corps, although most were necessarily recruited from the railways or railway industry.

Nationalization of the railways in 1948, whilst bringing comprehensive changes to the political and financial control of the railways and their organization, left the duties and responsibilities of the Inspectorate largely unchanged. The first major change came in the aftermath of the 1974 Health & Safety at Work Act. Although the Robens Committee, which led to the 1974 Act, had recommended that transport undertakings should be subject to separate arrangements, the Act embraced all working people and, through some rather ill-defined clauses, the protection of the public as well. The Inspectorate was required to enter into an agency agreement with the Health & Safety Commission whereby, whilst remaining part of the Department of Transport (which had taken over responsibilities from the Board of Trade on its formation in 1919), it performed duties under the Act on behalf of the Commission. The Inspectorate, which had always been a very small team – its total strength was only 14 when the present author joined in 1968 – grew significantly with the recruitment of some 16 additional railway employment inspectors to carry out the extra duties required under the agency agreement. Also, in 1968, the appointment of inspecting officers was made via open competition, before then officers being nominated by the War Office/ Ministry of Defence. These changes, coinciding with the run down of military railway activity in the Corps, heralded the end of the long association between the Corps and the Inspectorate. It was inevitable, and only fair, that opportunities should exist for the new employment inspectors, many well qualified in railway engineering or operation, to rise to higher positions within the Inspectorate. In 1983, a senior railway employment inspector was appointed an assistant inspecting officer and in 1985 he became an inspecting officer, the first non-RE officer to hold the appointment since 1840. When the present author retired as chief inspecting officer in 1988 he was succeeded by a former deputy chief inspector of factories from the Health & Safety Executive. Two years later the Inspectorate was absorbed by the Health & Safety Executive. It is now about a hundred strong.

Although the direct line of succession of ex-RE officers has ended, happily the Corps' connection has not. One of the current inspectors served as a sapper in transportation before being commissioned in the RCT, and another served as a captain in a Specialist Team RE (TAVR) before joining the Inspectorate.

The Corps can be proud of its long association with the Inspectorate, during which time the railways became one of the safest of all forms of transport and the inspecting officers gained the confidence and respect of politicians, civil servants and railwaymen alike.

The table which follows shows the sapper inspecting officers from 1840 to 1996. It is reproduced, together with some of the biographical detail, from the excellent book by Stanley Hall, "Railway Detectives", which covers the detailed history of the Inspectorate over its first 150 years, and by kind permission of the publishers, Ian Allan Ltd.

ROYAL ENGINEERS RAILWAY INSPECTING OFFICERS – 1840 TO 1996

	Year Joined Inspectorate	Year Left or Retired	Number of Years Service
LT COL (later Gen) SIR J M FREDERIC SMITH	1840	1841	1
Lt Col R Thomson	1840	1840	1
Capt S C Melhuish	1840	1840	1
MAJ-GEN (later Gen) SIR CHARLES PASLEY	1842	1846	4
Capt J Coddington	1844	1847	3
CAPT (later Field Marshal Sir John) LINTORN SIMMONS	1847	1853	6
Lt Col (later Gen) George Wynne	1847	1858	11
Capt (later Lt Gen Sir Robert) Laffan	1847	1852	5
Capt Harness	1848	1850	2
Capt (later Sir Douglas) Galton	1850	1858	8
CAPT (later Sir Henry) TYLER	1853	1877	24
COL W YOLLAND	1854	1885	31
Capt G Ross	1858	1861	3
COL F H RICH	1861	1891	30
MAJ-GEN C S HUTCHINSON	1867	1895	28
COL SIR FRANCIS MARINDIN	1877	1900	23
LT COL SIR ARTHUR YORKE	1891	1913	22
Lt Col G W Addison	1895	1899	4
LT COL P G von DONOP	1899	1916	17
COL SIR JOHN PRINGLE	1900	1929	29
Lt Col E Druitt	1900	1918	18
Lt Col E Hall	1919	1927	8
LT COL SIR ALAN MOUNT	1919	1949	30
Col A H C Trench	1927	1949	22
Lt Col E P Anderson	1929	1934	5
Lt Col E Woodhouse	1930	1949	19
LT COL G R S WILSON	1935	1958	23
BRIG C A LANGLEY	1946	1963	17
COL D McMULLEN	1948	1968	20
Col R J Walker	1949	1952	3
Col W P Reed	1953	1968	15
COL J R H ROBERTSON	1958	1973	15
LT COL I K A McNAUGHTON	1962	1982	20
Maj P M Olver	1965	1989	24
Lt Col A G Townsend-Rose	1968	1986	18
MAJOR C F ROSE	1968	1988	20
Maj A G B King	1973	1996	23
Maj C B Holden	1977	1996	19

NOTES:

1 Chief inspecting officers are shown in CAPITALS.
2 The first two chief inspecting officers were known as Inspectors-General.
3 Capt Simmons was additionally secretary of the Railway Commissioners.
4 It is difficult to be precise about the dates of some of the earlier inspecting officers. Details have been extracted from the records of the Corps of Royal Engineers and the Board of Trade.

Repair of Slavonski Brod Fixed Bridge

LIEUTENANT COLONEL A P BURNSIDE BSc(ENG) CENG EURING MICE

Having recently served in Hong Kong, Germany, Gibraltar and with the RAF at Leuchars, Lieutenant Colonel Burnside considered himself fortunate to be posted to Belgium, to Staff Officer 1 post in Supreme Headquarters, Allied Powers, Europe, a tour that has so far proven to be far more adventurous than expected. After working in the Policy and Co-ordination Section of Allied Command Europe Resources Division for one year, he has been posted to the Staff Officer 1 Airfields slot in the Infrastructure Section of the same Division, where he will staff North Atlantic Treaty Organization-funded projects on airfields in Canada, France, Holland, Italy, Norway, Portugal and Spain for at least the next couple of years.

SLAVONSKI Brod and Bosanski Brod are situated on the northern and southern banks of the river Sava 120km east of Banja Luka. Before the confrontation they were busy industrial towns and their main link was a road and rail bridge that spanned the river, the central pier of which was recognized as the border between Croatia to the north and Bosnia to the south.

The bridge suffered major damage during the conflict, but was considered repairable during Operation *Joint Endeavour*, and Task Force *Eagle* planned to use it during redeployment.

INITIAL INVOLVEMENT

MY involvement with the repair of the bridge began soon after November 1995 when the planning for the Implementation Force (IFOR) was just starting to take place, I had no idea that I would be involved in the project at a later date. My posting to Regional Engineering Office Zagreb in June 1996, came as a bit of a surprise. In normal NATO fashion, I was told in the corridor on Thursday that I was off to Zagreb the following Monday, for a four plus month tour, and on arrival in Zagreb I learned that I was to become responsible for coordinating the repair of the fixed bridge at Slavonski Brod.

BRIDGE

THE road and railway bridge at Slavonski Brod, was designed between 1958 and 1960 and opened to traffic in 1968. With a total span of 522m it was constructed as two separate bridges, joining mid-span at the central pier on what appears to be a man-made island in the river. The main span of the southern half of the bridge is of a continuous reinforced concrete construction and the three main spans of the northern section of the bridge are of a steel truss through-bridge design, with the minor spans of reinforced concrete construction, *(see Figure 1)*. It is interesting to note, from discussions with the original designer of the northern side of the bridge, that the logic behind the two different designs was based on the span lengths between supports. Due to the length of the maximum span on the northern side, over the main navigation channel, it was cost effective to construct this part of the bridge out of structural steel, especially as the main metalwork fabricating factory was only a few kilometres away.

REQUIREMENT

THE repair of the bridge at Slavonski Brod was required for the reshaping and redeployment of Multinational Division North (MND(N)), the US led Sector. A MLC 110 wheeled and MLC 80 tracked single lane bridge was requested with a completion date of early September 1996.

The original design of the bridge was the limiting factor. The road bridge had been designed

Lt Col A P Burnside
Repair of Slavonski Brod fixed bridge (p50).

for 84-tonne special loads and the weakest link was the road pavement. Based on this information the replacement bridge was designed for MLC 80 tracked and wheeled vehicles.

Mabey Johnson won the contract for the supply of the bridge. It was the only company able to meet the requirement of a single lane MLC 80 tracked and wheeled three-span bridge with a total length of 162m and a single maximum span in excess of 70m, with components that could be constructed by troop labour within 30 days.

Bridge Damage

THE bridge *(see Figure 2)* was damaged in a number of stages:

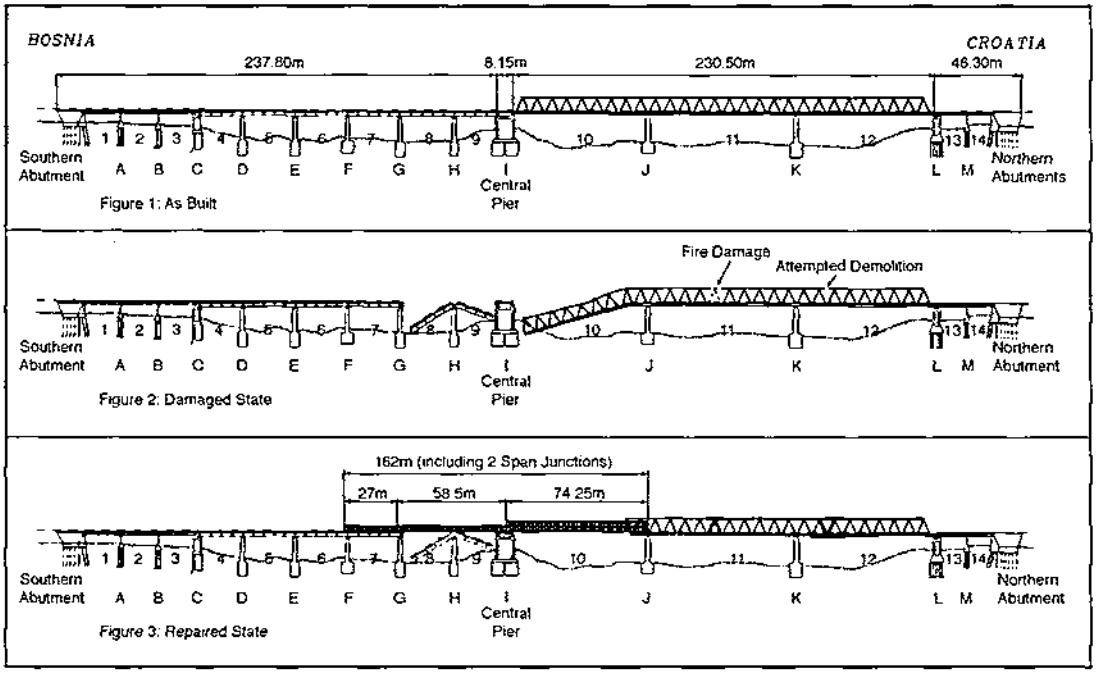
- **September 1991.** The initial damage was caused when a grenade attack hit an oil tanker parked across the bridge as a barricade, setting it on fire. The extreme heat caused buckling of structural members above the road surface on the eastern side of one bay of Span 11. The damage was minor and the bridge was still trafficable at this stage.
- **May 1992.** The first significant damage was to Span 12. Croatian reserve demolition charges were fired cutting 70 per cent of the structural members. The bridge was still passable but only by limited traffic.
- **October 1992.** Span 10 was cut at the central pier and the southern end of the span collapsed into the river. The span remained connected to and leaning against the main bridge. This rendered the bridge totally unusable.
- **February 1993.** Following the withdrawal of the Serbian forces from Bosanski Brod, Pier H was damaged, Spans 8 and 9 were cut and the adjacent Span 7 was damaged by a series of demolition charges.

In addition, mortar fire throughout the conflict caused local damage to structural members of the northern half of the bridge.

Damage Assessment

AN initial damage/repair assessment was undertaken by 62 CRE(Wks), MWF, and two main options were considered. Overbridging all of the damaged sections of the bridge, on both the northern and southern side, or a combination of overbridging and repair.

The decision to overbridge the southern part of the bridge was relatively straightforward and the only area for discussion was whether all three spans or just the two spans that had been cut should be included. Span 7 was originally designed as one of the central spans of a six-span continuous beam but would now act as an end span, and would therefore have an increased bending moment at Pier G. Because of the increase in loading and concern with the structural integrity of



Figures 1, 2 and 3.

Span 7, it was finally decided to overbridge all three spans. I say finally as the initial order excluded overbridging Span 7, and it was only after further on-site investigation by 64 CRE (Wks), that Span 7 was included.

Discussion on the repair of the northern section of the bridge centred on two main aspects. The repair or overbridging of Span 12, and whether it was necessary to cut away Span 10, the damaged section still connected to the bridge.

It was soon realized that whichever option was selected it would be necessary to undertake some repair of Span 12, to ensure that it was structurally stable, as the overbridging option would not prevent some dynamic load being transferred to this section of the bridge. Based on this, IFOR entered into negotiations with the Croatian government to obtain replacement steel sections that had been fabricated by Duro Dakovic Engineering in 1992 but not used due to an escalation in the conflict. It was hoped that this would be a relatively straightforward process but it proved to be a protracted affair.

Discussions on the need to cut away the damaged steel section, centred on structural stability in a longitudinal plane. The bearings of the southern end of the steel bridge were designed as fixed at the central Pier I, with dilatation being allowed to the north. The bridge bearings on the central Piers J, K and L allowed free movement in both a north and south direction.

The bridge had moved about 50mm longitudinally to the south on its bearings L, K and J and this was assumed to have taken place when Span 10 was cut. This was not considered to be a problem as it was within the tolerance of the roller bearings. With the cutting of Span 10, the original fixed bearing at I had been removed. The cut end of Span 10 resting on the river bed was now considered to be the fixed end as it was thought that the weight of the damaged section connected to and leaning against the bridge would be sufficient to prevent further movement towards the south. This proved to be an incorrect assumption and will be discussed later.

The two main bridge piers on the southern side had sustained some minor damage, from either mortar attack or small demolition charges. The piers were of a mass concrete design, without steel reinforcement. Following discussions with, and a design check by, the original bridge design agency, the damage was considered to be acceptable as the bridge bearings at the piers were free and only minimal horizontal force would be transmitted to the piers.

Bridge Repair

Based on the initial assessment and a time and cost analysis, it was determined that the repair and overbridging would be the most cost effective option and the one that would satisfy the tight time constraints. This option included repair of Span 12, reinforcement of the members damaged by fire at Span 11 and overbridging of the cut and damaged concrete and steel sections of the bridge on both the north and south side, Spans 7, 8, 9 and 10.

It was decided that troop labour would be used for the preparatory work on the southern side of the bridge and central pier and for the building of the Mabey Johnson bridge, and a civilian contractor would be employed to undertake repair of the northern side of the bridge.

The Hungarian engineer contingent (HEC) was tasked to carry out the work on the southern side and the Nordic brigade was tasked with mine clearance of a working area on the central island.

Once the Croatian government had agreed to release the bridge components and a contract had been let on Duro Dakovic Engineering, work started 8 July, with a target completion date of 31 August 1996.

Southern Bridge Repairs

Preparatory work on the southern side of the bridge and abutments was considered the least complicated. The main requirement was for construction of supports for the Mabey Johnson bridge.

The original design, by 64 CRE (Wks), of the supports at Piers F, G and I was based on a steel grillage resting directly over one of the main reinforced concrete beams at Pier F and on specially constructed steel frames at Piers G and I. The support at Piers G and I was based on a pair of simple independent structural frames, one on each side of the bridge. The grillage rested directly on top of the frames and consisted of six universal columns taking the main vertical load. The supports were wide enough to accommodate the two base plates on each side of the bridge.

During the initial damage assessment an assumption was made that the reinforced concrete diaphragm slab 2m below the road deck could take the full load of the bridge at about mid span. This assumption was probably based on the central pier being solid when in fact it

was hollow, a fact not known until the "As Built" drawings were located. Once it was realized that the concrete floor was only supported by the outside walls and not strong enough to support the full loading of the bridge a complete redesign was required.

A number of options were considered but it was soon realized that the original design load-path of the structure would have to be used. This meant that the outside walls would have to take the main load of the bridge.

Although it was possible to modify the Mabey Johnson design, this had to be done using available bridge components, and meant that a single support would have to be used at the central pier as originally planned.

Additionally, so that fabrication could start immediately, the redesign of the support at Pier I had to utilize available steel members as all structural steel was imported from Germany, with a ten-day lead time.

Duro Dakovic was tasked with the redesign. With the additon of four large universal beams (UBs) to span the 10.5m width of the piers, a pin-jointed capping frame was decided on. A maximum single component weight limitation of 6000 pounds was imposed because it was necessary to lift frame sections into position by helicopter.

A Blackhawk helicopter was provided by the US contingent, with ground control provided by an ad hoc team from Commander for Support. After a site visit, discussions with the safety officer, rehearsals and a dry run, the first two frames were lifted into position without incident. After refuelling it was planned to lift the two large UBs, each weighing over 5000lb, but by mid afternoon the temperature had reached 32°C and there was concern that the UBs would be too heavy; only at this stage was it understood that air temperature affected lift capacity and after a number of aborted attempts the lifts were postponed until the following morning. All lifts were completed within a three-day period.

Northern Bridge Repair

There were three main areas of repair on the northern side:

- Repair of the damaged section of Span 12.
- Reinforcement of the transverse end beam at Pier J, to support the Mabey Johnson Bridge.
- Reinforcement of the fire damaged section of Span 11.

Repair of Span 12 required the installation of a temporary support frame below the main bridge components to take the bridge loading during the repair and replacement process. Once this was in place it allowed the damaged sections of the bridge to be cut away and replaced. The whole process went without major incident.

The transverse member at Pier J had to be reinforced to take loading from the Mabey Johnson bridge. At the initial design stage only limited movement of the steel bridge was anticipated at this support. The beam was stiffened and supported off the pier below at two points. To allow for movement longitudinally and to minimize the transfer of horizontal force to the pier, the supports to the beam were pin jointed at the top and bottom.

The reinforcement of the fire damaged section consisted of welding steel sections on either side of the warped members to allow load transfer around them. This was a relatively simple process and went ahead without incident.

Support frame being positioned at central pier.

Repair of Slavonski Brod fixed bridge (p53).

Longitudinal Movement

On the night of 3 August 1996, following a hot day and intense construction activity on the bridge, the northern side of the bridge moved south on its bearing about 100-130mm *(Figure 4)*. This amounted to a total movement in this direction of 175mm and was outside the tolerance of the roller bearings. The rollers slipped out of their normal positions and fell into the 5mm recesses on the bearing plates. The rollers were now fixed preventing normal dilatation and the bridge had been lowered 10mm (5mm top and bottom). Although there was no danger of collapse there was concern over bridge stability and long-term durability of the bearings.

Throughout the construction process, a resident chartered engineer had been monitoring the progress of work, and it was agreed that a professional appraisal should be undertaken to determine the cause of the movement and action required to remedy the situation. The report concluded that:

- The movement was due to the oblique position of the collapsed structure and the fact that it rested on soil, giving rise to horizontal force which was further increased by the subsiding of the bearings on yielding weak ground. The force had been gradually pulling the structure south. On 3 August it appears that bearing rollers reached the overhang edge and after a slight movement they fell 5mm which resulted in a sudden additional movement of 100 to 130mm horizontally to the south.
- To eliminate the cause of the movement the heavy concrete deck slab must be removed and the greater part of the collapsed span separated from the main steel structure.
- After removal of the collapsed portion of the bridge it would be desirable to correct the roller positions for all bearings, to enable their proper functioning.

On the basis of the report it was decided that:

- The whole of the collapsed section of Span10 would be removed.
- If time permitted, the bridge would be jacked up and moved back to the neutral position on its bearings. The bearing at Pier L fixed, and bearings at Piers J and K would be free.
- Alternatively, the bridge would be left in position longitudinally with the bearing at Pier K fixed and the bearings at Piers J and L free. This option was selected, as once the plan for the removal of the collapsed section had been finalized it was realized that it would not be possible to move the bridge back into position without delaying the opening of the bridge.

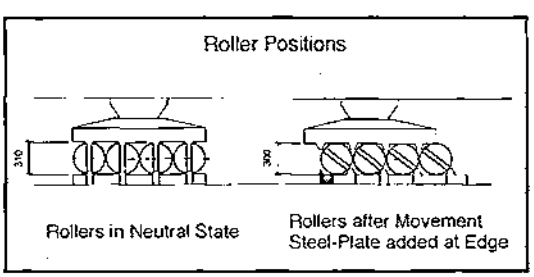


Figure 4. Bearings at J, K and L.

Removal of Collapsed Section

The plan was to remove the concrete deck slab and as much of the superstructure as possible to reduce its weight and then cut away and lower the damaged section. This was done by fixing the main bridge in position and then, by means of a series of blocks and tackles and two electric winches attached to the main bridge, taking the load of the collapsed section before the final cuts were made; this enabled the frame to be lowered in a controlled manner, avoiding causing any sudden dynamic load and torque that could cause deformation to the main bridge.

The whole operation went to plan and took 14 days. The biggest problem was co-ordinating timings for the firing of the demolition charges. To avoid restricting work on site, they were fired either before 0700hrs or after 1900hrs. The expertise of the demolition contractor was impressive, possibly due to his recent operational experience! And the local population was remarkably relaxed about unscheduled explosions in the early hours.

Construction of Mabey Johnson Bridge

The final design of the three-span bridge consisted of:

6 bay double single, 27m.
13 bay double single, 58.5m.
16½ bay double double, 74.25m.

The total bridge span was 162m, including the two span junctions at 1.125m each *(Figure 3)*. The 13 and 16½-bay bridges had heavy chord reinforcement on the top and bottom panels and the six-bay section had heavy chord reinforcement on the top panel only.

The bridge parts arrived during the first week of August and were to be built and launched from the southern side in 24 days, by members of the HEC; having built three of these bridges already, they were confident that the bridge would be completed on time. [1]Mr Pearson BEM, was the

[1]An article by Mr Pearson appears elsewhere in this *Journal*.

construction supervisor from Mabey Johnson, a recently retired RE warrant officer QMSI from the bridging school. He had worked with the HEC before, and his experience and leadership were great assets; his helicopter handling skills were put to good use during the positioning of the bridge supports at the central pier.

The final deck panel was laid on the evening of 31 August 1996 and the first vehicle crossed shortly afterwards.

Longitudinal Alignment

Once the bridge had been positioned over the support at Pier J it was realized that longitudinal alignment at the support of Pier G was out by about 420mm towards the south. The movement of the northern bridge south accounted for about 170mm, the other 250mm was probably due to a combination of error in setting out and some minor adjustment in the position of the support on site.

After discussions with Mabey Johnson it was agreed that the position of the base plate on the bridge could be adjusted 220mm further north, which left an eccentricity of 200mm at the support. This was within the tolerance of the bridging unit but would require monitoring in the long term. A design check confirmed that the structural support was capable of taking the eccentric loading but the grillage support beams running north to south failed in shear and the webs of the beams running east to west above the universal columns required stiffening. The agreed solution was to insert two additional beams at each support below the grillage *(see photo right)* and weld web stiffeners on the beams above the universal columns.

The insertion of the additional support beams required a combat engineer solution that consisted of jacking up the bridge to take the load off the support, and greasing of the end of the beams before they were hammered home. With a lot of hard work, muscle power won the day and the supports were fit for purpose. Fortunately it was possible to weld the stiffeners in place after the bridge had been placed in its final position.

Quality Assurance

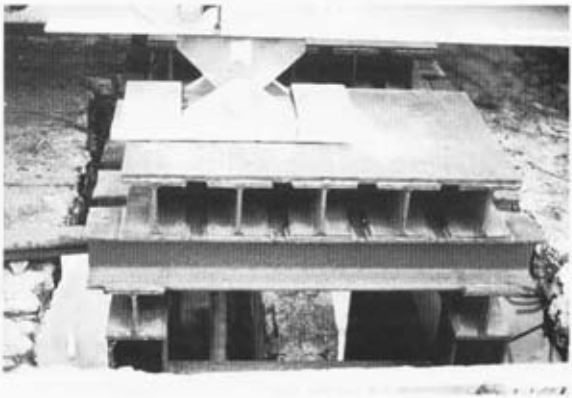
Quality assurance on the northern side of the bridge was undertaken by members of the Civil Engineering Institute of Croatia. They proved to be a valuable asset and their involvement was widened as the project progressed. In addition to checking the progress of work and testing all structural welds and bolted joints, they undertook a design check of all structural work on both sides of the bridge and load tested the complete bridge and the structural supports.

Load testing of the bridge involved the use of eight loaded tippers, totalling 205 tonnes, positioned at various points to simulate as close as possible the maximum live load. A load factor addition was included to take account of dynamic loading and deflection was measured before and after loading to determine elastic recovery. Load testing concluded that the bridge behaved technically correct and was suitable for MLC 80 tracked and wheeled vehicles.

Summary

Control of the bridge was handed over to MND (N) on 3 September 1996 and the official opening took place on 7 September 1996.

The bridge was completed on time and well within the $4.6m budget. Five nations were



Support at Pier G. The base plate is in its final position, 220mm to the right of the pin above, its originally designed position. The additional UB is in position below the grillage. Web stiffeners to UB, directly above the supporting columns to be added.

Repair of Slavonski Brod fixed bridge (p55).

involved in the project and all worked extremely hard to achieve an excellent result. Royal Engineer involvement was at a number of levels and made a significant contribution to the success of the project, through MWF, the ARRC, and Commander for Support.

The Hungarians were keen to impress, and they did in general. They might lack equipment but they certainly make up for this in muscle power and improvisation. Many of the officers and soldiers were hand picked for the operation and we probably saw the best of them. Their rank structure was certainly top heavy on the construction site and a number of the officers were employed as "hands on" within the section. They were a good bunch to work with and I was not surprised to learn on my return to SHAPE that they are one of the likely candidates for accession to NATO.

Lessons Learned

Many lessons will no doubt be drawn from this operation, but one point of interest was the speed of reaction of the NATO machine in the allocation of resources. From initiation of request from theatre to agreement of funding, staffing and administration, took four to five days!

One of the most rewarding experiences was seeing at first hand how other military organizations functioned. Each nation has it strengths and weaknesses and one of the most obvious strengths of the British forces was its military flexibility, something that was noticeably missing in much of MND(N). The professional attitude of British forces shone at all levels and showed the value of a professional army in which leaders at all levels are prepared to make decisions and, more importantly, take responsibility for them.

On a professional engineering note, I was very impressed with the support I received from members of the Croatian Institute of Civil Engineers, on this project and the other IFOR projects I was involved in at a later date. They had the contacts at government and professional levels and once an initial network had been established it was extremely supportive.

50th Anniversary Articles

The Editor of the *Journal* would be pleased to receive articles from anyone who took part in projects during the aftermath of WW2, or have something interesting to relate of happenings during the year of 1947, with a view to their publication on or near to the 50th anniversary of the event. Accounts of later events are also welcome as they can be kept for publication in the appropriate issue.

Escape from Singapore – 15 February 1942

MAJOR W GRAY

The following is a much edited account of Major Walter Gray's activities during 1942, taken from a record he made daily during his escape. It was sent to us by Lieutenant Colonel J C Court OBE, and is published posthumously with the kind permission of Mrs Gray. The full notes are lodged in the Imperial War Museum.

Sunday 15 February 1942

The day when Singapore was to be surrendered to the Japanese Imperial Army after a campaign which had lasted a bare two months and one week.

I was on the Chief Engineer's Staff at Fort Canning, Singapore. During the morning four of our staff, Dick Lane, Ray Long, John Court and myself, received instructions to report to a small steam-driven tug at the Harbour Board and en route to call at the Cathay Building where some trouble was being experienced. The Cathay complex was the largest building in Singapore rising to some 16 storeys. The whole area had been savagely bombed and casualties were very heavy, the more serious having been taken to casualty stations set up in the Cathay complex.

We left Fort Canning at 0930hrs and within a few minutes found ourselves being dive-bombed by Japanese whose bomb aimers were much too accurate for our comfort. We scrambled into a nearby monsoon drain for cover from a hail of flying shrapnel. The surrounding area was under continuous shellfire from Japanese artillery about four or five miles away on the Bukit Timah Road. On arrival at the Cathay, Dick Lane and myself set off to visit the Chief Engineer 3rd Corps (Brigadier Crawford) whose office was on the eighth floor. None of the lifts were operating and all the corridors, stairs etc, were crowded with refugees and casualties. The cinema auditorium and main restaurant were also overflowing with casualties, service and civilian of all nationalities, British, Australian, and Indian. Army and civilian sisters and nurses were tending the wounded as best they could and distributing biscuits and water. It was a pitiful sight.

On contacting Brigadier Crawford we learned that there was difficulty with water supplies, but there was nothing we could do to help as the mains supply was slowly diminishing from the reservoirs.

Frequent air raids continued as we made for the Harbour Board. It was a nightmare journey; roads strewn with debris, crashed and damaged vehicles, trolley-bus wires festooned traffic-ways and many victims still not cleared from the streets. Despite this chaos we managed to guide our car to the dockside were our small tug *The Phyllis "R"* (70 tons) was tied up. Here, we joined additional engineering staff, the object being to carry out demolitions of vital equipment in the area. We were subjected to continuous bombing attacks and it was a miracle that our working party suffered no casualties.

Later we were informed that Major Coode had obtained permission from GOC Singapore to make up a party of engineering staff to attempt a getaway to Java in *The Phyllis "R"*. There were 23 of us listed in this official party. We quickly organized into groups of two or three, each group responsible for carrying out specific tasks to ensure that the tug was made ready for what we all knew would be a hazardous journey. I was nominated ship's quartermaster, which included finding sufficient food for what we estimated to be a six-week journey. I set off with two helpers to reconnoitre the harbour board godowns, for imported foods. There were up to a hundred godowns with floor areas of some 10,000 square feet each, but luck was with us and it didn't take long to find what we were looking for. Briefly, we found crates of tinned soups, stews, steak and kidney puddings, fruit puddings, tins of cream, tinned Dundee cakes, every variety of fruit, condensed milk and tea, and last but not least, canned beer and cigarettes. Reasonable quantities of each commodity were selected and loaded into the tug's hold with much dodging into cover whenever enemy aircraft appeared. On one raid the tug was very nearly a severe casualty and we all had visions of our escape fading before our very eyes. It was then realized that we would need tools if we were forced to abandon the tug and make camp, travel through jungle, etc. The only chance of obtaining these was from a RE sub-store at Skinners Road, about three miles from the docks and mighty close to the advancing Japanese. With "fingers crossed" Ray Long, Tommy Hulme, and myself set off. We had no way of knowing if the store was still functioning, but after a hectic journey, we found ourselves turning into the store where a sergeant and two Asian clerks were still merrily dispensing

stores subject to the usual forms and signatures. We hurriedly collected a dozen or so shovels, picks and parangs and made our way back without mishap.

Two of the party were getting the boiler fired and raising steam making as little smoke as possible; no doubt a column of smoke from our *little tug* would have brought sharp action from the enemy aircraft continuously buzzing the area. At about 1745hrs, our preparations were almost complete when a staff car drew up and set down two passengers; one was recognized as the Chaplain General to the Forces and the other a civilian VIP, Mr Justice Peglar, who was the Lord Chief Justice of Singapore. We learned later that the authorities were very concerned about Justice Peglar's safety if he fell into the hands of the Japanese because of his involvement in an espionage case several years previously when he had passed sentence on a Japanese civilian. A few minutes later we cast off with the sound of rifle and machine-gun fire along the docks on either side, a clear indication that the Japanese were closing in. On leaving, and as a precaution against the tug being attacked and sunk, we took in tow a small motor boat with John Court and another of our party on board.

The conditions along the docks, the waterfront and Singapore town were appaling; from our position it seemed that Singapore was on fire from end to end. The whole area was engulfed in a pall of black smoke which stretched for about eight miles and there is no doubt that this alone contributed in no small way to our safe passage through the harbour area. The light was beginning to fade and visibility was worsened by the massive clouds of smoke. Although we were buzzed a number of times by enemy aircraft we were indeed fortunate to find ourselves outside the Keppel Harbour boom and nosing our way out to sea without mishap.

It soon became quite dark and we continued past the many islands in the vicinity. At about 2200hrs we discovered that the motor boat was no longer on tow and we could get no response to our flashlight signals. After further search it was decided to anchor for the night. Those not on watch tried to get a few hours sleep. We were called to action once when we appeared to be surrounded by small boats all showing lights but they slowly dispersed and we concluded that we must have drifted among a number of fishing fleets from neighbouring islands.

Monday 16 February 1942

Everyone was up and about at dawn and an early check of the limited navigation charts in our possession showed that the tug had drifted and dragged anchor during the night right through the centre of a minefield! At the time and after the previous week on continuous bombardment which we had suffered night and day from the Japanese artillery and aircraft, there was remarkably little reaction to the news and it was not until sometime later that we realized how lucky we had been to escape being blown out of the water.

Our first task was to search for the lost motor boat and crew. We were surrounded by the numerous small islands which make up the Malayan Archipelago and, after searching for an hour or more, we located them tucked away in a small bay none the worse for their night out. In manoeuvring into position to throw a line to the motor-boat our tug ran aground and it was the motor-boat which had in turn to rescue us. With the motor-boat towing and the tug churning up mud and sand we eventually got afloat much to everyone's relief.

At this stage we discarded our army image and the tug's official identity and passed ourselves off as a nondescript crew on a coastal vessel. This would certainly make us less recognizable from the air, as we were still well within range of patrolling aircraft from Singapore. The tugs name was forthwith obliterated and a variety of shirts were reluctantly surrendered by Justice Peglar who was the only one of the party to possess more clothes than he stood up in. This move probably saved us from trouble an hour later when nine Japanese bombers and six fighter aircraft passed right overhead; the tug must have been clearly visible to them and we can only conclude that our ruse paid off. Soon after this , several suspicious craft were sighted and as there was always the possibility of our position being reported to the Japanese it was felt wise to take shelter until the situation quietened down. We therefore stopped at a small island named Pulau Babi where we anchored the tug and all had a very welcome swim; after a mere two days the war seemed a long way off. We weighed anchor and set off up the Malacca Straits at a steady four knots. After a short while a solitary aircraft was sighted making towards us. As we were in open water there was little we could do but steam on. When the plane was right overhead it looked to have Dutch markings, for which we were very thankful.

Just before dusk we were quite suddenly confronted with a fast moving launch which seemed to be heading our way. Everyone jumped to prearranged action stations. The Oerlikon gun in the bow was manned, rifles and revolvers were ready

and loaded and everyone seemed happy to "have a go" at this launch (flying a red flag with stars in one corner) but it suddenly veered away and passed into the gathering dusk. We reached the island of Selat Ayer Itam and decided to anchor for the night, pulling in close to the shore where the jungle reached down to the water's edge. It was now quite dark and there was a good deal of movement of small craft and what appeared to be light signals between craft and shore. This caused some concern as we were well alive to the possibility of our position being reported to the Japanese. During the night, the tug again dragged anchor, drifted inshore and became entangled in the jungle setting up hoards of fireflies and other insects which settled everywhere on the tug. With the aid of the motor-boat and a few parangs expertly wielded we eventually pulled free although little sleep was had by most of the party due to the worrying beetles and insects.

Tuesday 17 February 1942

We were all glad to be moving about at first light. Weighing anchor at 5.30, we came to the small island of Tanjong Sama after a few hours. Several of the party went ashore in the hope of bartering for matches and a spare anchor. We had no luck but managed to purchase pineapples and bananas. There seemed to be no sign of war in this area. We pressed on through the Selat Panjang Straits, keeping well inshore and close to the island of Pulau Tebing Tinggi, the feeling being that if we were attacked from the air our chances of surviving would be far greater if we could reach the shore. The temperature was very high as we were just about on the equator. Our objective was the small port of Bengkalis on the east coast of Sumatra.

The food situation was working out quiet well, with three meals a day, usually cereals, tinned milk, biscuits and tea at breakfast, soup or steak pudding for lunch, tea, biscuit and tinned cake in early evening. It looked as though we would survive for some weeks.

Wednesday 18 February 1942

Having steamed through the night we "hove to" close off the island of Pulau Padang for breakfast. As usual when anchored there were cross currents; the tug drifted and swung around, this time with serious consequences. With engines at full ahead the tug did not respond and it seemed that she was stuck fast. It was then found that the tow rope of the motor boat had wound itself around the tug's propeller shaft and would have to be cut away. With no breathing apparatus this was a slow task, a matter of a deep breath, a dive, a few hacks at the rope and up to the surface. The operation delayed us for nearly two hours and everyone was very relieved when we got under way again. By 10.15 we were again steaming towards Bengkalis with everyone looking forward to going ashore; we were all beginning to look a trifle unkempt to say the least. Before we weighed anchor the Padre held a short service which I'm sure brought back to us all thoughts of our friends who were undoubtedly now prisoners of the Japanese.

We, of course, were by no means "out of the wood." We knew that the Japanese were fast moving north through Sumatra and our aim was to keep ahead of them. What the ultimate outcome was to be, no one dwelt on; we were free today and that's what mattered.

The small Dutch port of Bengkalis was reached at 1230hrs. After initial introductions to the town's officials who had come down to greet us, the question of the next stage of our journey was discussed. Our original intention was to make for Java but we were strongly advised against this as the last two supply ships had been sunk by the Japanese. We therefore decided to make for the small island port of Pekan Bharu, some 60 miles up the river of Sunger Siak running from the east coast to the foothills of the mountain range which run almost the length of Sumatra.

The Dutch settlers were very short of European food and had little hope of receiving any further supplies, so we decided to share what food we had with the settlers, who were delighted. They in turn allowed us to coal up from their stocks near the jetty. We left to cheers and encouragement from those on shore.

Thursday 19 February 1942

Some 20 miles up the river Siak, hemmed in by thick jungle, the heat was terrific and many of the party were suffering from the heat and sunburn. Progress was very slow and hazardous, the river being very narrow in places and bordered on either side by virgin jungle; bends were frequent and at the occasional clearing a few attar huts could be seen. This was another world and it is doubtful whether the inhabitants there even knew a war was going on. *Sanders of the River* had nothing on us and this river in places was typically "steamy and tropical." It was after 1900hrs when we negotiated what was the last bend before Pekan Bharu. It was

now quite dark and as we turned we saw the reflection of a number of large fires some distance ahead. Our first thoughts were that the Japanese had beaten us to Pekan Bharu and we had visions of this being the end of the road as the river was not wide enough to turn the tug around. Whilst we were debating whether we should take to the jungle, we were suddenly hailed from both sides of the river and signalled to proceed. To our relief, we had been spotted by Dutch Army patrols and learned that the fires were in fact caused by the Dutch Army destroying vital installations, etc. We were relieved to anchor for the night without further mishap.

Friday 20 February 1942

Members of the Dutch Army seemed to think our wisest course would be to make for Padang, a small port on the west coast of Sumatra, a long and difficult trek over the mountains to reach the nearest railhead at Fort-de-Kock some 200 miles away.

We off-loaded our remaining stores and food and, as the Dutch were running short of weapons and ammunition, handed over the heavier weapons ie three Lewis guns, one antitank gun and the heavy Oerlikon, together with several boxes of ammunition, for which they were very grateful.

It was here that we had to abandon our sturdy little tug; it was like leaving behind an old friend and we were all rather sad. A quick breakfast of beans and tea on the quayside and we were making ready to start on our trek when around the corner rumbled three open lorries. The drivers, Dutch soldiers, indicated they would drive us over the mountains to Fort-de-Kock! This was certainly a great relief because we had no accurate information about where the Japanese were and could easily have walked into their patrols. We wasted no time in boarding and were soon on the move. After about an hour's drive we were confronted by a wide (100yds) fast-flowing river. The crossing was to be made on a flat raft, large enough for one lorry only, with a hand-operated cable arrangement which the passengers used to ferry across. Soon we were on the road again. The eastern slopes of the mountains consisted of dense jungle, very steep climbs and tortuous bends, the jungle completely enclosing the road for many miles. To reach the pass, at about 6000ft, took nearly four hours. The western slopes were very steep initially but after 20 to 30 miles became more gradual and jungle free. After 6½ hours we arrived safely at the small mountain town of Payer Kebis where we became the centre of interest for the local population anxious to learn the latest news; they seemed to expect the Japanese close behind, and were relieved to learn that as far as we knew they were not. Soon on the move again, a further 20 miles brought us to the town of Fort-de-Kock, some 3000ft above sea level and the old capital town of Sumatra. Here we were taken to the Dutch Army local HQ which was housed in an old prison; a hot meal was laid on and provision made for us to sleep in the old prison cells on straw filled mattresses. This proved to be the most comfortable night spent since leaving Singapore. High praise is due to all members of the Dutch Army with whom we had come into contact; they certainly put themselves out in every way to assist.

Saturday 21 February 1942

After a hot breakfast in the prison dining hall we set off to walk to the railway station some two miles away. We must have looked a motley crew, the majority unshaven, most wearing tin hats and possessing only the khaki shirt, shorts and shoes we stood up in. We reached the railway station and as expected found a seething mass of Sumatrans; no surprise really as usually one finds that for every person travelling there are twenty friends and family to see them off. However, the railway authorities had obviously been briefed, and we were quickly directed to an empty coach. The journey to Padang was expected to take about five hours. We eventually arrived at 1300hrs and were informed that we were to be temporarily housed in a small Malay school about a mile away, where we were to await events. The situation generally did not look too promising, with the Indian Ocean between us and Ceylon to the west and the Japanese Army to the east rapidly advancing towards us. There was nothing for it but to try to sleep.

Sunday 22 to Wednesday 25 February 1942

Apart from meeting some of our old friends among the stragglers from Singapore, the weekend passed very slowly and with a marked lack of optimism. We waited patiently for a ship of some kind to take us away from Sumatra. There is news of the Japanese Army making rapid progress in our direction and enemy "recce" planes regularly fly over the town. However, I still feel optimistic and hope that something will turn up.

Thursday 26 February 1942

Today started as usual, and it was late afternoon before word went around that we were to make for the railway station. Having boarded a small freight

train, we were surprised to find ourselves entering the docks where we were led to a small Dutch freighter, the *Tonambo*. Later we learned that because of Japanese submarines, all shipping was sailing under complete radio silence but despite this, and at considerable risk to his ship and crew, the Dutch captain of the *Tonambo* had decided to make a last radio signal to Padang to offer his services. This was indeed a lucky break; it was the last commercial ship to leave the area. On board movement was severely restricted and we could do nothing but roll up in our blankets and await events. The ship eventually pulled away from the quayside and headed out into the Indian Ocean.

Friday 27 and Saturday 28 February 1942

Friday morning brought news that the captain had intended to head straight for Ceylon as there was insufficient fuel to follow the usual zigzag routine. It was well known that Japanese submarines were hunting in packs along this route with considerable success, nevertheless, with no alternative and if our luck held we could well get through. The ship had very little surplus food, and the additional mouths to feed posed quite a problem. Our diet consisted of rice flavoured with sardines, and tea without milk. The day closed with the ship plodding on at a steady 9 knots. The night passed uneventfully although sleep was hard to come by as the open deck where we lay was close to the engine room vents and very noisy. However, the morning was fine, the ship was progressing steadily and despite a reduction in our already meagre rations everyone was hopeful. The day passed without incident and after another small meal, we looked forward to a quiet night.

Sunday 1 March 1942

Everything went smoothly and spirits were high in the knowledge that each morning brought us another 100 miles closer to Ceylon. We were in the middle of the Indian Ocean, some 500 miles from land, when we received our first setback: without any warning the engines slowed and stopped. We were "sitting ducks." It appeared that a blockage in the cooling system was causing overheating in the main engines, and part of the system had to be dismantled in order for it to be repaired. Everything went well and after two hours the ship was under way again.

Everyone was very hungry. The continual inactivity and lack of news made life very tedious. Nevertheless, the general feeling was that having come so far with little trouble it was only a matter of riding out the time.

Thursday 5 March 1942

We seemed to be heading for another day of inaction but at 1115hrs smoke was spotted on the horizon. As we were more than seven days out from Sumatra it was felt that the chance of meeting an enemy ship was remote. All eyes were now on the thin spiral of smoke some 30 miles away. It would be another half hour or so before any firm identification could be made. There was no point in trying to avoid contact as the *Tonambo's* speed would rapidly be overtaken in a chase. Twenty minutes or so later and amid great excitement it was clear that the ship was a British cruiser, very soon confirmed with a message from the captain saying we had been instructed to proceed to Colombo, 40 miles distant. Dropping anchor in the outer roads of Colombo harbour, after three hours the *Tonambo* pulled into the inner harbour where we had to await clearance by immigration and security. It was not until the following evening that we were cleared to go ashore, to be met by other members of our Corps, taken to the Mess in the RE barracks and given a jolly good meal. We met up with old friends and learned from them that our wives and children had passed through Colombo three weeks previously, before heading for South Africa.

Friday 6 March 1942

It was now three weeks since Singapore fell and we had indeed been very fortunate to reach Colombo where we were able to relax for a few days. Although we did not know it, we were not to be entirely free of the Japanese as later in Trincomalee (North Ceylon), several of our friends were killed during severe bombing attacks. This was, however, the end of a phase in the war which most of us were unlikely to forget, particularly when set against the horrors suffered by many of our friends in the Japanese prisoner of war camps as later reported.

Singapore: 1942
The Last Days: 31 January to 15 February

MAJOR JOHN PIPE

THIS short piece describes a few of the tasks carried out in Singapore by 23 Field Company Royal Bombay Sappers and Miners, which went into action in north Malaya the day the Japanese Army invaded Siam and Malaya – 8 December 1941. The company was in action almost continuously until 29 January when it was ordered to leave the mainland, cross the causeway over the Johor Strait and proceed to the naval base to await further orders. The naval base was located on the north coast of Singapore Island, a few miles to the east of the causeway. A week or two before, the navy, with its very large staff of civilians, had left.

The King George VI Graving Dock was to be one of our prime concerns; with its enormous 250-ton crane, capable of lifting the gun turret of a capital ship, it could be seen for miles around. The engineering buildings close to that dock were equipped with foundries, forges and machine shops capable of refitting a naval fleet consisting of every type of vessel, and the Japs, who had had an extremely effective intelligence organization in peacetime, no doubt looked forward to capturing this great "pearl" intact.

Capable of taking a vessel of 45,000 tons, the dock needed a huge pumping capacity to empty it, and the enormous centrifugal pumps were not all that difficult to deal with; large charges of gelignite were placed on the bearings of each, and the resultant explosions produced a scene of utter chaos, especially as the whole installation was below ground. Delighted with this success, we turned our attention to the 250-ton crane. Consisting of a gigantic "carriage" on four legs with wheels which ran on a track the length of the dock, it carried a gantry that swivelled through 240 degrees. Cutting charges were placed on two of the four legs closest to the dock, and again we were very satisfied with the mess: the crane keeled over and came to rest at the bottom of the dock.

It must be said that, despite the lack of rest, almost continuous operations, very natural fears of being killed or wounded, the constant danger of being cut off and captured, our troops behaved wonderfully and most of the time morale remained high. Fifty-four years on one still feels very proud to have served with such men. It is a terrible thought that most of them suffered the worst privations during the following three and half years of imprisonment by the Japs, many not surviving.

Out in the strait were a number of small and medium-sized craft, anchored or moored to buoys. They obstructed the field of fire of the troops dug in along the shoreline, so to deal with the problem, one night I borrowed a motor launch and took out an NCO and a few sappers equipped with a good quantity of gelignite, primers, detonators and fuse wire. Grouping three or four boats together, we made up small charges, suspended them in the water a few feet down, lit the fuses and retired to a safe distance to watch the fun. The boats were blown to pieces.

We were left with two large iron barges moored side by side. They appeared to contain many five-gallon tins of fuel. I thought about this for a while but our orders were quite definite: we were to clear the water of craft. A larger charge was prepared and suspended in the water between the two barges. The resulting explosion set both barges alight and lit up the area; it was quite a sight. We watched the display for some time and, assuming the fires would soon burn themselves out, went home to snatch a few hours' sleep.

About mid-morning I went down to the dock area and soon realized that all was not well. There had been a fire. I asked one of the fire fighters what the trouble was.

"Some fool set two barges alight out in the channel during the night and they floated inshore on the tide."

One of them had floated into a basin, setting alight several craft moored alongside. But there was worse: the other had floated into a large boathouse apparently belonging to the Naval Officers' Yacht Club, and started a much bigger fire which they were still fighting. The sappers were not all that popular. The GOC 11 Indian Division (Major General Murray Lyon) was heard to say: "Please don't do it again."

Lying alongside another of the quays (unaffected by my incendiary activities) was an old merchant ship *ss Ruthenia* of about 7500 tons. She was

obviously in a bad way, but it was felt that she should be scuttled. An NCO and I boarded the vessel, working our way as far down as we could into one of the holds. A charge was placed onto what we hoped was an outside bulkhead. However, when the charge went off some smoke billowed up but nothing else happened: she didn't sink an inch.

I spotted a naval-looking person and explained my problem. He showed us where the sea-cocks were and we placed our charges, port and starboard. This time there was no mistake. Down she went.

On 8 February the shelling and bombing increased in intensity and it seemed clear that the enemy was preparing to invade the island. We were ordered to leave the base and take up a defensive position at a crossroads about four miles to the south. Despite some close encounters, we had no casualties.

The main landings had taken place on the north-west of the island sometime after midnight following a heavy artillery and mortar barrage. The next day, without coming under attack we received instructions to withdraw to a new location much further back. We came under mortar fire as we began to move and took whatever cover was available. When this stopped I looked around my section and was amazed and relieved to find that no one had been hit. Without coming under further attack, orders were received to withdraw to a position on the outskirts of the city where we joined the remains of HQ RE. We dug in but saw no further action and, apart from the air raids, were left in comparative peace. Elsewhere the noise of fierce fighting went on day and night as the enemy approached Singapore city.

On 15 February at 4.30pm we were called for a meeting with the adjutant and told that a cease fire had been called and that surrender would take place. It was shattering news. The orders were that the surrender parade would take place the following morning at 8.30.

An escape plan was drawn up. The eight officers left at this location would try to find a suitable craft to sail to Sumatra. It would be a dangerous operation and the chances of success extremely slim, but it was worth a try. Breaking this news to our troops was painful and very sad. My OC, Major Dudley Wilson, explained our intentions and plan to the VCOs and senior NCOs, who accepted the situation with sorrow but with understanding.

The escapees then prepared to leave. The journey back to the Royal Bombay Sappers and Miners Corps Headquarters at Kirkee, India, was an adventure which took 23 days. But that is another story.

Operations in FRY – A Resources Troop Commander's Perspective

CAPTAIN P A McCLELLAN

Captain McClellan was commissioned in 1995 having previously served as squadron sergeant major 45 Field Squadron and sergeant major instructor (materials) at the Royal School of Military Engineering. On commissioning he joined 36 Engineer Regiment as resources troop commander. During Operation Resolute *he was responsible for the provision of engineer resources throughout Multinational Division South West.*

The author is a keen sportsman and is the Army secretary for skeleton bobsleigh.

Introduction

In April 1996, Resources Troop, 61 Field Support Squadron deployed on Operation *Resolute* for six months. While supporting all operations in theatre, its main task was to inload and distribute stores for camp construction tasks in Bosnia. The stores were part of the urgent operational requirement (UOR 54/95) which cost $40m and totalled 3.6 million cubic metres in volume. Delivery of these stores was well advanced by the time we arrived but in spite of this, we went in at the deep end; the rate of taking in new information was most aptly likened to "drinking from a fire hydrant."

The system of support did not conform to the normal doctrinal template, as the troop was stationed in Split and provided both second and third line support to theatre. The remainder of the squadron was based at Tomislavgrad, some two hours drive away, while RHQ was at Gornji Vakuf. 3 Division (Main) was at Banja Luka, and Division (Rear) was collocated in the same barracks as the troop in Split. Consequently, a good deal of business was done directly with Division (Rear), while all the time keeping the squadron and RHQ fully in the picture. The arrangements worked surprisingly well.

There were two main locations where resources were stored. In Divulje Barracks, Split, the resources yard housed the offices, workshops and traditional engineer resources such as bridging, Tactical Handling Fuel Equipment, water supply equipment and AM2 matting. The other location at Plano, was 4km away. Here, the bulk of UOR stocks was kept, including wood and Hesco Bastion collective protection, accommodation, shower and toilet units, sewage treatment plants, kitchens, fuel and water tanks, medical units and over a hundred ISO containers with most of the "widgets" to join them all together.

As the previous resources experience of the troop commander had been limited to a two-week exercise at Barton Stacey the previous summer, the task seemed a little daunting at first. At any one time, the troop was resourcing seven or eight major tasks. After three months or so, the emphasis changed slightly, with a number of equipment bridges being built. This eased the pressure somewhat, as only materials for abutments and road fittings, such as barriers, signs and sleeping policemen had to be supplied. The bridges were funded by the Overseas Development Agency and were handled by ARRCs' materials management unit (run by two ex-RE SNCOs) in Split North Port. The latter part of the tour was devoted to the supply of materials for the construction of a

Captain P A McClennan
Operations in FRY (p64)

number of rebroadcast sites which were situated in some remote and rugged places, and collectively known as "the Hilltop Sites"; they were the bane of every RE in theatre and a few in Long Marston due to time constraints imposed.

Sufficient Personnel/Personnel Required to Complete Tasks Successfully

There were quite a number of problems encountered both before and during the tour. The most obvious, picked up from the recce, was that the number of resources specialists available to the troop was insufficient. A visit to Engineer Branch at LAND produced the instruction to go at "best effort", and we were told that the consequences arising from lack of trained manpower would have to be accepted. This was extremely disappointing, and almost had disastrous consequences.

The short tour interval was quoted as the reason why resources specialists would not be drawn from other units, yet we identified willing volunteers.

Resources Troop, 15 Field Park Squadron deployed with ten resources specialists the most senior being a very experienced and competent warrant officer. With a SNCO and a JNCO attached from 50 HQ Squadron, we could muster six, with a promise of one more corporal to come, although the resources troop clerk of works (also the troop health and safety supervisor) was re-deployed from Split to the Falkland Islands two months into the tour. At this stage, we were still anticipating a complete withdrawal from theatre in the autumn. Fortunately, there was a keen awareness at regimental and divisional level of the problem, and all possible help was given, and allowances made. An attendant problem was the lack of experience of the resources specialists. With the exception of our staff sergeant, none of the others had much experience of this scale of operation and this caused a few problems initially. R&R and two men (both Class 1 resources specialists) medevaced, saw us down to two resources specialists for a period of two weeks, and the system was stretched close to breaking on a number of occasions. We survived – just, which will no doubt leave some to feel vindicated, but it was a close-run thing!

Flexibility, Local Purchase and Pre-Tour Training

Local purchase was another problem to overcome, and in every case was the reason for delay in getting sufficient stores to site to enable the troops to continue work. We inherited a developing system from 15 Field Park Squadron. They had started the tour being funded by the UN, and then had to change systems as Operation *Grapple* evolved into *Resolute*. After some months, emphasis for the management of funding of a task moved to RHQs of respective regiments, after previously being split between the resources troop and subunits. The estimated cost for each aspect of the task eg roadstone, ready-mix concrete and electrical and plumbing stores, was drawn together by a coordinating officer and a "prudent reserve", typically 15 per cent, was added. This sum of money was then bid for through HQRE to the civil secretary (civ sec), who had to authorize all expenditure. Notwithstanding the rules laid down in JSP 332, civ sec also gave authorization for us to purchase items from the UK to a specific amount, and this gave some flexibility. The system seemed to be working well by the end of the tour, but could have been developed further. In some cases it was extremely frustrating to have to tell a troop commander that we were still waiting for the one "widget" required to complete his camp build from a local supplier who had assured us it was available. It was even more frustrating to know that the quickest way to get the said "widget" was to fly back to Brize Norton that day, purchase the bit, and catch the next plane back; in many cases it would have been cheaper too! The two things to draw from this are that you are in the hands of the supplier once the order has been placed, and that a little more flexibility can be negotiated with the civ sec, who seems to be able to circumvent rules where operational necessity dictates. This could, for example, enable a man on the rear party in Maidstone to go into town on receipt of a phone call, purchase the item and put it in the post. For larger items or orders, the usual supply chain through Long Marston would be utilised. The time taken to obtain items through Long Marston was typically ten to fourteen days, and provisioning branch were extremely helpful. Very often the notice they received was wholly inadequate for the deadline imposed upon them, as they too are in the hands of the suppliers once the order is placed. The arrival of HQRE 1 Division and a softening of civ sec's view, resulted in further streamlining of procedures for obtaining financial approval and permitted greater flexibility to buy in materials. The local purchase problem was often exacerbated, in the early days, by poor project management and the inexperience of troops when carrying out construction tasks. Often, construction would

proceed to a certain point and then stop for lack of an item. A panic would then ensue to obtain this item at the earliest opportunity so that work could continue. Having gone a little further, the work would stop again as another item was found deficient. Training at the RSME before deployment could have emphasized the need to rehearse the construction sequence mentally at an early stage, to check whether or not there were any gaps, so that missing items could be obtained in good time. As it was, one job had to have seventeen different orders of local purchase stores, and most had to have at least four. At one stage, the SNCO in charge of local purchase had over one hundred and twenty different orders in progress for a total of sixteen jobs.

Clear Instructions

The passage of accurate information is vital. In one particular instance, where a squadron commander needed a "cable jointing kit", there were huge problems. Great efforts were made to get this item to the squadron in time; the supplier in Split drove to Zagreb and delivered the part at two in the morning to resources troop; at first light a Lynx, which had been tasked specially, flew the part to Banja Luka. An hour later it was found to be the wrong part! Was the wrong part ordered? Was something lost in the translation between interpreter and supplier? It matters not. What matters is that great attention must be paid to ensuring that the right equipment is asked for and supplied.

Are Lessons Learnt?

After a recent presentation at the annual Engineer Resources Seminar, several people commented that some of the points made above were identical to those made after the Gulf war. Is notice taken of lessons learnt, or are post-tour reports sanitised to such a degree as to cause least embarrassment? The truth may on occasion be unpalatable, but if our procedures are to be improved for future deployments, now is the time to bite, chew and swallow, and do something about it.

Finally

Our challenging and rewarding six-month tour provided a snapshot in a continuum of Engineer Operations in FRY. The conditions we encountered have already changed, and a different set of problems assail 45 Field Support Squadron. Hopefully, with the reduction in forces, and with only one engineer regiment to support, life will become a little easier for them. Despite the commitment of British troops to theatre for the foreseeable future, it is urged that careful planning for the withdrawal of engineer equipments be completed with all speed, and that sufficient men of the right quality and experience be allocated to the task. This means withdrawing equipment as and when it is possible to do so, in order that a massive problem does not occur at the end, or if we are required to depart slightly faster than anticipated. Who knows, it could be Resources Troop, 61 Field Support Squadron which draws that lucky straw!

A Searchlight on the Phoney War

COLONEL R C GABRIEL

Please note that the addition of a "MC" to Colonel Gabriel's name in the above mentioned article, published in the December 1996 issue, was incorrect. We apologize for this error.

Royal Engineers or Armoured Corps Engineers?

CAPTAIN M D OWEN

Captain Marc Owen was commissioned into the Corps in August 1992. Following the Young Officers' Course, he completed a tour with 69 (Gurkha) Field Squadron in the Falkland Islands. In December 1996, he left 32 Engineer Regiment having spent January to May as an armoured troop commander with the Implementation Force in Bosnia. He is now Officer Commanding 7 Cadet Training Team.

Introduction

The recent field training exercise in Poland, Exercise *Ulan Eagle*, was the first for 7th Armoured Brigade since *Options for Change*. It was also the first time the concept of a close support engineer regiment was put into practice at this level since the two-year trial at 23 Engineer Regiment, in 1988/89. Many problems arose, some of them due to limited training opportunities prior to the exercise, but others as a result of the reformed war establishments brought about by *Options for Change*.

The aim of this article is to examine changes to the grouping and command of close support engineers with a view to improving their integration with and effectiveness within battle groups.

Standardization

The most significant problem encountered on the exercise was the absence of standardization across the brigade. Whilst this is generally not a problem within engineer groupings or commands, it is within battle group and higher formations. The great diversity in "standard" operating procedures (SOPs) between battle groups makes the work of attached arms and services particularly difficult. The ideal of a NATO-wide set of standard operation instructions (SOIs) is not possible when within a national brigade, each battle group uses different secure orders cards, reports (especially pertinent is the obstacle report), set drills, voice procedure and codes. Even the simplest of SOPs, for example the definition of H-hour or how to mark the obstacle-crossing site, varies between units.

Although the armoured engineer squadron that took part in *Ulan Eagle* was part of 7 Brigade, the other two engineer squadrons on the exercise were not. They were not therefore familiar with the brigade SOPs. It is likely to be ever thus as squadrons will continue to be regrouped to support brigades with which they may not have trained previously.

Another serious problem encountered was the misunderstanding by other arms, of engineer capabilities. It is important to try to overcome this in any reorganization in order to ensure that teeth arms commanders in particular know or can be immediately advised on the advantages and limitations of close support engineers.

The proposals that follow are designed to minimize the problems described above. Three new options are examined from a troop level perspective within a brigade, in the context of command and control, manoeuvre, and combat service support.

Troop Orbats

The field troop orbat for each of the options considered remains unchanged. The current peacetime

Captain M D Owen
Royal Engineers or Armoured Corps Engineers p67

establishment of an armoured troop is two armoured vehicles RE (AVRE), two armoured vehicle-launched bridges (AVLB) and three combat vehicles reconnaissance (tracked) (CVR(T)). The war establishment adds another AVRE, AVLB and CVR(T) with recce sergeant.

All the options discussed in this article allow the two armoured troop recce sergeants to be detached to work with battle group recce at close to medium range. This would give flexibility, redundancy and most importantly the sergeants will have an intimate knowledge of the crews, vehicles and capabilities of the assets they will be using. As a consequence of having a second recce sergeant in each troop's war establishment, it may be possible to disband the close support regiment's recce troop. The divisional engineer recce troop from the general support regiment would remain unchanged.

Option One
One troop permanently attached to each battle group.

THE first option allocates one armoured troop to each of the battle groups. This requires four troops, two to support armoured infantry battalions and two to support tank regiments. They would be an integral part of the unit, collocated with them, possibly as part of the support company or HQ squadron, but still wearing the RE cap badge and trained, as now, as armoured and combat engineers and tradesmen.

An RE captain with armoured engineer experience would become the battlefield engineering advisor (BGA), sitting in the battle group headquarters in war and collocated with the unit in peace. He would advise the battle group commander on engineer matters in general but especially close support engineering. He would not command the engineer troop, hence his title, but requests for engineer material would be passed to the brigade engineer cell through him. Armoured engineer assets would be under direct command of the battle group commander. The armoured engineer squadron headquarters as such would not exist. All routine administration would be the responsibility of the battle group, including the supply of spares and equipment support.

Field engineers would be attached to the battle groups as necessary. The allocation of one field squadron to a brigade would remain but troops would be able to move to support other battle groups, with command being maintained by their squadron headquarters.

The Royal Logistic Corps (RLC) would man the new tank bridge transporters. In peacetime, transporter troops would be grouped together in a close support squadron. In war, one troop would be allocated to each brigade. Resupply of other engineer equipment would be the responsibility of the engineer HQ squadron through the battle group echelon which would need to be increased in size accordingly.

Command and Control. The benefits to the armoured troop of being fully conversant with a single unit's SOIs, knowing the peculiarities of that regiment, familiarity with key personnel before operations and having an understanding of the unit's capabilities, are significant. On Exercise *Ulan Eagle*, time was wasted establishing basic but essential information on SOPs, BATCO, CEIs and reports. This would be avoided if a troop always supported the same battle group.

Only the battle group radio net would be used by the armoured engineers as a squadron net would not exist. This eliminates the need to encode obstacle reports into two sets of BATCO which wastes time and causes confusion. With the exception of the recce element, the whole troop can be on the battle group and sabre tank troop nets enabling the best possible dissemination of information whilst retaining good control.

One of the significant disadvantages to this change would be loss of flexibility. Battle group commanders may be very reluctant to lose their assets and the difficulty for a troop to adjust to a new battle group SOPs would remain.

The principle of keeping control of engineers at the highest level possible is not fulfiled, indeed quite the opposite; control will be delegated to the lowest level. Resources would be penny-packeted. Concentrating force and regrouping assets for the main effort would be more difficult than it is as present.

Manoeuvre. The limitations of the Chieftain chassis, notably reliability and speed, are well known. On Exercise *Ulan Eagle*, the "antiques road-show" became a standing joke and commanders went to unrealistic extremes in order to avoid having to use armoured engineers. Due to our vulnerability, we were kept out of direct fire by commanders insisting on having the assets four to six kilometres behind the forward edge of the battle area. When it became necessary to call resources forward it took time, and gun tank escorts frequently disappeared into the sunset in

the belief we were only just behind. If all infantry and armoured corps commanding officers were forced to maintain these aged vehicles, they would take more interest in pressing for their replacement

Combat Service Support. The disbandment of the very large armoured engineer squadron's echelon and its consequent reallocation to the RLC troop, the battle group echelon and HQ squadron, would increase flexibility.

Engineer HQ squadron would be responsible for engineer resources, for example Giant Viper, but battle group echelon would also be responsible for the collection of engineer resources from the engineer RV and would therefore need some RE representation within their organization to provide the technical knowledge required to prepare the equipment.

Resupply of spares in peacetime would remain a difficulty but would be significantly reduced if an engineer Challenger variant was to be introduced.

Manning this option is compatible with the arms plot system: when an infantry or armoured regiment is relocated as part of the arms plot, engineers would remain and postings would continue for them on the trickle-posting system. A perpetual cause of concern for potential armoured engineers at present is the perception of being sentenced to postings at Hohne or Tidworth. With this option, the number of posting locations would be vastly increased.

The ability to relocate engineer troops is perhaps a significant flaw in the plan. There are limitations on where 70-ton tanks can move and exercise. Stationing tanks in Hameln and perhaps Osnabrück may be politically unacceptable. It may well be unacceptable also to station tanks in towns where Warrior (at under half the weight) is tolerated.

Option 2
One close support engineer squadron to a battle group.

The second option increases the number of squadrons whilst maintaining a similar number of troops. Instead of one field squadron and one armoured squadron in a regiment (in addition to the headquarters squadron), each with three and four troops respectively, there would be four close support squadrons, each with an armoured and field troop. Each squadron is assigned to a battle group, although if the need arose the squadron could be placed in support of another battle group but this would be the exception, not the rule.

The squadron commander would provide engineer advice. The role and orbat of squadron headquarters and echelon would not change significantly, although there would be fewer assets for them to command and resupply, enabling echelon to be reduced slightly.

Command and Control. The situation in BATUS demonstrates the advantages of a fully integrated close support troop or squadron. Until recently, the sapper commitment consisted of a large combined troop. It was used as directed by the battle group commander, and was an asset of which he was assured, under his direct command. It is now a mixed squadron, again under control of the battle group using the same CEIs, BATCO and SOPs. The squadron commander would take on the responsibility of the battle group engineer (BGE), possibly making him redundant, giving the battle group commander advice based on more years of experience whilst still remaining in command of the engineer assets. He would have all his resources grouped relatively near to one another and controlling two troops is considerably easier than controlling four. However, if the position of BGE was eliminated and regrouping was to take place, there would be no one to advise the battle group on engineering matters.

It may be possible for the squadron net to be eliminated and radio traffic for the two troops to come through the battle group net, squadron headquarters listening to battle group net as well. The current difficulties of passing information on two nets would be greatly eased as everyone would receive the obstacle report and battle group orders at the same time, so sitreps and engineer material demands from the troop command vehicle to squadron headquarters would not be needed.

Combat Service Support. This option would require the squadron to maintain an echelon so that it can still function as a relatively independent body. This would still require a large number of vehicles, although less than the current establishment for a four-troop squadron. This would be less flexible although it would ensure that the squadron could maintain itself. It is a considerable improvement on the current system of two mutually exclusive field and armoured echelons. This would also give regimental workshops the experience of working on Chieftain

which is lacking under the current system and was seen as a significant weakness in Poland.

Option 3
Two troops amalgamated with each tank regiment.

The third option consists of two armoured troops grouped as "mobility" troops permanently allocated to each of the tank regiments. The soldiers would be armoured corps cap-badged. They would be trained also as assault pioneers.

The mobility troop would be under operational command of the battle group commander, although command would be delegated to the company or squadron commander for particular operations. The BGE would be drawn from a field squadron and would have no control over "mobility troop". He could advise on all aspects of combat engineering, but not armoured engineering which would no longer be a RE responsibility. Again, armoured engineer squadron headquarters would not exist and the field squadrons' grouping and command would remain unchanged. The RLC would control the tank bridge transporters, and also hold and distribute the very large resources such as fascines, armoured bridges and class 60 matting.

Command and Control. This option enables the soldiers in mobility troop to have an excellent knowledge of their own unit's procedures. However, it would be difficult to reallocate this troop in support of another battle group.

This option allows the BGE to advise the commander, with no concern for the command of armoured engineering, a difficult and time-consuming task. Radio procedures would be simplified considerably as there would be no separate armoured engineer squadron net. For field engineers in support of an operation, it is clearly preferable for them to be knowledgeable in the battle group's SOPs but not essential. They would be under tactical control of either the mobility troop commander, if a section or two was attached, or the battle group commander if a troop was attached, in the same way that they are now.

The loss of flexibility for this option is not as great as for the first option. However, commanding officers may be even more reluctant to lose their assets, especially as they would be the same cap badge. As with Option 1, control of "armoured engineer" assets is not at the highest level possible.

Combat Service Support. A major disadvantage of the third option would be the decrease in the number of combat engineers available on the battlefield. Although the mobility troop would be pioneer trained, there would still be a significant gap compared with current capabilities.

The desires of the Royal Armoured Corps need also to be considered. Although the expansion of their capabilities would probably be viewed favourably, acquiring Chieftain would, quite rightly, be viewed as a step backward. Whilst the replacement may be readily accepted, the current equipment could well be seen as a manpower intensive liability.

Summary

The first option allocates one armoured troop to each battle group in both peace and war. They remain cap-badged Royal Engineers but as independent units supporting their parent battle group. Flexibility would be lost as resources are penny-packeted. The key personalities would all be familiar with one another and each others' methods of work.

The second option is to have one close support squadron per battle group, each squadron consisting of an armoured and a field troop. This is the most flexible option, permitting the squadron to be affiliated to a battle group but allowing it to be reassigned elsewhere.

The third option disbands armoured engineers as we know them. They would become part of the Royal Armoured Corps, be known as "mobility troops" and would be trained as assault pioneers. There would be two troops in each regiment which may be detached to another battle group as seen fit by the brigade commander. This is a little more flexible than the first option and would lead to a very high level of understanding within the regiment both of armoured mobility assets and unit procedures.

Conclusions

It is necessary to consider changes to the current establishment of armoured engineers which permit the closer integration of armoured engineer support to the Royal Armoured Corps.

Option 1 would be the most difficult to introduce and perhaps does not go far enough to avoid a confusing chain of command.

Option 2, creating more close support squadrons whilst maintaining a similar number of troops, would significantly enhance the working

relationship between field and armoured engineers. This option, however, does not integrate sufficiently the armoured engineers with the sabre tank squadrons.

In Option 3, the loss of up to five Royal Engineer squadrons, with a good deal of associated history, an entire trade stream and a complete branch of the Corps may by a very difficult development to accept. However, the concept of closer integration between armoured engineer and tank regiments cannot be dismissed lightly. The lack of understanding of varying SOPs and engineer capabilities demonstrates the need for closer links. The ideal situation whereby every formation uses the same radio and operating procedures is perhaps as far away as ever, due partly to considerably fewer opportunities to train with other arms.

Although the amalgamation of armoured engineers into tank regiments may be seen as an extreme solution, it would appear workable, as practised by the United States and former Soviet armies. It is for this reason I would recommend the third option, that is the amalgamation of armoured engineers into the Royal Armoured Corps.

Journal Awards

The Publication Committee announces the following awards for articles of special merit published in the December 1996 *Journal*.

ARMOURED ENGINEERS AND MILITARY BRIDGING SOME OPERATIONAL REALITIES
by Lieutenant R Thomson – **£100**

OPERATION RESOLUTE – OBSERVATIONS FROM A SUMMER TOUR IN BOSNIA 1996
by Commanding Officer and Officers of 36 Engineer Regiment – **£75**

"BLACK AS HELL AND THICK AS GRASS" – REFLECTIONS ON RORKE'S DRIFT AND ISANDHLWANA
by Colonel T H E Foulkes – **£75**

A TWENTIETH ANNIVERSARY CELEBRATION
by Colonel M G IeG Bridges OBE – **£75**

THE THREE "RS"
by Major Andrew Willis TD – **£50**

Annual Awards

The Publication Committee announces the following awards for articles of special merit published during 1996.

Montgomerie Prize
ROYAL ENGINEERS AND RAPID REACTION FORCES
by Lieutenant Colonel P Lilleyman MBE – **£90 or a set of Corps History**

Arthur ffolliott Garrett Prize
REINFORCED SOIL DESIGN AND CONSTRUCTION WITH PARTICULAR APPLICATION TO BRIDGE ABUTMENTS
by Captain A H Hay – **£120**

Best article of the year
LIGHTS ON IN SARAJEVO – PRECONDITIONS FOR A CEASE-FIRE
by Major A M O Miller – **£120**

Best junior officer article of the year
ARMOURED ENGINEERS AND MILITARY BRIDGING SOME OPERATIONAL REALITIES
by Lieutenant R Thomson – **£60**

Best warrant officer article
There were no articles written by warrant officers in 1996.

Quarrying Operations in Bosnia Herzegovina

WARRANT OFFICER CLASS 1 P JACKSON

WO1 Phillip Jackson joined the Corps in 1974 as an apprentice plant operator mechanic at Chepstow. His first posting was to 3 Field Squadron in September 1977 where he saw service in Oman, Belize and Australia. He also served in 38 Engineer Regiment, 26 Engineer Regiment and 12 Royal School of Military Engineering before attending the military plant foreman's course, completed in May 1988.

His first posting as a military plant foreman was to 33 Engineer Regiment (Explosives Ordnance Disposal) where he qualified as a bomb disposal officer and in improvised explosive device disposal. A course in further education in the form of a posting to 105 (Tyne Electrical Engineers) Plant Squadron RE(V) was followed by a tour as squadron sergeant major of 45 Field Support Squadron, before he moved to 61 Field Support Squadron where he is employed as the military plant foreman for 3 (UK) Division. It was in this capacity that he deployed on Operation Resolute *from April to October 1996.*

Background

QUARRYING operations have been conducted in Bosnia Herzegovina since Operation *Grapple 1*, when they were mainly in support of route widening tasks where pavement materials were largely won from local borrow pits. Emphasis switched considerably during deployment of the Implementation Force (IFOR) in December 1995, when stone was quarried for camp construction, and for major route construction and maintenance works.

The large quantities of stone required for these tasks had to be won from quarries which had suffered from poor management, neglect and war damage. Few had working crushing and screening plants, those that did being inefficient with very poor output. Rock in the FRY is predominantly limestone of variable quality. Areas of granite and basalt can be found but during communist rule these sites were underdeveloped or completely ignored.

This article examines quarrying operations during IFOR's tenure and makes recommendations for future operations.

Quarries Database

INITIALLY, information regarding the location and suitability of quarries across the theatre was relatively poor so a "quarries and borrow pits" map was compiled showing quarries which might be able to provide stone for a particular project or area. Gathering information was difficult during winter months because of heavy snowfall and the need for EOD clearance of access tracks and quarry floors, but further analysis of potential quarries was carried out in 1996, making use of *Waffen SS* geological maps, together with helicopter and ground recces. Samples were taken where possible but were of limited value due to the lack of a properly manned and equipped materials testing facility. An updated map was produced at the end of August 1996.

Quarry Ownership

HAVING identified a suitable quarry for a given task the next stage was to ascertain who the bona fide owner was. This could be difficult in areas that had seen prolonged fighting or where ethnic cleansing had been carried out.

There were three categories of ownership:

- **No owner,** therefore the stone could be extracted at no cost. This category comprised mainly of borrow pits which were of limited use and poor quality.
- **Municipally owned.** In theory these quarries could be used without direct payment to the municipality which was supposed to claim the money back from the Bosnian government. In practice it was usually possible to negotiate a greatly reduced price in

WO1 I P Jackson
Quarrying Operations in Bosnia Herzegovina (p72)

return for direct payment, as compensation from the government was viewed with obvious scepticism.

- **Privately owned.** Direct payment was always required and private owners were always able to demand considerably inflated prices for their products.

Quarry Management and Control

Once a contract was approved and a unit tasked, the quarry section from the Tomislavgrad squadron would handle all aspects of management, control and accounting during drilling and blasting stages. When blasting was complete, the quarry section would move on to its next job, and responsibility would revert to the tasked unit. This system often caused problems because the quarry section could not maintain a continuous presence on site, which resulted in stone being taken without authority and, more importantly, without proper accounting, often leading to acrimonious disputes with the owner over final payments.

A solution to this would be to reorganize a handover/takeover of the quarry, the tasked unit then maintaining a presence until all required material was removed.

Equipment

The drill rig and compressor equipment currently in service are as follows:

- Atlas Copco Roc 460 PC drill rig.
- Atlas Copco 365XAHS MD Compressor.
- Atlas Copco COP 44 DTH (down the hole) Hammer with a 105mm drill bit.

This equipment, purchased in 1995, is primarily designed for use in modern, well-developed quarries with large, level benches. It would be normal for this type of rig to remain in the same quarry for periods of weeks, months or possibly its entire life. It is not designed for rapid deployment from one site to another, or to operate on steep, or uneven ground. The compressor was found to be particularly unstable, not operating correctly in some quarries until time-consuming ground-levelling work was undertaken using heavy plant. A further disadvantage was the relatively short length (20 metres) of the umbilical hose between the compressor and the rig, giving little scope for remote operation.

It is hoped that the above-mentioned limitations will be taken into account when consideration is given to replacement purchases.

The only crushing and screening plant currently in-service is located at the RSME for training purposes, and it is not known if there are any plans to replace it. During Operation *Grapple* an urgent operational requirement (UOR) for a crusher was staffed, unsuccessfully. A further UOR was staffed in May 1996 but was also rejected as it could not be justified within the framework for the Corps' future presence in Bosnia; not surprising as all major construction projects have been completed and there is now only a requirement for minor maintenance works. Problems encountered during the early days should be addressed before such deployment is contemplated in future, if the supply of large quantities of suitable stone are to be critical to the majority of construction tasks.

Initially the drill rig and compressor were perceived as the only equipments required for the winning of stone in existing quarries. However, it soon became apparent that heavy plant was also essential to improve access, improve or construct benches and to recover hammers which could not be retrieved by normal means. The quarry team's capability was greatly enhanced by the addition of an Atlas 1404 Medium Crawler Excavator (MCE) and a Caterpillar D6D Medium Crawler Tractor (MCT). The MCE was also provided with a hydraulic breaker and a ripper tooth. The MCT was equipped with rippers in preference to a winch. At times it proved possible to win poor quality stone solely by using these machines without the need to drill and blast, thus saving on time and explosives.

Tipper support is an essential component of any quarrying operation both for transporting material from the quarry face to the crusher and for final delivery of the stone to the construction site. Tippers were available from the UK fleet, from other NATO forces and from civilian hire. All three sources were used extensively and yet there was still, at times, a drastic shortage.

Blasting and Explosives

All blasting was designed using accepted methods which proved to be reasonably accurate but involved a certain amount of trial and error to determine optimum spacing, burden and blast ratios. In general, good results were achieved on the first, and sometimes the only, blast, which was very important as, due to the lack of processing plant, the stone was almost always used "as blasted." A variety of commercial explosives was used and exact loading densities were refined through regular usage.

Drilling in Sipovo quarry.

A non-electric system of initiation was always used down the hole and for the surface delays. However, an electric detonator had to be used at the point of initiation, fired by a shrike exploder and a conventional firing cable. A UOR was submitted for a nonel compatible exploder and starter tube because UK legislation requires that two means of initiation be used. In fact, by incorporating detonation cord throughout the full length of the shothole a third means of initiation was provided, adding a greater safety factor in the event of a misfire due to the failure of both nonel detonators. A misfire could be remedied by simply connecting another detonator to the protruding detonation cord.

Local purchase of explosives and accessories is now relatively straightforward with a lead time of approximately ten days. However, this was not the case during earlier quarrying operations, when problems arose due to poor availability because of the war and the need for import and export licences to transfer explosives from Croatia into Bosnia.

A sensible solution for future deployments would be to provide an initial "get you in pack", sourced in the UK. The size and contents are difficult to determine without knowing the exact requirements, but as a guide, a 100m x 100m vehicle hardstanding would require approximately 3000m^3 of stone. As a rough estimate the following explosives and accessories would be required to produce this amount:

1500kg of commercial explosive.
80 cartridges of PE4 (plastic explosive).
1 Electric detonator or nonel exploder complete with starter tube.
40 x 500ms delay detonators with 20m leads.
19 x 17ms surface delays with 5m leads.
350 metres of detonation cord.
100m firing cable.
Shrike exploder.

Manning

The quarry team was manned as follows:

1 MPF
(often absent from site due to other responsibilities)
1 Plant section commander.
1 Fitter RE Class 1 (essential to maintain equipment and carry out prompt repair work, also trained at RSME to operate drill rig.)
2 Plant operator mechanics.
1 Driver RE (DROPS MMLC (demountable rack offloading and pick-up system medium mobility load carrier.) Also trained in theatre to operate drill rig.)

Quarrying Operations in Bosnia Herzegovina (p74)

The above manning proved to be the absolute minimum required for sustained operations.

Training Issues

QUARRYING is a potentially dangerous operation and specialist training is essential. In particular it is vital to ensure the safety of the general public, and every effort must also be made to avoid damage to private property. All training within the Corps is conducted with the approval of the Quarry Products Training Council (QPTC), the only body which may issue licences for the different levels of competence. The QPTC recognize the following appointments as equivalent to their civilian counterparts:

CO	Quarry Owner.
MPF	Quarry Manager (must have blast design and shotfiring licence).
Plant SNCO	Shotfirer (must have shotfiring licence).

The qualifications are granted by the QPTC after successful completion of an approved training course and the gaining of relevant experience. All MPF now qualify for the blast design and shotfiring licences as part of their course syllabus, gaining the relevant experience with an attachment to a civilian quarry for a minimum of one week for each licence. It is possible to arrange longer attachments and this should be encouraged where circumstances allow. It is also advisable to arrange attachments for previously qualified personnel to allow them to carry out continuation training and remain abreast of new developments.

Plant SNCOs can only qualify as shotfirers if they have been warned-off for an operational tour where the qualification will be required. A special course will not normally be run and selected SNCOs will be expected to attend the first week of training for MPF. They do not however have to attend the same civilian attachment as the MPF and may arrange this independently with the approval of Construction Wing. Even after gaining this qualification a plant SNCO is not permitted to design a blast, and, more importantly, may not fire a shot until an MPF, who has inspected the circuit, is present.

Drilling on an access ramp.

In practice, our plant SNCO could not be dedicated as a shotfirer due to his many other commitments. A far better solution would be to train selected plant section commanders and one of these could be permanently detached to a quarry team, acting as 2IC to the MPF.

Conclusion

QUARRYING operations in Bosnia have been a success despite various limitations and many difficulties. It is felt that this success is partly due to the friable nature of the predominant rock type. If the only rock available was granite or basalt it is unlikely that stone produced from blasting would be of an acceptable size, angulation and grading without further processing by a crushing and screening plant.

Now is the time to review the lessons learned over the last four years and formulate a Corps policy for future quarrying operations.

Quarrying Operations in Bosnia Herzegovina (p75)

Memoirs

MAJOR PERCY ERNEST JOHNSTON

Born 2 January 1913, died 21 August 1996, aged 83.

FEW officers who are commissioned into the Royal Artillery achieve the privilege of having their obituary in the *Journal* of the Corps of Royal Engineers! However Percy Johnston, whose entire service as a paymaster was in support of Sappers, would have been both amused and delighted at receiving such an accolade.

Percy Johnston was born into an Irish family with an impressive record of service. His father was a colonel in the RAMC. Two of his brothers were highly respected missionaries and army chaplains in World War Two (one of them was a Chindit) and a third was killed in the North African campaign. In addition to two sisters, Percy and his four brothers all became clear Christians early in life and this faith proved to be abiding; they were both godly and manly.

Percy's early years of service took him to such varied stations as Cork, Singapore, Colchester, Iceland, Kenya and Calcutta. Percy enjoyed remarking that his arrival in South East Asia coincided with the Japanese suing for peace!

His final years as a Gunner were in Korea and North Wales, before he transferred to the RAPC in 1956 – the start of 17 years as a paymaster with Sapper units. Tours of duty in Osnabrück, Ripon and Christmas Island, where he witnessed the detonation and effect of five nuclear explosions, preceded his arrival at Chatham in 1965. Having married the daughter of a Sapper officer, Percy felt much at home, extending his service to age 59 before becoming the Officers Mess Accountant as a retired officer until he finally retired in 1978. He enjoyed stating that in his time with the Corps he had "trained" a goodly number of future Engineers-in-Chief! – and a review of the commanding officers and commandants under whom he served makes impressive reading.

The Corps was a good friend to Percy, especially after the sudden and unexpected loss of his wife, Sybil, in 1973 and so it was not surprising that the Corps, Medway towns organizations and Abbeyfield Homes, benefited from Percy's generous preparedness to give of his time and skills. When the Friends of the RE Museum was formed, Percy was a regular supporter of its activities and a willing hand at fund-raising. The museum was always a great interest and he delighted in bringing visitors to see it. He had a lasting interest in young officers at Brompton and Chatham, many of whom valued his influence at Officers' Christian Union activities. Percy's hard and meticulous work as Treasurer of the RE Historical Society helped to keep that organization on its feet. He was for many years Honorary Auditor of the Rochester Choral Society with which he sang regularly. His greatest joy was singing in Mendelssohn's "Elijah", a passion he had shared all his life with his beloved Sybil. He also completed the publishing of a biography of her father Lieutenant General Sir William Dobbie, who was Governor of Malta GC during the siege from 1940 to 1942.

Percy Johnston held the affection and respect of all with whom he came in contact. His cheerfulness, courtesy, loyalty, and courage were consistent and unfaltering. In later years, in spite of 23 years of widowhood and extended periods of pain, self-pity was conspicuous for its absence. It could be said of Percy Johnston, as it was of William Wilberforce, the slave trade abolitionist, that he has left behind him "the abiding eloquence of a Christian life".

WICD GWAN

Major Percy Ernest Johnston (p76)

BRIGADIER R MONTAGUE-JONES CBE MA

Born 10 December 1909, died 18 August 1996, aged 86.

BRIGADIER Ronald Montague-Jones was a Royal Engineers officer whose career in transportation and combined operations took him through North Africa, Palestine, France, Sicily, Italy, Burma, Malaya and Indonesia.

Ronald Montague-Jones was educated at St Alban's School, where his father was headmaster (an arrangement which the son did not recommend), the Royal Military Academy, Woolwich, and St John's College, Cambridge. A useful all-rounder, he represented St John's at swimming and athletics, and won a Blue for fencing (foil).

Commissioned into the Corps in 1930, Montague-Jones was soon selected for the Long Transportation Course at Longmoor, which entailed a year's attachment to the old Southern Railway.

In 1935 he was posted to Egypt, where the Army was on standby when the Italians invaded Abyssinia, and then to Haifa, in Palestine, where his task was to ensure that the railways were kept running in spite of sabotage. He remained in Palestine for three years, and was twice mentioned in despatches.

Returning to Longmoor in 1939, Montague-Jones was Adjutant of the RE Docks Group, which on the outbreak of war moved straight to the Channel ports in France, and in September was posted to the Movements Directorate at the War Office to oversee the dispatch of the BEF.

He began a course at the Staff College, Camberley, in 1940 but after ten days was sent to France for a brief attachment to the Advanced Air Striking Force. With assistance from the French Routier organization, Montague-Jones helped to plan the evacuation from France of the vehicles, ground staff and equipment of the 12 (otherwise highly mobile) RAF squadrons.

His next posting was to Admiral Sir Roger Keyes's staff at the newly founded Directorate of Combined Operations, which from 1940 was organizing Commando raids only to have them cancelled at the last minute. This frustrating situation persisted until the highly successful raids in the Lofoten Islands, followed by Spitzbergen and Vaagso in 1941. The next year Montague-Jones, by then a lieutenant colonel, became an instructor at the arduous Combined Training Centre at Inverary, but was recalled to the Movements Directorate of the War Office to organize the dispatch of the invasion force to North Africa (Operation *Torch*) which in November 1942 landed at Algiers, Oran and Casablanca.

In February 1943 he was at HQ 15th Army Group in Algiers, organizing the Anglo-American invasion of Sicily. In September he was Colonel Q (Movements) and HQ 8th Army organizing the invasion of Italy across the Messina Straits. In March he was posted to South East Asia Command, being promoted brigadier at the early age of 33. There he joined Lord Louis Mountbatten's staff as Director of Movements and was awarded the American Bronze Star.

After the surrender of the Japanese on 14 August 1945, Montague-Jones was transferred to HQ Allied Land Forces, where his responsibilities included organizing the repatriation of more than one million Japanese prisoners of war from Burma, Malaya, Indonesia, and other areas around the Pacific and Indian oceans.

Returning to England in 1947, he attended the Joint Services Staff College, which was followed by postings to Cyrenaica and staff appointments in Britain. His final appointment was as Commander, Engineer Stores Establishment, with responsibility for the organization and training of the RE (Resources) Unit of the Army Emergency Reserve.

He was appointed MBE in 1941, and CBE in 1944.

Brigadier R Montague-Jones CBE (p77)

After retiring from the Army in 1960, Montague-Jones worked with the British Iron and steel Federation until the Industry was nationalized in 1963. Having retired finally to Dorset, he became a county councillor in 1964, serving for 21 years. He was chairman of the county's Public Protection Committee, and president of the Royal British Legion.

Ronald Montague-Jones married first, Denise Gough, youngest daughter of General Sir Hubert Gough in 1937; they had one son. The marriage was dissolved, and in 1955 he married Pamela Harrington, only daughter of Lieutenant Colonel Roy Harrington. They also had one son.

LIEUTENANT COLONEL SIR JOHN VINCENT CORBET BT MBE OStJ JP DL

Born 27 February 1911, died 2 March 1996, aged 85.

JOHN Vincent Corbet was educated at Shrewsbury School, the Royal Military Academy, Woolwich, and Magdalene College Cambridge, and commissioned into the Corps on 29 January 1931. He had taken up rowing at school and rowed for Magdalene and the RE coxed four at Chatham, who won most of the regattas on the Medway during his YO years.

Corbet's first posting, in 1934, was to India. Nominally a five-year tour, due to the war in 1939 it was 13 years before he returned to the home establishment. Starting in the Military Works Services in Lahore, he was fortunate to be moved to Nowshera in 1935, was involved in the Northwest Frontier war of that year and then, after the disastrous earthquake in Quetta, also in 1935, was sent with many other Sapper officers to help with reconstruction of the devastated city and cantonment; in many respects an engineering dream.

After attending one of the first wartime Staff College courses in Quetta in 1940, came a posting to the south of India. Sailing from Madras for Rangoon in February 1942, his arrival coincided with the Japanese invasion of India, and immediately Corbet found himself caught up in the rearguard retreat up Burma to Imphal four months later.

A few months passing on his experiences as RE instructor at Quetta Staff College was followed by a returned to the Eastern Front as SORE 2, first in 33 Indian Corps and then in Fourteenth Army. Posted to 428 Field Company in December 1943 he was back in Imphal for the crucial battles leading to the first defeat of the Japanese Army. Corbet was largely involved in organizing water supply in the Imphal area and afterwards on engineer work on the line of communication, for which he was later appointed MBE.

In 1946 he found himself sent off to Malaya where the Japanese had created much havoc in their retreat. He was Mentioned in Despatches (Burma and Malaya).

After returning home in 1947 Corbet was posted as SORE 2 to Antiaircraft Command at a time when our air defences were being improved, urgently, in response to the Russian threat. This involved work on antiaircraft sites all over the British Isles.

Following short spells at the Senior Officers School and the School of Military Engineering, came a tour in BAOR as CRE Hannover during the closing stages of the occupation of Germany. This was a lucky posting which enabled him to indulge his passion for sailing with the British Kiel Yacht Club, and led to a recreation which lasted to the end of his active life, as after retirement he frequently sailed his boat across the Channel to explore the canals in France, Holland and Germany. He was a member of the Royal Thames Yacht Club.

Corbet retired in 1955. He had unexpectedly inherited family estates in Shropshire and the 7th baronetcy which had come down to him through an uncle. The second half of his life was thus spent in having to undertake the responsibilities of a prominent country landowner. He was an independent county councillor from 1963 to 1981 and chairman of the Roads and Bridges Committee for which his sapper experiences well qualified him. He was a deputy lieutenant of the county from 1961 and High Sheriff in 1966. Interested in church affairs, he was a member of the Church Assembly and then General Synod from 1960 to 1975, besides being patron of many parishes in the area. As chairman of the Red Poll Cattle Society he made frequent trips to Australia and New Zealand and it was there he met his third wife with whom he recently celebrated his 30th wedding anniversary.

APL

LIEUTENANT COLONEL SAM OLIVER OBE ERD BSc MICE

Born 15 December 1911,
died 24 December 1996, aged 85.

SAM Oliver was born in Beverly, East Yorkshire, being sixth of the ten children of Captain Samuel Oliver of the East Yorkshire Regiment. Obtaining a scholarship to University College, London, he gained a 1st class honours degree and was an active member of the Officer Training Corps.

While working as a civil engineer in Leeds, he joined the RE Supplementary Reserve of Officers and in 1939 was called up to join the advance party of the BEF sent to France, where he remained until being evacuated with his detachment on the day France fell in 1940.

Promoted to captain, he spent a short time as defence officer in Oxford before a posting to Malta, during the siege of 1941/42, saw him supervising airfield repairs. Next came India, where he was engaged in the preparations for the river crossing of the Irrawaddy in Burma.

Returning to the UK, Sam helped in the establishment of the Joint Services Staff College at Latimer in Buckinghamshire, spent the next three years in Kenya and then, from 1951 to 1953, was on the Duke of Norfolk's team which planned and managed the Coronation of Queen Elizabeth the Second.

Promoted to major, from 1953 to 1957 Sam was in Cyprus constructing the base at Episkopi, and this was followed by a move to Germany as Deputy Director of Works in HQ BOAR where he was involved on the committee which developed the West German building contractors' laws. During this period Sam was promoted to lieutenant colonel and was also appointed OBE in 1961.

Retiring in 1962, his work with works services in BAOR continued in a RO appointment until 1965, when he moved to Catterick, spending the next eleven years as deputy to the District Works Officer of the PSA during redevelopment of the garrison. The transformation was remarkable and the Civic Trust presented an award to the garrison commemorated by the large plaque at the camp centre. Sam was also much involved in the rebuilding of Helles, Vimy and Somme Barracks.

Even his final retirement in 1976 could not prevent him from continued association with the army – he became honorary treasurer of the garrison officers' mess where he remained an honorary member until he died.

Sam was a much loved and respected figure in the local community, chairman and later President of the Richmond Conservative Club, Honorary Surveyor of the Lartington Game Fair, and also area representative of the Lord Roberts Workshop.

Sam married, in 1939, Pearl Connelly, and is survived by her and their daughter Alex.

JS

Lt Col Sam Oliver OBE ERD (p79)

BRIGADIER M L CROSTHWAIT MBE

Born 20 August 1916, died 8 November 1996 aged 80.

BRIGADIER Michael Crosthwait was Brigade Major of 13 Army Group RE, the HQ responsible for the bridging operation when XXX Corps crossed the Rhine at Rees in March 1945. His brother, Major A E L Crosthwait, took part in the same operation and suffered wounds from which he died in 1947.

Michael Leland Crosthwait was born in India where his father was in Indian Survey. Educated at Wellington College, he was head of school and, after being commissioned into the Corps from the Shop in 1936, went up to St John's College, Cambridge to read mechanical sciences. After Cambridge he attended the usual courses at Chatham. Of that time MHC recalls: "Mike stood out from a batch that was highly individualistic and, probably, wilder than most, because he was not of that mould but straight, sincere, sensible and uncomplicated."

At the beginning of the war Crosthwait was appointed Adjutant of 1 Chemical Warfare Group and, after a spell as an instructor at the RSME at Ripon went to the Allied Force HQ in Algiers as SO2 RE. MHC, who shared a cabin with him on the voyage out, remembers Mike Crosthwait's authoritative and rather clipped, though not hard, manner of speech used when explaining to the third officer appointed to share their cabin that as he was a captain and they were majors, he would have to sleep on the floor. There was no argument on the matter. Later he commanded 621 Field Squadron in 7th Armoured Division, taking part in the Salerno landings in Italy in September 1943.

On their return to the UK in preparation for the invasion, Crosthwait was posted to the Staff College as an instructor but was back in more active service a few months after the invasion, in 13 Army Group RE. This group was the one allocated to First Canadian Army and was therefore both under command of and commanding Canadians. It was Mike Crosthwait's ability to speak with authoritative diplomacy that contributed much to the successful working of the group in their massive task all the way from the Normandy bridgehead to Nijmegen. Later, the Rhine crossings took place and for his professionalism and expertise in those he was appointed MBE.

Later he commanded 553 Field Company in 43rd Division. The end of the war found him involved with the clearance of a number of sea mines on roads approaching Hamburg and Bremen. A wartime colleague writes " ... many people will bear witness to Mike's reputation in the Corps. I can only say that it was a privilege to serve under him and learn from his professional skills. Beyond that, his calmness, kindness and good humour were an example to us all." After the war, he served in Egypt and Palestine first as Second-in-Command RE and then as Brigade Major 7th Infantry Brigade in 3rd Division.

Crosthwait returned to England in 1947 as SO2 RE HQ EinC at the War Office and then had two years in Germany first as a DCRE and later as Second-in-Command of 38 Corps Engineer Regiment. After attending the JSSC he went to America in 1953 as an exchange officer with the United States Army Corps of Engineers. Returning in 1955, he joined the Middle East team on the Joint Planning Staff at the Cabinet Office, where no doubt Suez among other crises kept him

Brigadier M L Crosthwait MBE (p80)

busy, until being selected to command 1 Training Regiment at Malvern.

From 1959 to 1961 he was AA and QMG East Anglia District and in 1962 went to Germany to command 11 Engineer Group at Hameln. In 1965 he returned to England for two tours at the War Office, first as DDPS and lastly as DEinC.

After his retirement from the Army in 1970, Michael Crosthwait was appointed Bursar of Darwin College. RMH writes: "These were early days for Darwin and the current reputation of the college for friendliness and administrative efficiency owes much to his efforts. He was liked and respected by staff as well as by the fellows and students." After retirement as bursar in 1981, he became president of the Society for Visiting Scholars of the university. He was also closely connected with Great St Mary's as the secretary of the Property Committee for over twenty years and as a frequent lesson reader. However he continued to maintain a close interest in Corps affairs. Already a contributor to the *Journal* (he won the Cooper's Hill prize for an article in 1947), he continued to write up to the 1980s, the "Early Days" series, annual extracts and comments from the issues of 100 years earlier. He was vice president of the Institution from 1970 to 1975.

Michael Crosthwait married in 1949, Natalie Leonard, and is survived by her and their two sons and daughter.

PJMP RMH MHC

Memoirs in Brief

Brief memoirs are published below of men whose deaths have been notified recently in the press and who served in the Royal Engineers.

Raymond Berry, who died on 22 December 1996, was chairman of Berry's Electric, which manufactured the famous flickering coal- or log-effect fire known as Magicoal. As a result of Berry's success in marketing this fire, invented by his father, Herbert, the Magicoal flame flickered in countries all over the world, from Canada's frozen north to the deserts of the Middle East. A miniature working model was produced for the Queen's dolls house, and the wardrooms of most RN ships were at one time furnished with one.

Raymond was released from serving with the Royal Engineers to join the family company in 1944 after the death of his elder brother in action.

William Graham Cowan, who died on 1 January 1997, was commissioned into the Corps in 1940, serving in Africa and Italy, and leaving with the rank of lieut colonel in 1946. He was appointed MBE in 1943.

After the war he was assistant MD to the North British Locomotive Co, exporting their products to such countries as South Africa and Spain where they could still be seen in use some 30 years later. Cowan took over as managing director of J H Carruthers & Co in 1950, a post he held for 34 years. During this time the firm gained the Queen's Award for Industry, and, for a crane of his own design which was manufactured and exported by his company, a Duke of Edinburgh's design award.

Cowan had many interests and was president, director, member or in some other way involved in the arts, employment, transport, Save the Children, and the National Trust for Scotland, to name but a few.

Major Lewis Henry Keyes Dunster, who died on 5 December 1996, served in the Corps during WW2, initially working on tunnelling projects in Gibraltar, and later commanding men in the 14th Army in India and Burma. After the war Lewis joined Lehane McKenzie and Shand and was active in the development of the Hymac range of excavators. He completed his career working with the building department of Derby Borough Council.

A keen engineer, he served twice as president of the Derby Society of Engineers, and was also a member of the Plant, and of the Mechanical Engineers.

He is survived by his wife Christine, and by his son, Julian, and daughter, Rosalind.

Captain Bertram David East, who died recently, served in the Corps during WW2. Always known as Barry, he was a property developer, whose company, Town & City, helped to shape the British urban landscape of the 1960s. Also interested in amateur sport, he was at various times president and vice-president of several football and cricket

clubs, and served on committees for the Commonwealth and Olympic Games during the 70s. He also raised money and supported several good causes and charities.

Major Bertram Hughes Farmer, who died on 6 February 1996, served in the field survey section of the Corps from 1942. During periods spent in Singapore, Indonesia, India and Ceylon (Sri Lanka), he gained the experience which led to his life-long interest in geography and the problems of South Asia. He commanded an air survey liaison section from 1944 to 1946, and was mentioned in despatches.

Following war service, "Benny" Farmer pursued a long and distinguished career at St John's College, Cambridge, of which he was president from 1967 to 1971.

The 2nd Viscount Hanworth, who died on 31 August 1996, was a lieutenant colonel in the Royal Engineers, a barrister, the author of two books and project manager of the Blue Streak underground missile-launching site before its cancellation.

Commissioned into the Corps in 1938, he was evacuated from France in 1940, served with 213 Field Company as 2IC, and was Senior Instructor 140 Officer Cadet Training Unit. In 1950 he was SO CE's Branch Hong Kong before being engaged in administrative planning in Singapore. Two years in Northern Army Group, saw him engaged in financial control of the Army Deutschmark. His last appointment was as CI at the SME.

Hanworth took night classes in law and passed his Bar examinations in 1958. After cancellation of Blue Streak, he became director of two companies for a while, assistant director of the Consumer Council, then technical adviser to the Consumers' Association. He sat in the Lords as a cross-bencher, specializing on energy matters.

Lord Hanworth married, in 1940, Isolda Parker, who became known for her work in archaeology. They had one daughter and two sons.

Lieutenant Colonel R W Horner OBE, who died on 24 September 1996, was a member of the Institution, and a wartime Sapper who served in Iceland, India and in Iran where he was engaged in maintaining road routes north of Teheran for the convoys supplying Russia in 1941. After the war he joined London County Council as senior engineer for the design of the Northern (later Beckton) sewage treatment works, later becoming operations manager for both Northern and Southern sewage works. In 1960 he was appointed Deputy Chief Engineer for Middlesex County Council and five years later Regional Engineer for GLC main drainage department. While with the GLC he became project manager of the Thames Barrier project, in which he collaborated with another Sapper, Colonel Stuart Gilbert. This great project by which four great gates can be drawn up to prevent surges from the sea flooding Greater London, has since proved its worth on many occasions. It was opened by the Queen in 1982, a few months after Ray Horner's retirement.

Ray Horner married, in 1941, Ruth Miller; they had a daughter and a son.

Major David Floyer MC, who died in November 1996, was a barrister and former executive of Burmah Oil, who served in the Bengal Sappers and Miners from 1942 to 1946. His war years were spent in India dealing with troubles in Waziristan until he joined 71 Forward Company in 1945 to take part in Operation *Zipper*, the invasion of Malaya. This operation was pre-empted by the Japanese surrender and shortly afterwards he was sent to Java in command of his company during the campaigns against the nationalist rebels. There Floyer witnessed the murder of his brigade commander during "peace" negotiations with the rebel leader – a fate he escaped by diving through a window into a canal and swimming to safety. Shortly afterwards his company was attacked and his leadership and enterprise resulted in the defeat of superior numbers after he had personally directed mortar fire from a position only a hundred yards from the enemy line.

After the war, Floyer took an engineering degree at McGill University and then returned to England to qualify as a barrister. After 20 years with Burmah Oil, mostly overseas, he returned to England to practise at the Bar. He retired to his home county of Devon and for ten years was governor of a school for blind and partially sighted children.

Correspondence

THE LAST OF THE KOI HOIS

From: Lieutenant G P Webb BSc(Eng) PEng

Sir, – Kirkee and Dighi in 42/43 retained much of the old Raj customs and protocol.

Part of this routine was the habit of some older regular officers to enter the mess anteroom at midday and call out "Koi Hoi?" meaning literally, "Anyone there?", but in practice, "Wake up!". On the hurried appearance of the mess bar man the officer would shout, "Chotta Peg Lao" or "Burra Peg Lao" depending on the degree of his perceived need for a tiffin-time stimulant.

One recalls a particularly somnolent individual who never seemed to be completely awake, was never observed to converse, except for an occasional muttered monosyllable. The only time he seemed to come fully alive was when he entered the mess and shouted "Koi Hoi!".

The influx of young officers from England brought a radical change to mess habits. The new blood brought enthusiasm, youth and a temperance at variance with the traditional behaviour.

Yet one retains a fond nostalgia for those early days in the Indian Army – a certain regret for the passing of the last of the "Koi Hois"! Sincerely – Geoff Webb.

SUSTAINABLE METHODS FOR CLEARING LANDMINES AFTER CONFLICTS

From: Brigadier J H Hooper OBE DL

Sir, – I was interested to read Johnny Wyatt's letter in response to the Warwick University article and my letter in the August *Journal*. There have been other responses direct to me and the team.

I will leave Warwick to deal with the objections he raises on the grounds of "administrative headache" of better and cheaper detectors etc. Suffice it to say that Warwick has been successful with its sustainable approach to personal protection equipment in Cambodia and there is great interest in it in Angola and Bosnia. I will, however, take up a few other points.

Thanks to the help given by the RSME, members of the Warwick team were able to get very thorough mines awareness training before they went to Cambodia, Angola and Mozambique. At least one of the team has spent many months in Cambodia and, dare I say it, I have made the odd contribution to the general pool of experience from my time abroad especially in Egypt, Oman and Cambodia. I consider the Warwick team, more than most, has a good understanding of the practicalities of demining. Been there, done that, bought the T-shirt!

Clearly, we have doubts about the benefits of rapid partial clearances. It is, however, a valid discussion point and we are concerned that while nations dither and waste money people are still being killed and maimed at an appalling rate. As for the percentages rubbish I am sure Johnny is aware of the ludicrous UN requirement for 99.6 per cent clearance. If only we knew how many mines were in the patch in the first place we would be a huge step forward and even then no one, but no one, can give guarantees whatever the cowboys say!! I wish the UN would try to understand the problem. As for the UN's waste of money ... words fail me.

At one stage in negotiations with the Overseas development agency (ODA) I believe I got ODA to accept Warwick as a clearing house for just the sort of things Johnny advocates in his plea for a central technical body to coordinate etc. I even used the phrase "a centre of excellence" which was accepted. Needless to say no financial help was forthcoming but there always seems to be money for civil servants and politicians to go on fact-finding missions to countries on which Warwick, I suspect Johnny, and certainly I, have thick files.

I am grateful for Johnny's contribution to the debate but I would be a lot more grateful for some serious money to further Warwick's very successful research work. Any offers? UN are you listening? Yours faithfully – John Hooper.

From: Brigadier P M Blagden CBE

Sir, – I sympathize with the views of Brigadier Hooper and those of Lieutenant Colonel Wyatt, and I too am disillusioned about difficulties in creating sustainable mine clearance, but not for the same reasons. Currently, the organizations trying to coordinate and control mine clearance rarely have the money or manpower to carry out the aims that they have set for themselves. The UN should be the obvious world "mine action" authority, but they are chronically under-funded, and

there is a lack of international will to change this. As recently as 1994, the independent audit committee that agrees UN expenditure (of which the UK was at that time a member) turned down an application to raise the UN Mine Action Office staffing from one post to two.

I do not agree that the commercial sector is a problem – in some countries it is difficult to think who will clear the mines, or teach local people to clear their own mines, if the commercial sector does not. The industry has its share of cowboys, but when it comes to letting contracts, these are usually weeded out unless they have powerful national or local government backing. There are some highly competent companies around, whose experience of clearance is considerably more than any army. Likewise there need not be a lack of quality audit (QA), and most current commercial contracts for mine and munitions clearance contain QA clauses. Some claim that these are not enforceable; I do not agree. If there is national will to enforce them, they will be enforced.

The main problems in the mine clearing industry stem from lack of funding, and lack of national and international support. Most of the peripheral ills mentioned by Lieutenant Colonel Wyatt stem from these principal shortcomings. There is a major lack of safe and effective mine clearance technology, but again this comes back to money and national and international will. Here, I agree with Brigadier Hooper that there is duplication and waste, as different research centres fail to communicate or cooperate with each other, even when they come from the same country.

In the meanwhile, there is plenty of work to be done, and I recommend anyone interested to shed their reluctance to participate, and get involved. Please try to do some active international humanitarian mine clearance first, to have a look at the problems at first hand, but then come and join those who are trying to right the ills highlighted by Lieutenant Colonel Wyatt. Yours sincerely – Paddy Blagden.

From: Andy Smith BA

Sir, – I read with interest Lt Col J R Wyatt's letter in response to the article I co-authored in the August *Journal*, and would like to respond in two areas. I hope the lieutenant colonel will not be offended if I suggest that his experiences seem to have left him understandably cynical both about what can be achieved in the manufacturing sector of developing countries, and about the demining "industry" itself.

The first area on which I take issue concerns the Development and Technology Unit's main claim to experience and expertise: local manufacture in developing countries. Lt Col Wyatt suggests that local manufacture of non-technical items would "in most cases" be an administrative headache and would not save money. I agree that such sourcing can be hard to establish, but the experience of most NGOs is that it is the only way for assistance to lead to genuine *development*. Interventions that rely on imported equipment and expertise almost always fail as soon as those props are removed. For *sustainable* mine clearance to be established, the means to continue and expand clearance *must* be affordable within the national economy. Also, it is my experience that the real cost of local production (established with care and forethought) is significantly lower than the lieutenant colonel seems to think. I am not alone in this opinion: many mine clearance NGOs find that local purchase both saves money and reduces the headache of trying to import manufactured goods to post-conflict regions. Examples are abundant: Norwegian People's Aid in Mozambique have trained locals to make uniforms, probes and trowels, and have PMN2 (Russian antipersonnel mine) disarming equipment made for them in neighbouring Zimbabwe. The Mines Advisory Group, which has long recognized the need for sustainable ground clearance to be interwoven with other development initiatives, sources as much equipment as possible locally and sets up manufacture when necessary. Even the Halo Trust, with a UK management that almost uniquely clings to the idea that they have no role to play in broader development issues, finds it convenient to source uniforms, probes and as much equipment as possible locally in Cambodia. The UN in Mozambique has a policy of buying as much equipment as possible on the local market. The German nongovernmental organization MGN *(menschen gegen minen)* in Angola does likewise. The list could go on but I think I have made my point. Mine clearance NGOs already buy locally, although sometimes what they buy on the local market has been imported. In my experience it is neither difficult nor expensive to have simple equipment made locally – as long as you recognize that doing so will require skills and experience other than those directly associated with mine clearance.

Perhaps Lt Col Wyatt had the local production of detectors at the forefront of his mind as he wrote? Certainly, an attempt to set up reliable production of sophisticated equipment in a post-conflict country with a ruined economy would be, at best, a gamble. Our suggestion is that manufacture of such goods could be undertaken in a neighbouring country, reducing costs and supporting the regional economy. For example, to serve the demining groups in Angola and Mozambique it may be possible to manufacture detectors in Zimbabwe (which has a sophisticated manufacturing base and a relatively stable economy but much lower production costs than Europe). In this example, our projection of cost savings (without loss of performance) is of at least 75 per cent, and since detectors are the most expensive single item of equipment used in manual clearance, this saving might be significant enough to allow many more deminers to be employed in the field.

Lt Col Wyatt goes on to question the suggestion that the toll of civilian casualties might be reduced by a two-stage mine clearing process. This is his area of expertise but I hope he will bear with me if I offer an opposing point of view. The questions he raises here are valid but the answers can only be subjective because the method has not been *formally* tried. That said, a two-stage clearance is used *informally* in many areas where untrained local people "deal" with devices as best they can prior to the arrival of trained demining teams. In Cambodia, for example, where the most optimistic estimate is that it will take 50 years to clear the known mined areas, remote villagers have little choice but to deal with obvious problems themselves. While waiting for formal clearance teams to arrive, between 50 and 75 people a week are joining the crippled beggars in Phnom Penh and at least as many are estimated to be dying in the field.

I was in Cambodia earlier this year and visited abandoned and repopulated villages that were no longer part of the battlefield but have been mined several times. The people picked their way around in what was obviously a rehearsed daily ritual of keeping to known ground. I have never felt more useless than when I watched women and children paddle away through mined paddies that give rice and take limbs. The number of limbless, blind and disfigured victims in that country made the need to increase speed of mine clearance "blindingly" obvious to me. And meanwhile the slow hand clearance goes on...

Lt Col Wyatt may be right to doubt the two-stage approach but my opinion (emotionally based of course) is that the rapid clearance of *most* (90 per cent plus) of the AP (antipersonnel) mines would reduce the carnage dramatically. I cannot present a compelling argument for this, but I *believe* that it could be achieved using a very small mine clearance machine, remotely controlled and built to withstand AP blasts. Such a machine is on the drawing board. It would cost very little compared to its big brothers used for minefield breaching, and so would be expendable if it detonated a larger device. Small machines have been developed before (notably by the Israeli arms industry) but are very expensive and not designed for regional manufacture or use by relatively unsophisticated operatives. Run in tandem with mines awareness initiatives in the part-cleared areas, and followed up eventually by manual clearance, such a strategy could be very effective. Of course, machines are notorious for leaving the odd mine behind, not to mention unexploded ordnance, so it would be necessary to integrate its use with a mines awareness programme that warns people of the remaining dangers. This would not be hard to arrange as most affected countries run some kind of mines awareness initiative alongside or in advance of mine clearance. Lt Col Wyatt seems to think that the eventual follow-up clearance might be less than thorough. He may be right. I would go further and say that in some countries follow-up clearance may never happen. None of us can know whether thorough standards will apply five, ten or twenty years after the ex-pats have left, but in some countries it seems unlikely. In that case, at least most of the mines in low priority areas will have been cleared in the first pass.

Having spent some time working with demining operatives in Mozambique and Cambodia, I think I understand why Lt Col Wyatt lacks optimism. I have seen some of the petty jealousies, met cowboys and treasure hunters, and met others who had taken as much as they could of hitting their head against this particular wall. But I have also seen commitment, achievement and enthusiasm. Sometimes it does seem hopelessly disorganized, but with short-term emergency funding and no overall authority, this is not really surprising. There is hope Lt Col Wyatt – with no money and only grudging support we have to believe that! Yours faithfully – Andy Smith, Manager – Mine Clearance Support Programme.

A SEARCHLIGHT ON A PHONEY WAR

From: Major J W Winckworth OBE DFH CEng FInstE MIMechE MIEE

Sir, – I was very interested in the article by the late Col Gabriel, in your December 96 issue. He was the junior officer in No 1 Section of "B" (not No 1) S/L Coy RE in 1939-40, and I was the junior in No 2 Section with Joe Inglis as OC.

However the article omits some of the odder incidents in which the unit was involved. On the move from Blackdown to Southampton we were stopped at a movement control post and refused passage as we were not on the list of units for loading for France. Protesting that as part of 1st AA Bde we must be, eventually we were told to go and hide in some woods near Romsey where provision existed for units in transit (two water taps). After a day or two we received orders to get to the docks, and rejoined the main body of "B" Coy on Southampton Common.

After we had been in France for some weeks the Secretary of State for War announced in the House, in reply to a question, that there were no searchlight units in France. This caused some concern as wives were writing to the men demanding to know where they were, why they were pretending to be in France and who was the hussy they were assumed to be with. Eventually it transpired that movement control had been right, officially we were manning sites down the Thames and not in France at all. Quite unknown to the War Office we had bluffed our way out, and the trouble had been caused by the omission of the clause "less 1st AA Bn RE", lost in transmission.

A friend of my sergeant, "Smudger" Brown (who I owe an immense debt to for his tactful guidance and ever-ready excellent advice), from the School of Coastal Defence Lighting at Gosport, said that one evening an order went up that as from the next day all RE staff were transferred to the RA and would draw the necessary badges etc from QM stores.

On morning parade the following day there was not a sapper to be seen. Then from the area of their quarters came the sound of *Wings* played in slow time and a sapper carrying a cushion covered by an RE flag on which rested an RE badge. He was escorted by a party bearing picks and shovels, followed, in impeccable order, by a body of Royal Engineers. They formed a square in the middle of the parade ground, dug a hole, buried the badge, sounded the *Last Post,* and marched off in good order. No sapper was seen within the barracks for the rest of the day.

The powers that be were, it seemed, rather upset, and as all RE officers had disappeared for the day, advice was sought from the War Office. Late that day, an order went up cancelling that of the previous day.

The following morning, shortly before parade time an improvized band was heard to start playing *Wings* in quick time. The same party marched onto the square, ceremonially dug up the cap badge and marched back to the RE quarters. When time came for the normal parade the sappers were there in full strength. Was it because of this demonstration that we, some 12 officers and 600 men, were saved from an awful fate? Or was Sgt Brown pulling my leg?

"B" Coy became the 12th, and "A" Coy the 13th Chemical Warfare Trg Bn. Chemical warfare sounds rather nasty but the units I served in included heavy mortars, rockets and flame. Early in 1943 their number was reduced and the survivors mostly turned into various forms of assault engineers which still included among their senior NCOs a number of the old "A" and "B" Coys. No less than 16 ex-chemical warfare units, now in other form, returned to France on 6 June 1944 and by chance, as far as I can check, there was one ex "B" S/L Coy officer with each of the three assaulting divisions, and we had all served in No 2 Platoon. Yours sincerely – John Winckworth.

From: Major A J Hardiman

Sir, – I was interested to read Rob Gabriel's account of 1 S/L Regiment in 1939, as I also was a young officer in B Coy. To me an outstanding memory of those days not mentioned by Rob, was the fine quality of the reservists who served in this company. They were called back from all over the UK, and were posted to Blackdown to rejoin a searchlight unit which included some of the more senior subalterns and younger ones from SME courses, such as Rob and me, who were section officers. As Rob rightly said we knew very little about the complicated searchlight operation.

There were six lights in a section, each one in the charge of a corporal who was not only much older but certainly more experienced than the young officers. Each attachment was sited three to four miles apart in positions dug in fields near farm roads. Our location from September 1939 until February 1940 was in the Calais-St Omer area, now intersected by the Paris-Calais motorway.

During that period we never exposed our lights. In daytime they were switched on to dry out. This lack of activity must have been disappointing for reservists who had so much experience to offer.

Conditions for those living on these sites were tough, the worst features being the rain, cold and the white Christmas of 1939. Consequently the maintenance of morale was an important feature. The cheerful spirits of the reservists, some of them quite elderly, was of great assistance in this respect, backed up by the section officers, who made great efforts to supply their daily needs, so often delivered to detachments after midnight in pouring rain.

Rob referred to Frances Day. When she arrived I was the entertainment officer for the event. Finding that the lighting at the St Omer concert hall was insufficient she refused to perform. So I called in our searchlight technical staff, who quickly righted the matter. So despite not having gone operational, they did serve some useful purpose!

The main object of this note is to underline the high calibre of the reservists of those days, and the vital contribution that they made to the war effort. Yours faithfully – John Hardiman.

THE THREE "Rs"

From: Colonel R J Griffiths MBE

Sir, – The lively and erudite article "The Three Rs" (December 1996 *Journal*) does indeed pose a number of questions. HQ RE TA was established to find the answers and our progress to date gives cause for optimism, not least for our agreement with some of Major Willis' suggestions.

He is right to identify the over-arching importance of *Relevance*. The TA was an insurance, with a relatively low premium, against an imminent Warsaw Pact threat. The Pact no longer exists and any future threat from that direction would take some years to rebuild. The likelihood of nuclear attack *tout azimuth* has also diminished. Our spending on regular forces has been correspondingly reduced and the premium we pay for the TA is now more significant. We would be remiss not to scrutinize this expense, given the changes in the military situation.

The vacuum left by the demise of the Warsaw Pact has been filled with good intentions for a new world order but also, sadly, a succession of intra and inter state conflicts, some of which threaten our own interests and those of our close allies. Our regular forces are being structured to provide the "capability" for expeditionary intervention, more likely in concert with close allies, to safeguard our vital interests abroad. An expeditionary army can only be effective if it is ready to deploy *without delay* and the scope and complexity of likely tasks in this context demands the leadership of professional officers and NCOs. Readiness can best be achieved with full-time soldiers in quarters rather than part-time soldiers living in their own homes.

The cost of a regular standing army for expeditionary purposes is justifiable but a standing army capable enough to meet every eventuality is hardly sustainable. We therefore have to accept that our regular army could become overstretched or their capability be exceeded by demand. An ex-regular soldier is a useful back-up but is limited by his degree of skill-fade. A citizen who voluntarily contracts to be regularly trained (but not quartered) in formed units by professional officers and NCOs is the next most affordable military resource to call upon before we have to resort to more costly and burdensome compulsory service. Individual reservists and TA should be prepared to augment the regular army with individuals and small groups. The TA should also prepare to increase the fighting power of the UK with the provision of formed units and the basis for further force regeneration, should the scale and duration of conflict demand it. The new Reserve Forces Act is designed to facilitate more use of individuals but preferably on a voluntary basis, with minimal domestic and economic impact.

We will not sustain regular volunteer forces without popular support. A high level of operational commitment focuses public attention on the regulars but it is easily distracted by issues closer to home when operational commitments are low or protracted. With the regulars away on operations or concealed behind the anti-terrorist security curtain they are no more visible to some than a "broken-down 4-tonner on the M4"! The TA is a part of the general public and it has positive affiliations which reach into every niche of British society. This valuable channel of communication should be two-way not only to help the regulars put their message across but also to learn the strengths and weaknesses of the TA in order to make best use of it. We are now developing new affiliations between regular and RE TA units.

The role of the TA is as relevant to national defence today as it was in the days of Sir Ian Hamilton and Lord Haldane. An organization which offers accomplishment will retain its people and make recruiting easier. HQ RE TA has

therefore focused on training. We are endeavouring to identify a better compromise between that which the professional regular army expects and that which a citizen volunteer can reasonably be expected to achieve against domestic and economic demands of life in Britain today. Perhaps then we can make a dent in the traditional 30 per cent turnover the independent TA suffers and bring it down to the better percentages of the TA specialists. We are breaking down regular training into three categories for the RE TA, ie that expected in peacetime, that which is required between mobilization and deployment and that which is not required. A clearly understood compromise will also help reconcile the hard-won professional military standards of the regular to the part-time experience of the volunteer and give the latter a good conceit of himself as a soldier. The training should be accessible, progressive and motivating. It should contribute to the volunteers' personal portfolios of skills and qualifications. Our proposals, many of which are original, have been provisionally accepted and we are about to trial them with 71 and 72 Engineer Regiments (V) in 1997. The wider army has also demonstrated serious interest and support.

If the army wants to make better use of individual volunteers then it must aim to recruit from the age group which has the capacity to give the most time, say 17 to 23 years of age. The majority of this group will be either in tertiary education (facing increasing personal costs but with long holidays to train and earn), gapping or deciding on which career path to follow. Many will have yet to take on family responsibilities. They should be looking to enhance their portfolios and the means to sustain themselves. The value of TA training and pay are still exploitable recruiting facets. Increasing employment mobility should allow the army to use more senior volunteers on an opportunity basis. Our RE TA progressive leadership and management proposals are designed to allow RE TA SNCOs and officers more service opportunities as well as their contributing more to the training of the RE TA, particularly between mobilization and deployment.

Our recruiting marketing must distinguish, as the regulars do, between officer target groups and soldier target groups. We can thus better identify the personal benefits of volunteer service. Our recruiting marketing requires more central direction and discipline to ensure both corporate identity and that key messages are passed down from the national to regional/local levels in the most cost-efficient manner. HQ LAND, DAR and the TAVRAs are already proceeding on this tack.

Major Willis' questions and suggestions concerning the TA go back beyond the time we first set aside village greens for archery practise. Call it fyrd, general levy, trained bands, general militia, local militia, yeomanry and volunteers, territorial army or anything else and the three "Rs" will still remain *relevance, retention* and *recruiting*. Trying to get them right will serve us well enough for future use. Should we face any further onslaughts from accountants, I extol the defiant finger gesture of our longbow-men forebears at Agincourt – made less in the confidence of the fléchette against armour, more in the knowledge that we are still good value for money. We should be prepared to adapt and accept that our size and shape may change but *requiem* is most unlikely in our second millennium! Yours sincerely – R J Griffiths.

RESTRICTED SITE BRIDGE BUILDING

From: Major A G Marsden

Sir, – In his article in the *Journal* of December 1996, Lieutenant Thomson describes a restricted bridging site at Kulen Vakuf, but does not say how he actually built the bridge, except for demolishing a house and some steps.

He goes on to say that training at present does not provide enough guidance on restricted bridge sites.

His problem seems to be typical of those encountered time and again by Eighth Army throughout the Italian campaign. We had no training in this either. The first operational Bailey was only built in November 1942 in Tunisia. Compared with what were to follow in Italy, there were precious few built, in the Mediterranean theatre at least, during the following period. There was no precedent for restricted site building, and we just had to get on with it.

The various expedients included the obvious one of leaving the front of the bridge undecked and using the decking as counterweight. In the case of a double story, leave the front as single, and use the spare equipment as counterweight too. Counterweighting had the obvious disadvantage of having to manhandle the equipment to the back of the bridge each time before booming out. An alternative was to build a gantry, which sat astride the bridge, which moved forward under inverted rollers. Or one could build one or more temporary piers to reduce the launching span and/or make

more room to build. There was even a case of the bridge components being manhandled across the gap to be assembled on the far bank. All this, of course, was time-consuming, and which method was employed had to depend on the circumstances at each site.

As for training, Eighth Army and Allied armies in Italy issued a stream of notes on building and other subjects. RE Training Memoranda published by the War Office came later. Courses at the SME, Capua, helped, though it was sometimes a case not of them teaching us, but of us teaching them. But that, of course, is what the lessons on the campaign are all about.

What the official histories, and even articles in the *Journal* during the years following the war had to say I do not remember, but there must be a lot of information tucked away somewhere, under half a century's dust, if one knows where to look for it. Yours faithfully – A G Marsden, Major (retd).

ARMOURED ENGINEERS AND MILITARY BRIDGING

From: Major R E Ward

Sir, – Although I have been out of the Army for 32 years I have been absorbingly interested in bridging since boyhood and have endeavoured to keep in touch by reading the *Journal*, the *Sapper*, and anything else I can find, and also by visiting sites whenever possible (such as the new Normandie Bridge and the new Severn Bridge) while under construction.

I have therefore found Lieutenant Thomson's account of bridging in Bosnia of tremendous interest, and I particularly admire the coloured photograph of the MGB at Kulan Vakuf which I have framed and put up opposite where I write.

I was particularly intrigued by his final question – "How should troop commanders be taught to build on restricted sites?" Having had some experience of this in the Wadi-el-Kuf in Cyrenaica (RE *Journal* April 1992) I ask myself "How did we learn?"

While in the UK during the war we nearly always trained on unseen sites on major rivers, all over the country, but few of these were anything like Bosnia. In northwest Europe I saw many remarkable bridges but, being in an assault squadron, we only built one large continuous Bailey, the rest of our work being with assault bridges and ferries: again nothing like Kulan Vakuf. But in Italy, where I never served, I have read that such conditions were much more common and towards the end of the war and during the early years of the peace we were able to read about these in the regular RETMs (Royal Engineers Training Memoranda), documents which I am told are no longer in use.

So it seems to me that by the time we reached the Wadi-el-Kuf one was not unused to the idea of building on cliff roads and sharp curves – in fact one was very eager to try it out. In fact we had to cut away a lot of cliff to make a turning circle for low-loaders – NOT for tracked vehicle that can slew – and also a recess to clear the tail. So what I am trying to say is that one must learn from reading the experiences of others as well as by direct experience which may be hard to come by. Lieutenant Thomson refers to Sir Alan Harris' article in the August *Journal* and I see that Sir Alan says "That he must study", and refers to Napoleon!

Maybe earlier RETMs can be resurrected and perhaps Robert Thomson and his colleagues can produce similar reports, like the old RETMs (giving more detail with sketches than in the *Journal* – from which I find it hard to follow the exact method because I am NOT familiar with the MGB). Perhaps a full set of reports from Bosnia, like those from Italy would be valuable, especially for those who were not there, or will follow later. (Maybe they are in hand?)

Actually I did train my troop commanders on dry wadis in Palestine, in quiet periods, but by the time we reached the wadi they had all been demobbed and I did not have a troop commander at all but I did have an extremely experienced sergeant from Italy, now In-Pensioner SSgt Bill Chalmers of Chelsea; aged 85 this year! When a new national service troop commander arrived we were on the point of launching so, as he had just come down from Cambridge, I made him fully responsible for all the launching calculations and from then on he took full charge working very happily with Sgt Chalmers and they did the most difficult part of the launching and jacking while I was away on a course. So it seems that, as in 26 in Bosnia, a combination of academic and practical experience does the trick.

Other books that are very valuable for studying the lessons of the past are "The RE Battlefield Tour – The Seine to the Rhine" and "Bridging Normandy to Berlin", both issued in BAOR in 1947. When I visited 28 Amphibious Engineer Regiment on exercise on the Rhine in 1991, the then Colonel Tom Foulkes told me that he was in the habit of studying an episode from the

"RE Battlefield Tour" daily and he pointed out that constraints of finance and environmental bureaucracy made it very difficult to get realistic training. That is why he advocated studying past operations – others have told me the same.

Incidentally I was employed at Chatham on part of "Military Engineering Volume III, Bridging", but Tom Foulkes also told me that such books are no longer in use – nevertheless the 1957 edition which I have here does give some advice on launching on restricted sites – it might still be of use!

26 Squadron's experiences with resources and loading of HGB, and the handbook, fill me with horror – we used to rely implicitly on the old field park squadrons and the Royal Army Service Corps bridge companies and also on handbooks. I was in resources when the HGB came in but I never heard of any of these difficulties before.

Nevertheless I am filled with admiration for the work of all the Sappers in Bosnia and wish to congratulate Robert Thomson on a most interesting and stimulating article. Yours sincerely – Roland Ward.

"WHITE CITY" REVISITED BURMA – DECEMBER 1996

*From: Major C V E Gordon MC**

Sir, – With a great deal of invaluable assistance, last year I was able to organize a visit to the area called the White City, the wartime Chindit stronghold of 1944, which lies on the southern border of Kachin State in north Burma; a sensitive area from the security viewpoint in that some unrest between the Burmese and the Kachins has only recently ceased.

I joined Brigadier Mike Calvert's 77 Brigade in August 1943 in preparation for the second Chindit campaign in North Burma. As OC 217 Special Section, KGVO Bengal Sappers and Miners, I provided engineer support to 36 Column 3/6th Gurkha Rifles during the operations based on White City in March/April 1944.

"White City" was so named from the number of white air supply parachutes caught up in the trees.

Leaving Rangoon by train late on 12 December our small party arrived in Mandalay on the 15th. After visiting the many sights of Mandalay we headed north in our second train and soon found ourselves crossing the great Ava bridge over the Irrawaddy on the way to Mawlu, some 200 miles north of Mandalay. These two train journeys and the third one back to Rangoon were unforgettable for their discomfort. The carriages were perfectly clean and comfortable but the line was so bad that you were continuously in danger of being thrown from your seat. On our longest journey this continued for 14 hours, with little chance of sleep. (We had decided to avoid air travel to reduce costs.)

Mawlu was reached at five the next morning, and we had a few hours welcome sleep before being taken to White City, a mile to the north.

So the great moment had come – would I be able to recognize anything? At first I was astonished by the number of houses and density of population compared to how I had known it. The population of Burma is now 43 million – more than double that of 1944. In no time I realized that we had reached the bridge over the Nankye Chaung with Pagoda Hill beside it. This was the key point between the road and the railway line which we had occupied during March/April 1944 – blocking communications with Myitkina. The span of 52 years fell away. I remembered my brave companions who had fallen here so long ago. It was very moving.

As we climbed Pagoda Hill we noticed a number of disused entrenchments – bunkers and slit trenches. To my surprise I was told that these were not Chindit defences but had been built by the Burmese army when it had occupied the area during the recent troubles. This brought home to me the transitory nature of life – World War Two is only a dim memory in the minds of a few old people and has since been overtaken by other events.

By this time we had been joined by U San Win, a local villager almost as old as myself, who had been living in Henu village on the arrival of the Chindits in 1944. He produced a spent bullet from those days, and another man presented us with the bent tail-fin of a mortar bomb. I looked south from Pagoda Hill and instead of open paddy fields I could see that the whole area was covered with housing, palm trees and vegetation. I reflected on the satisfaction of seeing the area now full of peaceful happy people instead of the destruction of war.

The rest of White City was unchanged. There was the railway bridge over the Nankye Chaung in front of which I had laid an antitank minefield. There too was the light plane strip from which so many wounded, including myself, had been evacuated by our gallant American pilots. I contemplated searching for my old section position near OP Hill but found the undergrowth impenetrable without tedious cutting. The hills were heavily overgrown but the flat valleys between were planted with

Pagoda Hill, Henu.
Scene of fierce fighting in the initial occupation of White City. It was here that Lt Cairns, South Staffordshire Regiment, won the VC.

paddy, peacefully tended by a local farmer and his bullocks. We were unable to discern any direct evidence of Chindit occupation during our visit, but this was not surprising considering the passage of time. (At his visit in 1962, Bernard Fergusson describes how, at that time, defensive positions were actually visible.) We circled through the main positions and I noted the northern perimeter, which in 1944 was heavily wired and against which the Japanese had thrown so many fruitless attacks.

That afternoon the eastern limits of Mawlu were visited to see the area of Calvert's successful clearing operation. We then visited the stationmaster's office where I had blown open the safe in 1944 only to find a few morse keys and some signal equipment. My relation, Major Colin Pringle, Royal Signals, had later used this to listen-in to Japanese conversations on the telephone line. Also in this area we viewed the railway bridge I demolished after the attack on Mawlu.

Moving north of White City we were partly successful in locating the area of the ambush operation I had been involved in, intended to cut off the Japanese returning from their nightly attacks on the northern perimeter. The approaches were in fairly thick jungle opposite the small village of Thazi, which we could see across the paddy. We scrambled on hands and knees up a steep slope that gave onto an area of more open teak. This looked familiar. Two of the escort stood in the jungle to simulate the Japanese and I recalled how difficult it had been to see them at the time.

We ended the visit by driving a few miles north to the village of Nansiaung. We met three village elders who recalled the war. When asked "Do you remember British troops coming here in 1944?" they replied "Yes, they destroyed Henu and Mawlu villages." This reminded us of the suffering born by the local population due to wartime operations.

That evening a happy crowd of Mawlu inhabitants promenaded past our rest house to view the unusual visitors. I was told that we were the first "westerners" to sleep in the village since 1948.

Our return journey to Mandalay was by launch down the Irrawaddy and, where the river narrows at the Third Defile, we landed to see the monastery of Anyathihataw, near Singu, where 19 Indian Division crossed in 1945. We slept on board and continued next day to Mingun to see the giant bell and the half-finished pagoda.

Since everyone with personal memories of White City will soon have passed on, I would like to think that a small memorial might be erected to mark the location of this battle site for posterity. Maybe I can help to realize this idea. Yours sincerely – Major C V E Gordon.

Correspondence (p91)

Reviews

PRISONERS OF HOPE

MICHAEL CALVERT

First published by Jonathan Cape, 1952. Revised edition published by Leo Cooper, 1971. This revised edition published in 1996 by Leo Cooper, 190 Shaftesbury Avenue, London WC2H 8JL – Price £ 12.95 ISBN 0 85052 492 X

THIS is a book about fighting, fighting as it really is, with all the violence, the danger, the fear, the tiredness and worry that goes with it. It is also about leadership, leadership in battle, and the responsibility that falls on the commander. Three of the chapter sub-headings will give the flavour: "We will impose our will on the enemy", "The boldest measures are the safest" and "No surrender".

The author is a sapper, a brigadier at 30, who took over Wingate's brigade in Burma in 1943. He must have been a hard man who didn't suffer fools gladly, if at all, and with his trenchant views must have been a difficult subordinate. A brilliant leader, who could drive his men ruthlessly when the occasion demanded, Brigadier Calvert was very much a wartime soldier and it is perhaps not surprising that his postwar career was not so successful.

"Prisoners of Hope" reads as fresh today as when it was first written over 40 years ago. It tells the tale of 77 Infantry Brigade, flown into northern Burma in March 1944 as part of Wingate's second Chindit expedition. Overshadowed at the time by events nearer home, this was the largest airborne operation of the war with some 30,000 men and 5,000 animals being landed behind the enemy lines and maintained for several months. There was even a flight of Spitfires based for a time at Broadway, 77 Brigade's stronghold east of the Irrawaddy, where they constructed an airstrip. This airstrip, and several others, all constructed some 150 miles behind the enemy's lines were not only used for resupply but, more importantly, for the evacuation of sick and wounded, a great morale booster when the alternatives were stark indeed.

Michael Calvert led from the front, where the commander can influence the battle, and he was often involved personally in counterattacks and hand-to-hand combat. Whether this was the right place for the brigade commander, the reader must judge for himself, but he never asked his men to do anything he was not prepared to do himself. He was a great protagonist of Wingate's ideas and can hear no ill of him. Others were not so enthusiastic and deemed Wingate a fanatic who was determined to get his own way and could not be trusted to tell the truth. Slim, the army commander, commented that few could meet so stark a character without either being violently attracted or repelled. He had no such reservations though about Brigadier Calvert who he considered one of the most distinguished of all the Chindit commanders.

It is not often that memoirs can be classed as "unputdownable" but this account is certainly in that category. It is full of little nuggets and some quite outrageous comments that cannot but make one smile and the reader will certainly not agree with every word. He will however find this book both provocative and thought provoking, as well as a thoroughly good read.

GLC

THE CHARGE

THE REAL REASON WHY THE LIGHT BRIGADE WAS LOST

MARK ADKIN

Published by Leo Cooper, Pen & Sword Books Ltd, 47 Church Street, Barnsley, S70 2AS – Price £19.95 ISBN 0 85052 4695

THIS is, almost certainly, the first complete book by a professional soldier devoted to a detailed study of the charge of the Light Brigade. The author's research has covered every first-hand account known to most experts. He has painstakingly considered the actual ground, calculating what could be seen from where and, more important, what could not be seen; and he has made many time and distance calculations deducing, for example, that (despite Tennyson) at no time was the Light Brigade fired on by guns from three directions simultaneously. There are excellent photographs, maps and, a new idea, sketches as from Lord Raglan's viewpoint at various stages of the battle, so that we are able to see what the CinC could see, the better to judge whether the decisions he made, and the orders he gave, made military sense. The author questions several long-standing beliefs about

the earlier events of the day – the stand of the 93rd and the Heavy Brigade charge – and of course about the Light Brigade charge itself; in each case he gives thoughtful reason where he disagrees with the existing belief. Not everyone will agree with the conclusions but they will find the book compulsive reading. It is a major contribution to the literature on the subject, destined to become the standard work on one of the most famous incidents in British military history.

CR

IMPERIAL ECHOES
Eye-witness Accounts of Victoria's Little Wars
Robert Giddings

Published by Leo Cooper, Pen & Sword Books Ltd, 47 Church Street, Barnsley, S70 2AS – Price £18.95
ISBN 0 85052 394

This is a whirlwind tour of the British Empire at war told through the eyes of some of those who took part. Despite the subtitle it includes the whole of the nineteenth century and thus starts with Wellington in India. There are 28 chapters each covering a campaign or battle grouped by area so, for example, India gets six – from Wellington's campaigns to the Mutiny, Africa twelve – from the First Ashanti War (1824-31) to the Second Boer War, and so on. As the content comprises largely quoted material the author's own introductory comments on the build-up and background to each campaign or battle is necessarily very succinct and detailed descriptions of battles only appear insofar as they are given in the eye-witness accounts. This is no criticism; more admiration for a tour de force in which a vast amount of material has been reduced to its essentials and the stories speak for themselves. In fact, in this way, the book forms a handy reference for the bare essentials of those little and not-so-little wars for those of us who have difficulty in remembering such matters as whether the Zulu War came before the First Boer War or vice versa and just in which, if any, Sir Garnet Wolseley did not take part.

There are obviously some disappointments in this treatment where complicated situations have to be oversimplified. For example, of Isandhlwana we learn that "General Thesiger left with a reconnaissance party, leaving the camp command under the command of Colonel Anthony Durnford" thus neatly, and to many inaccurately, ducking one of the most contentious matters of the Zulu War – just who was in charge that day, Durnford or Pulleine of the 24th? Again, the responsibility for the Second Boer War appears to lie squarely on the shoulders of Rhodes with the aspirations of the British government and Milner somewhat glossed over. These finer points of debate are not the aim of the book which is full of colour and excellent background to anyone just wanting to get a feel for how the British thought about their Empire and the consequences of maintaining and expanding it.

In such a selective book it must be difficult to decide what to include and what to leave out. India is slightly unrepresented where the Scinde and Bhutan campaigns are excluded as are the many North-West Frontier fights. But it is good to see the Gurkha War, two Burma wars (though no mention of Prendergast) and two Maori wars covered, all fierce affairs often forgotten, not to mention two Kaffir wars. Also, the Sapper interest is slight. Only Gordon is quoted (and that in the Crimea) although of course Napier and Kitchener appear in the stories. The more is the pity as one of the author's dedicatees is his brother, national serviceman Reginald James Giddings, Sapper, Royal Engineers 1947-49. Certainly the Corps Museum and library could offer a wealth of eyewitness material from the archives every bit as interesting as that included in the book. Perhaps Robert Giddings might be persuaded to include some in following up with this successful and enjoyable formula.

GWAN

GO TO YOUR GOD LIKE A SOLDIER
The British Soldier Fighting for Empire 1837-1902
Ian Knight

Published by Greenhill Books – Lionel Leventhal Ltd, Park House, 1 Russell Gardens, London NW11 9NN – Price £29.95
ISBN 1 85367 237 8

Foyles bookshop has recently introduced a separate subgroup in its military section for "Colonial Campaigns" to cope with a resurgent interest in the Victorian Army and a resulting flow of reprints of contemporary accounts and the extensively illustrated contributions of modern historians. Our own Corps Library is itself a treasure-house of original Victorian books, journals and reports backed by a representative selection of recent studies. It also has

the advantage of being more accessible than the National Army Museum or similar collections. This new Greenhill book is an ideal introduction for a newcomer to the period.

Mr Knight is a founder member of the Victorian Military Society, a worldwide body of less than a thousand enthusiastic professional and amateur historians, which aims to foster interest in military matters of the Victorian era. He is a former editor of that society's magazine and is currently the secretary of its very active Zulu War study group. He has devoted more than 20 years of detailed attention to that campaign and several of his books on that topic have been reviewed in the *Journal*. Most recently he has given the Corps Museum extensive help in mounting the "Red Earth" exhibition which ran from May to November last year.

In this book Mr Knight has extended his range from Southern Africa and the enemies of Queen Victoria to the whole gamut of Victorian military life. Starting his task with the intention of explaining to the general reader how a conservative organization like the British Army rose to the challenge of colonial campaigning, he soon found he had to include the conventional warfare of the period, as well as the way of life of the common soldier, set in the political context. He has drawn extensively on earlier contacts made through the Victorian Military Society, enabling him to include many rare illustrations from private collections, as well as being assisted by public and regimental museums. Of these he singles out three, including our Corps Museum, as meriting special thanks. He has striven to strike a balance, in his own words, between the dull and ditchwater analytical approach of some current historians and the blood and thunder mythology of others.

Ian Knight has had to achieve a miracle of compression and so inevitably minor errors and omissions can be pinpointed and some sketchy treatment has to be accepted. The organization and development of the Royal Engineers is described in about a thousand words in chapter four supplemented by equal treatment of blockhouses and telegraphic/heliographic communications. Individuals named are Kitchener, Napier, Blood, Warren, Gordon, Durnford, Chard, Leach, Hart and Henn.

One might have hoped for a more representative account of the Corps' development from the limited number of general service and survey companies of 1837 to the 1899 organization, which is given in some detail. The struggle to establish, and expand, from 1855, the RE Train, with its pontoon, general equipment and telegraph troops, through the large increases resulting from Lord Sandhurst's 1885 committee to the tacit acceptance by many that, with the increasing numbers of field companies and the mounted troop, the Corps had become "The Fourth Arm". However it is inaccurate to declare the company strength as 203 (this only applied to some companies and for a short period only); a strength around 120 was more common. The contributions of Burgoyne and Simmons as well as the achievements when attached to other government departments and the colonies could also have been mentioned.

In general this is an enjoyable, if slightly pricey, book by one of today's leading experts in his subject, conveying the flavour of soldiering in Queen Victoria's army in an attractive and authoritative style.

RGM

ON THE FIELDS OF GLORY
The Battlefields of the 1815 Campaign
Andrew Uffindell and Michael Corum

Published by Greenhill Books, 1 Russell Gardens, London NW11 9NN – Price £25.00
ISBN 1 85367 232 7

This is a most interesting history of the short campaign which, probably more than any other, shaped the history of modern Europe. Napoleon was back with a vengeance but, sadly for him, France needed him to prove it before he could be given the unequivocal support of his countrymen. The Allies were, as ever, in some disarray with national and self interest taking precedence over the suppression of a fallen emperor who threatened to re-establish his influence upon the emerging nation states of Europe. He had to be stopped, but how and who by, was less clear.

The authors have provided a thoroughly researched and eminently readable account of the events which led up to what was, in effect, a three-day war in June 1815. A war which resulted in the consummate defeat of Napoleon and a peace in Europe which was to last for 50 years. Waterloo was not an afternoon's scrap in a square mile meadow close to an obscure hamlet south of Brussels. It was the culmination of a skilful campaign of manoeuvre, the outcome of which was determined as much by the courage and endurance of the participants as by any extraordinarily astute

generalship. Wellington described the campaign and particularly its final battle, as a "near run thing". Just how close it was is meticulously related by Messrs Uffindell and Corum. What is particularly valuable is the way they have allowed the reader to view the events from three different perspectives: Wellington's, Napoleon's and Blücher's. This gives a fascinating, three-dimensional view of the campaign which provides a balanced understanding of the whole. For those schooled upon a nationally-biased approach to history this is most refreshing. Blücher's arrival, for example, has traditionally been treated in English texts as both late and almost incidental to the course of the final battle. The authors demonstrate conclusively that this was certainly not Napoleon's view. Indeed, had the Prussians not begun to have a powerful effect on the course of events from as early as 1.30pm on 18 June the French may well have defeated the Allies piecemeal. They had, after all, won at Ligny and drawn at Quatre Bas in the previous two days. Indeed, if d'Erlon had intervened in either battle, rather than marching between the two as the unwitting pawn of Napoleon and Ney, the French would almost certainly have had a decisive victory and Wellington's troops would undoubtedly have abandoned Brussels to its fate rather than deploy for battle at Waterloo. But history is littered with "ifs" and the authors are to be congratulated for exposing many of the crucial ones which have been overlooked in the victors' histories of these events.

The inclusion of a plethora of excellent sketch maps together with carefully researched contemporary material brings this campaign to life. "On the Fields of Glory" is a "must" for students of the history of this period and an invaluable guide for anyone wishing to walk the battlefields.

CMD

SERRE: SOMME

JACK HORSFALL AND NIGEL CAVE

Published by Pen & Sword Books Ltd, 47 Church Street, Barnsley, S70 2AS – Price £9.95, ISBN 0 85052 508 X

THIS IS another book in the Battleground Europe series produced in handy A5 format with laminated covers and suitable for carrying on a battlefield visit. As with its predecessors there is an outline of the battles, in this case June 1915 as well as the main Somme battle and also those of July and August 1918, followed by greater detail on individuals and particular unit actions. *Serre* deals with one of the toughest parts of the Somme battlefield and a particular section deals with the death of the poet Robert Leighton, fiancé of Vera Brittain.

Like its predecessors it is very well illustrated with photographs, both contemporary and recent, maps and diagrams designed to help the explorer round the area. It includes three suggested walks and two car tours. This treatment gives a more thorough insight into the battle than would a more general guide but has the obvious consequent disadvantage of only covering one small area.

GWAN

FIRE AND STONE
THE SCIENCE OF FORTRESS WARFARE 1660-1860

CHRISTOPHER DUFFY

Published by Greenhill Books, Lionel Leventhal Limited, Park House, 1 Russell Gardens, London, NW11 9NN – Price £19.99 ISBN 1 85367 247 5

A TITLE like "Fire and Stone" immediately conjures images of fortifications and sieges. One may relate this phrase more readily to medieval times but this book, by Christopher Duffy, covers the classic period which was dominated by a man called Vauban, Louis XIV's Chief Engineer, (1633 to 1707).

This was the era of engineering science and precise angles. The advance in artillery had rendered the medieval fortress useless. Enfilade fire and mutual support, familiar terms to the modern soldier, became the important method of protection against a siege. Duffy begins by covering the use and siting of fortresses. Borders, mountain passes, important towns, were all given the "Vauban" treatment. Massive angled bastions protected by ditches and ramparts with outer works called ravelins, teneilles and lunettes formed the fortress. Duffy continues by guiding the reader carefully through all the definitions with appropriate illustrations, many from original drawings. He credits all the major military engineers who developed this system of defence but the V-name seems to spring out at every page. He developed the most formidable bastion, perfected the ravelin system, designed the best magazine and so the eulogy goes on.

This chapter is followed by a short section on the garrisoning and sustainment of the fortress. Prussia

had fortress troops (sick, lame and lazy who earned the derogatory nickname *Mauerscheisser*). France cycled its line regiments through fortress duties. Duffy describes the important position of the governor and the command and control system. It is noteworthy that the chief engineer was often appointed second-in-command as he was the only man who understood the full workings of the fortress. The security of a fortress at night had a familiar ring from my own experience in Gibraltar: the guard sergeant-major handing the keys to the governor.

Having described the defence the author switches to the attack. There is a long chapter on the "march of the siege". Vauban was not only a master-defender but also a master-besieger. Few fortresses fell to *coup de main* and the attacker depended heavily on sapping forward to provide gun-lines for his heavy cannon. The weakest point of the fortress was bombarded until a breach was created. The governor was then offered terms for surrender. He often accepted, preventing massive casualties for the attacker, and rape and pillage of his town. One notable exception was Badajoz in the Peninsular Campaign (the Sharpe novel is a fairly accurate account). The British suffered over 5000 casualties in the breach alone. Wellington, normally the strongest of disciplinarians, allowed his troops to ransack everything in revenge.

Duffy concludes his book with a chapter on the great sieges of the period. He assesses that the classic period ended in 1860 due to yet another advance in artillery. Rifled guns rendered the single large fortress with detached works obsolete. It was supplanted by a series of smaller mutually supporting strong points sited skillfully using the ground. Verdun was a classic example in World War One. The much maligned Maginot Line and Hitler's Siegfried Line were similar.

I found Christopher Duffy's book (a revised reprint of an earlier edition) a jolly good read. My personal expertise is in 20th Century fortification plus a good knowledge of Gibraltar. The book filled many gaps. One should always try to learn lessons from history. This account provides many, and as I read I noted a number of similarities where we re-invented the wheel in Northern Ireland. The Corps museum is in the Ravelin building. The basket gabion was the forerunner of that funny wire box which has been so successful in Bosnia. I would recommend the book to any Sapper officer in the hope that he may remember at least one useful lesson for service in the field. This was the classic period of fortification and in this age of media ops protecting our troops is even more important.

Finally a word on that book title. Red-hot shot was one of the most effective attacking weapons in this period. Masonry was vital to a well protected and maintainable fortress. It is worth recalling that in the Great Siege of Gibraltar, the masonry Kings Bastion, the first structure built by the military artificer engineers in 1773, protected the cannon, that fired the red-hot shot, that destroyed the Spanish bombard ships.

GT

A FIGHTING RETREAT THE BRITISH EMPIRE 1947-97

ROBIN NEILLANDS

Published by Hodder and Stoughton, 338 Euston Road, London, NW1 3BH – Price £20
ISBN 0340 635 207

WHILE this book is aimed at a wide public it will be of particular interest both to those whose military careers spanned the run-down of the British Empire and others who followed in their footsteps. Many who were involved may well jib at the use of the word "retreat" in the title, but the author's view is at least tenable insofar as the timing of events goes and it should not put anyone off.

The author relies largely on personal accounts to set scenes and to tell what is a very remarkable and inspiring story. Many names will be familiar. Furthermore the analysis of events is realistic, thoughtful and often illuminating.

Given the book's title, it came as a surprise to find two chapters devoted to Northern Ireland. However they struck your reviewer as the best short survey of the relevant history that he had encountered.

Perhaps this is more a book to borrow than to buy immediately, but it is well worth reading.

JNE

Explanation of Abbreviations and Foreign Words Used in This Journal

2IC ..... second in command
AA ..... anti-aircraft
assistant adjutant
ARRC .. Allied Command Europe Rapid Reaction Corps
ASD ..... army staff duties
AVRE ..... armoured vehicle RE
BAOR ..... British Army of the Rhine
Bde ..... brigade
BEF ..... British Expeditionary Force
Bn ..... battalion
Bundeswehr ..... West German Armed Forces
CinC ..... Commander in Chief
CO ..... commanding officer
COM ..... commander
COS ..... chief of staff
Coy ..... company
CQMS ..... company quartermaster sergeant
CRE ..... commander RE
CSM ..... company sergeant major
DAR ..... Director of Army Recruiting
DCRE ..... deputy commander RE
DDPS ..... Deputy Director Personnel Services
DROPS ..... demountable rack offloading and
pick-up system
DTU ..... Development and Technology Unit
EOD ..... explosive ordnance disposal
etc ..... et cetera
FA ..... Football Association
Fd ..... field
ft ..... feet/foot
FRY ..... Former Republic of Yugoslavia
G3 ..... operations
G4 ..... quartering/logistics
G5 ..... Civil Affairs
GHQ ..... General HQ
GOC ..... general officer commanding
HE ..... high explosive
HQ ..... headquarters
HQ LAND ..... HQ Land Command
hr ..... hour
IC ..... in charge [of]
ie ..... *id est* = that is
Indep ..... independent
ISO ..... International Standards Organization
JNCO ..... junior non-commissioned officer
JAAC ..... Joint Services Staff College
JSSC ..... Joint Services Staff College
kph ..... kilometres per hour
lb ..... *libra* (a pound or pounds weight)
LSgt ..... lance sergeant
Lt Col ..... lieutenant colonel
m ..... metre/million
mm ..... millimetre
MGM ..... *menschen gegen minen*
Mk ..... mark
MLC ..... military load class
MO ..... medical officer
MP ..... member of parliament
mph ..... miles per hour
ms ..... millisecond
MT ..... motor transport
MWF ..... Military Works Force
NAAFI ..... The Navy, Army, and Air Force Institute
NATO ..... North Atlantic Treaty Organization
NBC ..... nuclear, biological, chemical warfare
NCO ..... non-commissioned officer
NGO ..... non-governmental organization
No ..... number
OC ..... officer commanding
ODA ..... Overseas Development Administration
PMN2 ..... Russian *antipersonnel* mine
PSA ..... Property Services Agency
psyops ..... psychological operations
QM ..... quartermaster
QMG ..... quartermaster general
QMSI ..... quartermaster sergeant instructor
RA ..... Royal Artillery
RAF ..... Royal Air Force
RAMC ..... Royal Army Medical Corps
RAPC ..... Royal Army Pay Corps
R&R ..... rest and recuperation
RCT ..... Royal Corps of Transport
RE ..... Royal Engineers
REME ..... Royal Electrical and Mechanical Engineers
RHQ ..... Regimental HQ
RSME ..... Royal School of Military Engineers
RUSI ..... Royal United Services Institution
RV ..... rendezvous
SHAPE .. Supreme Headquarters, Allied Powers, Europe
SHQ ..... Squadron HQ
S/L ..... searchlight
Sgt ..... sergeant
SNCO ..... senior non-commissioned officer
SO ..... staff officer
Sqn ..... squadron
SSgt ..... staff sergeant
SSM ..... squadron sergeant major
STRE ..... Specialist Team RE
TA ..... Territorial Army
TAVR ..... Territorial and Army Volunteer Reserve
TAVRA ..... Territorial Auxiliary and Volunteer
Reserve Association
Topo ..... topographic
Trg ..... training
UK ..... United Kingdom
UN ..... United Nations
US ..... United States
USA ..... United States of America
VCO ..... Viceroy's Commissioned Officer
vip/VIP ..... very important person
Wks ..... works
WO ..... warrant officer
yds ..... yards
YO ..... young officer