THE ROYAL ENGINEERS JOURNAL

AUGUST 1990 VOL 104 No 2

Guidelines for Authors

The Editor is always glad 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, specially if an article is witty.

Length. Normally, chance of publication is in inverse proportion to length. More than 4500 words (5 pages of text) tends to lose most of our readers. Blockbusters can sometimes be serialised.

Clearance. Opinions are an author's own. The wise man clears an article with his boss on any policy matters. Security clearance must be obtained locally.

Copy. Ideally the text should be double space typed and include the author's pen picture and captions for art work.

Photographs should be black and white. Coloured photographs rarely reproduce well unless they are very good quality with sharp definition. A head and shoulders photograph of the author would also be helpful.

Line drawings, if possible, should be drawn in proportion with the page (5.75in x 8.0in). Size is immaterial.

Rewards, can be generous. The committee has about £250 in prize money to allot for each issue plus the valuable annual prizes. All authors receive £5 to cover costs.

Pseudonyms, may be used. They will not be revealed by the Editor under any circumstances.

Contributions to the Journal should reach the Editor by:

9 October for the December 1990 issue
11 February for the April 1991 issue
10 June for the August 1991 issue

Submissions before the deadline will be particularly welcome.

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ISSN 0035-8878

THE ROYAL ENGINEERS JOURNAL

Published in April, August and December by The Institution of Royal Engineers, Chatham, Kent ME4 4UG.
Telephone Medway (0634) 842669 or Chatham Military Ext 2299.

Printed by Staples Printers Rochester Limited, Love Lane, Rochester, Kent

Volume 104 AUGUST 1990 No 2

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4,400

Editorial

THE posts of Secretary of the Institution and Corps Secretary have now been combined and I find myself as first occupant of the joint post. No satisfactory title has been found for this hybrid and I can become somewhat confused as I answer one of the telephones on my desk. I suspect some of the callers are equally confused. But this is nothing new. Frequently, when the posts were separate, the Secretary of the Institution and I received calls which were meant for the other person, and many within the Corps were not clear on our functions.

I can assure members that I find little difficulty in separating the interests of the Corps and the Institution when these conflict and I can put the needs of the Institution first when the situation demands it. What has become quite clear to me in my short period in the post is the valuable function the Institution performs. Reading Lieut Colonel Ayling's article in the April *Journal*, it occurred to me that in the Corps as a whole we have a tendency to try either to make too much of the Institution or to make too little of it. What I am quite sure of is the continuing interest that members show in the affairs of the Institution and what is happening to it. I get many telephone calls and letters on a myriad of subjects from both home and abroad. The *Journal* is read widely and in great detail. Admittedly, interest seems to increase in a direct relationship to the ageing process, but there are articles of great value from younger members, who are quite prepared to make their views known.

There is also a great interest shown by our civilian counterparts in what is happening in the Institution and the Corps. We have had a splendid Joint Meeting with the Institution of Civil Engineers in London, after which we were royally entertained. We have also had excellent joint meetings at local level with not only the Civils but also the Mechanicals, Electricals and Chartered Surveyors.

All this does not mean that we should not seek change. But what I have seen convinces me that we have strong foundations in the Institution. Clearly we can modify or extend what we build on those foundations, but whatever happens we have something worth preserving and cherishing.

As I re-read this, it is clear to me that I have not written an editorial in the erudite manner of my predecessors. For this I apologise. I shall try to do better in future.

Back to Dunkirk

MAJOR GENERAL A E YOUNGER DSO OBE

We are indebted to the author for the following personal account of events during the BEF's retreat from Dunkirk.

At the end of May 1940, 61 Company, Royal Engineers, *defended* a hill near the Franco-Belgian border called *Mont des Cats*. I put the word defended in italics because our actual ability to stop a German attack, if one had been launched against us, was minimal. The orders had been to abandon our transport at Merville, about a dozen miles away, and march to the *Mont des Cats* where we spent the first day digging slit trenches. The trenches were sited to give all-round defence, but the main advantage in completing them was that they gave us comparative safety against attack by German dive bombers, which paid us altogether too much attention for comfort.

I was a 2nd Lieutenant and commanded 2 Section in the Company, under the OC, Major W F Anderson, who had had considerable experience of operations between the Wars in Palestine and on the North West Frontier. Early next day, around 3am, I was woken by a runner from the OC summoning me to his headquarters. There, together with the other two Section commanders, I was told to abandon my position and march back to Dunkirk, a distance of some 40 miles, for evacuation to England. We all realized that the campaign was not going well for us, but this was a completely unexpected order. We had received no information about what was really happening, except that heard on our Company Quartermaster Sergeant's battery operated radio. From the BBC we heard that German troops had broken through to the south and attacked Calais, but had been repulsed there. The reality of this report had been brought home to us in no uncertain way the previous evening, when four German tanks emerged from the wood below, about five hundred yards away. We kept very still in our trenches as we observed them, in the hope that we would not be noticed, because we had no means of stopping them if they should advance against us. Luckily for us they seemed more interested in the big old monastery at the top of the hill, which was the location of our excellent CO, R H Maclaren and his staff. They suffered some casualties, including our adjutant, who was killed there.

I returned to our Section position and briefed my NCOs. There was a glimmer of daylight in the east, so I told them to get their men out of their trenches quickly, whilst they were still invisible to the Germans, and form them up behind the monastery. They all saw the sense of speed, and it only took a few minutes before Sergeant Barrett, my Section Sergeant, reported to me that the men were ready to move. I had been studying my maps and had worked out what appeared to be a safe route back. Unfortunately Sergeant Barrett, with his usual efficiency, had found that two men were missing. It was getting lighter by the minute so I ordered the men to proceed and went back to find the missing men. A search of the trenches revealed nothing and only when I returned to England did I hear that they had been offered a lift by the Quartermaster, who had the only company vehicle on the Mont, and they had, of course, jumped at the chance and gone off. I had a good look round and then returned up the hill to the back of the monastery. Whom should I meet up there but Hugh Davis, another 2nd Lieutenant and the Commander of 3 Section. He had been on a similar mission and had also sent his men on under his Section Sergeant. "Come on, let's get out of here", he said, and I could not agree with him more.

Shells were landing at frequent intervals, but nothing too close to be worrying, until, after about ten minutes we reached the top of the rise and a salvo landed fairly close in front of us. The track we were on dipped down steeply and then rose up again to our level. There was a road junction at the bottom of the dip and, peering over the top of the ridge, I could see several battle-dress clad corpses down there. Another batch of shells arrived, so we took cover and considered what to do. There appeared to be no prominent observation post from which the Germans could watch what was going on at the road junction, so

they had to be firing blind at it. The fact that the junction was marked clearly on the map, rather supported this conclusion.

The shells were coming at regular intervals, and I timed this on my watch and calculated that we could reach safety on the far side if we ran really fast. Obviously we could not lie where we were indefinitely, so Hugh agreed to give it a try. So, after the next burst, we took off. I have never run so fast in my life. I kept an eye on the second hand of my watch and, just before the next batch of shells was due to arrive, I shouted to Hugh "Down!" We flung ourselves into the ditch and, exactly on time, the next salvo burst behind us. We quickly covered the final few yards to the top of the hill and then left this unpleasant place behind us.

Reaching comparative safety, I heard a moan coming from the ditch and, on investigation found this had come from an army padre, who had a nasty wound in his right shoulder. He was bleeding quite badly, so we put a field dressing over the wound and then, with an arm over each of our shoulders, helped him down the road. He told me he was attached to the Somerset Light Infantry, and he showed great courage.

Methodically we plodded on, and I was wondering just how far we would be able to continue with the padre, when we came upon an abandoned small staff car, half in the ditch. It was obvious that the same thought passed through all our minds. Could we use it?

In those days, cheap cars did not have an ignition switch, just an on-off switch, so, lowering the padre gently onto a bank, Hugh clambered into the driver's seat, whilst I prepared to push. The engine started almost at once and, after a good deal of effort, we got the car onto the road.

We lifted the padre into the back seat and started off. This was an unbelievable piece of luck. I pulled out my map to chart a course back to Dunkirk, where I felt sure we would be able to find doctors who could cope with the padre. However, we had only covered about half a mile, when on a long straight stretch of road, we saw ahead what looked like a piece of machinery. As we approached this, two soldiers ran into the middle of the road and I realized, first, that we were looking at a machine gun pointing at us and, second, that the soldiers were German.

Mercifully there was a road off to the right, with a house on the corner that blocked us from view. With a squeal of tyres, Hugh turned down it and accelerated away.

This road took us towards Poperinge, of World War One fame, and not too far off our direct route to Dunkirk. As we approached the town, it was under heavy attack by German dive bombers, but by another piece of luck, there was a sign on the outskirts indicating that a field ambulance was located there. Bombs were dropping all round as we drove in, and the unit was packing up to move, but we managed to hand the padre over to the duty doctor, who gave his opinion that the wound would raise no serious problem. Hoping for the best, we left him there and I have often wondered what happened to him. He never once complained and I felt he deserved to survive.

Walking out of the field ambulance's building, we were highly disappointed to see that our beautiful staff car was on fire and burning fiercely. However, it had been a real help for the padre, so we abandoned it and walked into Poperinge. The bombing was still going on, but one asset when being attacked by dive bombers was that one could see when an attack was dangerous. Needless to say, we watched the sky continuously, and whenever a bomber appeared to be coming our way we took cover at once.

Poperinge proved an unpleasant place to walk through. A Belgian regiment of horse drawn artillery had been caught by the bombing, and the streets were full of dead and dying horses, with up-turned guns and spilled ammunition everywhere.

Emerging from the north of the town, we passed a building outside which were stacked hundreds of bicycles. The battalion that used these for transport was inside, and a bored Belgian sentry sat smoking outside. He appeared to pay little attention to his task so, reaching the end of the stack, we pinched a couple of bikes and rode off fast. A shout went up behind us, but we took no notice, hoping that the sentry would not use his rifle. All too short a time later, there was roar of rage just behind us, and the sentry, clearly a professional cyclist, had caught us up. We dismounted, apologized and gave up our loot. There was nothing for it, we were going to have to walk back to Dunkirk.

By this time it was midday and we were starting to feel a need for food. We stopped at a few farmhouses and succeeded in buying two hard boiled eggs at one. Continuing our march, I noticed a tin in the ditch which turned out to be greengage jam from a British ration pack. We ate this complete, and I still feel a touch of nausea when offered greengage jam today.

As we walked on we passed hundreds and hundreds of abandoned British army trucks and the scale of the disaster that was hitting us became more apparent. There was very little on the road, but after some hours we were overtaken by a French army lorry, which stopped in front of us and we were invited to jump in.

Joining the poilus in the back, we found that a bottle of brandy was being passed round. We gratefully accepted this and took good draughts of the fiery liquid. They were all most friendly, and their leader, a sergeant, said, in good English, "Now you tell us dirty joke to make us laugh. I translate".

Hugh took up this challenge at once. "Before this war started" he said, "I was up at Oxford."

"What you study"?, said the sergeant.

"Forestry", said Hugh.

"*Ah, oui; les arbres. C'est bon.* Now the joke."

"I went to the wedding of the man who was captain of the Oxford boat race team. You know, the rowing team."

"Yes, I know."

"We made an archway for the bride and bridegroom to pass under when they left the church by holding up oars. Well, I heard a man behind me say, 'Cor, look at all them oars.' At this his friend replied, 'Them's not whores, them's bridesmaids.'"

The only laughter came from me, but Hugh gallantly tried to explain in his schoolboy French why this was meant to be funny.

During this, our vehicle had stopped and we heard argument going on at the front. We were told that no vehicles were permitted to cross the bridge in front, and that we must all dismount. Reluctantly, with much handshaking, we said goodbye to our good natured hosts and set off again on foot.

Immediately across the bridge we realized we were quite close to Dunkirk, as French troops were busy digging trenches along the canal bank. A French officer harangued the line of marching men, telling them to remember Verdun and to come and help him defend this ground against the *sales Bosches.* We walked on towards Dunkirk, which was clearly marked by a huge plume of smoke. Later we were to see that this came from burning oil tanks, but it had a most beneficial advantage for us as the wind carried the cloud directly over the beaches. Any German dive bomber that flew below the cloud was fired at by tens of thousands of rifles, and most were shot down. Quite a lot of bombs exploded on the beach whilst we were there, sometimes causing casualties, but the damage they would have inflicted if the pilots had been able to see their targets would have been infinitely greater.

Soon after leaving the French officer we heard a single rifle shot. A British soldier came running up in some distress and asked us if we had seen the French officer at the bridge.

"Of course." we said.

"Well one of those Frenchies has just shot him," he said.

Clearly not all the French soldiers wished to be reminded of their responsibilities, and were more interested in escaping the threatening net than in volunteering to help the gallant officer.

After a miserably uncomfortable night on the concrete esplanade, we rose at first light to decide what to do next.

A number of pleasure boats and yachts was coming in from the sea. Most did not anchor, but dropped off a rowing boat which made for the shore. There were hundreds of men standing in the shallows, who immediately waded or swam out to these rowing boats, with the result that several were swamped, to the obvious annoyance of both the owners and those who wanted to climb into them.

I felt that this was not an attractive route home for us, so we set off towards the main harbour to see what that had to offer. On the way, who should we run into but Sergeant Barrett with my Section. He reported that they had suffered no casualties, but also like us, had had no food and were wondering just what to do.

After trying to obtain advice from various officers, most of whom were just as confused as we were,

I discovered that there was a rudimentary organization at the port. Groups of 50 men were assembled, given a number and then, when a fresh destroyer came alongside the mole, numbers were yelled out and the relevant groups moved up to the mole, where a final control directed them to a ship. The need for rapid movement was obvious, as the area was being shelled, and neither the Navy, nor those ready to embark, wanted to hang around.

This simple organization was run by a major, sitting in a slit trench in the sand and the groups of 50 were within earshot of him. I approached, saluted, and was told that my group would be number 26. Destroyers came and went, each one taking about half a dozen groups. After about an hour, I noticed the major emerge from his trench, join a group, which was presumably his normal command, and double towards a destroyer. Nobody took his place, so, rather than allow this tenuous organization to break down, after a few minutes I stepped into his trench.

I should explain that many of us were wearing our plastic gas capes over our uniform, as an extra slight warmth after the chilly night in the open. One's military rank was therefore not visible, but it did give me some mild amusement when a captain, a senior officer in my eyes, came up and saluted me smartly. I gave him a number for his group and pointed out to him where he should take them.

I sat there for a couple of hours, telling successive commanders what their numbers were and ordering the earliest groups forward methodically when a ship came in. At one point Sergeant Barrett came up with the gloomy news that a Lance Corporal from 1 Section had joined the group and he had seen Major Anderson and the whole of Company HQ being marched away by German troops, and carrying some wounded with them. He also reported that 1 Section had stopped in a barn for a rest and a smoke soon after starting the march from the *Mont des Cats*. He had dived into some bushes to answer a call of nature, only to see the barn being surrounded by Germans, who then fired through the wooden walls. He did not know about casualties, but feared the worst. The only good news was that Lieut Colonel Maclaren had been seen safely back.

On a signal from the mole that three more groups should move forward, I shouted to 18, 19 and 20 to go. Strangely, no-one answered for 20, so I called out the number again. Still no response. So, pointing at Hugh, I shouted "Go on number 20, get moving." Without hesitation, he called our men to their feet and moved off. Also without hesitation, I followed my predecessor's example and left the command slit trench to join my men.

Once on the mole, we saw that it was "Y" shaped, with the two arms pointing out to sea. An officer was standing at the centre of the "Y", directing groups down whichever arm a destroyer had come alongside. We had only been at the base of the mole for a couple of minutes when a salvo of shells arrived and burst on the concrete surface, killing the officer and a number of the members of a group that happened to be passing at the time.

Getting some of our men to help the wounded back, I once more assumed authority and stood in the centre of the "Y" to order groups forward as requested by the Navy. Another ship arrived, and with it another salvo, but luckily this dropped into the sea and nobody was the worse for it. It seemed a very long time, and was probably about 20 minutes, before the next one arrived. The Navy yelled at me to tell the men to double up, so I yelled at the groups. It was with not a little pleasure that I saw that Hugh was leading the last group and, when it went past I joined the tail, once again I regret to admit, abandoning my responsibilities to whosoever would take them on.

We were shelled as we left and bombed on several occasions on the way back to Dover. It saddened me greatly to learn later that our wonderful destroyer was sunk on the very next trip it made back to Dunkirk. However, once on board, what a relief! No responsibility! I slept the whole way, apart from being woken for a mug of tea and a good chunk of beautiful fresh bread.

It had been quite an eventful couple of days.

The Editor of the *Journal* would be pleased to receive further articles from anyone who took part in World War Two, with a view to their publication on or near to the 50th Anniversary of the events described. We are now considering, in particular, the events of 1941 but accounts of later events are always welcome as they can be kept for publication in the appropriate issue.

Military Works Force and the Project

MAJOR R W DIXON BSc(Eng)

The author was commissioned from RMA Sandhurst in December 1969. He was a troop commander in 2 Armoured Engineer Squadron and 16 Field Squadron. At RMCS Shrivenham he obtained his degree on an electrical/ mechanical course - Power Generation and Plant. In Ripon, he was 2IC of 11 Field Squadron and during this period he spent six months in Belize and a similar period at Ballykinler constructing a range. After attending Professional Engineer Training he was a team leader in 520 STRE conducting essential services surveys of RAF stations. After a period as an instructor in Electrical and Mechanical Wing, he was appointed to command 50 Field Squadron (Const) for three years. His tour as OC was followed by a civil attachment to the Hawker Siddeley Group. He is currently OC 524 STRE (Wks).

Background

Many people, even within the Corps, much less in the rest of the Army and other Armed Services, are unaware of the existence of a specialist unit known as Military Works Force (MWF). Situated at Chilwell, just west of Nottingham on the borders of Derbyshire, the unit provides a multi-discipline consultancy service to all three Armed Services in the fields of electrical, mechanical and civil engineering. In addition to the military training undertaken by all units, much of the year is taken up producing designs for a wide range of construction projects. The projects range from annual exercises to tasks in support of military operations and requests for assistance from other Government Agencies. Just what we do is normally determined by EinC although directives for scheduled annual exercises are issued by HQ UKLF.

Aim

The aim of this article is to review the life cycle of, and MWF involvement in, a military construction task and indicate possible ideas for change.

Conception

The military have always been an inventive group. Radical thought has, if successfully applied, been a route to "fame" at least with one's immediate superiors (conversely unsuccessful application leads to infamy). Such thought processes are frequently the start of a task. The task may be to provide a service that does not exist or to provide a more effective alternative to an existing service. This is probably the most important stage in the life cycle - conception of the statement of requirement (SOR). It is also probable that the conceiver is not an engineer or has not sought engineer advice. Unless there are overriding reasons otherwise, this statement should be one of function, eg to move 1000 tonnes of stores a day from A to B - maximum individual package two tonnes and one cubic metre or to provide washing facilities for 50 men per hour rather than a road from A to B, or 12 showers. It is quite likely that the optimum financial/engineering solution will be the road or 12 showers but such a statement at this stage may well preclude alternative solutions being considered. In a similar vein to a contact report the SOR needs to cover:

- What is the function of the task?
- Where is it to be carried out?
- By when is it to be complete (not yesterday please)?
- Who has the authority to make decisions?

Major R W Dixon BSc Eng
Military Works Force And The Project

A Construction Material Technician (CMT) checking results from a computer controlled soil test.

Birth

Once this analysis has been completed the task is in the real world and could be considered as born. If there is a possibility of Royal Engineer involvement, the next stage is referred to, in the always ready-to-hand RETD No 1, as the Defining Stage with the aim to "clarify and refine the client's original proposal sufficiently for all parties involved to decide whether to proceed with the planning sequence".

The Initial Reconnaissance

If the proposal survives the Defining Stage, MWF will be tasked to undertake an Initial Reconnaissance (IR), usually led by one of the more senior officers. The function of this reconnaissance is to assess the feasibility of meeting the requirement, the method of meeting the requirement, identification of relevant local restrictions and regulations and in very broad terms, the bill in respect of manpower, equipment and cost. At this stage no detailed design will have been undertaken and therefore this bill can only be based on something similar with factors for local conditions. The results of the reconnaissance will be formulated in a report and used as a discussion document for interested parties to decide whether to continue the planning process or seek an alternative route to achieve the requirements of the client.

The Detailed Reconnaissance

If the task has survived the earlier decision points, it reaches the stage in which MWF has the most involvement, the Detailed Reconnaissance (DR). Dependent on the scale and complexity of the task, a suitably qualified team from one of the Specialist Teams Royal Engineers (Works) (STsRE(Wks)) will be directed to carry out a reconnaissance at the site to gather all the information necessary to complete the detailed design and an outline administrative plan. To support the STsRE(Wks), MWF has other specialist departments capable of collecting almost all the information that is likely to be needed such as survey data, soils and materials analysis and availability of construction materials from local sources. The duration of the on-site phase can vary considerably from as little as two weeks for a troop-sized task to as much as six weeks or more for a squadron sized task in the back of beyond. On return to Chilwell, the time consuming process of producing the Detailed Reconnaissance and Planning Report (DRPR) starts. Even relatively small tasks require considerable effort to ensure that all the small details are tied up and consistent throughout the report. The design sequence proceeds from the general to the detail and it is not until relatively late in the day that a detailed estimate of cost can be determined. Major specialist items are normally costed directly with suppliers whilst smaller items are costed by reference to trade catalogues or local suppliers' price lists. This can lead to problems, particularly in less developed countries, since until the detailed design has been done there cannot be a stores list to price during the earlier site visit and availability of anything other than basic materials fluctuates violently.

The other factor that has a major effect on the report is the vexed question of labour constants upon which the cascade plan and project duration are based. Except on operational tasks, we are

now instructed to plan for a five day week with seven working hours per day. The tradesmen within any particular unit will have a wide range of differing skill levels and experience but on average, outputs should balance overall.

The labour and plant constants used are scaled down from civilian rates with further modification from any available information of military rates under similar working conditions. More accurate estimates will be possible when more feedback on rates actually achieved is received. The end product, and that which the tasked unit eventually receives, is a report that gives a method by which the task can be achieved within the manpower and time limitations imposed on the project and where applicable, the standards to be achieved. It is *not* the only way that the task can be done.

Mounting and Construction Phases

Once issued and approved the DRPR forms a basis on which the tasked unit can plan for the task. This may or may not be the end of MWF involvement. During the Mounting and Construction Phases MWF can advise, discuss queries and in some cases, when tasked, provide technical back-up to the construction unit.

The Recovery Phase

Eventually the joyous day comes when the site work is complete. Thoughts of home and the delights of being back within the Regiment are to the fore. The death of the task is nigh - but not before the as-built drawings are completed, the Handover Board has sat and deliberated and the Project Final Report has been sent up the chain of command. The final report is where we hope to find details of the labour constants actually achieved to enable us to be more accurate in future planning. Eventually the letters of appreciation, or otherwise, from the client arrive and the task is relegated to the past except perhaps for articles in this *Journal*, *Sapper* Magazine or *Soldier*.

Scope for Change

The above sequence is typical for a task undertaken by a UK based unit although a similar sequence involving different agencies will be used in any other theatre of operation. Except for high priority tasks, the life cycle of a task will normally last in excess of two years. The aim would be to complete the IR two years before the planned start of the task and the DR about a year before. That is not to say we cannot react more quickly.

Where a high priority, operational tasking is received the same stages must still be followed but the reaction and decision times are considerably reduced. In civilian practice, this type of project management is more typical and known as "fast track". As an example, electrical and mechanical layouts may still be in the process of design when the shell of the building is actually being constructed. This type of project management is more risky because construction may have started before the detailed design of all aspects is complete and it will not be possible to undertake the cross-checking of all engineering disciplines to avoid conflicts of space. This has financial implications because, depending on the form of the contract, any variations may be the subject of claims for additional payment. The main effect of this type of project is that there are no gaps between the stages and the stages may even overlap. This can be frustrating to anyone used to the longer time frame of an annual exercise. On a recent project in Northern Ireland it was necessary to issue partial stores lists at 14-day intervals starting six weeks before the project was due to commence on site to allow for the procurement of long lead items. On the same project, because of the operational urgency, it was not possible to publish the DRPR until about one week before the unit was due on site. This would not have given the unit adequate time to do

A Field Survey Team equipped with theodolite electro-optical distance measure and field data logger.

any planning at all and therefore unit representatives were involved during the period of the DRPR production receiving information as soon as it was identified in the form of partial drafts and advance copies of drawings. In this way the surprises in the approved report were, we hope, kept to the absolute minimum.

Computer Aided Design

In 1972, RETD No 3 stated that it was the policy of the EinC to encourage the Corps to make cost effective use of computers to aid engineering design and control engineering. Over the last two years, progress has been made introducing this assistance in the form of computer systems to the design process. At present, the main areas to benefit are in the preparation of drawings and conversion of survey data into recognizable site plans and cross-sections. Not all drawings are yet produced on the computer system since some are more economically produced manually and there are not enough terminals for all draughtsmen to be working at the same time. There are some software programmes available on an elderly Hewlett-Packard system to assist with some aspects of design but most of the detailed work is still done manually. It is hoped that additional software and hardware will be available to MWF in the future to speed up the preparation of stores lists and design calculations. Each team now has a portable computer with word processing and spreadsheet capabilities. These are being successfully incorporated in the DRPR production process and can reduce the production time considerably.

Project Planning

The method of project planning practised by the Corps for several years is the cascade plan. The purpose of the plan, is to produce a model that incorporates the logic, activity durations and resources required. This model can then be used to determine which activities are critical, which have float and when is the latest time that a particular item must be at site without affecting the overall duration. The procedure is a logical one and can be readily adapted for use with computers. Several years ago, the programme in use on our Hewlett-Packard was developed at Chatham and is still going strong. It is not however compatible with the range of equipment that we and units hope to receive. There are several project management packages available commercially but none that is able to produce the printed output in exactly the same format. It is perhaps time to review the use of cascade planning in the Corps and adopt one software package as the Corps standard. A possible bonus in doing this is that provided the unit and MWF computers are compatible there is scope for the tasked unit to have a copy of the plan on disk for use on site. This would enable them to consider changes and implications of changes to the work sequence more quickly and be an aid to project management. The information could also be readily utilized in periodic progress reports at not much more than the touch of a button, saving valuable draughting time.

Coordination of Project Information

A considerable amount of time is currently spent producing the Method of Works and Works Specification sections of the report. One of the reasons for this is that, unlike a civilian practice, it is fairly unusual to be tasked with a project that is similar, to any great extent, to a previous one within the memory of team members. Each project is a one-off. These sections are created from scratch each time to match the respective project. A possible way of improving this situation would be for us to adopt a civilian system of Coordinated Project Information. One concept is based on Standard Method of Measurement 7 (SMM7) which breaks any construction project into a series of sections of work sections covering like aspects. This scheme is called the Common Arrangement of Work Sections. Only those sections relevant to a project are used. Connected by section references, there are libraries of standard clauses covering workmanship, product specification and method of work. It would be possible to base a similar version of this scheme on the equivalent Royal Engineer Standard Method of Measurement (RESMM) except that a considerable amount of work would be needed to match the specification and workmanship details to the relevant RESMM section as they are arranged in a different order to SMM7.

PSA/DOE already have these libraries to be used with SMM7 in the form of published General Specifications and Minor Works Specifications and these are available in suitable formats to be used directly in a variety of computer systems. The system can be applied throughout the project from taking off to completed design and enables additional information to be referred to from drawings without extensive notes. Another advantage is that additional information can be made available for the procurement team. The traditional stores list is fairly terse with a military-like description and possibly a manufacturer's part number. If the exact item is available there is no difficulty but where the exact item is not available and an alternative is required it can be difficult to identify the function of the item and therefore to determine whether a particular alternative is suitable. The additional information available in the specification section should assist the Resources personnel to make this decision. As an example, if an electrical switch fuse rated and fused at 200 Amps is specified but not available, it would be possible to replace it with a switch fuse rated at 250 Amps from another manufacturer's range and fuse it with the same type of fuse rated at 200 Amps. The dimensions of the replacement switch fuse are unlikely to be identical and would therefore require minor changes in layout but this should be within the capability of the tradesmen on site with agreement of the project officer. The only significant change to the tasked unit if this form of report was adopted is that the layout and format of the report would have changed. All the same information would be there in a more logically arranged format with easier cross-referencing capabilities but it would not comply with JSP 101.

Field observations are transferred directly to the main computer which automatically produces site plans.

Almost the End

The existing sequence of project planning has been in use for many years and providing each stage is done correctly is the recipe for a successful project. There is a great danger in missing out or rushing any of these stages. In the future we are all going to be monitored in some form of value for money assessment. An aid to improving this would be to adopt available technology and some civilian practices outlined above to assist us to improve the quality of service provided in a shorter time. We are a long way behind our civilian counterparts and do not appear to be catching up. The impending inundation of the work place by terminals to provide Information Technology to our managers is not likely to improve the computer design capabilities in MWF or any other RE unit. The Corps needs computers to replace the calculator just as some will remember the calculator superseding the slide rule and the change must be as soon as possible if we are to maintain the level of service expected from us.

Military Works Force And The Project (3)

The Gordon 'Journal'

CAROLINE M REED BA

Caroline Reed has been Curator of the Royal Engineers Museum since its move to the Ravelin Building, Prince Arthur Road, Gillingham in 1985. Prior to that, having taken her history degree at Bristol University, she worked for ten years as a research assistant in the library of the Imperial War Museum. She is currently working on the re-display of the Gordon Chinese collection at the RE Museum.

In June 1989 the RE Museum was able to purchase Charles George Gordon's 'journal' of his period in command of the Ever Victorious Army and its part in the suppression of the Taiping Rebellion, 18 March 1863 - [28] August 1864, with generous and much appreciated assistance from the Friends of the National Libraries, the Museums and Galleries Commission's Purchase Grant Fund, the National Heritage Memorial Fund and the Corps of Royal Engineers. The acquisition was a story in itself. The catalogue price of £7,000 - £10,000 was considerably less than the agent's valuation of £18,000 plus, assessed after considerable research. In the event the hammer price was £8,000, but the offers from the funds would have enabled the museum to go up to £18,000 without any increase to its own contribution of £2,500. In this article the RE Museum Curator explains how the document came to be written and assesses its significance.

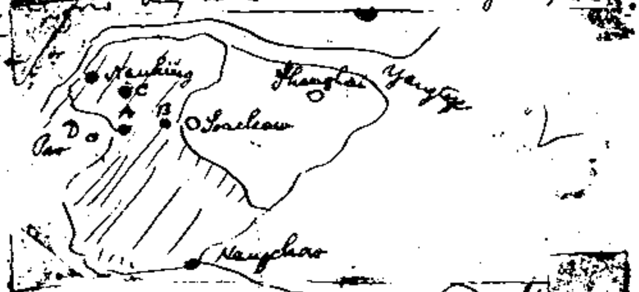
One of the most famous 'eminent Victorians' and certainly one of the better known Royal Engineers of the period is Major General Charles Gordon, nationally mourned as 'Gordon of Khartoum' after his death at the hands of the Mahdists in 1885, but earlier acclaimed as 'Chinese Gordon' for his exploits in the 1860s commanding a Chinese force, fighting a Chinese rebellion against the Manchu Emperor. Gordon arrived in China a twenty-seven year old captain in September 1860, just in time to assist in the British and French destruction of the Emperor's Summer Palace at Peking. This gesture, intended as retaliation for the maltreatment of European ambassadors, was the final blow in a war which forced the Imperial government into ratification of a favourable trade treaty.

The Emperor had been weakened in this struggle in the north by a civil conflict that had raged in southern China for a decade. By October 1860 when the trade treaty was signed, the Taiping Rebellion controlled a swathe of territory in the south and had virtually usurped Imperial authority in the area surrounding the Europeans' commercial base of Shanghai. Britain continued to maintain a stance of neutrality and attempted to negotiate terms with the rebels, but relations steadily worsened and during 1862 there were a number of clashes between the Taipings and British forces based in Shanghai. Increasingly, Britain saw her best interests as served by supporting the Manchu government. The young, recently promoted Major Gordon RE, who had been engaged in surveying the area around the treaty port, was thus allowed

Caroline M Reed
The Gordon Journal

and are buried close to an
monument and near the old
stockades close to River bank
vide map except Mr Jay
who was buried at Quinsan
The force returned to Quinsan
~~stated~~ The Rebellion is
now very like an hour glass

I cannot go into this affair now it would take too long. It is very well for people to judge at a distance of what to do but not so easy to carry out their advice.



G. thought if he took (A) Liyang
& (B) Yesing it would cut it
in two. he might then fall
on C Kintang & turn Chanchu
-fu. Imperialists of Tdlong Gwo
forgot army were at D. it
was necessary to clear off all
idea of getting provisions up
& to carry enough with us as
we were going at the heart of
the Rebel power
Started in snow & hail on
19 Feby. arrived to Wusieh
camped near Pagoda outside
city at the foot of which the

70

This page from the Gordon 'journal' covers the period 5 December 1863 - 19 February 1864. The map, illustrating his comment that 'the Rebellion is now very like an hour glass' has been taped back into place after removal by Mossman to allow the wood engraver to produce a facsimile for inclusion in his published version of the text. The marginal note is in red.

secondment to become a general in the Shanghai merchants' native mercenary force, officered by Europeans, which formed the Ever Victorious Army (EVA).

Gordon's brief 'journal' of his command of the EVA between 18 March 1863 and 28 August 1864 has proved a fascinating addition to the collection of the Royal Engineers Museum at Chatham (1). The document is an eighteen page looseleaf manuscript written in Gordon's own hand and subsequently annotated by him in red ink. It includes five rough sketch maps of areas described in the text. It is not a diary or regularly kept journal of events in the strictest sense, but rather a bald summary of Gordon's part in the campaign produced by him in Shanghai some months after its successful conclusion, apparently at the request of Samuel Mossman, then editor of the *North China Herald*. As Mossman describes it, the 'journal' was 'presented' to him 'for the purpose of furnishing in the columns of that journal an accurate account of the numerous engagements undertaken before that rebellion was stamped out' (2). Mossman also mentions receiving from Gordon at this time a silk map showing the area around Shanghai in which the campaign was fought (3). Interestingly, the description which he gives fits exactly a map, understood to have been drawn by Gordon and an assistant, which has been held by the RE Museum for many years, but whose provenance is unclear. The Gordon manuscript bears every sign of having been written in haste, probably at one sitting, with various notes and dates added for clarification at a second reading. There are several crossings through, seeming inconsistencies in place name spellings and some wild grammar and punctuation. The handwriting grows larger, more widely spaced and more difficult to decipher towards the end of the document.

It would seem likely that in producing this summary for Mossman Gordon drew on a much more comprehensive journal, probably kept on a near daily basis during the campaign. As evidenced by his Khartoum journal, published shortly after his death (4), it was his habit to keep a regular diary at the most hectic of times as well as to maintain a copious correspondence with friends and relatives. During much of the Taiping campaign he wrote daily letters to his mother (5). References to a 'Chinese' journal appear in many sources and two nineteenth century publications, Andrew Wilson's *The Ever Victorious Army* and A Egmont Hake's *Events in the Taeping Rebellion*, claim it as source material (6). Wilson's would appear to be the more credible claim as his book was published during Gordon's lifetime and at a time when he was in England. There are reports of Gordon's having destroyed a journal account of his period in China at some time, probably during the 1870s, when he was being pressed to publish it in full (7).

In the absence of further evidence then, this eighteen page summary would seem to be the only complete account in his own hand now extant of Gordon's part in the Taiping campaign. Its contents are not entirely unknown to researchers as they were published in a somewhat butchered form, with lengthy and occasionally misleading interpretive passages, by Mossman in the year after Gordon's death. Examination of the Mossman volume *General Gordon's private diary of his exploits in China, amplified by Samuel Mossman* (8), made in conjunction with the original text, shows that Mossman confused the order of certain passages and omitted others altogether. There is an obvious impact on the sense of Gordon's draft which makes it doubly satisfying that the manuscript has at last come into the hands of a public archive where it can be made available to researchers. The Mossman volume, like some other early published material on Gordon, is itself now something of a rarity. An excellent collection of such nineteenth century sources, with a representative selection of more recently published biographies, is held in the RE Library at Chatham.

From Mossman's account the summarised journal must have been prepared by Gordon in about November 1864 when he was in Shanghai and preparing for his imminent departure for England. By this time he had been honoured by the Imperial government with one of the highest accolades which could be bestowed on a foreigner in China. Refusing all offers of a cash payment in recognition of his services he had held out for 'the Yellow Jacket', traditionally worn only by the Manchu military elite, 'or nothing' (9), and been granted the rank of *Ti-tu*, Field Marshal, in the Emperor's

Gordon, photographed in the full regalia associated with his Yellow Jacket. The portrait was probably taken in London very shortly after his return from China at the end of 1864. Gordon sent miniature copies of the photograph to a number of friends.

Army. He had been invested in the rank, and presented with the eight full sets of elaborate Court Dress to which its holder was entitled, at a day long public ceremony (10). The most symbolically significant garment, the Yellow Riding Jacket, and much of the rest of this Imperial gift of costume and jewellery is now held in the collection of the RE Museum.

By November Gordon was claiming to fear and to hope to avoid an embarrassingly effusive send off from China and a similar reception in England where he had become something of a national hero (11). This was the mood in which his summary for Mossman might be taken to have been written. The 'journal', however, is scarcely self-effacing. Understandably, because it is an account of his own 'exploits' and the operations of the EVA, it does little to dispel the myth by then widely espoused in England that the Chinese rebellion had been suppressed virtually single handed by this paragon of British military virtue, with very little assistance from his native co-generals. In fact, Gordon and his EVA played a crucial, but relatively minor role in support of the main Imperialist force led by a provincial governor, the *Futai*, General Li Hung Chang. It must be said that even in this brief outline account Gordon is quick to praise his Chinese allies, especially when he can draw favourable comparisons between their performance in the field and that of French officers also fighting in the Emperor's cause. He also praises Taiping courage and tenacity on a

number of occasions. He is at his most damning in his treatment of previous commanders of the EVA and their 'spoiling' of the men, and he is once sharply critical of his own tactical judgement.

Despite these flashes of anger or generosity, where Gordon's personality shows through, the 'journal' as a whole has a rather repressed and self-conscious air, in some areas almost defensive. Gordon avoids outright self congratulation, but it is clear that he will brook little criticism. He purposefully declines to comment on either of the more controversial aspects of the campaigns, the assassination of the leading Taiping Wangs, or princes, by their Imperialist captors at Soochow and his own, perhaps over hasty, disbanding of the EVA once the Imperialists had captured the last rebel stronghold at Nanking.

The mercenary force had once been seen by many Europeans as a possible nucleus for a Chinese standing army, to be employed by the Emperor after the suppression of the Taipings and to ensure stability around the trading base of Shanghai. This was one of the justifications cited for Britain's abandoning her posture of neutrality on the Rebellion and allowing Gordon to become involved. In the event, even under his strict command, the EVA never lived up to the title of 'The Disciplined Force' by which Gordon liked to call it. It was apparent by the end of the campaign that the Army's survival might well pose a threat rather than offer any protection to the cantonments. In the 'journal' Gordon refers to none of this, but merely states: 'The force returned to Quinsan is paid off and broken up' (sic).

On the question of the murdered Wangs, he is even more deliberately reticent. He notes in the margin of the text 'This is no place to go in to the Wangs affair'. In December 1863 Gordon reacted to the murders by withdrawing the EVA from action. By February 1864, however, he justified his return to active command by claiming 'I do not apprehend the rebellion will last six months longer if I take the field. It may take six years if I leave' (12). Another marginal note is his only reference in the 'journal' to the controversy his actions had caused at home: 'I cannot go into the affair and it would take too long. It is all very well for people to judge at a distance of what to do but not so easy to carry out their advice'.

To summarise then, at first sight the RE Museum's newly acquired document might seem disappointingly sketchy and impersonal. On closer reading, however, it can be said to shed some interesting light on Gordon's thoughts in late 1864 on the recent campaign, and possibly on his own reputation, as he prepared to leave China for home. Despite its early publication by Mossman in a somewhat distorted form, the full text has not been available to researchers until now and the 'journal' makes a valuable addition to our national archives on this strangely complex Victorian hero.

ACKNOWLEDGEMENTS

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Ibid (4) Nutting. pp81 - 82.

8. *Ibid* (1).
9. Note on the symbolism of the Yellow Riding Jacket in Gordon's hand, dated and signed 10.5.80. REM collection 4801-70.
10. *Ibid* (5) Hake: *Reminiscences by one who served with Gordon in China* [Major Story], p. 523.
11. *Ibid* (6) Lord Elton. p. 93.

Ibid (4) Nutting. pp. 78-79.

12. Allen, Bernard M. *Gordon in China.* London: Macmillan and co. 1933. p. 195 (quotes PRO FO.17 No 407).

Fifty Years Ago

LIEUT COLONEL D R STENHOUSE MBE MA FCIT

Denis Stenhouse was commissioned into the Corps from The Shop in 1933. After training at the SME and Sidney Sussex College, Cambridge, he served with 12 Field Company RE during the Arab uprising in Palestine. He did a railway course at Longmoor and on the Great Western Railway in 1937-9. After Norway he served in Persia and Iraq and then joined 231 Independent Brigade as Military Landing Officer for the invasion of Sicily in 1943. He then became 2IC of 1212 Railway Construction and Maintenance Group RE in Italy where he was wounded, losing a leg. In 1945 he became an instructor at Longmoor and after a course at the Staff College did a tour as GSO2 in Hong Kong. He served on t he staff of HQ AFCENT at Fontainebleau in 1952-5 and then commanded 17 Post Training Regiment RE at Marchwood. He retired from the Army in 1960.

In April 1940, 8 Railway Construction and Operating Company RE was working on the construction of railway lines for rail-served base depots for the BEF in France, when it was ordered to return to Longmoor prior to joining the North Western Expeditionary Force in Norway. At that time I was a subaltern in 29 Railway Survey Company RE which was also working on the development of base depots in France, when I was ordered to return to Longmoor to join 8 Company.

One of the objects of the Norwegian campaign was to take over the railway line which runs from the Swedish iron ore mines to the Norwegian port of Narvik, and thus to secure the ore for the allies and to deny it to the Germans. For this reason 8 Company, one of the only two regular railway companies, was included in the Order of Battle.

At Longmoor we were re-equipped for the campaign. As Norway was said to be very cold our mothers saw to it that we had a good supply of warm woolly vests, and kind ladies in many parishes knitted us Balaclava helmets. On 12 May we entrained at Bordon for Glasgow, where the following day we embarked on the Polish liner *Batory* and sailed down the Firth of Clyde. On 14 May we sailed through the Western Isles and two days later crossed the Arctic Circle.

On 17 May we reached Harstad, the principal town of the Lofoten Islands, a group of some ten islands just off the Norwegian mainland opposite Narvik, and about a 100 miles inside the Arctic Circle. We might have been in the Mediterranean; the sun shone brilliantly, the sea was calm and blue and the air was warm! But in the distance we could see some of the snow-clad peaks of Norway, an unforgettable sight. As we landed, there were two small air-raids, but all the bombs fell in the sea and there were no casualties. The Company was billeted in four barns in a pleasant valley by a rushing stream just outside the town. The family who lived in the farmhouse was very friendly; they both farmed and fished and codfish were hanging on lines all round the barns drying in the sun and making a considerable smell!

8 Railway Construction and Operating Company consisted of a HQ and four sections (which would now be called troops), three for construction and one for operating. The construction sections had many platelayers and steelwork erectors and also surveyors, riggers, carpenters, etc. In the operating section were such trades as traffic operators, blockmen (the army term for railway

Lieut Colonel D R Steinhouse MBE MA
Fifty Years Ago

signalmen), railway engine drivers, firemen (locomotive), brakesmen and shunters and carriage and wagon repairers.

As soon as we had settled into our billets our Company Commander, Major Walter Wheeler, allotted jobs to his various sections. One of the construction sections was to erect a pier in the docks and two were to erect Nissen huts and lay roads to form a new RE stores dump. As we had not yet captured Narvik, the chances of operating a railway from there at any rate, for the time being, appeared remote. Transport between the islands was provided mainly by small diesel-engined boats called "puffers", each with a crew of about four Norwegians. I commanded the operating section and Major Wheeler decided that as we had no railway to operate we had better operate the puffer boats instead.

Accordingly the following day with Sergeant Eaton, my Section Sergeant, an expert railway traffic operator, I took over an office in the docks for running our puffers. The requirement was mainly the distribution of supplies, ammunition and stores from depots in Harstad to formations and units in the islands and in positions on the mainland nearby. I put a sapper on board each puffer to see that the crews obeyed orders (though they were in fact all very willing) and we sent them off on the various jobs in accordance with the priorities that I had been given. We had air-raids on most days but these were mild compared with those later in the war; however that first day's raid was effective and destroyed the oil tanks in the docks.

To begin with we did not have nearly enough boats to do all the jobs that were necessary. The Navy at first found it difficult to understand why they had to go to the Army to ask for a boat but soon got into the way of it. One day a naval officer came into my office while I was out and asked for a puffer. Sergeant Eaton was a bit doubtful as we had so few available. "It is a bit urgent" said the officer politely. Sergeant Eaton looked at him more closely; it was Admiral of the Fleet, the Earl of Cork and Orrery. He got his puffer!

We gradually acquired more and more puffers, and the construction sections let us have more men to go on them. On 30 May the ADTn, Colonel Rex Gage, warned me that we would soon be evacuating the islands, and that I was to acquire as many puffers as possible to assist in the evacuation. The following day I took on a further 38 puffers, making 110 in all. I drew 3,500 daily rations, (for the sappers and crews) and had a party working throughout the night making piles of rations for each boat. I also drew 300 fleece-lined coats in case of cold weather.

On 1 June I organized the boats into 11 flotillas each under an NCO, gave written orders to each, rationed them for six days, and sent them off to various parts of the islands, except for two flotillas which I kept under my own control at Harstad. On 2 June, Sergeant Eaton and I and a few others left the Company billet and moved into our office in the docks. We were quite comfortable there sleeping on and under our store of fleece-lined coats and eating our store of tinned rations.

Meanwhile in the docks as much equipment as possible was being loaded. Half of our Company equipment was still in the ship it came in; most of what had been landed was demolished, but we made a point of reloading our compressor. We were to abandon our personal kit apart from what we would be able to carry on board ourselves.

On 3 June the evacuation began. I took five puffers over to Borkenes, where troops were to embark at the jetty, and stood by in case the jetty was bombed and the destroyer unable to get alongside. However all went well. I was impressed by the speed at which the destroyer came in and tied up; the troops were quickly aboard and the destroyer left again at high speed. As I returned to Harstad at midnight the orange-red sun hung just above the horizon to the West; we never saw darkness during our time on the islands.

The evacuation of Harstad began on the same day and the main body of 8 Company embarked then. The movement continued for five days with destroyers coming in to the piers in the morning and evening. I kept one flotilla of puffers at each end of the docks in case the piers were destroyed. However the weather had turned cloudy and no enemy aircraft came over; we hoped that this would continue!

On 7 June we completed our evacuation. I concentrated all the puffers in Harstad but kept them in readiness to act as ferries in case any of the destroyers should not be able to come in.

When the last destroyer HMS *Havelock* came in I ordered all the sappers ashore, and we said goodbye to our Norwegian crews who had served us so well. Our interpreter, a splendid fellow, and some others decided to come with us and continue the fight.

I was very relieved when I got all my men, about 120, on board. Only one of them was late reporting to me on the quayside owing to some over-indulgence in the free bar that was so readily available there. Finally we got him aboard with the others and HMS *Havelock* left the quay and sped out to sea. After a lot of manoeuvring on a very cold night we transferred at sea to the Blue Star liner *Arandora Star*. It was a lovely ship though of course not designed to receive a mass of troops, but they certainly did their best for us. After everyone had had a meal I got some sleep on a really comfortable bed.

The next night we had an air-raid, only one plane and it did no damage, but we had been spotted. As we headed south we heard that the RAF Hurricanes which had defended us against the vastly superior Luftwaffe, had all successfully landed on the Aircraft-carrier *Glorious* (the first time that such a landing had been attempted), but tragically the *Glorious* had then been sunk in an action with the *Scharnhorst* and the *Gneisenau*. Our convoy consisted of seven transport liners and was surrounded by 12 destroyers. We were full of admiration for their seamanship as they took us offshore, but they did look awfully small! As the light increased one morning we could make out on the skyline behind us the enormous outlines of a British battleship and a battle cruiser. We felt much happier after that!

On 12 June we sailed back through the Western Isles and up the Firth of Clyde, and anchored just inside the boom. The next day we disembarked from the *Arandora Star*; we were sad to hear later that she was sunk on her next voyage. At Glasgow we met Lieut Peter Davies and 60 more men of 8 Company. We entrained that night and got back to Longmoor on the afternoon of 14 June. There we found the rest of 8 Company, now complete and without any missing. At Longmoor we were re-equipped ready for service elsewhere.

Recollections of an Amateur Sapper
Two Ten at War - Fireworks Galore!

COLONEL F H FOSTER DSO OBE TD DL RIBA

John Foster is a retired architect. He was commissioned in the TA in 1924 and by 1939 was commanding 210 (Sussex) Field Company. His unit was with the BEF and demolished twenty major bridges prior to Dunkirk. Appointed CRE 4 Corps Troops in 1941. From 1942 to 1945 was CRE 1st (British) Infantry Division being the only TA officer ever to hold the appointment (UK, North Africa, Pantelleria, Italy and Palestine). In 1947 he reformed the 44 Div RE (TA), later becoming their Honorary Colonel. Was Commandant Sussex ACF 1960-69.

This article is an extract from a complete book written by Colonel Foster, recounting his experiences throughout his peace and wartime service, and which is now lodged in the Royal Engineers Corps Library. The extract is published with the author's kind permission.

By the end of March 1940 the whole of the units of the 44th Division were complete with all weapons, vehicles etc and all G1098, and soon we were ordered to move to the BEF. I sent Lieut Gough and his section sergeant, Sergeant Baker, plus a small squad first as Advanced Party and then all the transport properly loaded with all G1098 equipment under Lieut Clayton Bannister.

The main body of the company left Beaminster, Dorset, (myself, Captain Amlot, Hughie Clements, 2nd Lieut Wilson, CSM, CQMS and all ORs) entrained at Crewkerne and embarked at Southampton. (My Army Form B199A Record of Service states 'Embarked for BEF 210 Field Company RE 9 Apr 40').

We crossed the Channel during darkness, the ship zig-zagging about, presumably to puzzle enemy submarines. We arrived at Cherbourg in the morning where we were given a hot meal. I was greeted by Colonel Bently who was a Seaford resident and an old friend. He was commanding a pioneer battalion. As soon as my lads were settled, he took me off to his Mess for lunch - a very good lunch! Rather too good! I went back to the Docks and took 210 for a route march round Cherbourg. I felt full of the joys of spring!

We entrained again about 6pm. After a long train journey via Le Mans where we were given hot water to make tea, we arrived early in the morning at Beaumont - our first billet in France - where we were greeted by Lieut Gough and our advance party with joy and acclamation!

Our vehicles had already arrived too under Clayton Bannister. We spent a few days at Beaumont and here we received our French liaison officer. He was a great help with the language problem and other duties in connection with billeting etc. His name was Beguie - and I understood he was a Reservist in the French Army. It was in this village we had to part with our small squad of First Reinforcements. We had a good party supper to say farewell to Lieut Wilson with much champagne, which we were able to get from the NAAFI for 2/6 a bottle!

Colonel FH Foster DSO OBE TD
Recollections Of An Amateur Sapper Two Ten At War-
Fireworks Galore!

Cutting from the *Daily Telegraph* 30 May 1940

The critical position of the British and French forces in Northern France and Belgium is shown in this map of the battlefront, in which the approximate extent of the Germans' penetration is indicated by shading. The map, which can give only a rough idea of the enemy's lines, is based on communiqués issued last night.

Early next morning after the party, we were on the road for our next area. This was a great moment for me because for the first time since we embodied, I was able to drive in my PU at the head of my field company at war strength complete with everything - all vehicles and equipment - 230 all ranks and 35 vehicles not forgetting my motor cyclists. My driver, Foster

and I being in the leading vehicle had to make sure our map reading was 100 per cent. The vehicles had to keep to strict road distances 10vtm (vehicles to the mile) and a speed of 15mih (miles in the hour). All vehicles had route cards and the motor cyclists were invaluable in keeping the column up to scratch. It meant that my field company took up a road space of about 3 and a half miles, Amlot (2IC) bringing up the rear. I was always very relieved when Sergeant Comben, my transport sergeant came along on his motor cycle at intervals and reported "They are all there, Sir."

We moved up across France and found billets in the following areas; Evereau - Rotangy - Seux - Troisvau - Croix du Bac. The usual drill was, when we arrived in a village, Beguie and I would seek out the Mayor and he would indicate where there were village halls or barns that we could take over as billets. Also he would indicate where we could obtain straw for bedding. Usually I, as 'Monsieur le Commandant' would be escorted to his home and be offered his best bedroom!

On arrival at Croix du Bac we took over billets from 208 Field Company. They had come out to the BEF in the early days to be part of 'X' Force. Here we settled down for about ten days or so. We went out to the Franco-Belgian frontier daily to construct pill boxes, breastworks etc. Belgium was not at war and when siting our work one could not go a few yards over the frontier to look at it, as one ran the risk of being interned!

During these days, officers were studying diagrams and other gen regarding bridges over the River Escaut with a view to demolition. We knew things were hotting up!

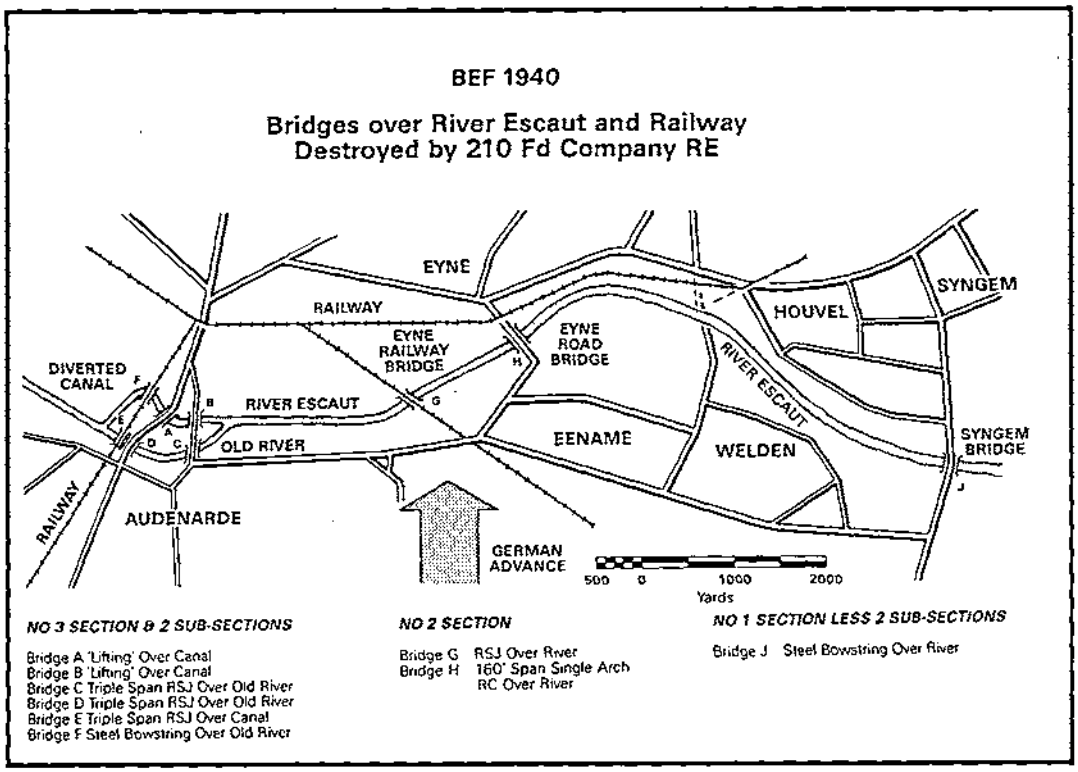
On 8 May I had to waste time from my company in being a member of a court martial. An infantry officer had become very drunk a few days before and struck a sentry. I never saw the end of this matter as I was summoned by the CRE to an 'O' Group very early on the morning of 10 May and learned that the Germans had broken through at Sedan and my orders were to move 210 into Belgium passing over the 'start line' at 1600hrs. Our task was to prepare for demolition, the bridges over the River Escaut from Audenarde to Syngem (both inclusive).

We were to find billets in Wannagem Lede just to the north of Audenarde. A troop of anti-tank guns was to come under my command to protect our column and to take up positions to guard the bridges on arrival.

We moved off and passed over the start line on schedule, the order of march being - myself and driver leading, followed by the troop of anti-tank guns and then the field company. We travelled at 20mih and 15vtm. Having passed over the Belgian frontier I was somewhat puzzled by the cool reception of the people and then I found that they didn't know whether we were friend or foe. So at next check at a level crossing, we shouted we were British. There were loud cheers and food and wine was pressed on all as we passed. Second in command, Amlot who was bringing up the rear of our column was almost inundated with expressions of goodwill. Having the guns under command, reminded me of the old days of promotion exams, when one always seemed to be dealing with 'a small force of all arms'. This column of mine wasn't exactly 'all arms' but at least I had four guns under command!

We arrived at Wannagem Lede at 1900hrs and found accommodation in an attractive chateau, set in lovely grounds and also in the village school etc. I called an immediate 'O' Group and decided to recce the river line at first light next day with Clayton Bannister. The 'O' Group to reassemble again by our return at 1000hrs. I had a very comfortable bed in a handsome room in the Chateau and was very loath to leave it when the sentry called me half an hour before first light. As we drove away from the Chateau and came in sight of the first bridge in Audenarde it was difficult to appreciate that at last after many years of training, this was our first job 'in real anger'. The countryside looked just as peaceful, just as usual, but we knew things were 'hotting up'!

We completed our recce by about 0900hrs. The job took rather longer than we expected as there were no less than six bridges in Audenarde, four road and two railway bridges. From the map it wasn't easy to see that the river had been canalized and that in addition to the two electrically controlled 'lifting' bridges (the bridges could be raised to allow canal traffic to pass under), there were two triple-span steel girder road bridges



with timber decking over the old river. Then we had to visit the two bridges at Eyne, one of them a long single span RC road bridge and the other a railway bridge. Finally we looked at the RC bowstring bridge at Syngem.

However, at my 'O' group at 1000hrs, I allotted work as follows (see map): Six bridges in Audenarde - No 3 Section (Clayton), and I gave him two sub-sections of No 1 Section to help him.

Two bridges at Eyne - No 2 Section (Hughie). One bridge at Syngem - No 1 Section (less two sub-sections of No 1 Section) (Goughie).

Section officers with their NCOs made their recces during the remainder of the day and preliminary preparations commenced.

The 44th Division almost in its entirety arrived in the area on 12 May and my anti-tank gunners reverted to command of CRA. The 11th Field Company joined the Division and were preparing the bridges over the Escaut on our immediate right starting at the same time as we did. 131 and 132 Infantry Brigades started the preparation of a defence line on the Escaut assisted by 209 Field Company under their OC, Brevet Lieut Colonel Donald Portway.

I made arrangements for the necessary timber for supporting the explosive charges and boxes for the gun cotton charges from a timber yard in Audenarde. I solemnly signed a bill for the timber produced by a very pretty and helpful girl who I think quite believed that it would eventually be paid.

By 14 May, refugee traffic had increased enormously and its control added a big problem. It was indeed a sad sight to see these poor people who had left their homes with a few of their most treasured possessions in hand carts and perambulators, some even driving a cow. Those that owned cars were chock-a-block with their family inside and on the roofs were lashed double mattresses and bedding.

On 15 May explosives were delivered and reserves of explosives on the following day. Due to the German advance, it became clear that the prolonged defence of the River Dyle was impracticable and the withdrawal of the BEF to the line of the River Escaut was ordered to

commence on 16/17 May. As several Divisions would have to retire over our bridges they would be classified as 'Final demolitions' so on 17 May charges were placed on bridges but no firing circuits were laid. However on the morning of 18 May, orders came through that the FID (Fuze Instantaneous Detonating) and electrical circuits would be laid with gun cotton primers and detonators but the latter would not be inserted in the charges. Firing parties were to be prepared to blow the charges at short notice.

On this same day, 10 Belgian Division started to take over the left part of 44th Division sector but 210 was to remain responsible for blowing the bridge at Syngem and for the bridge at Eyne but would do so under orders of Commander 10 Belgian Division transmitted through a Belgian officer stationed at each bridge. As these bridges were required for the retirement of the BEF, it was arranged that the Commander 10 Belgian Division would obtain agreement of the Commander 44th Division, before ordering the bridges to be blown.

By the night of 18 May, all demolition preparations were completed and the bridges for which we were responsible, were ready for blowing.

The bridge at Syngem which was Goughie's responsibility, was a reinforced concrete bowstring bridge on brick abutments. We found that there were prepared demolition chambers in each of the abutments. Goughie had detailed a firing party to be in position to await instructions of Commander 10 Belgian Division. The bridge was in use with part of the BEF withdrawing over it. Back at Divisional HQ, no approach had been made by Commander 10 Belgian Division regarding the blowing of the bridge, when about 1500hrs, a message was received that it had in effect been blown. Our Divisional Commander and the CRE visited the bridge and found the information was correct. Although the bridge had fallen, the charge in the enemy abutment had not detonated and the tops of the bowstrings were sticking out of the water and so formed a possible infantry crossing place. The CRE ordered the demolition party to blow the enemy abutment and cut the bowstrings; and this was done.

The result of this early demolition was that 3 Division which should have retired over this important bridge had to be diverted to the south across another bridge.

It transpired subsequently that the Commander 10 Belgian Division, with the intention of ensuring that the bridge was not blown before necessary, had sent a letter to the Belgian officer at the bridge. On the envelope of the letter he wrote 'Not to be opened until the enemy approaches so close to the bridge that there is a danger of it falling into his hands'. Inside the envelope was an order to blow the bridge forthwith. It appears that the Belgian officer on the bridge opened the envelope without reading the instructions on the outside. Consequently he gave orders for the bridge to be blown. Goughie was shown the order and not the envelope and as it was signed by the Belgian Divisional Commander, he blew the bridge. It seems to me to be a classic example of how not to give an order on this important subject. This episode is on record in the History of the Corps of Royal Engineers Vol VIII page 29 (here the wording on the envelope 'close' is defined as 300 yards).

Now we come to Sunday 19 June when I much, much regret to record that we had our first serious casualties. The demolition of the road bridge at Eyne was Hughie's responsibility. This bridge was a large (160ft) single span reinforced concrete one built to commemorate the crossing of the River Escaut by the 37th Division of the American Expeditionary Force in 1918. It was not of true arch construction and the two halves were separated by an expansion joint in the centre. Each cantilever consisted of about six reinforced beams which carried the decking of the bridge. The spaces between the bottoms of the beams were also concreted in. As a result the whole bridge was totally enclosed and looked like an ordinary arch bridge. There were steel doors into this hollow bridge but they had obviously not been opened for years and the air inside was so foul it was almost impossible to work there to fix the charges. Fresh air was blown in from a compressor and even then sappers could only work in short shifts. Owing to the great number of beams a great deal of explosive was required and many initiation points involving much FID.

As I have said, this bridge was ready for blowing on 18 May but on this Sunday at 1100hrs an

enemy air attack came in, and this bridge was one of the targets. Some bombs fell beside the bridge and smashed up all the external circuits. Some bombs hit the bridge itself and large lumps of concrete were displaced from the inside of the decking and charges and FID circuits were dislodged but none of the charges were detonated and the bridge was quickly cleared for the heavy traffic. Sadly, casualties were inflicted on the demolition party. (Details later).

The CRE visited the bridge with the Divisional Commander and formed the opinion that the time taken in clearing debris and reconnecting the charges would be so long that there would be danger that the work could not be completed before the arrival of the enemy. Permission was therefore given by the Divisional Commander to blow the bridge. A fresh set of charges were prepared inside the bridge across the crown of the arch and the existing FID circuits connected. By this time it was estimated that there was over three tons of explosive in the bridge and the whole was detonated successfully. Only a mass of tangled reinforcement hung down from each abutment. I remember looking at the huge empty gap with the CRE and he said: "a really complete demolition" which was praise indeed from him. It was no mean bang and every house roof within 300 yards was holed by falling debris!

The railway bridge at Eyne had to have holes cut into the brickwork to form abutment chambers and the piers were drilled and filled with explosive. Hughie Clements blew this bridge at 1700 hours.

Now let me tell of the six bridges in Audenarde, which were the very considerable tasks given to Clayton Bannister with his No 3 Section and two sub-sections of No 1 Section.

There were two railway bridges in the town, one was a three- span steel girder bridge on masonry piers and the other a steel bowstring bridge on brick abutments. In the case of the latter, the abutments had already been cut for demolition charges by the Belgian army.

The sappers plodded on and the two railway bridges were destroyed successfully by 1615 hrs on this Sunday 19th.

There were two routes through Audenarde. The westerly one had firstly a triple-span steel girder bridge on concrete piers over the old river, then after a shopping street another bridge which in this case was an electrically controlled steel 'lifting bridge' over the canal (this bridge could be raised for canal barges etc).

The easterly route through Audenarde was precisely the same as the westerly. There were two bridges of the same specification, ie one a steel girder bridge and the other a 'lifting' bridge.

The piers and abutments in the two triple-span bridges had to be drilled. The 'lifting' bridges had explosive chambers already in the abutments and drawings of them were produced by the CRE.

Orders were received on this Sunday to blow all bridges by 1600 hrs except the two on the easterly route through Audenarde which were now to be 'final demolitions' on the final route for our forces.

The enemy air raids that came in at 1100 hrs attacked not only the bridge at Eyne as previously related, but targets were also the two triple-span bridges in the town. The bridges were not hit but bombs fell within a few yards and explosives were dislodged and electrical connections broken. Sadly, again casualties were inflicted and our losses for the day, including those at Eyne road bridge were six sappers killed and five wounded.

Bridges on the westerly route through Audenarde required work. Repairs to the triple-span bridge charges were necessary and it was blown piecemeal at 1400 hrs and the lifting bridge by 1600 hrs.

This left in the whole divisional sector only the one route intact viz the easterly route through Audenarde, here the triple-span bridge was blown at 2359 hrs. Brigadier Steel, commander 132 Brigade, Clayton and I were present. It was of course a terribly important demolition, being the last link. We all walked down the street together to inspect the demolition which we found to be a complete one. We were astonished to find that in spite of the tremendous blast - a hurricane lamp was still standing upright and intact on the near abutment of the bridge.

132 Brigade continued to hold the 'island' between river and canal and a party of No 3 Section was left to blow the one remaining bridge over the canal. In the event, when the Brigade

withdrew on the night of 21/22 May, their commander refused permission to blow the bridge on the grounds that it would betray his retirement to the enemy.

On 20 May, 210 moved to Knocke and had not been there more than a couple of hours before orders were given to send practically all of us to the high ground west of Audenarde to prepare a defensive position. Hasty defences were constructed and digging went on through the night. Captain Ken Black was sent from HQ RE to help with things and I got to know him well after the war. He was a brother architect and many years afterwards he used to remember some 'wonderful' tinned bacon that we had for breakfast! Another officer the CRE sent me was Lieutenant John Read, a regular sapper officer (afterwards to become - Lieutenant General Sir John Read).

The CRE then ordered me to proceed at once to Courtrai and to take over and prepare for demolition the bridges over the River Lys. It was a tall order because there were eight of them including the bridge south of Weveighem. I found that an army field company was already at work on some of the bridges but they had orders to hand over to 210. While on this recce 210 moved to Dadizeelfhoek near Courtrai and from there took over the bridges and commenced work. We found that little had been done and what little there was, was certainly not to our standards, so we tore it out and made a fresh start! We had to move fast, because during the night of 21/22 May, orders were received to blow the bridge south of Weveighem and all the bridges in Courtrai, except the bridge carrying the westerly main route through the town. This was accomplished by dawn. However the GOC Division personally ordered me to proceed to the bridge at Bisseglhem and destroy it at once. I had got to know him well ever since we were together on the Course at Chatham and he came with me to the bridge and said "Blow now". Afterwards he asked me how I was and I said I had little sleep in the last few days and the only thing he said was that that was bad management!

During the morning of 22 May, 2 Section worked feverishly on the bridge carrying the westerly route through the town to get the work completed and it was finally blown at 1500hrs on the orders of the CRE. There was a cross roads near the bridge and the working party and the NCO detailed to actually blow the bridge took cover round the 'safe corner'. I was with the party and we thought we were free from flying debris. We didn't observe that we were too close to a large plate glass shop window and when the bridge was blown, large chunks of glass fell around us. Fortunately none of us were hurt.

I have previously mentioned that I was short of sleep. I found too, the responsibility of ensuring that demolitions on two river lines to fit in with the Divisional plan was a great strain and naturally I worried a lot. It was taking a tremendous lot out of me. One used to do a good deal of training in peacetime with dummy demolitions but of course one never blew up a bridge 'in anger'. It is I suppose, the one task that one can never be sure of success until the final moment when the exploder handle is pushed down.

I don't know how it came about, but I was driving myself in my Humber utility truck and I had only proceeded a few miles from this bridge that I have just mentioned on my way to our billets, but suddenly I must have dropped off to sleep for a second and the next thing I knew was that I had hit the low parapet of a small bridge over a stream and plunged down, fortunately the right way up in four or five feet of water. The utility had spun round and finished up with its bonnet under the bridge! I picked up my haversack with my secret files and 4oz of Log Cabin tobacco, clambered up the bank and was picked up by a passing vehicle and driven to my billet. I remember nothing more until I woke up after a very long sleep and found that I had been put to bed by my batman. I was distressed to find that 210 had left for the area of Fletre leaving me with my batman and a driver with another utility. Why, oh why, was I driving myself that day? I shall never know. How stupid can you get!

When we arrived in Fletre, I found Amlot had set up our HQ in a brewery. The general situation was then becoming very confused and 210 came under command of 133 Infantry Brigade.

On 23 May, 210 was ordered to prepare for demolition three bridges over a canal in the general area of Foret de Nieppe. Some work of

an elementary nature had already been done but it had to be stripped out and completely redone. Two of the bridges were blown at 1400hrs and firing parties left on the final demolition.

The Company endeavoured to rest on 24 May but were under constant long range fire the whole time. On 25 May the final demolition at the Foret de Nieppe was blown and German tanks could be seen about two miles away.

During the night of 27/28 May, parties were sent to Caistre to construct road blocks and to place the town in a state of defence. At the railway crossing, railway carriages were pushed across the roadway and the wheels blown off. Sundry other blocks were made at other entrances to the town. Shelling continued all day, two of the Company were killed and five wounded during the construction of the road blocks. This really is the moment that we carried out our last sapper task because on 28 May, Hughie Clements and his No 2 Section were sent to report to 4 Royal Sussex Regiment to take up a defensive position and act as infantry.

I should say at this point in this narrative that this is the fourth account that I have written about our activities in Belgium. The first time I put pen to paper was just after the end of the war when I was asked to do so by Brigadier B T Godfrey-Fausett who, as I have previously said, was our CRE at the time. I was given great assistance by Clayton Bannister who acquitted himself well with and after leaving 210 and became a Lieut Colonel and won the MC and Bar. This first account is entitled 'Activities of 210 Field Company with the BEF May 1940'.

Secondly, I produced a booklet entitled '210 and the BEF' and is largely reproduced from an article appearing in a magazine that an ex-sapper brought to one of our 210 Reunion Dinners.

Thirdly, I produced an extract from 'A guide to Royal Engineers Battlefield Tour - The Seine to the Rhine'. I feel that all ex 210 Sappers who were with the BEF, can feel proud that their exploits were considered by the 'Top Brass' to be used as a classic example for training sapper officers of the future.

Now to return to what was to be our last billet ... Fletre.

I went along to Caistre to see what 4 Royal Sussex had in store for Hughie and his Section. RE parties had already been there on the construction of road blocks as previously mentioned. There had been a big tank attack on Caistre involving twenty light and medium enemy tanks and enemy shelling continued throughout the day. I was informed that our No 2 Section would be employed with the infantry. I recollect I was asked by a padre: "Are your men going to be facing a dangerous role?" I replied that I did not like the look of things at all. Whereupon he said "Would the men like to say their prayers"? I replied that although this might be very desirable, I didn't think it would raise their morale. I'm afraid I had to leave it at that.

I brought home with me my message pad and I have preserved a few messages in my Scrap Book. Code names were used to identify units, consisting of four letters. These code names were changed daily. It struck me that it was extra-ordinary that 210's code word for 28/29 May should be EPIC seeing that we were about to face the 'epic of Dunkirk' as so many of the Press called it.

I was summoned to an 'O' Group at 133 Brigade HQ at 1800 hrs on 28 May and was ordered to move 210 to Dunkirk starting to leave Fletre at midnight. I returned immediately and held my own 'O' Group. There was the usual to organize because as far as we were concerned it would be a normal move, although all realized that there were few roads that the Germans did not occupy after I had painted the picture to them.

We had a good meal, put up haversack rations and ensured water bottles were filled and usual ball ammunition was carried. Route cards and marked maps were issued. I was advised by Brigade to use the road running almost due north out of Fletre which would avoid Caistre, but as the Brigade Major said I must use my loaf because the situation was so confused that he could give little advice. I must say I had found commanding 210 to have been a great responsibility during our operations with the BEF, I now realized that we all had our greatest trial to come.

I feel that the public at home in the UK had a much better idea than we had of the sore plight of the BEF. Reports and maps were published daily

how we were completely surrounded. We had absolutely no idea of the big picture. I don't see how it could really make any difference to our final journey to Dunkirk. In fact, on reflection it was better not to know how slim our chances were of ever getting there.

I led 210 from Fletre on schedule time, the vehicles moving in pitch darkness, no normal lights except on rear axles. All went well until some distance from Fletre when, owing to the darkness, other columns cutting in and dense traffic, when we reached a fork in the road, I, with the first leading half of our column took the left fork and the remainder or some of the remainder took the right fork with the result they ran into the enemy. I was told afterwards, from some of them that had debussed and escaped capture, that they had been very lucky. To me however, this was most distressing and on looking back on the whole affair afterwards, I wondered how much was my fault but I felt that it was impossible to control the column from the front or any other position in it on such a dark night and apparent closeness of the enemy.

We that took the left fork drove slowly indeed with many checks to our progress, even our motor cyclists being unable to report to me what was happening to our column. When dawn broke, we were a mile or so south of the main canal running east/west across our route where we were heading for Bray Dunes. From there on, progress was impossible. Orders were given to smash our engines so that they could not be used by the enemy, abandon the vehicles and move forward on foot. The scene was indescribable. Hundreds of vehicles on their sides in ditches and men smashing generally. It was heartbreaking and something that never occurred to us could ever happen. After endeavouring to muster up as many 210 chaps as possible with their haversacks and rifles, we moved forward on foot through about five miles of smashed and abandoned vehicles and by about 1500 hrs found ourselves on the beaches of Bray Dunes.

Here I found the Brigade Major of 133, and soon after, my CRE. There were ships of all kinds, large and small, anchored a few hundred yards from the shore. Queues of soldiers, waist deep in the shallow water, waited to be picked up by ship's boats. Much has been written and photos taken. It was an incredible scene.

I was ordered to get my chaps to man any small rowing boats we could find and to get soldiers of any arm into them and row out to the ships. I was to make up parties of 50. I remember working close and into the water at the tide line, my boots and socks were saturated, likewise my trousers with a thick dark oil. We remained on the dunes until dusk engaged in this ferrying job and as soon as it got dusk we dug slit trenches and spent our first very uncomfortable night. There was shelling all the time and periodic bombing from aircraft. It was very cold in the small hours.

The next day was spent under similar conditions getting men off in small parties and shelling and bombing persisted, and I certainly don't want another experience like it.

This very appropriate little poem was handed to me by its author on my return from the BEF:

THE SKYLARK

1939 I

"Any more for the Skylark this morning?"
The bluff old fisherman roared,
"All the girls and the kids love the Skylark
So bring 'em along on board;"
"Any more for the Skylark this morning?
She's going for a trip round the bay,
"Come along" he cried, "there's a fine strong tide
And a breeze that's a treat today".

So up from the sands that morning,
Jumped Eddie and Bill and May
And the kids with their Fathers and Mothers,
To go for a sail round the bay.
They laughed and made love on the Skylark,
And trailed their hands in the sea,
While they talked of the flicks and the
landlady's tricks
And the herrings they'd have for tea.

1940 II

"Any more for the Skylark this morning?"
The bluff old fisherman bawled,
In the cold, grey dawn of Dunkirk,
Where the worn-out soldiers sprawled.
As weary and wet and hungry,
In uneasy dreams they lay,
They heard through the breath of the sighing
of death
"Any more for the Skylark today?"

Like ghosts from the sands that morning,
Rose the men who were dazed by strife,
They struggled on to the Skylark
And she carried them back to life.
She challenged the enemy's hatred,
She landed them safe in the bay,
And they heard a shout as they scrambled out,
"No more for the Skylark today".

VMS 1940

On Saturday morning I was told if we marched along the beaches there was a good chance of being taken off at Dunkirk harbour. I made up a party of about 50 including 45 of 210 and so we got away. I got on to a small drifter named *Forecast* with Lance Corporal Jack Pettitt, Sapper F Larkin and A N Other. At about noon we steamed out of Dunkirk Harbour and arrived at Dover during the evening. I learnt afterwards that we took 'Route Z' about 39 sea miles. We got a welcome drink and food at the harbour station as we had almost nothing to eat or drink all the while we were on the beaches.

I feel that my description of what happened whilst we were on the beaches is very inadequate but it is difficult now to write up something that happened so long ago and it was one of those places where I didn't take notes!

On The Durand Line - 50 Years Ago

MAJOR GENERAL PARTAP NARAIN (RETD) MA (CANTAB) FIE

This article originally appeared in The Journal of the United Service Institution of India, *October-December 1988 edition, and is reproduced with their kind permission.*

KUMAR KOCHHAR was one of the finest gentlemen I knew, we joined the army together. He had been to the Royal Indian Military College at Dehra Dun and had a head start on me. His father Col Kochhar, a distinguished army doctor, arranged for our training with the 8th Punjab and Probyns Horse at Lahore in drill square bashing and riding.

Of all the Indians, Chinese, Iraqis and other non-British who went to the Royal Military College, Sandhurst or the Royal Military Academy, Woolwich - (The Shop), Kumar was the only Indian cadet who was selected to become an under-officer.

We got back to India after nearly five years - he went straight to join 15 Field Company - which had been selected for Indianisation, whilst I drove my car up from Bombay to spend a few days with my parents at Lahore.

One day the Local Civil and Military Gazette came out with the news of the Waziristan operations against the Faqir of IPI who was gathering his lashkars for a fight. Always envious of Kumar I couldn't face the prospects of not having taken part in this little war and thus depriving myself of a medal. So I wrote to the headquarters at Bangalore and got posting orders to also join 15 Field Company at Razmak.

It was good to get away from the head hunting fond mothers looking for suitable husbands for their daughters. I shall never forget one overpowering lady, who only wanted me to say yes; she would then call me to tea to meet her most beautiful daughter, whose main qualification was she didn't even know how to boil water, a grim prospect for an old boy-scout!

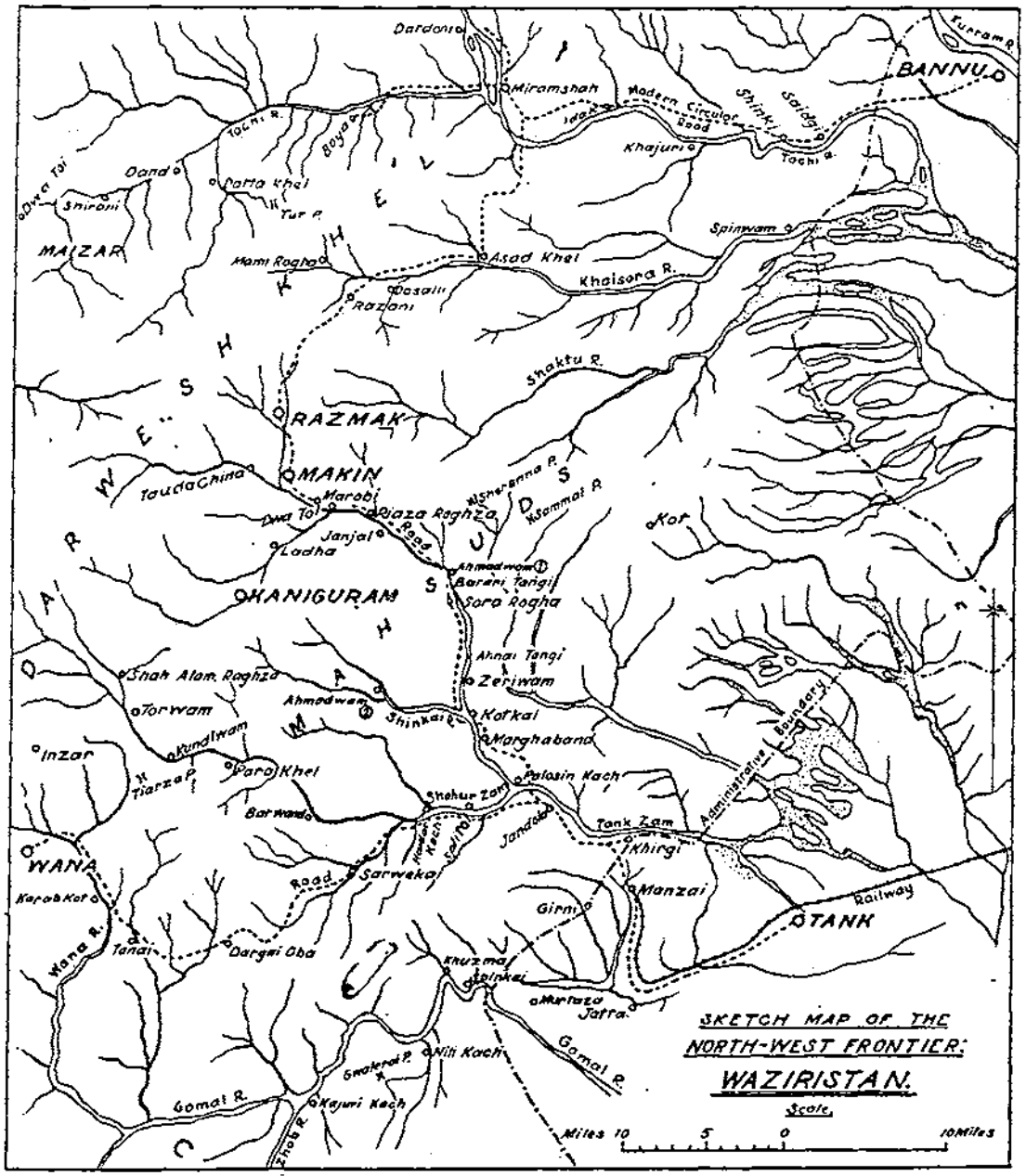
Travelling to the frontier was an experience, from Lahore by the Frontier Mail to Rawalpindi and then by car past Kohat to Bannu, night at the mess and then by car which fortunately the CRE had arranged complete with two Khassadars.

There, I reported to my OC Major E H T Gayer. He was our instructor at the Royal Military Academy, Woolwich - a hand picked officer for commanding the first Indianised Field Company.

The same afternoon he told me to set up a water point for the new arrivals outside the perimeter. I calculated the number of men and materials required, as per the book. I needed 20 men, but was told that the Company was fully deployed. I should ask the subedar sahib - Munu-Swami to let me have the sick and other stragglers in the lines for the job. The water troughs for the mules etc were taken to the site to be connected up to the standpipe at the camp-site, the work party got down to work as explained. In spite of my precise planning I discovered that I had forgotten the ubiquitous white-tape for traffic control - I went back to the camp to draw it. On returning half an hour later, to my horror I found the sappers watching a football match. I was furious with the NCO - but he said that the work was finished (*Ai Pocha*!) To this day I remember the dedication to work of our Madras Sappers.

The tribal areas including Waziristan lie between the North West Province and the kingdom of Afghanistan. These inhospitable and bare hills are inhabited by a number of tribes - Afridis, Mahsuds, Wazirs, Baluchis etc generally called Pathans. They have been independent from times immemorial and have only been marginally ruled from Kabul. It is perhaps not well known that even at the time of Akbar the Great, whose kingdom extended from Afghanistan to the very South, he did not exercise actual control over the territory below Kabul down to the Indus for the first 28 years of his rule, as Humayun on his death-bed in 1556 had given the kingdom of Kabul to Hakim, a three year old son from his youngest wife.

This territory which has never been subjugated



The above map is reprinted from the book entitled "The Indian Sappers and Miners" by Lieut Colonel E W C Sandes DSO MC, facing page 374

is inhabited by fierce highly proud tribesmen whose main ambition is to own a rifle and move about the hills seeking a prey on the highways. Lord Curzon had visited Kabul as an MP; on becoming the Viceroy, he initiated the forward policy; tribal areas administration was placed directly under the Central Government, instead of through the then Governor of Punjab. After the first Indo-Afghan war in 1919-21 Razmak, Wana and other Central points in Waziristan were

occupied. The control of the tribal areas was exercised through the political department with political officers posted to various areas. They were backed by local retainers not in uniform but on regular payroll called Khassadars, who were in charge of keeping peace along the roads, providing work parties to the MES for maintenance of roads.

Next came the guides and scouts - para military forces - dressed in Mazri (grey) uniforms, officered by specially selected *Pushto* speaking British officers. Battalions were organised in class companies of different tribes - Mahsuds, Wazirs, Afridis etc - each under subedars; jemadars, from their clans. The guides and scouts were well disciplined - they had regular stations with well guarded armouries - life was tense at times, when the weapons were stolen, they had to be recovered!! They were ultimately backed by the regular army.

The political officers had judicial powers and administered their areas through the Maliks (Head-men) and occasionally held Jirgas (gathering of particular tribes) to deal with law and order problems. Justice was quick as per special tribal laws.

Razmak, cantonment for a Brigade plus, under the command of General Norton of Everest fame is located just short of the Durand line - the recognised border between India (now Pakistan) and Afghanistan. It is a bleak and cold place at a height of 6500 feet. The accommodation was constructed of concrete block walls and corrugated, galvanised steel sheet roofs. The brigade headquarters was a double storey building on a wide tarred road. The camp had a double random stone perimeter wall, the watch towers and gates of stonework were continuously improved by the sappers. The camp was defended day and night by picquets on the hill tops and watch towers - a strictly male domain - I believe no woman had ever stepped in!

A kutchha airstrip lay on its East where our No 1 squadron of the Indian Air force would sometime land their Wapitis, noisy propeller driven biplanes. The playing grounds were on the West. There was also a local civil headquarters, office of the AGE Razmak and the transport lorries of Harichand Kapur & Sons - who ran the service from Bannu to Razmak.

King Commissioned Indian Officers were new entrants to the scene. The doctors had been in the Indian army since World War One, - Behari Kapur and Puri were at Razmak with the Field Ambulance cum Hospital before the influx of the infantry officers from Sandhurst/IMA to the Indianised 6/13 Frontier Force Rifles - the famous Piffers. This was followed by Sappers led by Aserappa. We got on very well together, the troops looked up to us, the British Officers watched us like hawks, the Viceroy's Commissioned Officers took time to get over suspicions.

Mohamed Musa who rose to become Chief of the Pakistan Army, Akbar "the General Tariq", who led the Pakistan tribes attack on Kashmir in 1947, Mohamed Yusuf whom I had met as a young scout at the world jamboree at Birkenhead in 1929; Pran Narang who unfortunately was killed in World War Two, were excellent company. We had some excellent Desi Khanas in the 6/13th mess - the Sunday curry lunches were very popular with all. Another activity was bridge, we played auction bridge those days!

The daily regime was fairly hectic, we got up for early morning PT parade, ended in the evening with games, basket ball or volley ball inside the camp area, hockey and football matches on the grounds outside the perimeter. The Madras Sappers as usual did well at Hockey, we won a challenge trophy. There was even a golf course on the West round the airstrip.

The camp was well protected, tops of surrounding hills had picquet posts - round stone wall sangars held day and night by the men from the infantry battalions. One dark night, the tribesmen crawled up to a post held by the 1/9th Gurkhas and managed to surprise the sentry and inflicted a gash across his stomach. His sathis awoke, took out their Khukris and let the invaders have it. The Gurkhas, once their ire is on, and have taken out their khukris are formidable; by tradition a khukri is never sheathed till blood is drawn - even from one's own finger! They cut down the heads, arms whatever came in their way. The enemy fled taking away their wounded - next morning, the amount of blood around the post had to be seen to be believed. The sentry when he was brought to the field ambulance hospital had his intestines

Author in front of HQ Razmak Brigade

hanging out. Behari Kapoor performed an excellent operation, sewed him up and the Jawan was back hale and hearty soon after. I believe the Gurkhas behaved in a similar exemplary way in the Falklands war, which came to an abrupt end soon after they had landed!

The brigade was entirely based on animal transport. Motor transport was allocated when required. The company equipment except for a petrol engine driven Warsop drill for boring holes for demolitions, a Petter engine for lighting was archaic. The picks and shovels were kept highly burnished under the watchful eyes of the British NCOs. We had horses and mules on our establishment - saddlery and special harness (Khajas) to carry the equipment on the mules.

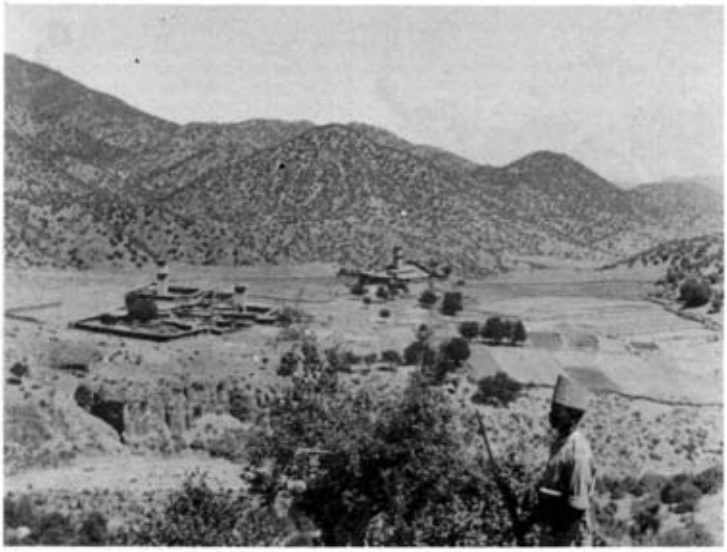
It was bitterly cold - we would gather in the evening outside the wall, wrapped up in Poshteens - have a whisky mac - a concoction of whisky and brandy developed by Capt Lillie, our second in command before going to the 1/9th Gurkhas mess for dinner, just over our boundary wall. I was a confirmed beer drinker, I hated whisky. When served on mess nights in the Chatham Mess I used to quietly pour it into the potted palms. I used to gulp the whisky mac as a medicine - looking back it was like tossing vodka.

Sappers had besides training and education - maintenance and road improvement tasks. We once had to build a high retaining wall which involved cutting a toe foundation, Jemadar Subbarayan was in charge; when he was ready to

1/9th Gurkhas working party on Razani Road

start building he showed it to me - a green horn engineer, I said it ought to be deeper. Within minutes of the additional excavation, the whole hillside started slipping - after that I never questioned his practical judgment!

Another interesting job was realignment of a hairpin bend - Greenwood's Corner - named after CRE. We always had half the section deployed for local defence. The sapper manpower was therefore limited, the local coolies when arranged by the department were a lazy lot, consisting of young boys and old men. Two men with one shovel between them - one holding the shovel and the other pulling it with a string - were less than half as effective as a sapper. The infantry working parties were effective. I shall never forget the 2nd/11th Sikhs - the famous Royal Ludhiana Sikhs, an excellent specimen of men, all six footers, well led by the British Officers who always worked alongside - they could shift the earth really fast. The first time they worked for me - on the new road from Razmak to Razani - they finished the four hour task in less than two hours - I therefore increased it - in spite of protests by Capt McLoed, the O/C detachment; they got down to it - with their war cry *Sat Siri Akal* and marched off well before time.



Pathan villages with towers

The *faqir* of IPI was a Tori Khel, by name Mirza Ali Khan; he came into prominence by championing the cause of ISLAM, starting with the case of Islam bibi, a minor Hindu girl, who eloped from Bannu with a young Muslim student. On the 26th February, he made a most inflammatory speech asking the Maliks and Khassadars to desert government service. We went out for various route marches called columns. The system of passing columns through ravines was the same as practised by Pollock in 1882 when he forced the Khyber pass. The columns consisted of all arms, with conventional advanced guards, main force and the rear guard - except that we started with a large advanced guard and ended with a much larger rear guard. The advanced guard commander used to carry a double viewing stick, he would call up one of the officers and detail him to capture the *Tekri* (hilltop) indicated, the detachment would double up the hillside to hold it till the rear guard had passed through the defile safely and then join the rear guard. The pace of the column was the regulation three mile an hour with ten minutes halt to the hour. As precaution against the snipers, officers wore the same headdress as the troops, our sappers wore cardboard *shakos*; we had to wear pith helmets and presented conspicuous targets on our horses. I shall never forget the first shot which whizzed past my head. We had to be vigilant all the time. Excellent training under conditions approaching active service; with a system of regular reliefs the whole army benefited.

Most of the columns mounted by Razmak Brigade were for showing the flag - the show of efficacy of our mountain guns - 3.7 Pack Hows was very impressive. The guns were carried on specially selected mules; one carried two wheels, another the breach etc. The mountain gunners, specially selected strongmen, could slap the guns together in minutes, fire a few rounds and just as quickly dismantle and swing up the parts on the mules.

On The Durand Line 50 Years Ago (1)

The Pathans and Rajputs have a common heritage and code of conduct. They carry animosities for generations, shelter their guests whatever their status, are extremely hospitable, sometimes embarrassingly so, they insist on peeling the egg for your breakfast with their not so clean hands!

Their villages have look-out towers - like the water towers in the West - sometimes two. We had the unpleasant task of destroying a village of the Tori Khels, who had refused to punish the culprits alleged to have shot one of our political officers. The ultimate step was taken after all other methods of persuasion and coercion including the holding a *Jirja* (meeting of the clans) failed. The villagers were warned to evacuate: to make sure pamphlets were dropped by the air force. IAF Army Cooperation and Fighter Bomber squadrons were used for bombing, strafing and air observation. The tribesmen could only shoot at low fliers with their rifles. Jumbo Mazumdar, Subroto and Awan of No 1 Squadron based at Miranshah, only a few minutes flying, flew overhead when we reached our target.

As usual we assembled outside the camp area in the dark, and started at dawn, going through the *Sahor-Tangi* (defile), picketing the hills. The village lay in a valley - near a stream and consisted of twenty or so houses, mainly mud walls and thatched roofs. Only the house of the headman - Malik - who had more resources having worked with the MES, was a bit more substantial with corrugated iron sheets for roofing. The watch tower was a square double-storey structure.

The infantry surrounded the village which was deserted, sappers went in with their gun cotton and gelignite charges and blew up the houses, this was possibly more a political show of strength - blowing up the houses with the consequent noise of explosions. Finally, the houses were set on fire and from our ridge we saw them burning well, with the wind from the west rising, the tribesmen fired desultory shots at us from a long distance. With the high cost of ammunition, they don't like to waste it - these shots were a token expression of their resentment. A quick and orderly withdrawal - well executed followed, and we were back to the camp for dinner.

The ding-dong skirmishes went on for quite sometime, till IPIs men laid a siege round the camp, cut off our telephone lines and the road. There we were, stuck on top of Razmak hill with the next post at Dosalli on the Khaisora river about 35 miles down the hill - with only the occasional Wapiti dropping the mail.

The General decided that he had had enough and asked the sappers to reconnoitre and re-establish communications. Lillie and Kochhar were at Dosalli, Harkirat had been posted out, only Lawny Gayer, Aserappa and myself were at Razmak - I was detailed.

Starting at dawn with the usual commotion caused by mules kicking we started down the hill - my escort, the Gurkhas the winners of the khud races - were extremely agile running down hill, took the shortcuts, whereas I had to walk along the road full 35 miles measuring gaps - of bridges and culverts blown, noting the telephone posts destroyed. On top of it, I was dressed in battle order, breeches and boots with map cases, binoculars, compass, camera to take photographs, haversack, water bottle festooned like a Christmas tree. By noon we got down the hills and stopped for a short break for lunch, then came the long haul from the foothills to Dosalli, the last ten miles or so - the sun beat mercilessly and the breeze died down with the result that I still remember very vividly putting my hand in my haversack and finding the chocolate bar gooey and messy! The water bottle was long empty.

The sight of Dosalli on Khaisora river was good for the eyes - we were welcomed by the garrison; there was a permanent Tochi Scouts post, plenty of water, Capt Lillie and Kochhar's detachment were building Braithwaite tank towers. Kumar looked after me extremely well, we sat by a small swimming pool and regaled ourselves with tea.

The night as is usual came down suddenly and just as I was getting back on my feet - we got a signal from Waziristan District Headquarters calling for the report immediately. Believe it or not! - I was dead beat and was in no condition to sit down and write a report. Kumar came up with the solution - have a whisky soda - I did as a medicine, the report was written and dispatched in time.

Royal Engineer Geologists and the Geology of Gibraltar

Part IV - Quaternary "Ice Age" Geology

COLONEL E P F ROSE TD MA DPHIL MIWEM FGS AND
MAJOR M S ROSENBAUM RE (V) BSc PHD ARSM DIC EURING CENG MIMM FGS

This is the last in a series of four articles describing Sapper-related geological research on the Rock of Gibraltar. It is also the last of eight articles contributed to the Journal *by Colonel E P F Rose, and marks the end of his career in the Territorial Army after nearly 30 years service.*

Ted Rose first put on uniform at the age of 14 as a cadet in Emanuel School Combined Cadet Force, where he began service by winning the School's annual CCF recruit's prize (Warren Cup) and finished as senior cadet NCO in its RAF section. He then enlisted in the Oxford University Officers' Training Corps, so joining the Territorial Army. After commissioning, he continued service with the OTC before transferring via the Queen's Own Oxfordshire Hussars and the Oxfordshire Rifles into the Corps in 1969. He effectively became the senior geologist in the Engineer Specialist Pool in 1972, and officially served as such for the 13 years 1974-87, before promotion to Colonel and additional appointment as Commander Royal Engineers Specialist Advisory Team. He has contributed a chapter to Military Engineering *Vol XV* Applied Geology for Engineers *and over 50 geotechnical consultancy reports for Corps projects in locations ranging initially from Bangkok to Brussels, and latterly from Belize to Berlin. These projects have included brief attachment to many Army, Navy and Royal Air Force units and the United Nations Force in Cyprus: also direction of the military feasibility study which led to establishment of a Public Works Department geological survey and new geological map series for Hong Kong. His appointment as Commander of the RE Specialist Advisory Team and the ten Specialist Teams RE(V) sponsored by Central Volunteer Headquarters RE expired on 1 April 1990 and he consequently transferred to the Regular Army Reserve of Officers.*

INTRODUCTION

PART III of this series described recent observations and interpretations relating to the Mesozoic bedrock geology of Gibraltar, of relevance to engineers dealing with tunnels through the Rock or the foundations of major construction works upon it. Part IV now deals with the "superficial" deposits, geologically of much more recent age, which overlie parts of the bedrock surface. In Gibraltar, these superficial deposits contain unusually spectacular accumulations of scree breccia and sand. The breccia has long been quarried as a source of fill for land reclamation and subsequently the floors of old quarries themselves have provided level sites for later building works. The sand has also been quarried, to provide fine aggregate for use by the building trade which has boomed on post-War Gibraltar, even though it is not ideal for this purpose. Moreover, due to the steep slopes above, quarrying has been at some threat to the stability of the higher ground, notably that occupied by the east coast water catchments.

Both breccia and sand were deposited during the Pleistocene epoch, popularly known as the "Ice Age". This epoch in fact consisted of a series of climatic oscillations of which the present is but part of the most recent temperate stage. Most Pleistocene deposits formed at times in the past when climate and sea-level differed significantly from those of present-day Gibraltar. Raised wave-cut platforms and their associated former marine cliff lines provide spectacular evidence for at least two ancient sea-levels. Raised beach sediments and other marine erosion features provide evidence for many more. Caves are associated with some of the cliff lines, and the Rock is honeycombed with additional caves and fissures formed by groundwater when the climate was more humid and relative sea-level (and consequently groundwater level) different to that at present.

These caves were put to use for protection first by prehistoric animals (many now extinct), later by prehistoric man (*Homo neanderthalensis*, also extinct), and more recently by Sappers (who still survive there).

This final part in our series of articles on Gibraltar therefore summarizes present knowledge of geologically recent features on the Rock to explain the occurrence of the most readily worked natural stone resources and building levels and also the caves which, partly through Sapper support or guidance, are enjoyed annually by so many visitors.

Quaternary Sediments

Figure 1, simplified from the Quaternary component of a geological map of Gibraltar prepared in 1989 by M S Rosenbaum (as described by Rose & Rosenbaum, 1990), illustrates the distribution of the six most widespread types of superficial sediment on Gibraltar:-

Contemporary and Recent Beach Sands and Gravels. The most extensive natural sandy beaches occur along the east coast: at Sandy Bay, Catalan Bay, and the eastern margin of the Isthmus. A brief unpublished report by Captain G B Alexander RE in 1947 described the general northward drift of these sands, and the rapid erosion of tunnel spoil dumped on the eastern beaches. He also recorded pebbles of igneous and metamorphic rock, presumed to be derived from offshore submarine outcrops (although redistribution of ships' ballast by sea currents could also have produced such pebbles). Some pebbles on the Isthmus' eastern beach are now certainly being added from building spoil dumped at its southern end.

Isthmus Sands. Smith (1846) and Ramsay & Geikie (1878) described the Isthmus in the 19th century as a sandy plain, full of marine shells, "a most perfect example of a raised shallow sea-bottom". The surface sands have been penetrated by a dozen boreholes: four shallow wells bored for the Sanitary Commissioners in 1869; the 24 metre Ramsay borehole of 1878; the 92 metre Roberts' Well borehole of 1892; and six British Geological Survey boreholes of 1985. These proved that the surface layer of fine to medium grained marine sands is some 10 metres thick, underlain by an extensive marine clay, in turn underlain by more variable sediments to a total depth of some 20 metres in the west and at least 60 metres in the east. The sequence was almost certainly deposited within the last 10,000 years during the Holocene rise in sea-level which accompanied melting of the North American (Laurentide) and Scandinavian ice sheets at the end of the last glacial stage of the Pleistocene (Oxygen Isotope Stage 2 in the scheme of Shackleton & Opdyke, 1973). The sands were readily excavated by Spanish military engineers during the various sieges of Gibraltar, notably with the creation of saps to assist their advance. Today the sands are almost totally obscured by the runway and airport buildings, but they still have some significance as an aquifer which is tapped by shallow wells across the North Front.

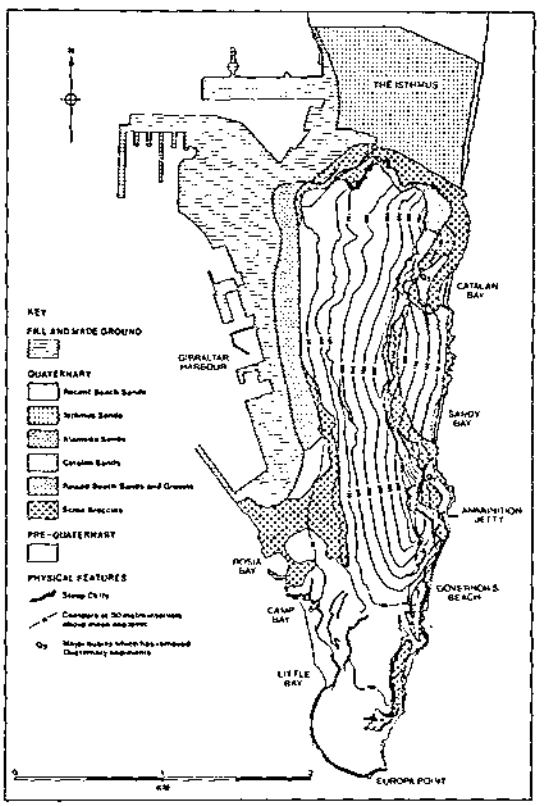


Figure 1. Map of the Quaternary geology of Gibraltar, extracted and simplified from a computer-drawn geological map compiled by M S Rosenbaum on base map at 1:5000 scale; derived from manuscript geological maps by Ramsay & Geikie (1876) and Alexander (1947) and fieldwork during the years 1980 to 1989 by G Cunningham, E P F Rose and M S Rosenbaum

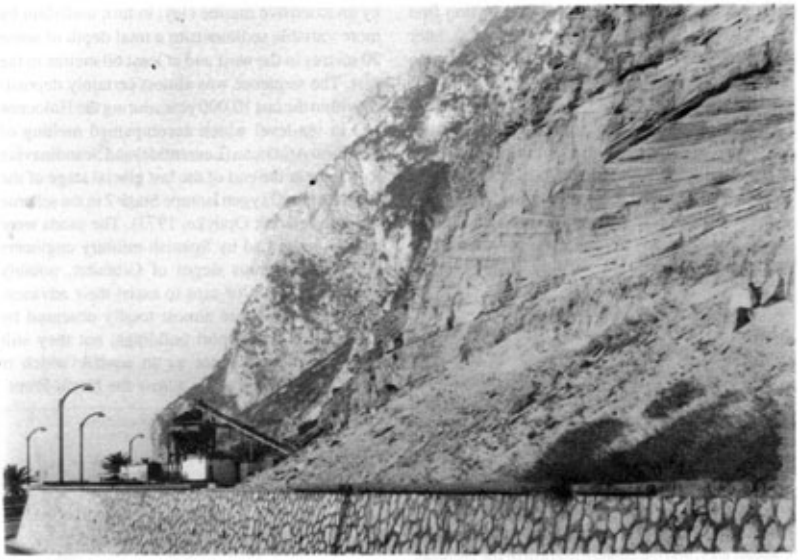


Photo 1. Catalan Sands, at foot of main water catchment area near Catalan Bay, viewed from the north; the large-scale cross-bedding, together with the roundness of individual sand grains, indicates formation as wind-blown dunes. (Scale indicated by quarry hopper and street lamps to left of photo.)

Alameda Sands. Ramsay & Geikie (1878), and to lesser extent Greig (1943), refer to the red sands which lie beneath much of the area now occupied by the town on the western side of the Rock. They may still be seen at the surface in parts of the Alameda Gardens. These fine-grained, quartz sands have well rounded grains and are thus probably aeolian (windblown) in origin. It is likely that they formed at a time during the Pleistocene when sea-level was lower (ie during a glacial stage) and quartz-bearing sediments were exposed to wind erosion in a region now covered by the sea. However, their red colour is due to a thin coating of an oxidized iron mineral, probably haematite, which typically forms by pedogenic (soil-forming) processes under seasonally humid warm climatic conditions. The Alameda Sands have been reported to reach 50 feet (some 16 metres) in thickness, and are frequently encountered in building site excavations within the town. Their extensive red coloration has considerable implications for pedogenesis.

Catalan Sands. From 18th/19th century paintings, water catchment construction records, and recent borehole evidence these sands are known to underlie much of the lower slope beneath the major water catchment area on the east coast. They can currently be seen in cuttings and quarry faces at the toe of the slope as a series of about 30 truncated dune cross-bedded cemented sand units *(Photo 1)*. The sand consists mostly of quartz with subordinate microfossils and lithic fragments, the grains being generally well rounded. The sand is well sorted, with the grain size mostly medium but with 15 to 30% coarse (0.6 to 2.0mm) sand and only 5% fine (0.06 to 0.2mm). Since there is very little cement the porosity is high. Although the principal bedding planes dip gently to the east, most of the stratifications within the dunes dip westwards at between 20 and 30 degrees.

The Catalan Sands clearly originated as windblown dunes and as such are typical of similar deposits found elsewhere in the western Mediterranean region (Butzer & Cuerda, 1962). The high

percentage of quartz grains indicates that they have been derived from a source outside Gibraltar (since Gibraltarian rocks have almost no quartz-bearing strata). The most likely source is the area which now forms the sea floor east of the Rock, at a time in the past when sea-level was low enough to expose this floor to wind erosion. The grains are too large and heavy for wind to have moved them far, and westward dip of the minor bedding within the dunes is consistent with winds blowing from the east.

Alexander's (1947) map legend noted that, like the Alameda Sands, the Catalan Sands were more recent than a 25 foot (= 8 metre) raised beach. However, site investigations in 1983 and 1987 for proposed slope stabilization projects indicated that the Sands may extend across an even higher platform which truncates breccia at about 20 metres above present mean sea-level.

Zeuner (1954) recognized that the Sands were not deposited under uniform conditions. A fossil soil or concentration of soil material, indicated by a reddened horizon, is still visible in the lower slope near the Caleta Palace Hotel. This horizon lacks internal bedding, but contains rootlet impressions and occasional fragments of weathered Limestone which must have fallen from cliffs above. This testifies to a period when the sand dunes were relatively stable so that a soil profile could develop prior to renewed dune deposition, or perhaps to relatively rapid erosion of soil material from above or to windblown dust transfer. Red fossil soils (where not composed of transported soil material) have been inferred to mark warm and seasonally humid climatic intervals elsewhere in the Mediterranean region.

The Catalan Sands were used to smooth the profile of the slope above, which is predominantly composed of breccia, prior to covering it with corrugated iron sheets to form the water catchment area. The Sands have also been used as the major local source of building sand on Gibraltar, although their uniform grain size means that they are not ideal for this purpose. Moreover, the resulting quarry faces have only marginal static stability.

Raised Beach Sands and Gravels. Sediments associated with raised beaches which are sufficiently extensive to be shown on *Figure 1* occur only along the eastern side of the Southern Plateaux. Smaller deposits occur widely throughout Gibraltar, at various heights, as described below. Gravels with well-rounded beach cobbles (*Photo 2*) are sometimes found at their base, but the overlying sediments are generally medium to coarse grained sands, frequently cemented by calcite (calcium carbonate) precipitated from percolating groundwater. The sands may reach some 25 metres in thickness and show large scale cross-bedding, as can be seen in the vicinity of Monkey's Cave above Governor's Beach, but are generally much thinner and lack sedimentary structure.

Such cemented sands are easily worked for building stone and have been quarried for this purpose in the past (Smith, 1846). For example, shaped blocks of raised beach sandstone have been used to line gun embrasures at Woodford's Battery Left Flank in the south of Gibraltar, and to reface the main gateway leading into the town from the south. However, the low resistance to long-term weathering processes of such weakly

Photo 2. Water-rounded boulders fringing the northern edge of Hole-in-the-Wall Road at a height of 80 metres above present sea-level; raised beach evidence for a former higher sea-level stand relative to the Rock. (Scale indicated by 50 pence piece at centre of photo.)

Photo 3. Scree breccia exposed in disused quarry north of Catalan Bay; the large size and sharp angularity of the rock fragments as seen in the quarry face indicate formation by frost action under a more extreme climate than presently exists on Gibraltar. (Buildings conveniently indicate scale.)

cemented materials can be recognized from the much decayed pre-18th century church doorway preserved near this gateway.

Scree Breccias. Scree breccias occur widely on Gibraltar but the most important deposits are at the base of the North Face of the Rock, along the east coast, and south of the west coast harbour area. They form extensive slopes, characteristically with angles of inclination ranging from 30 to 35 degrees, the angle of repose of loose coarse fragments.

The breccias are formed largely of Gibraltar Limestone which has been broken into angular fragments (*Photo 3*). Fragmentation was almost certainly caused by the freezing action of water within cracks in the massive Limestone cliffs above. As the water in the cracks froze, so it expanded and the fragments became displaced. The fragments have subsequently been packed by finer sediment becoming washed between them and bound into rock by calcite precipitated from percolating groundwater.

Above the areas of major scree accumulation steep cliffs of Limestone are found. These developed particularly where the Limestone was underlain by weaker Shales whose erosion in the past contributed to progressive collapse of the overlying Limestone cliffs. Removal of the fallen debris by marine erosion helped to develop the extensive high cliff faces. Once sea-level began to drop, the falling Limestone could not be removed so effectively and the extensive scree deposits started to accumulate. Moreover, as argued by Ramsay & Geikie (1878), the screes must have formed when temperatures were colder, or more extreme, than at present. Freeze-thaw action was thus more intense, producing the very large blocks found in the screes, with their characteristic sharp rather than smooth weathered edges. Such conditions prevailed during the colder periods of the Pleistocene, probably when glaciers developed in

Photo 4. Europa Flats, viewed northwards; the platform in the foreground, now developed as a sports ground, is here interpreted as an ancient wave erosion feature. It is backed by a former cliff line eroded into the Windmill Hill Flats, interpreted as an earlier feature of marine abrasion. In the background, westward dipping Limestone of the Main Ridge towers above these two Southern Plateaux.

northwestern Europe. Scree breccias are known to continue to at least 20 metres below present sea-level at Rosia Bay (Fleming, 1972), consistent with the low sea-level to be expected during a time of major glaciation.

A well-cemented, dune-bedded sandstone separates an older from a younger scree breccia along the eastern margin of the Southern Plateaux, near Governor's Cottage Camp. This may indicate that there have been at least two periods of scree formation on the Rock, as inferred by Ramsay & Geikie (1878) and Alexander (1947). This is not surprising since there have been 15 glacial stages in the last million years and considerably more occasions when continental glaciation has extended across mid-latitude regions like northwestern Europe. That the screes reflect gravitational terrestrial processes is demonstrated by fossilized shells of land snails found in pockets of soft sand in both North Front and eastern coast screes (Trechmann, 1943).

Scree breccias form a much weaker rock than unfragmented Gibraltar Limestone. Consequently, major scree slopes have been extensively quarried from 1880 onwards to provide a source for fill. The need for rapid production of fill, especially for airfield construction during the 1939-45 World War, led to single face operations which have left vertical quarry faces. The combination of steep slope, uneven distribution of pore-filling cement, and seasonal weathering of the faces, some of which are up to 30 metres in height, has led to some concern regarding their stability.

Erosion Levels

During the Pleistocene, not only were sediments laid down upon the bedrock of Gibraltar but the Rock itself was terraced or notched at many levels by marine erosion. These features indicate that there were times when sea-level relative to the Rock was at a higher or lower level that at present for long enough for significant abrasion to take place. The evidence is provided by the spectacular platforms which form Europa Flats and Windmill Hill Flats, submarine platforms, and numerous smaller platforms with raised beach sediments upon them.

RE Geologists and the Geology of Gibraltar (3)

Wave-cut platforms. The two Southern Plateaux of the peninsula are striking features (*Photo 4*; also Rose & Rosenbaum 1989a, *Photo 1*). They apparently represent the most important and well-defined sea-level stands to affect the Rock:-

Europa Flats: The platform at the extreme southern tip of Gibraltar is approximately 500 by 400 metres in area, sloping southwards from about 40 down to 30 metres above sea-level. A 30 to 40 metre ledge also continues northwards along the east side of the Rock by Europa Advance Road. Smith (1846) reports that marine raised beach deposits were found on the Europa Flats, before the Flats were artificially levelled by the placement of fill in order to make them flat enough for recreational use, consistent with the origin of the Flats as a wave-cut platform. Ramsay & Geikie (1878) attribute a "pebbly limestone conglomerate" cropping out on a sea-worn limestone platform near Prince's Lines at the North Face of the Rock to this same still-stand level.

Windmill Hill Flats: A second well developed platform is situated at Windmill Hill Flats immediately to the north, and above, Europa Flats and at its maximum is 350 metres wide and 750 metres long. Its elevation above sea-level slopes from about 130 metres down to 90 metres in the south, and although no marine deposits indisputably attributable to this horizon are now visible on the plateau (again it has been artificially levelled), Brown (1867) recorded "pot holes filled with coloured flints", and it is probably associated with the cliff line along the west side of the Rock (eg below the Apes' Den). The true height of the base of the cliff line is difficult to define because of the scree that has accumulated at its base. However, the present altitude of this ancient landform appears to slope downwards towards the south. This would be consistent with submarine evidence obtained by Fleming (1972), who found that many of the underwater terraces around Gibraltar were not truly horizontal. A good example of this is Fleming's "60 metre" submarine terrace, which slopes from 59 metres below sea-level in the north down to 70 metres below to the south over a distance of approximately 1.5 kilometres.

Such a slope could reflect the natural drop of the wave-cut platform towards the offshore, or it could be the result of tilting of the land surface subsequent to the formation of a near-horizontal platform. The difference in degrees of tilt between the two Flats favours this second interpretation, the presumably older Windmill Hill Flats being more strongly tilted than the Europa Flats.

Submarine platforms. Submarine platforms provide evidence for former low sea-levels. Fleming (1972) records measurements by echo sounding, direct observation and scuba diving that identified extensive platforms at about 5-10, 25-30, 60 and 95 metre depths, principally developed on the east side of Gibraltar where marine erosive energy was greatest and subaerial terrestrial debris least. These he infers might be compatible with a descending sequence of sea-levels under conditions of rapid erosion compared with the rate of change of sea-level during the last major European glaciation - an inference as yet unsupported by other than landform evidence.

Superimposed on the four major platforms is a sequence of minor terraces and solution notches at 91, 74-77, 67, 52, 46, 35, 24-25 and 20 metres below sea-level. These represent oscillations during the subsequent rise in sea-level to that of the present day according to Fleming (1972), but are amenable to other interpretations.

Raised beach sediments. Raised beach sediments and less spectacular landform features provide evidence for other sea-level stands higher than that of the present day. There is good evidence for at least six levels additional to those of Europa and Windmill Hill Flats (*Figure 2*). Evidence for even higher levels is controversial: Alexander (1947) mapped features at 620-700 and 850-900 feet (185-210 and 255-270 metres), but the deposits shown on his map could be re-interpreted as tectonic or scree breccias lacking evidence of marine reworking. However, scanty superficial deposits have been observed elsewhere:-

At 180-190 metres. G Cunningham has noted a poorly exposed shelly sand on the southeastern

HEIGHT	FEATURES
1-3m	Narrow platforms around much of coastline, developed in stronger rocks including scree breccias; occasionally with overlying poorly cemented sands and gravels containing a modern shelly fauna. Platforms are fissured and filled with terrestrial sediments to below present sea-level indicating a temporary fall to below present sea-level since the 1 - 3 metre relative still-stand. (?=5 metre level of Zeuner, 1959.)
7-9m	Narrow platforms at Europa Point; also flat areas at Little Bay, and town areas west of Main Street. Cemented sands at Governor's Beach and other east coast localities. (25 foot raised beach of Ramsay & Geikie, 1878; Alexander, 1947; 8.5 metre level of Zeuner, 1959.)
15-17m	Narrow platforms at Europa Point; platforms weakly developed at Little Bay and to the east of Rosia Bay, well developed at Catalan Bay. Raised beach sediments recorded at Europa by Smith (1846) with many fossil shells, but no longer visible. (50 foot raised beach of Smith, 1846; Ramsay & Geikie, 1878; Alexander, 1947; 15 metre level of Zeuner, 1959.)
20-25m	Platforms weakly developed at the east coast Water Tanks (south of Sandy Bay); base of cliff line at Catalan Bay. Raised beach sediments with fossils recorded during scarping of the Europa cliffs by Smith (1846). (70 foot raised beach of Smith, 1846; 75 foot raised beach of Ramsay & Geikie, 1878; Alexander, 1947.)
30-40m	Europa Flats; also platform occupied by South Barracks. (120-140 foot raised beach of Ramsay & Geikie, 1878; 33 metre level of Zeuner, 1959.)
50-60m	Platforms forming the ledges on the east coast south from Ammunition Jetty to Governor's Cottage Camp. Cliff line with base at approximately 50-55 metres cuts into older raised beach deposits as well as scree breccias behind Governor's Cottage Camp and the adjacent Navy laundry; well defined cliff line also visible at this height at the southwest corner of Windmill Hill Flats to the east of Europa Road. Marine sands are associated with the east coast ledges; also, well sorted conglomerates with chert, shale and limestone clasts crop out on top of the Gibraltar Limestone and below a scree breccia at Queen's Lines, at a height of some 55 metres on the northwest part of the Rock. An oyster bed at 170 feet is recorded by Smith (1846) above the Europa Flats. (175 foot raised beach of Alexander, 1947; 62 metre level of Zeuner, 1959.)
80-86m	Narrow platforms on the east coast above Governor's Beach, with basal conglomerate and overlying marine sands; well defined ledge and cliff line at the southwest corner of Windmill Hill Flats; extensive platforms near Buena Vista (partly eroded by later 50-60 metre level landforms). Extensive cemented marine sands west of Governor's Cottage Camp, partly eroded by features associated with the 50-60 metre level; also a conglomerate of large, well rounded, locally derived limestone and dolomite cobbles north of Hole-in-the-Wall Road. (264 foot raised beach of Smith, 1846; 260 foot beach of Ramsay & Geikie, 1878; 275 foot beach of Alexander, 1947.)
90-130m	Windmill Hill Flats. (370 foot level of Ramsay & Geikie, 1878; 99 metre level of Zeuner, 1959.)

Figure 2. Table of the most widely developed landforms and sediments interpreted as having formed by Pleistocene shoreline processes on Gibraltar. Height (in metres above Alicante Datum) and place names derived from Gibraltar Town Plan Scale 1:5000 Map Series M984 Edition 5-GSGS (1984).

side of the Rock towards the bottom of the Mediterranean Steps. The nearby Martin's Cave also contains shelly sands, with occasional well-rounded quartz clasts up to 10mm in diameter, implying marine deposition.

According to Dorothy Bate (1943), Major R V Dawes RA, when collecting the skull of a fossil deer from breccia exposed during excavation of the Farringdon Chamber, recorded "that at a height of about 600 feet there was a limestone platform about 160 feet wide, backed by a cliff 70 to 80 feet in height. On this platform rested a marine deposit 3 to 4 feet thick, consisting of a number of water-worn pebbles capped with sand; above this lay the red breccia, which attained a maximum depth of a little over 70 feet". Additionally, Zeuner (1959) lists a beach level on Gibraltar at 180 metres.

At 210 metres. Smith (1846) recorded sandstones with marine shells at approximately this height (from 600 to 700 feet). Gignoux (1926) mentions an ancient beach on Gibraltar at 200 metre height; Zeuner (1959) a beach level at 210 metres.

At 240-250 metres. On the west side of the Rock, above Apes' Den, G Cunningham has observed fissures in the Gibraltar Limestone infilled with yellow sands containing relatively unworn fragments of marine organisms: bryozoa, sea urchins, corals and molluscs.

At about 300 metres. During excavations of Mammoth Cave in the cliff above the east side water catchments, G L Palao recorded borings in the Limestone walls that he attributed to the action of marine bivalved molluscs.

From the many different erosion levels and widespread superficial marine sediments reaching high up the Rock it thus appears that much, perhaps all, of Gibraltar has been submerged beneath the sea during relatively recent geological time.

Similar evidence of change in sea-level relative to land is known from coastal areas in most parts of the world. It can be interpreted in terms of two processes, acting independently or in combination:-

Eustacy: rise or fall in global sea-level, particularly in response to changing global ice volumes.

Vertical crustal movement: isostatic or tectonic elevation of the local land mass.

Traditionally, raised shorelines in the Mediterranean region have been interpreted in terms of eustacy. Depéret (1918) and other authors up to Zeuner (1952, 1959) established a classic sequence of altimetric stages which finally distinguished six horizons named after type localities on the Mediterranean coast, each supposedly characterized by a distinctive height above present mean sea-level:-

Epi-Monastirian	3 metres
Late Monastirian	6-8 metres
Main Monastirian	18-20 metres
Tyrrhenian	28-30 metres
Milazzian	55-60 metres
Sicilian	90-100 metres

(Increase in height was inferred to correspond with an increase in age of formation.)

However, Hey (1978) has shown that the concept is invalid. There is little evidence for global sea-level rise during the Pleistocene in excess of about 8 metres above Ordnance Datum (Shackleton, 1987) and variation in level of former shorelines clearly reflects vertical crustal movement. Certainly the higher sea-levels recorded on Gibraltar and elsewhere cannot be the result of glacio-eustacy alone. Fairbanks (1989) has shown that global sea-level was lowered about 120 metres during the last Pleistocene glacial stage, but melting of all the present day glaciers would cause a rise in sea-level of only some 43 to 65 metres (Nilsson, 1983) - far lower than the Gibraltarian features well developed at 80 metres and above. Moreover, Hey (1978) and Cadet & others (1978) are amongst many authors who have clearly demonstrated that there is no consistency in ancient beach level heights around the Mediterranean: even the most recent (1 to 3 metre) beach is warped. All beaches have been to some extent displaced vertically by recent tectonic crustal movements, making correlation over long distances difficult. High beach levels are thus more likely to result from crustal movement than eustacy.

Caves

Gibraltar is honeycombed by natural caves as well as by Sapper tunnels. 143 principal caves have been distinguished to date situated above present day sea-level, and more are known to occur below. The positions of entrances above sea-level are recorded on an unpublished map prepared by G L Palao, Surveyor to the Gibraltar Cave Research Group. Many of the caves have been subject to very detailed topographic surveys, and from these surveys, maps and cross-sections have been prepared on scales ranging from 1 inch:4 feet to 1 inch:25 feet, predominantly the former scale. Detailed but unpublished descriptions also exist in manuscript for many of the caves. The Gibraltar Cave Research Group maintains an active interest in the caves; its survey records are kept by George Palao with a view to eventual publication.

The caves originated in two ways:-

Solution cavities. Most solution cavities formed as weakly acidic groundwater slowly reacted with the Gibraltar Limestone. Some caves developed preferentially along faults or major joints because these facilitated groundwater movement thereby rapidly removing the reaction products and introducing fresh acid to the rock surfaces. Others developed preferentially along beds of dolomitic limestone that occur within the Gibraltar Limestone succession. The mineral dolomite is more soluble than calcite and dolomitized limestones tend in any case to have a higher porosity (dolomite being denser than the original calcite from which it formed, and so occupying a smaller volume) thereby

exposing a larger surface area of rock to the dissolving acidic groundwater. Most caves developed initially at horizons related to former relatively stable groundwater levels, because of the enhanced solution and frequent replenishment of acid within the zone of fluctuating water level. These themselves are controlled in part by the prevailing position of the sea-level and thus variations have occurred reflecting the various different sea-level stands that have existed before the present.

Sea caves. Several levels of caves were eroded by marine action at times when sea-level differed from that at present. Some are but former solution cavities breached by the sea, but they indicate periods when sea-level was stable for long enough for such erosion to take place. Caves of this kind are well developed to the south and east of Windmill Hill Flats.

In common with many other Mediterranean caves situated close to the sea, Gibraltar's caves usually contain one or more characteristic sediments:-

Travertine. Layers of travertine, sometimes developed as *stalactites and stalagmites*, form in caves through which there is drainage of groundwater. The calcium carbonate of the travertine is precipitated from water dripping from the cave roof or walls or on to the floor. Many Gibraltar caves are today too dry for stalagmite formation, yet contain spectacular deposits of travertine, sometimes buried beneath other sediments. These indicate periods of more humid climate in the past.

Cave-earth. In some caves the surface deposit on the floor consists of a loose earth, usually soil transported into the cave by water, but sometimes with components of chemical weathering or of organic detritus. Such cave earths tend to be well stratified; in contrast, loose, unstratified cave-earths indicate the effects of wind deposition (perhaps suggestive of a more arid climate, of greater sediment availability through lower sea-level, lower vegetation cover, or variation in global dust flux).

Cave breccias. Cave breccias consist almost exclusively of angular pieces of rock identical to those in which the cave is situated and with no significant wear observable on the fragments. They must, therefore, have formed from material detached from the walls or roof of the cave. None are forming on Gibraltar at the present day, and the climatic conditions under which they formed must have been different from the other two cave deposits just described. Such breccias are thought to indicate physical weathering in the form of fresh fracturing, and develop best in a climate with frequent frosts.

The coastal caves sometimes contain marine deposits, whose fossils may be useful for correlation with other Mediterranean caves. In the Mediterranean as a whole, marine cave faunas as a rule indicate a warm climate, because these were the times of relatively high sea-levels.

Gibraltar caves have served for war time shelter (Glen Rocky) and peace time storage (Poca Roca). Some have been assessed as potential reservoirs of freshwater (Ragged Staff). A few caves have been excavated by archaeologists (Genista, Devil's Tower, Gorham's) and some are noted tourist attractions (St Michael's). The best known caves are:-

Genista Caves (Busk & Falconer, 1865; Warren, 1865; Brown, 1867). Earliest scientific cave exploration on Gibraltar began on Windmill Hill with the Genista caves, named after Captain Frederick Brome, Governor of the Military Prison. (Genista derives from the formal Latin name for the plant called "Broom" in English.)

According to Garrod (1928), this was terminated when Brome was dismissed from his post and from the Services because he had employed prison labour for scientific purposes, although the work had earlier seemed to have the approval of both the Secretary of State for War and the Governor, and Brome's achievements were deemed "worthy of the highest commendation" (Busk & Falconer, 1865). The caves yielded numerous fossil bones, including those of bear, rhinoceros, aurochs, deer, ibex, wild horse, leopard and hyaena (Busk, 1877). Busk (1869) figured the Genista and many other Gibraltar

caves as then known, and discussed their archaeological contents. The most accessible of the Genista caves yielded human remains "found lying in every imaginable direction and position".

Devil's Tower Cave (Garrod, 1928). This famous rock-shelter overlooking the Isthmus from the base of the North Face, at its northeast corner, has yielded a Neanderthal human skull and flint implements of the cultural type long known as "Mousterian". Deposits yielding these remains rested on a marine beach 8-9 metres above present sea-level. The vertebrate fauna as determined by Bate in Garrod (1928) indicates a climate somewhat cooler and damper than at present, with ibex being frequent and the great auk and alpine chough also present. (Radiocarbon dating cited by Nilsson (1983) gives an age of approximately 49,000 years Before Present for part of the Gibraltar Mousterian, although this age is probably beyond the limit of reliable radiocarbon determination, and the basis for the date is not specified).

Gorham's Cave (Waechter, 1951; Zeuner, 1954). Zeuner (1958) inferred that this important cave on the east side of the Rock of Gibraltar was formed during the Main and Late Monastirian sea-levels, a concept now known to be invalid. The cave has yielded numerous artefacts. Those from the lower levels in the cave have been ascribed to the Mousterian culture, those from higher levels to the Upper Palaeolithic, but the sequence is currently being reinvestigated under the joint direction of Dr Jill Cook of the British Museum and Dr Chris Stringer of the Natural History Museum, London.

St Michael's Caves (Shaw, 1953; 1955a,b). The most easily accessible and celebrated cave on Gibraltar is St Michael's, a noted tourist attraction and large enough to serve occasionally as a concert hall. A Gibraltar Government Tourist Office leaflet currently summarizes brief details of interest. Shaw (1955a,b) provides an extensive account of the history of exploration of the cave and the numerous bibliographic references to it since its earliest citation by the Augustan geographer Pomponius Mela in 45 AD. The cave is now more properly named Old St Michael's, to distinguish it from New St Michael's Cave discovered in 1942.

During 1942 a tunnel was being driven into the largest chamber of the Old St Michael's Cave so that it could be used as a store with a reasonable air circulation. This broke into the system now known as New St Michael's Cave, which has been controlled and looked after by the Royal Engineers ever since. Shaw's (1953) account provides the best description of the system and is illustrated by ten photographs together with a brief bibliography. New St Michael's not only contains stalagmite formations rivalling those in splendour of Old St Michael's, but also a lake (*Photo 5* and *Figure 3*), some 30 metres long and up to 11 metres wide and 6 metres deep. One of the lake's remarkable features is the size of calcite ledges formed at the margin by deposition from the surface of calcium bicarbonate saturated water, ledges

Photo 5. New St Michael's Cave: "The Lake".

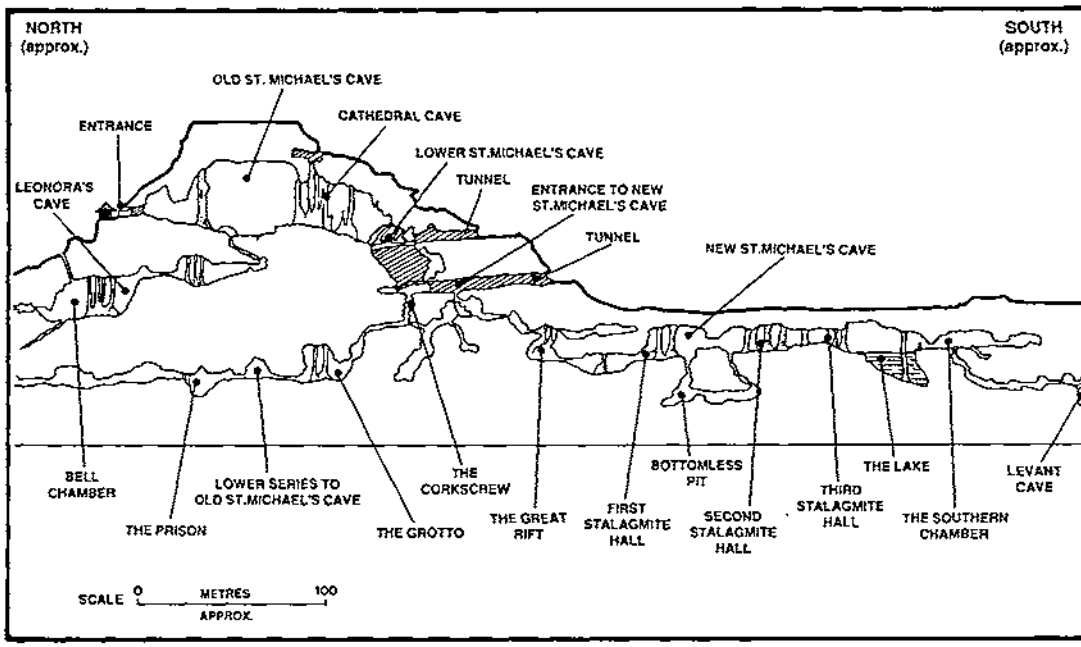


Figure 3. Cross-section through the St Michael's Cave System, Gibraltar (from an original survey and diagram by G L Palao included within an unpublished geological report by Captain D L Loughman RE(V) of the Engineer Specialist Pool). Shaded areas are primarily man-made excavations rather than natural caves.

broad enough to walk upon. Under Sapper supervision, about 4000 people per year currently take a two-hour trip through the cave system.

Sequence of Quaternary Events

As elsewhere across the globe, it is possible to recognize the effects of the Last Glaciation, and succeeding Holocene and immediately preceding Interglacial periods (*Figure 5*). Bowen (1985) provides a summary of conflicting views on stratigraphic correlations and age ascriptions for the Quaternary in general which enables Late Pleistocene and radiogenic age ascriptions to be extended to Gibraltar.

Prior to the Late Pleistocene, the sequence of events on Gibraltar is more difficult to determine, although marine erosion features, cave horizons and the different superficial sediments can all to some extent be related to former sea-level stands relative to the Rock.

Wave-cut platforms, best seen on the eastern coast, appear to form a sequence from highest (oldest) to lowest (youngest). Thus in the cliffs south of Governor's Beach wave-cut notches corresponding to raised beach heights of 7-9, 20-25, and 30-40 metres are all relatively well preserved, and this fresh preservation may indicate a consistent lowering of relative sea-level and tectonic uplift of the land since formation of the highest notch, so that high early features are not affected by lower later erosion. Near Europa Advance Road, marine deposits assigned to the 80-85 metre beach level are eroded by features associated with the 50-60 metre level, so here the lower level is clearly later than the higher.

Where cave levels within the Rock can be related to former groundwater levels they necessarily relate also to the former relative sea-level stands. Caves at high levels should therefore be generally older in origin than caves at low levels, although it is not yet possible to demonstrate this from their contained fossils.

Some scree breccias are notched by wave-cut platforms, so must have formed before them. Other breccias lie on top of raised beach sediments upon the platforms, so are obviously of younger age. (The windblown Alameda and Catalan Sands must similarly be younger than the platforms beneath them).

The apparent high (old) to low (young) sequence may, however, be somewhat oversimplified. It is well known that there are considerable difficulties in determining former sea-level height from geological features and in establishing a precise sequence of events (as discussed by West, 1977; Bowen, 1985). At Gibraltar as elsewhere relative sea-level in the Quaternary would have fluctuated as a result of both global (especially glacio-eustatic) sea-level changes ranging over some 160 metres, and tectonic movements of the Rock - the continuation of movements which had overturned the Limestone of the Main Ridge some 20 million years previously (Rose & Rosenbaum, 1990). Very precise dating of fossils from within the raised beach sediments is necessary before the Gibraltar sequence can be confirmed.

Many authors (such as Alexander, 1947; Zeuner, 1954, 1958, 1959; Giermann, 1962) have correlated sea-level stands recognized on Gibraltar with mean Mediterranean sea-levels, and thus indicated correlation with global events in the Quaternary. However, more recent work by Hey (1971, 1978) and Cadet & others (1978) indicates that Mediterranean raised beaches show no clear preference for any particular level or levels. All have been vertically displaced by earth movements, so they can no longer be used to indicate precise values for the altitudes of Quaternary eustatic still-stands - only as evidence for recent crustal movements. If evidence for sea-level change cannot yet be used to indicate reliable ages for Quaternary events on Gibraltar, it does at least confirm that the Rock has not remained stationary during this time.

Engineering Geology

Not all the surface features of Gibraltar are geological in origin. The influence of engineering works on final shaping of the Rock can be readily appreciated by comparing large scale late 18th century models of the peninsula preserved both in the Gibraltar Museum and the Royal Engineers Museum at Chatham with the up-to-date model at Fortress Headquarters Gibraltar. Additionally, Arkell (1956, *plate 10*) and Rose & Rosenbaum (1989a, *Photo 1*) illustrate similar views of the Rock at different times and comparison therefore demonstrates part of its urban development over the last 25 years. *Figure 4* here indicates the four main surface features which have been influenced by engineering activities:-

Made Ground. Prior to 1880, minor quantities of locally derived fill were used to level the lower areas of the town adjacent to the city walls, and to fill the lagoonal area known as "The Inundation" which provided a defensive marine barrier immediately to the north of the town. From then until the 1939-45 World War very extensive deposits of fill, mainly quarried from the scree breccias which fringed the southern, eastern and northern margins of the Rock, were used to develop the harbour region to the west of the town, and later the airfield lying across and out to the west of the Isthmus. Tunnel spoil was also used intermittently, but

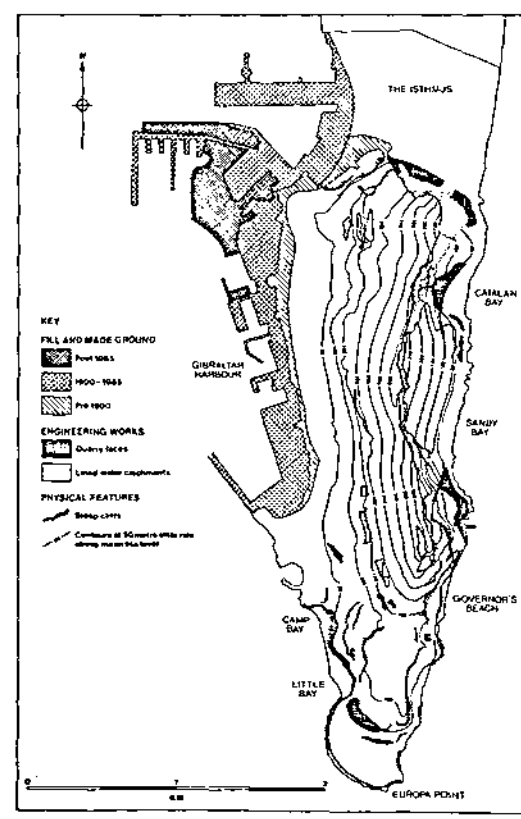


Figure 4. Map showing the most extensive areas of fill and made ground and major engineering works based on geological features on Gibraltar. (Small areas of fill and quarrying and the unlined Rock Gun water catchment area are omitted.)

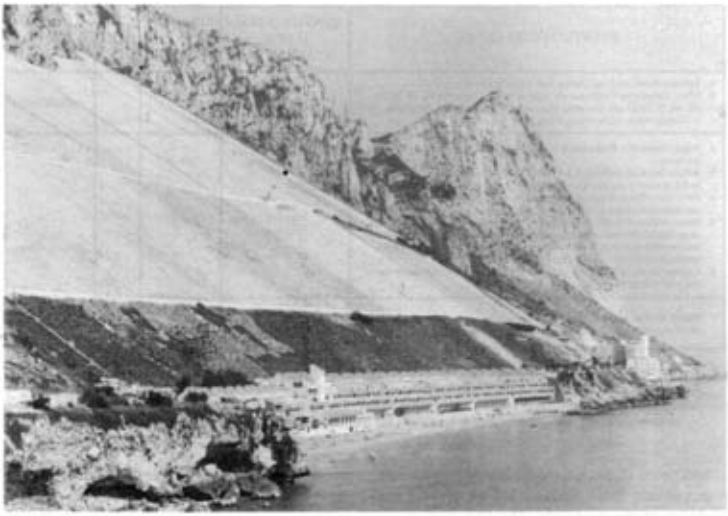


Photo 6. The main east coast water catchments, above Sandy Bay, viewed from the south. (Buildings at the toe of the scree breccia/sand slope conveniently indicate scale.)

the volume of material from this source was far less than from quarrying. During the 1980's the northern part of the harbour has been partly infilled using dredged sands. The most extensive reclamation, in 1989, has used offshore sands dredged from off the southeast of the peninsula. Disposal of explosive ordnance dredged with these sands has involved active participation by Royal Engineers of 33 Engineer Regiment.

Quarries. Quarries have been developed primarily at the foot of the North Face, northwest of Europa, between Little Bay and Camp Bay, and both north and south of the east coast water catchment area. Comparison of *Figure 4* with *Figure 1* shows that the material quarried was primarily scree breccia. This reflects its relative ease of extraction, and also the need to remove scree material to gain access to the massive Gibraltar Limestone beneath. The earliest major period of quarrying south and east of the Rock was at the turn of the 19th/20th centuries to provide fill for the dockyard extensions. Major quarrying at the north of the Rock also started at the turn of the century to provide stone for the dockyards, and resumed in the early 1940s, together with development of one of the east side quarries, to facilitate development of the airfield. Additionally, quarrying on a scale too small to be conveniently shown on *Figure 4* has taken place throughout history to provide local building materials and to scarp fortified areas to make them less accessible to attack.

Water Catchment Areas. Gibraltar's potable water is supplied principally from boreholes, surface catchment areas, distillation and importation. Shallow vertical boreholes tap aquifers in the Isthmus Sands and formerly tapped groundwater in the superficial deposits beneath the town area. Horizontal boreholes tap water in fissures within the bedrock. Together these boreholes currently provide some 25 per cent of the potable water requirement. An

EVENTS ON GIBRALTAR	CONVENTIONAL ALPINE STAGE NAME	OXYGEN ISOTOPE STAGE	AGE	EPOCH
a. **Isthmus Sands** deposited during final rise in sea-level. b. Minor **Submarine Platforms** and solution *notches formed at* 91, 77-74, 67, 52, 46, 35, 25-24 and 20 metres below sea-level, arguably formed during oscillating rise in sea-level (according to Fleming, 1972).	Post Glacial	1	10,000	HOLOCENE
a. Major **Submarine Platforms** at 5-10, 25-30, 60 and 95 metres below present sea-level. b. **Raised Beach** on platform at 1-3 metres above present sea-level; formed prior to fall in relative sea-level to below that of present day. c. Some **Cave Breccias** formed under cold climatic conditions; bones of animals and birds favouring *a cold climate deposited* in some caves. d. Marine **Caves** of Devil's Tower and Gorham's occupied by Neanderthal man using flint implements of Mousterian cultural type found in sediments above and therefore later than 7-9 metre erosion level; Upper Palaeolithic cultures subsequently inhabit Gibraltar caves. e. **Catalan Sands** and **Alameda Sands** deposited by wind during time of low sea-level and therefore glaciation.	Last ("Wurm") Glaciation	2 to 5d	122,000	LATE PLEISTOCENE
Raised Beaches formed, first on platforms now preserved at 15-17 metres above present sea-level, subsequently on 7-9 metre platform.	Last ("Riss-Wurm") Interglacial	5e	132,000	

Figure 5. Events on Gibraltar correlated with the conventional Alpine stages widely used in older literature, Oxygen Isotope Stages of Shackleton & Opdyke (1973), and age in years Before Present (after Johnson, 1982). It is not yet possible to separate on Gibraltar events in total here ascribed to Oxygen Isotope Stages 2 to 5d. (Such stages have been defined in deep sea cores, where differences in the O^{16}/O^{18} isotope ratios in sediments have been explained primarily in terms of global ice volumes.)

additional 10 per cent is provided by rain water catchment areas, constructed on the natural slopes of the peninsula. The first part of the major water catchment area of the east coast (*Photo 6*) was constructed in 1903 by smoothing the surface of the original scree breccia slope which was in part overlain by Catalan Sands. It was then covered with sheets of cement-washed corrugated iron nailed to wooden battens driven into the sand cover. The project was very successful, and so the catchments were extended to their present size between 1911 and 1914. Other, smaller catchment areas have been constructed on sloping Limestone bedrock by clearing it of soil and vegetation and sealing the fractured and fissured surface with cement grout.

Cliffs. Additional to quarry faces, Gibraltar has many steep cliffs which result from contemporary or Pleistocene marine erosion. Planes of weakness (through bedding, jointing or faulting) necessitate stabilization of some of the near-vertical faces by wire netting, rock-bolting or cement grouting above populated areas.

Conclusion

Over the last two million years, geological processes have, therefore, facilitated military and civil engineering tasks on Gibraltar by brecciating the massive Gibraltar Limestone and thus making it easier to quarry; depositing sands in sufficient quantity for them to provide sources of fine aggregate and the only flat area large enough for the construction of an airfield runway; notching the surface of the Rock with erosion levels many of which have now been developed for building construction; and honeycombing the interior of the Rock with caves exploited both for shelter and for recreation.

It is not currently possible to date the whole sequence of events on Gibraltar in terms of an absolute time scale for the Pleistocene. However, it now seems clear that crustal movements as well as glacio-eustatic changes were at work during this epoch, and that Gibraltar has indeed risen from the sea over the last few million years. Some of the evidence for this slow rate of change is now more rapidly being eroded by civil engineering work on Gibraltar, so it is to be hoped that sufficient will be conserved for the enlightenment and interest of future generations of inhabitants and visitors as well as Mediterranean geologists.

ACKNOWLEDGEMENTS

Observations credited here to G Cunningham are

amongst those recorded more fully in an extensive Field Guide to the Geology of Gibraltar accepted for publication by the Gibraltar Museum (Rose & Rosenbaum, in review). The School of Military Survey is assisting with the preparation for publication of a version of the new geological map of Gibraltar cited here and in Part III (Rosenbaum & Rose, in draft). Acknowledgements listed in previous Parts of this series are also applicable here, with additional thanks to A P Currant (Palaeontology Department, The Natural History Museum, London), G L Palao BEM (Gibraltar Cave Research Society), Joaquin Bensusan MBE (Curator, Gibraltar Museum) and especially Professor J Rose (Geography Department, Royal Holloway & Bedford New College) for commenting on a draft of the manuscript; to the current OC 1st Fortress STRE (Major P D Luscombe RE) for permission to use *Photo 6* from STRE archives; to Keith Denyer of Royal Holloway & Bedford New College for printing photographs for publication; and to Brigadier K A Timbers of The Royal Artillery Historical Trust for copies of the Gibraltar publication and career details of Lieutenant (later Col) A Burton-Brown.

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Pay Attention Please

CAPTAIN S STUART

The author joined the AAC Chepstow in 1962 and following training served six years with 4 Field Squadron Nienburg, gaining promotion to Corporal. Tours then followed with 34 Field Squadron, 25 Engineer Regiment in Osnabrück, Junior Leaders Regiment at Dover and by then a WO2, with 33 Independent Field Squadron as the QMSI Brigade Search Coordinator. He was SSM of 45 Field Support Squadron and SMI at the Combat Engineer Training Centre until commissioning in 1988. He is currently Senior Instructor at 3 Training Regiment.

MANY readers will be aware that during the past three years, a review of Combat Engineer training has taken place within the Corps. At the beginning of this review, our old system of training combat engineers had been in force for seven years, but it became apparent that this system did not provide a progressive and efficient means of training our soldiers, particularly from Class 3 through to Class 1 level. It was found that students returning to 3 Training Regiment or attending the Combat Engineer Training Centre (CETC) Hameln for up-grading courses to Class 1, had retained little of their overall knowledge of combat engineering since attending their Class 3 course. Therefore, through necessity, much of the Class 1 course syllabus was swallowed up in revising Class 3 subjects rather than providing a course with a much higher percentage of new material.

It was widely acknowledged that heavily committed regiments found it extremely difficult to keep their Class 3 and Class 2 combat engineers fully practised in all but a few of the combat engineer disciplines. This, coupled with the absence of formal training in raising our soldiers from Class 3 to Class 2 level, did little towards ensuring they were kept fully up to speed and capable of accepting a higher level of training in the form of the Class 1 course which, in the end, unfortunately became little more than a re-run of the Class 3 course.

Clearly, if criticism from CTAD staff was to be avoided, and more importantly, our Class 1 combat engineers were to benefit from attending up-grading courses, the then current Job Specifications and Training Objectives for Class 3 and Class 1 courses required some adjustment.

Following the guidelines set out in the Systems Approach to Training, the review began in earnest in 1986. A Job Analysis to determine exactly what our soldiers were required to do at each level of their training was the first step. This analysis took the form of a very comprehensive questionnaire prepared by the RETDT in consultation with 11 Engineer Group, Field Engineer Wing RSME and CETC Hameln which listed all aspects of combat engineering from Class 3 through to QMSI. These questionnaires were dispatched to 20 Sapper units, requesting that they put forward their collective opinions on what should be taught, on which course and at what level each individual subject should be taught. Additionally, they were asked for their views on whether or not any

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particular aspects of combat engineering could be learnt "on the job" and finally, any additional subjects they would wish to see included in a particular syllabus.

As can be imagined, the response from such a wide selection of units showed some variation in what each considered each course syllabus should contain, but in the main, the response suggested that much of the training requirement contained in the then current Job Specifications and Training Objectives was about right. However, apart from the ongoing concern over the system of up-grading Class 3 combat engineers to Class 2 level, two main suggestions came from the analysis. First, that some subjects being taught to Class 3 students were deemed to be over-training; and second, that supervisory controlling or directing skills should be re-introduced into the Class 1 syllabus to take into account the needs of our sappers and JNCOs prior to becoming section commanders.

Both these suggestions were welcomed. In the case of the Class 3 syllabus, it was simply a case of removing the more technical aspects of some subjects and adding them to the Class 1 syllabus as new material. These minor adjustments meant that the Class 3 soldier would have less to learn, more time to practise what was being taught and of course less to remember during his progression to Class 1 without seriously affecting his capabilities as a section sapper. In the Class 1 syllabus, as well as the introduction of the new material transferred from the Class 3 syllabus, the introduction of the supervisory/controlling elements meant that a completely new approach to the design and style of the course could be employed. This achieved a definite distinction between the two courses and at the same time provided a much more interesting and demanding course for Class 1 students.

Following the Job Analysis, the task of drafting the revised Job Specifications and Training Objectives began. Each specification and related training objective was discussed in detail by committee members drawn from within the training organization who, after some 18 months of hard work, were able to produce the final working documents. Course design then followed. The new Class 3 course was ready in March 1989 for implementation in April 1989 and, although this course has yet to be fully validated, no major adjustments are foreseen.

Because of differences in training facilities and the availability of resources, the design of the new Class 1 course was carried out independently by the CETC Hameln and 3 Training Regiment. Where possible the formats of both courses have been closely matched with only minor differences in style. However, the content of each course is as stipulated by the Training Objectives, any differences being in interpretation rather than ingredients. CETC Hameln spearheaded the trial of the new course, beginning their first two courses in September 1989 and achieving very favourable results. 3 Training Regiment began running their courses in January 1990, so by now both units will be in a position to discuss those areas where further improvements to the design of the course can be made.

My reasons for requesting the attention of all those involved in combat engineering to this short article are twofold. The first point is that in redesigning the two courses the problem of retention of knowledge has not disappeared. Retention will continue to be a stumbling block for potential students unless those in a position to do so take an active part in ensuring that students nominated for up-grading to Class 1 are given every assistance in preparing themselves for the course. Some eight weeks before the course, nominated students will receive a test booklet designed to encourage revision of the Class 3 syllabus. It is imperative that students are given the time, encouragement and support, by way of up-to-date pamphlets, to complete the test. Should this not happen, then not only will students find difficulty in accepting the more advanced level of training, but the whole exercise will have achieved little.

Second, I would like to draw attention to the importance of external validation. This simply implies determining whether or not the aims of the training have been achieved. Theoretically, the conduct of a job analysis and production of job specification should ensure that training objectives reflect the requirements of the job. However, jobs change in terms of equipments, techniques, and the context in which they are performed. It is therefore essential that ex-trainees are assessed to discover how successful they are

at carrying out their tasks and hence whether or not training objectives need changing. Basically, if we are to ensure training is sound and that the training system adjusts automatically to changes in techniques employed by the Field Army, then unit support in feeding back information about the performance of students is essential.

In summary, a great deal of effort has been put into improving the efficiency and effectiveness of our combat engineer training, only time will tell whether or not this has been justified. We hope that, with the support of all those involved in combat engineering, it should not take another seven years to find out.

Pre-War Service in Peking

LIEUT COLONEL F N CROFT FRICS

Lieutenant Colonel Croft joined the Royal Engineers in 1925 and has seen service, worldwide, mainly with Works Services. His postings have included Peking, Singapore (Changi, Formosa and Japan as a POW), Malta, Egypt as CRE, Tel al Kebir, Cyprus and, in between, the UK.

After he retired from the Corps in 1960, he worked in Nigeria and East Africa for seven years, first with the Ministry of Works, Nigeria, and next with the East African Railways and Harbours Corporation. He returned to the UK in 1969, where he was engaged as contracts consultant for a civil engineering firm. He retired (finally) in 1976.

The following is an account of service in Peking in the period prior to the Second World War. Before the War, when the former British Empire was rather more far flung than now, the British Army was called upon to garrison some far away and interesting outposts. It was my good fortune to serve in the British garrison in Peking at a time when the centuries old tradition, charm, gaiety and old world fragrance of that city still lingered and before they were eclipsed by the communist way of life.

In 1934 I was posted to Peking as a Military Foreman of Works with the rank of Staff Sergeant. The voyage from Southampton to North China on the old troopship *Somersetshire* took nearly seven weeks. Conditions on board were cramped. Families of other ranks were accoenmodated in small cabins at the stern of the vessel and husbands on the mess decks near the bows where they slept in hammocks. My wife shared a four berth cabin with another wife and her four young children. We had no stewards and we had to keep the decks and accommodation spotless enough to pass the daily inspection of the Captain and the 0 i/c troops. The voyage ended at Ching Wang Tao and the last stage of the journey, of about three hundred miles to Peking was by train.

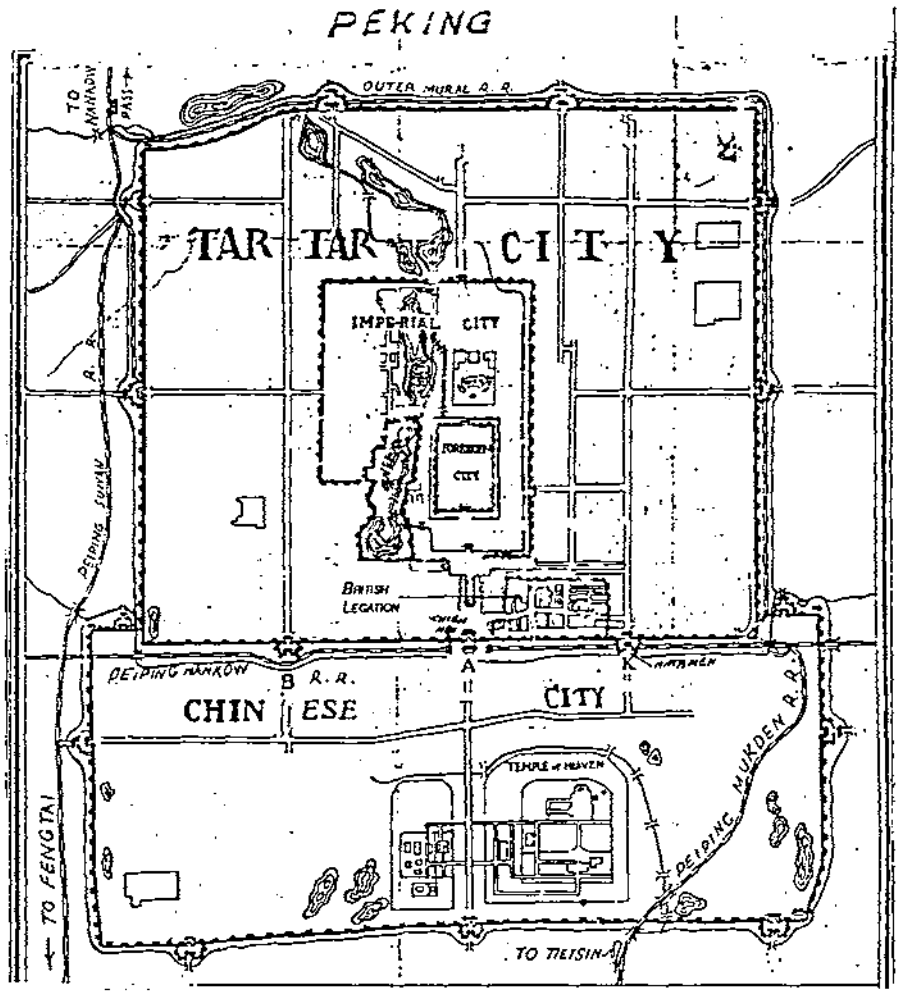
Peking, formerly the seat of government and home of the Emperor, was undoubtedly the show place of China and one of the most interesting places I have lived in. It was practically the only city in China that was planned before it was built. The sketch plan, opposite, gives some idea of the symmetrical layout of the place including the Forbidden City, the Tartar City, the Imperial City and the Chinese City.

Each of these cities was surrounded by a castellated wall about 40ft high and 25ft thick with gates set in the wall at equal intervals. The walls had towers like small forts built over them and the entrances through them were like tunnels. Surrounding the Forbidden City was the Imperial City where the Emperor's courtiers and government officials lived. The Diplomatic Area containing the foreign legations was also in the Imperial City.

The city walls enclosed magnificent pleasure gardens, lotus covered lakes, gorgeously lacquered pavilions, vast palaces roofed with golden yellow terracotta glazed tiles, green and blue roofed temples and multi-roofed ceremonial archways. Most of the bazaars and shopping areas were conveniently situated in the Chinese City within easy rickshaw ride of the British legation.

I was allotted a comfortable bungalow adjoining the works yard and office. The British Garrison was quartered in barracks adjoining the British Legation and my job as Foreman of Works was to supervise all new building and maintenance work there.

Lieut Colonel F N Croft FRICS
Pre War Service In Peking



Most of the work was done by a Chinese Contractor named Mr Fung. He and his foreman were courteous old gentlemen. I found them to be efficient and reliable and once they had made a promise they would go to extreme measures to keep it, even to the extent of working all night to complete work by the time promised, rather than lose face. They would not however use machinery which would cause unemployment in their labour force and some of their methods of working were antiquated.

If I ordered them to renew a barrack room floor, nothing would happen for a month and then two or three camels would arrive in the works yard carrying sections of tree trunks which had to be sawn into floor planks by hand in a saw pit with a huge cross-cut saw and then planed by hand. The finished work would be quite good but would take about two months to complete.

The lack of machinery caused little delay in the time taken to complete building work because labour was cheap and plentiful. Men would swarm on to a job and work all night if ordered. Manpower was used to haul trucks carrying building materials and on the site coolies carried loads in baskets rigged on each end of a bamboo pole. The garrison swimming pool was baled out periodically by hand using an ingenious system of buckets rigged on poles swinging up and down from the top of standards.

On the other hand metal work was done quickly. Peking had many small native workshops which included foundries. If a cast iron part of an imported

cooking range was broken, the supply of a replacement part from home would take months. The local Chinese foundry would however cast a new part and deliver it in less than a week at a fraction of the price.

Painting work had to be supervised very carefully. It was done very quickly by swarms of painters. If the contractor supplied the paint he would try to use cotton wool instead of brushes. In this way a very thin coat could be put on. The paint supplied by the contractor was usually very inferior and satisfactory work could be obtained only by the WD supplying the paint to the contractor and charging him for it.

One of my jobs was to see that the wall surrounding the legation was kept in good repair and that the loop holes and gun platforms were in good order in case of attack. One of the gates in the wall was known as the 'Lest we forget gate'. At the time of the siege of the legations this gate was marked by shell splinters and bullets and was kept in that state as a reminder of the siege. We had two field guns manned by infantrymen under the instruction of the Master Gunner.

When we arrived in Peking it seemed that I would have an easy and pleasant tour of duty with plenty of time to study for a professional examination but this was not to be. Funds were allotted to provide water-borne sewage disposal to replace the thunderboxes in the Legation Guard Area. This was more than enough for one Foreman of Works to survey and supervise. The site was completely flat and involved the building of numerous septic tanks with reverse interceptors to enable the effluent to run at a very low gradient into a concrete impounding tank. An electrically operated sewage lift raised the level so that the effluent could be discharged into an old mongol drain outside the legation area.

Accurate use of the level was essential. The Chinese contractor produced a contraption for this purpose composed of a piece of timber four inches by two inches by three feet long with a groove running along the top to a sinking at each end. The groove and sinkings were filled with water and two identical chips of wood, one floating at each end, were used to sight in the invert levels. This "telescope" was mounted on a stand like the top three feet of a flag pole from which an iron pin protruded. This enabled the "telescope" to be traversed. I was worried about the possibility of some of the drains running uphill if this inaccurate method was used and I therefore had to do all the levelling myself with the proper instruments.

The Contractor's working hours during the Summer months were from sunrise to sunset and this job together with my other duties kept me working well into the night.

The climate of North China ranged from minus six degrees Fahrenheit in mid-Winter to 110 degrees in mid-Summer. The legation staff moved to Pei Ta Hoe on the coast in the hot weather and sections of the Guard went for a change of air to an old Chinese fort at Shan Hai Quan, situated on the Great Wall of China at the extreme eastern end where it ends at the Yellow Sea. When time permitted I was sent there to supervise maintenance work on the troops' accommodation.

Shan Hai Quan was about three hundred miles from Peking and the journey there was by the train to Manchuria which stopped before it passed through the Great Wall near the town. The sleeping berths on the train were six to a compartment for ladies and another compartment for six men. Segregation was not often observed and sometimes the opposite berth was occupied by a man and a woman. At that time the Mexican silver dollar was used as North China currency, which was so debased in value that the metal in the coin was worth considerably more than its local purchasing value. Consequently a lot of the coins were smuggled out of the country by people leaving by train and it was a common sight to see passengers stripping off and dressing with underwear containing secret pockets for the dollars. It was also a common sight to see the police at the border stations making passengers undress on the platform in their search for smuggled coins.

Paper money was also issued by all the separate Banks in China and during the month some would go insolvent leaving one holding worthless notes. The worn and dirty paper money was rarely renewed by the Banks and sometimes a trader would give you as change a note torn into several pieces and pasted onto a piece of newspaper. To save the cost of metal, a Bank might issue a note worth as little as five pence and

those notes were trusted more than new ones which might be counterfeit.

The fort was about three miles from Shan Hai Quan city and was reached in great style on the "Fort Express" which was a flat car holding eight passengers, running on a decauville track. The motive power was a large mule trotting along in front between the rails, and the driver was a Chinese mafoo. A large Union Jack flew from a tall pole in the centre of the car. The track ran through plantations of kowliang, a kind of millet which grew up to a height of eight feet and completely hid any car on the line. The Royal Engineers laid the main line to the British fort. The French and Japanese were allowed to use it to reach the spurs running from the main line to their change of air camps. As we laid the main line we had the right of way and the purpose of our Union Jack which rose above the kowliang, was to give warning of our approach to French or Japanese on cars coming towards us on the single line. They then had to reverse back on to their own spurs or lift their cars off the line out of our way.

A lucrative industry in China was banditry. Many of the bandits were deserters from the armies of the various War Lords who paid their soldiers very little and very irregularly. The wealthy Chinese had high walls built around their houses and employed watchmen to deter the bandits. The district near Shan Hai Quan with its kowliang plantations, was a risky place. The bandits used to lurk near the pathways through the plantations and grab wealthy looking people into the thick kowliang. A ransom would then be demanded from the family of the victim and if there was no response a further note would be sent, accompanied by one of the victims ears. Visibility from the top of the wall was good and any likely trouble of that kind could be observed in good time.

Our contractor's main worry when he paid his workmen was in bringing the money from Shan Hai Quan City to the fort. After being robbed many times on the way he employed one coolie dressed in rags, to walk continuously between the city and the fort with a few dollars, until he had sufficient for the month's pay. The decauville track which carried the "Fort Express" was erected by Captain E F Tickell RE who later became Engineer in Chief. The track crossed a stream on a bridge known as Tickell's bridge. We were having trouble with the Japanese who tried to run their heavy trucks over the bridge which was not designed for such loads. I managed to stop them by cutting notches in the embankments approaching the bridge so that the wheel span of their trucks was too wide for passage over the embankments.

During the winter months the lakes and moats in the Imperial City were frozen over, affording excellent skating areas for the local people. My wife and I spent many delightful hours skating there. The ice was quite thick and safe except where it had been cut up into blocks by the Chinese ice merchants who buried it under turf and straw until the summer. It was then sold for use in ice boxes for the preservation of food. It was called "creek ice" and being contaminated, it was necessary to keep food and ice from making contact.

Electricity supply in those days was inadequate for appliances other than lighting.

The Great Wall

Peking was a City of contrasts in which hospitality, impressive manners and graceful courtesy were marred by poverty, starvation, harsh savagery and callous indifference to suffering. The road to the Temple of Heaven passed alongside the execution ground where criminals were publicly executed by various methods, depending on the severity of their crime. Before we took visiting friends to see the Temple of Heaven it was necessary to make sure that it was not on an execution day.

About twelve miles northwest of Peking was the Summer Palace of Tzu Hsi, the former Empress Dowager. Here there were many treasures in which marvellous craftsmanship was displayed. Chief among these was the Temple of a Thousand Buddhas where the walls were covered by a thousand coloured glazed tiles containing the image of Buddha. There were also the Jade Pagoda, the Marble Bridge and the Marble Boat. The story is that the Empress Dowager asked her government for a sum of money with which to build warships for the defence of the coast from marauding pirates. The only boat which was built with the money was the Marble Boat situated on the lake at the Summer Palace. It was used as a tea pavilion when we were there. To enable the Empress to reach the boat, a covered way about half a mile long was built. This was a most ornate structure with beautiful hand paintings on each beam.

Shopping excursions in Peking were easy because similar trades were to be found together in one street. For instance there was Lantern Street where all the shops sold beautifully carved lanterns and standards with hand-painted silk panels on the lanterns. There were also the carpet makers, copper workers, iron workers, leather goods makers, etc, all located together. Butchers were also found in one district but shoppers had to be prepared for the sight of an animal being slaughtered on the paving outside the shop.

Cars were of little use in Peking because there were few roads worthy of the name, outside the walls. Everyone travelled in rickshaws - a very convenient form of transport. A rickshaw could be hired from the rank outside the legation and the rickshaw and puller would stay with you all day if necessary. All your shopping could be carried on the rickshaw at your feet. If you lost your way in the narrow and winding hutungs of the city you had only to hail a rickshaw and say to the puller "ying wha foo" and he would take you straight back to the legation. Many a time a soldier would go out for an evening's pleasure and would be incapable at the end of the evening of knowing where he was. However his rickshaw puller would always bring him back to barracks and collect his fare from the guard.

There was a tradition among the Chinese that after death the spirits of the departed roamed the world and had a powerful influence on the fortunes of the living. This belief was manifested in several ways which were puzzling to the newly arrived foreigner. When we first arrived we were sometimes disturbed by a clapping noise which was heard during the night. Our servant explained that the noise was made by a watchman whose job it was to drive away evil spirits from the environment by clapping together two piece of flat wood.

There was a belief that spirits could travel only in a straight line. Some of the larger houses of the wealthy Chinese were protected by a perimeter wall. Inside the gate in the wall, a spirit screen was erected. The object of this screen was to stop evil spirits from entering the compound. Some of these screens were magnificent structures of masonry covered with multi-coloured glazed terracotta tiles.

The hip tiles of the ornate tiled roofs of the temples were formed in the images of small animals such as dogs and chickens which were revered locally in some way. Members of the American Guard Unit used to attend services at the British Legation Chapel and before leaving Peking for a home station they presented a parting gift of a magnificent brass eagle lectern. It was regarded with some awe by the Chinese cleaners who shocked the padre by referring to it as the Holy Chicken.

During my tour of duty in Peking I used whatever time I had in studying for the final examination of the Royal Institution of Chartered Surveyors, with the help of a correspondence course from home. When I passed the examination I was promoted to the position of Surveyor of Works with the rank of Lieutenant and returned home to take up an appointment at Catterick Camp.

The Marble Boat

The journey home was delightful for my wife and I and so completely different from the outward voyage. We first cruised down the East Coast of China to Shanghai on a small coastal vessel calling in at the interesting ports of Cheefoo, Wei Hei Wei and Tzing Tao.

The ship carried Chinese deck passengers who slept, fed, and did everything else on the open well decks. Piracy was common in those days and pirates were known to come aboard a ship as deck passengers, overpower the crew at night, rob everybody else on board and then leave the ship on a pirate junk at a pre-arranged spot. As a precaution the well decks were fenced off from the raised midship superstructure with steel grills, and guards, usually white Russian refugees from the Bolsheviks, were posted at the gates in the grills, armed with a steam hose and a shotgun.

The trip from Ching Wang Tao to Shanghai lasted a week. There were very few first class passengers and we dined with the Captain who entertained us with accounts of his experiences plying along the coasts of China and the Far East. We disembarked from the Ship at Shanghai and were accommodated in an hotel at the corner of the Bund and the Nanking Road. We spent a week exploring the International Settlement during which we were lavishly entertained by British members of the Chinese Customs. At that time the Customs were run by British staff. Apparently the Chinese trusted Britons more than they trusted their own people for such work.

We left Shanghai on the RMS *Naldera*, a large P & O liner which was moored in the Yangtze river. The service, food and accommodation on the ship were lavish and in striking contrast to those experienced on our outward voyage. Being among the first passengers to board, we were invited to dine at the Captain's table and during the voyage we had some interesting table companions including two generals, a high commissioner, an attorney general and several high Indian government officials and their ladies. The experience was interesting and informative but we both felt that we would have had more fun on one of the other tables, occupied by young officers returning on home leave after six years' service in India. Some of these officers who were paid the money for first class fares, elected to travel second class and spent the difference having a good time in a more relaxed social atmosphere where they were able to enjoy themselves to the full in the free and easy second class without the need to dress for dinner. The sounds of hilarity and laughter coming from the second class passengers gave evidence of this.

The voyage home was a holiday in itself. When the ship called at Hong Kong, Singapore, Penang, Colombo, Bombay, Aden, Port Said and Malta to embark or disembark passengers we had time for excursions around these interesting places.

We disembarked at the London Docks and so ended a most interesting and enjoyable tour of duty in the Far East.

Pre War Service In Peking (2)

Letters Home

MARGARET HOTINE

My late father, Martin Hotine, was commissioned into the Royal Engineers on 6 June 1917, just before his nineteenth birthday. The following year, he was posted to 63rd Field Company, Queen Victoria's Own Sappers and Miners, then at Bangalore. He wrote long letters for family circulation, (see August 1989 Journal*) accompanied by numerous photographs. We still have them.*

18 April 1918
2nd Sappers' Mess, Bangalore

From 6.30-7.30 I roll up on early drill parade, and ride round making a nuisance of myself. To be an efficient officer you must above all be expert at making a nuisance of yourself, and if you're very good at it you get a staff job. Personally, I don't see much use in shouting in a loud voice at poor inoffensive wretches who are obviously doing their best, but the Colonel likes it, so I put in overtime when he's there and when he's gone I confine my vocal efforts to *Shabash* (which means "well done"). It works ever so much better, and you're apt to get thirsty if you shout too much in this climate. Twice a week we do company drill, and turn out resplendent with pack mules and jingling picks, and water pakhals and ropes and tackles - all ready to march off to war if ever there is one.

At 8.30 until 12.30 I go and teach the company Field Work. Then after *tiffin* I either do some more FW or punt round the tank (they always call a pond a tank in this country) showing 'em how to row. After all that I begin Hindustani. I shall try my hand at the Colloquial Exam next month. At Roorkee and Kirkee, some old Subedar gets you to translate a few sentences like "What did your brother do before he got married?" and if you get anywhere near it you're through. Here you have an enormous board and you have to lecture a picture of misery on various military subjects, and not only do they knock off marks for every hesitation, every trivial fault of Accidence and Syntax, but some Subedar on the board questions the Sepoy on what you've been talking about afterwards.

16 June 1918 ... I derive the keenest pleasure in wandering round the mule lines after I've finished work in the afternoon and chatting with the drivers about their mules and family troubles. They simply line up and wait for me, to tell me this or that mule won't eat his food and how worried they are about it, and how one of them has just had a man child, and how proud he is of it; and then again of the faithlessness of a wife, and what should he do about it. They are very reserved at first but a little sympathy removes this, and they forget that some of them are old enough to be my father. It's wonderful in a way, and I think I've learnt more about human nature in three months like that than I should have in as many years at Home.

He was learning other things too - fast. Those who knew him later, when he moved to Survey, eventually becoming Director of Military Survey in World War Two, and the first Director of Colonial Surveys after the war, will smile at this early encounter with authority.

2 June 1918

In India there is an old buck who goes by the glorious title of Inspector General of Engineers and Pioneers, and once a year (in the cold weather for preference) he rushes round the country and inspects. At present this enviable position is filled by Major General Dickson CIE, and on Friday he blew up here, with ADCs and chargers and staff cars and all the rest of his glory. Everyone promptly got the wind up, and by Saturday morning, when he proposed to inspect 63 Company, a metaphorical gale was in progress.

In the morning we drilled, and beyond a marked display of horsemanship on the part of the staff (wow-wow) nothing much happened. Discipline forbids us to relate the perversity of one of the pack mules who got fed up with its driver, charged the General's horse and nearly pitched him off.

The night before, Gurney (Major Gurney, CO of the Company) and I accidentally sat next to a

5.6.18. Bending rails with a Jim Crow.

7.6.18. 2nd stage of the railway bridge. Shifting the main girder across with the aid of rollers.

certain member of the Staff and proceeded to oil him well. Before long he told us what the General thought of giving us on Works the next day, on condition we both swore we wouldn't tell either of the 63 Company officers. They say all's fair in love and war, and from a good many points of view this may be considered both.

Next morning, Dickson hurled his puzzles at us in great style, and then took out his watch and counted the seconds before we started. The first was a railway bridge, 30ft span -material available 9ft x 9in x 9in plus 13ft x 12in x 12in timbers; the second, a railway curve between two given straights, one of which went over the bridge.

Now if you remember rightly, I did a very short Construction course at Chatham, which included nothing at all about railways. Well, when I got here I found it was obviously a part of my job to know all about the subject, so I settled down and learnt it. There is an awfully nice tempy officer here who served eight years on the Burma railways and he supplied all the little practical tips that you can't get from books.

I can lay out a curve beautifully with a theodolite, but a theodolite is a perverse machine to adjust nicely and it doesn't grow side by side with mangoes. On Service, I understand you usually guess curves if you haven't a theodolite; and if an engine comes off the line, you just smile, shift the rails a bit with a crowbar and try again. There is no happy medium suitable for such shows as Dickson's inspection, where you've got to do everything as quickly as on Service and you aren't allowed to do it as badly. Well, a month or so ago, a way of doing it quickly and accurately struck me (I'm not going into technical details), but I thought nothing of it at the time. It would only be applicable to more or less sharp curves up to 500ft radius say - so it's quite obvious why you never see it in text-books intended for Civil Engineers.

To get back to the inspection. The Colonel was awfully nervous about this curve. He came up and worried me while I was sitting on a rock pushing a slide rule about, but I told him I could do it quite well, although I'm sure he wasn't convinced. I never worked so hard in all my life, and I'm not sure even now how I did it without making mistakes, but I had the curve pegged out in three and a half minutes from the time the General pointed out the two straights. I worked out offsets going round the curve while the Jemadar measured them off and drove pegs in. In four minutes I had a level adjusted and was directing level pegs being driven in all round the curve to the correct gradient. The Jemadar was putting men digging or embanking to formation level as the pegs went in. In fifteen minutes I was starting to run a line of levels across the gap for the bridge and within twenty minutes from the start, the Jemadar on the bridge had the depths of his foundations, and heights of his piers and abutments. Then the General came round.

At first he was inclined to be sceptical, "You've guessed this curve extraordinarily well, young man." I informed him I'd done nothing of the kind, so he said, "Well about what radius do

you think it is?" I told him again as frigidly as one can with a General, that it was 120ft and no approximations. Then he got interested, when he'd finished laughing, and asked me to show him how I'd done it. I did, and he became duly impressed.

In September, 1918, 63 Company was posted to Persia on Active Service.

UT *Pentahota*, The Gulf

We're at sea at last, and expect to arrive in Bushire, where this will be posted, about Sunday. The ship is very slow (average speed something like seven knots) on account of its heavy cargo and thickly encrusted keel. It's also twenty-seven years old, and the shock of fast motion might strain it, I suppose.

... It is rather funny to see Gurney wandering round the ship with a mule at all times of the day. He has a firm conviction that a mule doesn't get enough air in the ship's cesspit where they exist and he's not far wrong. We started by pulling one or two of them out of their stalls and putting their heads in the cowl ventilator opening. It was pathetic to see the poor beasts putting their heads up as far as they could and sucking for dear life while it lasted. Now you can always see Gurney walking round the ship, up gangways and along decks, with a mule.

After disembarking at Bushire, on the Persian Gulf, he was sent to do forward survey for the railway being built to Shiraz.

7 November 1918

In the blue

... When I have time and am outside the shadow of the Censor, and am also in the most philosophic of moods, I shall write a history of this War. It is very unique, not being run in the manner of most wars, and should be amusing. For instance, there are specially privileged people called Political Officers (mark the essential element in the guiding hand of all wars) who draw huge salaries and get CIEs. They know all the chiefs we are supposed to be fighting for, personally, and keep up constant correspondence with them. They appoint new chiefs; and on the occasion of the coronation of one of them, a British force marches anything up to a hundred miles to see it done. As a rule, as soon as the King's horses and all the King's men march away again, Humpty Dumpty gets his throat slit - and all the cavalry and artillery and infantry all go back again, fire at and charge the echoing hills and then come home.

So far, you see, the object of the War, in common with most other wars, is to provide light amusement for the politicians; but this War has a secondary object, which is to make roads and railways and telegraphs. Occasionally, the wily Persian takes up a few rails to roof his house with or lays hold of a bit of telegraph wire to mend his cart; and then there's another row. He thinks, quite logically, that he didn't ask for all these curious contrivances and he doesn't want a very noisy train to rattle past his harem windows anyway; so he won't have them. The Persian government may want them but that is no concern of his. So he goes and makes a mess of things one night. Perhaps a village gets burnt next day, or if he comes again he finds he gets more than he did last time. If he only knew it, he could hold up the railway far more safely and easily by pulling out the pegs

6.7.18. Cliff Roadway finished. One of the Engineering wonders of the world.

with figures on them, that the Survey Sahib puts in; but I thank God for the dullness of perception of the average Persian. Anyway, he gets thrashed, and as he hasn't a home to go to that night he spends it in the open with the nice gun given him by a gentleman named Wassmuss (German ex-consul in Bushire), and fires shots over our camps. His rifles are very good but they don't fire through the ground and hit people in perimeter trenches.

After a stay in Hospital at Reshire, he managed to get back to 63 Company, engaged on road-making and based at Malu Camp.

Christmas Day, 1918

Last night, a few sporting Persians came out and sniped us to celebrate the occasion, so to speak. It was so pitch black and the rain was falling so thickly that they couldn't have seen their sights, so all they did was to wake up the pickets, who promptly opened up rapid fire all night at absolutely nothing.

I don't think anyone in this camp loves anyone else. For example, it has been our custom at the end of a perfect day to go down to the river and fish. The only line we use is a foot or two of fuse, sunk by the weight of a 15oz slab of guncotton. It is a very pleasant occupation and supplies all the messes in the Force with fresh fish every day. Most people were reasonably grateful as bully beef is the rule outside the Base. A few days ago, the OC of this section of Lines of Communication moved his HQ up to here, so we naturally included him in the general distribution. Almost immediately, an order came round from him that killing of fish in that part of the river by bombs or any other form of explosive would be strictly prohibited. Beyond the fact that he is a keen angler the reason for this is rather obscure. We are not robbing the country because the Persian doesn't fish; we use hundredweights of explosives during the day on this road, so what difference a pound makes God only knows. Also it is a far more humane way of killing a fish than dragging him through the water with a hook in his mouth. Fresh fish, as a relief from tinned stuff, is a preventive to diseases such as scurvy and dysentery. Of course, once we bomb a pool it is going to be some little time before our friend the colonel catches any with a rod and line.

Anyone will tell you the two people you must NOT run foul of on Service are the Sappers and the S & T, and he found out his mistake in less than twenty four hours. His bed broke down that night and he came round next morning all smiles and started giving us instructions as to what he wanted done to it. We were very, very sorry indeed, but with so much work of an urgent military nature on hand, we could not possibly undertake anything of a personal nature - unless we had authority to do so from the CRE at the Base. Even then we had no material at all suitable for it. He talked for about half-an-hour, but he didn't get his bed mended. If he believes in making and sticking to absurd regulations, so do we - and yet, if he'd visited our workshops half an hour later he would have seen two carpenters making a chair for an S & T sergeant, in return for which he showed us the position of the guards over his dump at night.

Another attack of dysentery in April 1919 led to him being sent home to England, but in May 1920, he returned to 63 Company, now at Lahore, stopping at Bangalore on the way.

Most of the officers here now are quite strange to me - but it is not so with Indian officers and men. It has touched me very deeply to see the obviously sincere welcome these fellows have extended to me. They waylay me in knots to try and get a word in. Old Jemadar Visualingam is pensioned, but hearing I was in the depot, sent his son along with his salaams - he was too sick to come himself. In addition, I've met crowds of NCOs and Sappers of other companies, as well as quite a few from 63 who are down here on leave.

In Lahore, just before leaving for Service in Mesopotamia

I went to a War Dance of Khattak Pathans in the Baluchi lines the other night. It was one of the most impressive sights I've seen. A long line of white robed figures swirling and swaying, in the red light of a wood fire, the glint of swords swirling in absolute rhythm, and a wild chant to

the accompaniment of shrill hill music. It is enough to inspire anyone's martial ardour - it even beats the rum ration. There was also a sportsman who sang love songs in Urdu - which in London wouldn't pass in the lowest of music halls. Perhaps the turn I most appreciated (mainly because it was a bit above me) was given by a man dressed in the salmon robes of a Sadhu and consisting of an almost complete exposition in song of the philosophy of Hinduism. A comic item was the Orderly Room - the Sepoy explaining his defence to a Havildar - the Havildar translating it into slightly more respectful Urdu to an Indian Officer - and the Indian Officer dishing it up to the Company Commander, very slowly and painfully and as much like English as he could make it. The man who impersonated the British Officer was screamingly funny. He had got hold of every mannerism and magnified it - and his Urdu was I'm afraid only too truthful a copy in most cases nowadays.

He arrived at Azzizeih, Mesopotamia, in September 1920. This letter was written a few weeks after his arrival.

One is very grateful to the Arab for giving us a change of Active Service, but it sticks in the gizzard of most soldiers out here to have to hunt and harry them into submission. This show is more than an outbreak of local rioting - it is a determined attempt to throw off the burden of our bureaucratic methods of Government. The Arabs are not a conquered race and if they don't choose to accept our forms of government what right have we to force them. They are a fine race and have always been perfectly happy before we came along with our passion for introducing the miseries of civilisation.

In common with inhabitants of other barren countries of the East, the Arab has been in the habit of levying tolls on caravans as a guarantee for their safe passage. This 'robbery' we have stopped, giving the Arab no alternative method of making a living and expecting him to remain quiet and starve, while we impose the heavy burden of taxation for our expensive civil administration. In lieu of this Arab 'robbery', we have instituted a system of Customs (which is surely exactly the same thing). In his protest against our methods, the Arab has killed many Englishmen in a brutal fashion and for this he's got to be brought to his knees. This we all realize, but surely it's largely our own fault in the beginning of things.

Martin Hotine pictured during Road making operations in Persia in 1919

There are over fifty of these letters - the last is dated 18 November 1920 - and over two hundred photographs. It was very hard to make a selection!

Letters Home (3)

Commemorative Plaque to Sir Donald Bailey

COLONEL J H JOINER BSc MICE FIStructE

A Service of Dedication was held at The Priory Church, Christchurch, on 14 September 1989, at which a commemorative plaque in memory of Sir Donald Bailey Kt OBE, was unveiled by Major General Richard Peck, Engineer in Chief (Army). The Service was conducted by the Reverend Canon Basil Trevor-Morgan and the congregation of over 400 included Lady Bailey, Sir Donald's son Mr Richard Bailey, Councillor John Moss (the Mayor of Christchurch), Mr Alastair Patterson (President of the Institution of Civil Engineers), and a number of senior officers from the Corps of Royal Engineers, including Lieut General Sir John Cowley.

The bronze plaque, commissioned by the Corps of Royal Engineers and sculptured by Mr David Norris FRBS, depicts the building of a Bailey Bridge during the Italian Campaign, in the Summer of 1944.

Donald Coleman Bailey was born in Yorkshire in 1901. He graduated from the University of Sheffield in 1923, and after local employment came south in 1928, to join the Experimental Bridging Establishment, Christchurch, as a design engineer.

He was responsible for the development of a wide range of equipment for the Corps of Royal Engineers, but is renowned for his invention of the Bailey Bridge during the early stages of World War Two. Large quantities of the equipment were manufactured, and the bridge was used in all theatres of war. Field Marshal Lord Montgomery expressed the view that the bridge made an immense contribution towards final victory, and that without the bridge it would have been impossible to maintain the forward momentum of his troops in 21 Army Group.

After the war Donald Bailey was knighted for services to the war effort and went on to become the first civilian Director of MEXE. He then became Dean at the Royal Military College of Science at Shrivenham, in the early 1960s, but returned to live locally after his retirement until his death on 4 May 1985, aged 83. He was sadly mourned by members of his family and the many friends that he had made during his distinguished career.

Two important milestones in the history of the Royal Armament Research and Development Establishment, Christchurch, were also acknowledged on 14 September 1989. The Royal Engineers first came to Christchurch in 1919, to form the Experimental Bridging Company RE, the forerunner of the Military Engineering Experimental Establishment and the present day RARDE Christchurch. To mark this 70th anniversary, and also the 20th anniversary of the granting of the Freedom of the Ancient Borough of Christchurch to MEXE in 1969, it had been planned that the Band of the Corps of Royal Engineers would march through the town during the afternoon. Unfortunately however, torrential rain precluded this event, although not the excellent tea in the Council Chamber that was provided for a number of the guests of the Mayor of Christchurch. The Band gave a very enjoyable concert at RARDE later in the day, rain having prevented the Beating Retreat; this event was followed by a Reception at the Officers' Mess, attended by many representatives of industry and the civil engineering profession.

14 September was a most enjoyable day for those who were able to attend the various functions at Christchurch, and marked, in a fitting manner, the close connection between Sir Donald Bailey, The Corps of Royal Engineers and the town.

The Bronze plaque, commissioned by the Corps of Royal Engineers and sculptured by Mr David Norris FRBS

J H Joiner BSc MICE
Commemorative Plaque

Training for Better Engineer Support
A Personal View from BATUS

CAPTAIN S P W BOYD BSc

Steven Boyd joined the Corps in 1987 from Sandhurst. After attending No 91 YO Course, he was posted to 7 Field Squadron as a Troop Commander. In December 1989 he moved to the Junior Leaders Regiment where he has continued as a Troop Commander.

SAPPERS have been supporting battle groups (BG) at The British Army Training Unit Suffield (BATUS) since 1972. During this time the form of this support has altered several times and most recently in early 1988 when the Close Support Concept being trialed in BAOR was adopted. It was as the Commander of a close support troop that I took part in *Ex Medicine Man 7 1989* leading a composite troop from 7 Field Squadron and 26 Armoured Engineer Squadron. During the Exercise the Troop, while performing well in some fields, was disappointing in others. This article seeks to identify the problem areas and to suggest changes that could be made within the Corps to rectify the failings.

The Close Support Troop with which I deployed into the Prairie was organized as a typical troop could be in BAOR. It was a balanced grouping of, in addition to command and reconnaissance, two sections mounted in APCs, two AVLBs carrying No 9 bridges, two Chieftain AVREs fitted with ploughs and two CETs with integral engineer stores and REME support.

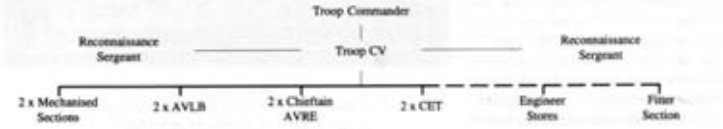
A *Medicine Man* exercise probably represents the nearest equivalent to the operation of a close support troop that is possible in peacetime. The Troop was shown to be a flexible and resourceful unit, well able to provide rapid and timely support in a variety of situations. Despite this success and first-rate engineering skills the Troop was weak at its interface with other arms.

The process of engineer support on the battlefield is essentially composed of four elements as follows:

- Engineer advice.
- An understanding of the commander's intentions.
- The task.
- Reporting of progress up to and including completion.

To fulfill their role to the highest standard Sappers must be proficient in engineering skills, able to appreciate and anticipate the problems of the all-arms commander and to communicate effectively with him and his headquarters.

The Sappers taking part in *Ex Medicine Man 7*



Captain SPW Boyd BSc.
Training For Better Engineer Support

were quite capable of performing the tasks given to them. The standard of basic combat and assault engineering was high and the initiative which the Corps prides itself on was evident at all levels. Command and control at JNCO level were excellent and minor tactics were well followed after a short lead-in period. For those involved in the reconnaissance, planning and control of tasks, the extensive facilities at BATUS provided a realistic and demanding environment which was a very satisfactory experience. However, several weaknesses were apparent. Some of these shortcomings may have been peculiar to the personalities in the Troop I commanded and were probably magnified by the speed of mobile, armoured action. In my opinion, however, many of the failings observed were due to a lack of adequate and suitable training.

The weaknesses experienced were not in the execution of engineer tasks in which all ranks were well trained, but at the interface between Sappers and other arms. The two main areas where improvements were possible were all-arms awareness and signals. The other field in which the Corps lags behind is reconnaissance, but this is now slowly improving due to increased Sapper involvement in all-arms reconnaissance training and exercises.

All Arms Awareness

Experienced and otherwise proficient NCOs found it difficult to anticipate or even follow events on the battlefield. This ability which is very necessary to set battle procedure into motion early was absent due to a lack of knowledge of BG tactics. Sapper NCOs showed themselves to be otherwise at least of the standard of those a rank above themselves in other arms but were sadly lacking in this area. Although many NCOs have developed a basic understanding of infantry/armoured tactics, this is the exception rather than the rule and those that have, have done so by their own endeavour. Others have had the opportunity to learn by observation and from background information passed on during training. In general, however, our NCOs have a lamentably low level of understanding in this area due to a lack of any instruction through their careers and any emphasis placed by the Corps on achievement in this area.

Sapper officers progress through their careers by a series of courses and examinations based on all-arms operations, but no similar system is in place for NCOs. Indeed, in many other arms it is not required, but Sapper NCOs often have cause to work with officers from other arms when their lack of tactical knowledge is all too apparent.

To improve all-arms awareness within the Corps the following steps could, and in my opinion should, be taken:

- Joint training between sappers and infantry/armour should take place at all levels wherever possible. Special attention should be given to JNCOs who, as our future SNCOs, should begin to learn to work in an all-arms environment at an early stage.
- A greater level of all-arms instruction should be carried out during rank based courses at RSME. These courses should form a gradual introduction to working as a part of an all-arms formation. The tactics element of the course should be presented not as background interest as at present, but with the aim of teaching the student basic BG tactics. To encourage assimilation and to emphasize the Corps' commitment to excellence in this area, final course reports should include a separate section and perhaps a separate grade noting a student's performance in the tactics part of the course.

Suitable course content would be as follows:

Field Section/Engineer Tank Commanders' Course
- Role and organization of armour.
- Role and organization of infantry.
- Role and organization of artillery.
- Composition of a BG.

Field Sergeants' Course
- Conduct of all phases of war at BG level.
- Tasks of an engineer reconnaissance sergeant in a BG.
- Tasks of an engineer staff sergeant in a BG.

QMSI's Course
- Conduct of engineer operations at brigade level (especially interplay with other arms).
- 1 BR Corps Operational Plan.

The excellent Close Support Troop Commanders' and SNCOs' Courses should be continued for

those working in a close support troop environment. However, the courses should be centrally controlled and must take place where appropriate vehicles and training facilities are available. Two possible solutions for a permanent location for this training would be an extension to the RE Wing (Bovington) which is at present primarily a driver and maintenance school, or the creation of a specialist centre elsewhere.

Despite the unfashionably slow nature of engineer support, senior officers should fight for the inclusion of realistic engineer play in all-arms CPXs. This would allow NCOs to be extensively employed, both as players and as lower controllers with ample opportunity to learn and to practise their understanding of all-arms tactics.

BGs should be encouraged to use Sappers on all FTXs and CFXs, to allow our soldiers to develop their grasp of infantry/armoured tactics.

Exercises such as those undertaken at BATUS will then prove more beneficial to all, as Sappers will understand more keenly the problems of their masters and through closer cooperation, BGs better appreciate the difficulties of engineer support.

Signals

Well qualified and experienced signallers found difficulty in working with other arms at the speed necessary to keep up with a mobile battle. This failing was not a result of clumsy radio procedure, but a lack of knowledge of the tools available to ease rapid communication. At present the Combat Signaller RE career structure is based on a continual progression in knowledge of equipment, after initial and rigorous voice procedure instruction. Although knowledge of equipment and fault finding skills are important, the existing system fails to teach the Corps' signallers how to operate a busy all-arms net. This task is left to individual units and herein lies the problem. Although all Sappers work in conjunction with other arms, communication at brigade level and above is often by secure means. This results in regimental and squadron signals NCOs being out-of-date and inexperienced in insecure procedures and unable to instruct in them. In addition, the poorly-trained troop signallers have little opportunity to practise their skills, other than on rather sedentary Sapper nets leading to a fear of those with more traffic. Signals training within the Corps should reflect the aim of instructing and practising soldiers to a point at which they can confidently operate on a BG net. Without that vital communications link the Corps cannot provide the support our masters require.

To improve radio communications in an all-arms environment the following steps could, and in my opinion should, be taken:

- Combat Signaller RE careers courses should, whilst still covering equipment and fault finding, address the radio procedure and communication tools required at vehicle, troop and squadron levels.
- The aim of this training should be to instruct and practise operators to reach the following standards:
  - Vehicle Signaller. To work a Sapper net and to confidently answer up on a BG net.
  - Troop Signaller. To control a Sapper net and to understand and confidently work a BG net.
  - Squadron Signaller. To control a Sapper net and to understand and confidently work a brigade net.

Courses to achieve these aims would have content similar to those taught at present, but emphasis should be placed on working on busy nets. The earlier introduction of several skills is required which will be difficult for soldiers having only recently completed training. To facilitate this, signals streamed personnel should not be called forward to attend a combat signaller RE 3 course until after they have gained six months' experience in a unit. In addition, the Combat Signaller RE 2 qualification should no longer be based on a retention test, but on an instructional course after another suitable period of experience. With the exception of instruction on equipment, suitable course contents would be as follows:

Combat Signaller RE 3 (Vehicle Signaller)

- Batco.
- Batco Vocabulary Cords.
- Use of Army Unit SOPs (chapter 109 only) to send simple reports.
- Passage of orders concerning AFW 9811.

Recce Platoon, 1 Royal Irish Rangers at BATUS

Combat Signaller RE 2 (Troop Signaller)
- Use of Secure Orders Cards to receive orders.
- Use of Engineer Operating Procedures to send progress reports and stores bids.
- Use of Army Unit SOPs to send reports (including intention to lay, sitrep, NBC 1) and resupply demands.

Combat Signaller RE 3 (Squadron Signaller)
- Modification of procedures required for use with secure communications.

The Signals Corporals' Course at present qualifies students as regimental signals instructors, able to teach within units up to Combat Signaller RE 2 level. If this is to continue to be the case, corporals need to receive a much greater depth of instruction and extensive classroom practice during this course.

The post of regimental signals officer within a unit should be filled whenever possible if necessary in preference to a squadron operations officer.

The post should be considered as one vital to the effective operation of a regiment's communications and as a good career step for junior officers as it is in the units of other arms. Only when the officers of the Corps begin to take signals seriously, will the standard of our training in this area improve and other arms cease to treat our signallers as security risks.

Bird table communication exercises should be employed extensively to practise commanders and signallers down to vehicle level as a regular part of unit training.

SUMMARY

In my experience, Sappers display very high standards of engineering and leadership. But the Corps performs badly in some areas, notably at its interface with other arms at a low level which is clearly visible at BATUS. I have identified where this happens and the reasons for it. The changes I suggest are aimed not only at improving the level of training of our soldiers, but also at the attitude of the Corps to these subjects. The shortcomings perceived may be peculiar to a close support troop, although I believe they are not, and some of the alterations to training suggested may already be in place. Despite this, I hope that my observations lead, if not to direct change, at least to discussion of the problems.

Training For Better Engineer Support (1)

Presentation of Colours to the Bombay Sappers

MAJOR GENERAL E M HALL CB MBE DL

IN the August 1989 *Journal*, there was an excellent article by Major General Ian Lyall Grant, on the ceremonies surrounding the presentation of Colours to the Bengal Sappers. A similar ceremony took place in February last at Kirkee (now Khadki) with the Bombay Sappers being the recipients. As in the case of the Bengal Sappers, a very kind invitation was given by the Commandant to any who would like to come out with their wives - in the event 12 of us and five wives undertook the trip.

Planning as far as we were concerned started last Autumn, based on a programme which was noted as Provisional. However, on the last day of December a revised programme was received, which caused some headaches to travel agents! In mid-January, a telephone call was received telling us that the President had been forbidden to fly on medical grounds and therefore the ceremony had to be postponed from 2 February to 21 February - sadly it was too late for us to change our plans. A phone call was made to the Commandant, who quite understood - he said "please come and we will lay on a programme for you". So we all foregathered on the 31 January - to discover that the following day we were to enjoy a full dress rehearsal for the big day.

On the 31st those of us who had arrived in time were taken on a nostalgic tour round Poona (Pune), visiting well remembered places. Major General John Bowring and I were accommodated with our wives in two guest suites near the Mess - all the rest stayed in the old bachelors' quarters, still known as the Workhouse and the Almshouse, and still the same with more modern plumbing! Under the guest suites, there was an area to sit or collect - with a Bar and facilities to give us a very good lunch. That afternoon, my wife and I strolled around and I got completely lost. It was all the same, but I still had to ask the way twice! That evening we were invited by the Commandant to a buffet supper at his residence, still called Pioneer House. The latter was virtually unchanged with a lovely garden full of flowering shrubs and lit by strings of fairy lights, all a greeny-blue. This was a very happy occasion.

The next day was a packed one. We were in position by half-past eight under a shamiana beside the saluting base - itself abutting onto the War Memorial. This was in time to see the parade form up, which it did impeccably - there were, we were told, some 500 all ranks on the parade. The full dress uniform was well described by Ian Lyall Grant, but one added point of interest was that all other ranks wore identical pagris, whatever their faith. The Group Band (no longer Sikh Pioneer) was augmented by Pipers and the band of the Sikh Regiment in their saffron uniforms. The "President" duly arrived - a Major with appropriate white hair! Then the full ceremonial of Presentation of the Colours took place and it was most impressive.

After the parade, we foregathered for a cup of tea, where we met a lot of retired officers and VCOs. Then there was a nice little ceremony. Major Budge Francis had brought out a British Legion wreath of Poppies. The Commandant agreed that we would be allowed to lay this on the War Memorial which Budge duly did, to be followed by the Commandant who laid another one.

Our next visit was to the Group Museum, recently extended and refurbished. Perhaps the most interesting part of it was the history of individual companies and other regiments, such as the Sikh Pioneers, who were merged into what now is known as the Bombay Engineer Group. From outside the Museum, one could just see the roof of the Commandant's office that we old hands remembered! Thence we moved to the Bhagat Memorial Hall - shrine to the memory of the late Lieutenant General Prem Singh Bhagat, who as a subaltern won the first VC awarded to any Indian in World War Two. It also records those who have won India's highest award - the PVSM. All beautifully presented.

The last move was to Group HQ - an imposing three storey block. After a group photograph, we were shown around the very spacious offices,

including that of the Commandant on the third floor. Thence to a very welcome beer or two and a formal sit-down lunch in the Mess. Those who have not visited since '47 were impressed by the enlarged Dining Room and also the Silver Display. After a catnap, we were off to see the finals of the Group Inter-Regimental Basket Ball competition between the Training Battalion TB1 and a TA Railway Engineer Regiment. The latter won, but it was remarkable to see the CO of TB1 (Colonel Rebelo) taking part.

That evening we were invited to a dinner in the Mess. The Officers were all in Red Sea rig, while we the guests were asked to wear the Group tie, which had been presented to us among several other gifts. The Colonel Commandant of the Bombay Engineer Group - Lieutenant General N S J Narahari PVSM - now joined us with several ex Colonel Commandants. The band was in great form as were the orderlies bringing round the drinks! Several of our party took part on the dance floor. Buffet supper was served and the party went on. It had been decided earlier that this would be the occasion for the visitors to make a presentation of a message from our Chief Royal and a silver salver from our Association, suitably inscribed. The counter presentation of a silver salver to us was to await the actual parade day. This was over-ruled by the General - but he was enjoying himself! Finally the gifts were exchanged at about 1am.

For those who stayed on, interesting visits had been laid on to the CME (RSME equivalent) and the National Defence Academy. Thus ended a memorable visit. As I said in my presentation, the efficiency, hospitality and friendliness shown by all made us very proud to have been Royal BOs.

Two footnotes. By a stroke of genius, Colonel Hugh Neill, who ordered the salver, asked for only the month and year to be inscribed - I gathered that our Hosts had been more optimistic! In order to get the gift salver back to the UK, it was arranged that Alan Rhodes would call in on the important date of the 21 February actually to receive the salver. He duly arrived at Bombay to find that the Indian Airlines, following a crash, had grounded all their flights. So he never got there. But we did try!

General P S Bhaget VC Memorial Museum, Bombay Sappers, Kirkee

Presentation Of Colours To The Bombay Sappers

Memoirs of Major General W Cave-Browne CBE DSO MC

(Major General W Cave-Browne CBE DSO MC was the father of Brigadier J R Cave-Browne MC whose memoir appears in this issue.)

General Cave-Browne was commissioned in 1905 and joined the Bengal Sappers and Miners. He took part in the Abor Expedition in 1911 and during the First World War, served in Mesopotamia, Egypt and Palestine. Between the wars he served in a variety of appointments in England and then went to Malaya as Chief Engineer. Returning to England in 1938 he was appointed Chief Engineer Eastern Command and, on the outbreak of war went to France as Director of Works BEF. He returned from France in June 1940 to take up his final appointment as Director of Fortifications and Works. He retired in 1941.

General Cave-Browne maintained a diary during much of his early career and it contains much fascinating detail particularly of the Abor expedition. He also wrote a complete memoir of his time in the Army from which the enclosed extracts have been taken. The diary and memoir have been donated to the RE Corps Library by Mrs Ricky Cave-Browne, widow of Brigadier J R Cave-Browne MC.

Mesopotamia

During January and early February, the 3rd, 14th and 15th Divisions were advancing, towards Kut, on the right bank of the Tigris but the attack of the 7th Division on the Sannaiyat trenches did not begin until 22 February. By the time this attack began the Turks L of C was threatened by the Divisions on the right bank and the Turks in Sannaiyat trenches were driven out without great loss to us.

Going over the Turkish trenches two days later I was struck by the large number of casualties that the Turks had suffered from our shrapnel fire.

On the 26th I went into Kut. What appeared to me most was the large number of dead and dying cats about the place. The Turks had left very little material behind.

Our Division followed up the retreating Turks on the left bank of the Tigris, but owing to the long line of communications, the supply of rations etc was difficult so the advance was not fast, we averaged about ten miles a day.

March 1917

On 6 March we reached Zeur, 13 miles short of Ctesiphon, and in the early morning of the 7th orders were received for two RE captains to go up in aeroplanes and cut a railway bridge beyond Baghdad with explosives. Farly (E L) and I were chosen , and we started in two planes at noon from (the) de Haviland squadron. We carried with us 96lbs of guncotton with the detonators already fused. To avoid being seen from Baghdad we swung out towards the Euphrates and at 6000ft it was a wonderful sight to see the Tigris and Euphrates just below us. After getting well clear of Baghdad we swung back on to the line of the railway and followed it along to near Beled where I saw a bridge over a stream, so both planes went down and landed in a depression about 400 yards from the bridge. While we were getting out of the planes we saw a large body of armed Arabs approaching us on the edge of the depression. I realized that we could do nothing in their presence, so I ordered both planes up. As we rose over the Arabs they fired at us. Owing to shortage of petrol we were unable to look for another bridge and so returned to our camp. I was sadly disappointed as I should have loved to have cut the Kaiser's Baghdad railway and stopped the Turks from taking their rolling stock away. It was the first time I had been in a plane and I enjoyed the trip on the way out but got very cold on the way back as I had taken off my coat to get to work and had not had time to put it on again.

The Division crossed the Tigris near Ctesiphon on the night of 8-9 March and I led the division in

a night march and we came on the Turkish position covering Baghdad at daybreak.

The Turks held us on the 9th and 10th but withdrew during the night of the 10th-11th and we entered Baghdad on 11th.

Baghdad

We were surprised to find what a good railway station the Germans had built there and were delighted to get a good wash after three days constant moving and no washing.

The Turks had half damaged any rolling stock left behind but as our troops had followed so close on the Turks the bazaars had not been looted by the Kurds and soon began to open. I enjoyed a jolly good omelette at the hotel that day!

We were only in Baghdad two days before the Division advanced and marched out after the Turks and drove them back from Mushaide on 14 March.

I met my brother Horace on the 17th and 18th, he had come up as Staff Captain to the 6th Cavalry Brigade.

We were then working a few miles north of Baghdad till 4 April, making up the river embankments as a big flood was coming down the Tigris and to the west of Baghdad there was a flood as far as one could see.

I went out on two road reconnaissances towards the Euphrates.

On 5 April the advance began again and we reached Samarrah on the 23rd, after two fights with the Turks at Beled and Istabulat.

Samarrah was an interesting old walled city on left bank of Tigris. We later had a pontoon bridge across the river connecting our camp with the city.

I was at Samarrah till 4 May when I started back for a month's leave in India.

At Samarrah we found many locomotives and rolling stock which had been more or less damaged, but our men got to work on them and I left Samarrah on the first train to go back to Baghdad.

1940 - BEF[1]

On 4 January, I went on ten days' leave home via Cherbourg and Southampton. During the time I was away the Directorate moved from Le Mans to Gouy and on returning via Dover and Boulogne I found my HQ established at the latter place. We were billeted in the village. I, with three others, had rooms in the Chateau, a fine old house but sadly neglected. Our offices were Nissen huts in the Chateau grounds.

By this time work on the following depots and bases was well advanced: St Nazaire, Nantes, Rennes, Le Mans, Cherbourg, Rouen and the Medical Base at Dieppe. The project for the advanced base depot in the neighbourhood of Abancourt was just commencing and Le Havre was being used as a port.

The second Medical Base at Boulogne was starting.

During the time we were developing the depots I several times visited Paris to meet M Collin, who had been appointed adviser on building matters. He was on the whole very helpful.

As the Works on the L of C was getting too big to be properly administered by me direct, I had two Chief Engineers appointed who each had three GPEs under them, Stafford was CE of the Forward Area with HQ at Rouen and Withington of the rear Area with HQ at Rennes.

I was constantly moving from Arras to Rennes and Nantes which meant many hours on the road but I had a 26 HP Humber and two very pleasant drivers which made travelling pleasant, and I did a lot of the driving myself.

On 10 May I started early in the morning for Rouen and on reaching the Camouflage Factory there I was told that the Germans had moved into Belgium and consequently our forces had moved on to the Desle.

Some time before this it had been decided to form two armies and I had been notified that I was to be Chief Engineer 1st Army with the rank of major general and had been warned that I should go to England where the HQ of the armies were to form - owing to the sudden advance the armies were never formed.

[1] *See also* Recollections of an Amateur Sapper, Two Ten at War - Fireworks Galore! *By Colonel F H Foster DSO OBE TD DL RIBA, this Journal, page 112*

In April it was decided that the Director of Works appointment was to be a major general's. The Military Secretary told me early in May that this had been approved but as it never appeared on paper in France, I did not put up the rank badges.

In March I flew to England for a day to see the Tarsan hut made of sawdust and cement and was so impressed with it that I proposed to start a factory for the construction in France, as our forestry companies were producing quantities of sawdust for which there was no use.

I twice visited John, who was with the 5th Field Company, at a place on the Belgian frontier where the company was busy on the pill boxes on the defence line.

When the Corps moved forward into Belgium, rear GHQ remained in the villages round Arras.

On 18 May we received information that the Germans had reached St Quentin and were advancing on Amiens and Arras. We were therefore ordered to prepare for an early move. We collected village carts and blocked all entrances to Gouy and packed our belongings and burnt all papers which we could not take away.

That evening all my HQ except those who could get into our cars left for Boulogne by train. I stayed the night at Gouy and went to Boulogne early next morning by car - In the afternoon we moved out to Wimereux.

General Brownrigg, the AG, then took command of the three ports of Boulogne, Calais and Dunkirk. On the 20th it was decided to prepare the bridges over the River Canche for demolition and early on the 21st the parties of the Tunnelling Companies, who had arrived near Boulogne, went out to put in the charges. General Brownrigg decided that the bridge at Hesdin should be blown forthwith and the bridges downstream of that blown if the Germans advanced.

As I was particularly anxious about the Hesdin bridge I went out on that road and overtook the demolition parties and was present when the bridge was blown. The roads were crowded with refugees and it was very difficult to get along them. The demolition parties were bombed and machine gunned in a village on the way and the lorry carrying the demolitions was damaged, necessitating transference to other lorries.

I returned to Wimereux that night and reported to General Brownrigg.

Next morning when reports came in I found that three of the bridges had not been destroyed and I sent out parties to blow them if possible. They were met by Germans on the way and one of the parties was captured. The only troops in the neighbourhood were Artizan Works Companies and General Construction Companies and Pioneer Companies and no artillery, in fact they were the troops who had been building the hospitals. Until two battalions of Guards arrived from England on the 21st there were no troops to stop the German advance.

On the evening of 22nd the Germans were close up to the South of Boulogne and were temporarily held by the Guards.

All telephone communication with GHQ and England was cut and some German tanks were past Wimereux on the road to Calais, so General Brownrigg decided to send for a destroyer to take GHQ to England and he would then conduct the defence of the posts from a destroyer or wherever he could land.

At this time I only had Inglis and Bateman with me and Wood, as the rest of my directorate had been sent off to Bergus with all our kit on the 21st.

We left Wimereux in cars and lorries at one am on the 23rd and on arriving at Boulogne harbour we found that the destroyer was already crowded to full capacity, so our party spent the night in an underground subway in the station. Luckily my batman had left behind my greatcoat, mackintosh and bag of washing gear. I have never spent a more uncomfortable night for we were crowded like sardines among troops and refugees.

When day broke we went up into the station but it was pretty unhealthy as the Germans were shelling us, and we had several casualties including the two Naval Transport Officers.

About 11am a destroyer arrived bringing Marines and a Royal Engineers demolition party. The

remainder of GHQ, including my directorate and the Medical directorate returned to Dover on the destroyer and thence went by train to a camp at Aldershot. I went to the Aldershot HQ and reported our arrival and then proceeded to Wimbledon.

On 24 May I reported to the War Office and was told to collect kit and be ready to return to France in two days to help organize an advance across the Somme.

On the 25th, as an advance northwards was found to be out of the question, I was told that I should not return and was ordered to go to Hounslow to help Tomlinson, who was then Chief Engineer, Eastern Command. I remained working at Hounslow till the 28th, but as I pressed that I should go back to supervise work on the L of C I was ordered to cross on the 29th. I crossed from Southampton to Cherbourg and thence to Le Mans, arriving there on the 30 May.

General Karslake had assumed command of the L of C, having been superimposed over General de Fonblanque - it was a most difficult situation - I then assumed the position of Engineer Adviser to General Karslake as well as Director of Works. There was little I could do in the latter capacity, as no Works were going on in the forward area and the rear area had its own CE. I therefore busied myself looking after the supply of stores for the 51st Division on the River Aisne and the Composite Division in front of Rouen and the Air Striking Force.

Bateman, Guinness and Wood had come back with me.

I was visiting the Area HQ in Rouen on the night we had to evacuate it. I had previously been busy collecting materials from the Engineer Store Base Depot for rafting purposes to augment the ferries downstream of Rouen.

I left Rouen and moved back to Le Mans. At this time the 52nd Division was arriving in France and I met the CRE and arranged for Engineer Stores for him but they were never required as the brigades which had arrived were soon re-embarked. I spent a day with Clark, CE Air Striking Force and had great difficulty in getting to his HQ near Tours owing to the streams of refugees.

On the evening of 14 June we were ordered to evacuate from Le Mans and the greater part of the L of C HQ moved to Redon. I moved with Guinness to Rennes and joined Withington the CE at his HQ.

On 15 June I visited de Fonblanque who was at Yitre and as everybody that was not essential was to cross over as soon as possible, I decided to return to England and leave Withington as de Fonblanque's Engineer Adviser.

On 16 June Guinness and I visited the Engineer Stores Depot at Rennes and then went by car to St Malo and in the afternoon crossed over to Devonport, disembarking on the 17th and arriving Wimbledon that evening - For the work in France I was twice Mentioned in Despatches.

On the 18th I reported to the War Office and found that I had been appointed DFW. I had an interview with General Venning (QMG) and General Collins and it was impressed on me that my chief job in life would be to be tactful to the Advisory Committee on Army Building which had just been set up under the Chairmanship of Mr Jameson of the Anglo Iranian Oil Company!

I took up my duties as DFW on Monday 24 June.

Relics of an Earlier Age

ALEXANDER KENNAWAY

This first appeared in New Scientist magazine, London, on 5 August 1989, the weekly review of science and technology and is reproduced with their kind permission.

THE major British engineering institutions were founded in the 19th century. The aim was that they should function as learned societies, allowing engineers to swap experiences, and to read papers on the science and practice of engineering. They soon found it useful to offer qualifications and to set examinations in order to enhance the professionalism of engineering. This was especially necessary, because the acquisition of skills and of useful knowledge was considered by society to be, at best, a matter for the artisan classes; there were no university degrees in engineering and the elite were not encouraged to study for or to enter the engineering professions.

There has been a slow change; indeed there is now a plethora of university courses in engineering. It is, however, still true that the British people do not hold engineering in high regard. The cleverest children are usually steered by family, friends and teachers into other professions. Employers are still reported as being willing to pay more to graduates, even in engineering, to work in fields other than technology. It is, therefore, hardly surprising that the country still faces a shortage of highly motivated and gifted students entering engineering courses and careers. The membership of the institutions, especially the younger members, looks to the institutions to do something to improve their status and pay and prospects. It must be said that they have so far looked in vain. This is not the fault of the institutions; indeed, it can be argued that is not a role that they can fulfil and that they *cannot* deliver the required objectives.

So do the engineering institutions still have a role? For some time now most professional engineers have been graduates and it is rare for people to qualify as chartered engineers by examination of the major engineering institutions. This role has gone.

Each institution still takes to itself the role of accrediting university courses and devotes significant time and money to this activity. It is questionable whether this is the best way of ensuring that university courses meet the needs of the profession. Various reasons suggest themselves. First, modern engineering has increasingly become interdisciplinary. How can one be a mechanical engineer, for example, without some understanding of systems and control engineering, electronics, chemical and physical processes, and flow processes and materials, embracing a wider range than is commonly taught in such departments? If indeed accreditation is to be done by institutions, then surely it should be done for all branches of engineering by an interdisciplinary engineering body.

Second, the people on the accreditation groups usually work for other bodies, such as universities, industry or national bodies. It is a historical accident that they come together under the ægis of the professional institutions; they could just as easily do the job by appointment to each college in the way that external examiners or assessors are appointed now. The institutions are an unnecessary intermediary.

What do learned societies do? They organize lectures and meetings on special subjects, provide a source of data such as a library and then publish papers, monographs and books. The engineering institutions increasingly face problems with these roles. This is partly because they are getting bigger, partly through mergers, partly through the developing breadth of their discipline. Thus members find only a very small proportion of the activities and publications of direct interest to them. Indeed, many people find membership of the specialized clubs (the smaller societies), devoted, for example, to concrete, polymers, composites, bioengineering, computer aided engineering, computing and electromagnetism, more rewarding. The very act of growing larger in order to finance the activities diminishes the value of membership. The explosion of electronic

data-searching and accession, the existence of many other libraries, commercial educational publishing houses and conference organizers all provide effective competition to these functions of the major institutions.

Analysis of the members' responses to a recent questionnaire shows that members are agreed in wanting the cachet of the "letters" after their name and that they expect the institution to promote their status. The former objective, not very praiseworthy in itself, arises from decades of persuasion, stemming from the days before an all-graduate profession. In fact it would be hard to find an employer who insists on membership of an institution or provides more rewards to a member than to a non-member. Employers judge the worth of employees by the contribution they make, and that is the best way to acquire respect and reward in any profession. Were this love of "letters" to be real, then there are cheaper ways of providing them. One suspects that the Engineering Council could do more to enhance society's understanding of the engineer than can the institutions; the council already awards "chartered engineer" which leads to "Euro engineer" status. It could also run the professional practice schemes which are, rightly, seen as essen-tial additions to an academic qualification.

In my view, then, the institutions have outlived their usefulness. Surely the way forward is for the institutions to dissolve themselves, subsuming their residual functions of status-seeking for the profession, the award of titles and the overview of professional practice experience into the Engineering Council. This already assumes many useful roles on a national and international level as well as doing, through the regional councils, essential if mundane work in promoting engineering in schools, local industry and society. Were this dissolution to occur, then we could see one Engineering Centre with common services including pooled libraries perhaps, meeting rooms which could be hired by the specialist clubs if they wished to have a discussion in London, and so on. The functions of learned societies would be more effectively carried out by much smaller, specialized clubs, which may wax or wane as the subject demands.

There is no case for a self-perpetuating, expensive institution that performs functions done better by other organizations. I used to think that the way forward was for the major institutions to amalgamate, but this simply reduces the proportion of the total service on offer that is relevant to an individual member. The large institutions lie uncomfortably, and arguably uselessly, these days between the Engineering Council and the specialized smaller clubs. It is true that many engineers have concluded that the Engineering Council is, as it stands, not the ideal body to represent all engineers, but with an influx of talent from the ranks of engineers who have worked in specialized societies and the major institutions it should not prove difficult to improve it dramatically and to carry out an imaginative, umbrella role for the profession as a whole.

The Engineering Council's regional organizations are doing excellent work, for example with local firms and promoting Young Engineers' Clubs in both primary and secondary schools. The regional organizations work on an interdisciplinary basis, as they should. Surely here is a ready-made organization which can be expanded to interest the public in engineering and to provide a wide forum for all engineers to broaden their experience.

There are no effective roles left for Britain's engineering institutions; there are only ceremonial ones for the few who aspire to them. For them there is the newly formed Worshipful Company of Engineers!

Were the major institutions to subsume their work and experience into the Engineering Council, or some successor body, and sell their properties, we could have a genuine British Engineering Institution, as exists in other countries and which could play a truly national, integrated role on the European scene. At the same time engineers could return to small learned societies such as the specialized clubs, which spring forth as new and often interdisciplinary fields of endeavour emerge.

Memoirs

BRIGADIER J R CAVE-BROWNE MC BA

Born 6 January 1917, died 8 August 1989
aged 72

JOHN RABAN CAVE-BROWNE was the quintessential Sapper, professional through and through as soldier and engineer. He was the son of a Bengal Sapper, Major General W Cave-Browne, who had taken part in the Abor Expedition in 1911. John was brought up in England by cousins and educated at King's School, Bruton, The Shop and Cambridge University.

Commissioned into the Corps in 1937 he served with the BEF in France and was evacuated from Dunkirk. He was attached to No 5 Commando from July 1940 to March 1941. He returned to the Corps as second-in-command of 6 Field Squadron. OMcCR writes: "The squadron was a young wartime unit of national servicemen with young inexperienced officers just starting on its armoured divisional war training. He brought with him maturity and experience, combined with that innate courtesy and what might best be called command by suggestion, that was a part of his personality. Members of that unit remember to this day that he would address the squadron on parade as 'Gentlemen' because, he used to say, 'All Royal Engineers are gentlemen'. The squadron was sorry to see him leave after only twelve months, shortly before the Division embarked for active operations in the Middle East."

After joining 233 Field Company he took part in the D-Day landings and subsequent operations in NE Europe. He was awarded the Military Cross for his part in the Nijmegen battle.

After the war he went to Staff College and tours followed in the Far East and then Germany as CRE 1st Armoured Division Engineers. Later, as CCRE 1st British Corps, he is remembered as "having the ideal qualities of the Senior Sapper at Corps Headquarters. Always cheerful, he was popular and influential and responded readily to the needs of his regiments." He attended the IDC in 1967 and his last tour of duty before retirement was as Assistant Chief of Staff to CinC Allied Forces Central Europe.

FS writes: "Even as he retired in 1971 he was suffering from the arthritis which never left him. But he was quite undaunted. On retirement from the Army he was involved with a charity looking after a chain of old people's homes. This meant travelling all over the country. While on one of these trips he suffered a heart attack and, characteristically, would not go to hospital but drove himself home.

He never stopped being active. A great worker with his hands, as well as his brain, he roofed his house, fitted central heating, built a workshop and created his garden (he used to take cuttings from the charity's gardens; as I walk along the path past his house I see two wisterias he grew from these).

Meanwhile he was pulling his weight in Wonersh as Chairman of the Memorial Hall committee and, more importantly he would have thought, in the management of the Parish Church. He had a deep Christian faith and a sense of loyalty to the Parish. He was on the PCC and the Deanery Synod. The Church owes a lot to his analytical mind, his integrity and to his direct speaking."

His wife Ulrica (Rickie), and their two daughters, survive him.

OMcCR SRG MET FS

Brigadier J R Cave Browne MC BA

MAJOR C R WAMPACH

Born 19 August 1921, died 10 December 1989 aged 68

CYRIL WAMPACH was possibly the youngest soldier with the BEF in March 1940, probably the oldest batchelor in the Corps, when he got engaged on his 50th birthday, and certainly one of the most popular Quartermasters of his generation.

While a pupil at Sutton Valence School in 1938, he volunteered for service with the RAF and appeared before an Officers' Selection Board in January 1939, but his eyesight let him down. He enrolled at Cloughs Commercial College in Folkestone, on leaving school, with the intention of making a career in journalism. He enlisted in the Corps at Hythe in January 1940, but gave his date of birth as 8 January 1919, because you had to be aged 20 to go to France.

He served with BEF from March 1940 to July 1940 and was a Dunkirk Veteran before his 19th birthday. For the rest of the War he served in Iceland, UK and North West Europe, being Mentioned in Despatches for Gallant and Distinguished Service in March 1945.

When he re-engaged as a Staff Sergeant in August 1945, he tried to give his correct date of birth but this was not accepted; however, his record was amended to give his date of birth as 19 August 1920. He was promoted to WO2 on 1 August 1946, 18 days before his 25th birthday. Following service in West Africa, UK, Malaya and Singapore, he was commissioned in February 1963 and posted as Quartermaster of 114 Corps Engineer Regiment (TA) in Hackney.

HPM writes: "I knew him as the QM while I was a Squadron Commander, Regimental Second in Command and Commanding Officer. Having done the job myself in India (for the record there were no QM commissions in the Indian Army and combatant officers did this job), I thought I knew most 'tricks of the trade'. Cyril taught me a thing or two and used his knowledge to help others. When the Regiment was being disbanded in 1966/7 it was largely due to his work and to that of a devoted staff of TA Civilian employees, that the unit finished with a clean record."

He served with 17 RSME Squadron and the British Gurkha Depot at Dharan in Nepal before being posted to 10 Field Squadron in April 1970. The unit moved to Gibraltar and it was there that he met Jenny and they became engaged on his 50th birthday. Thereafter they enjoyed 17 years of happy married life in 38 Engineer Regiment and throughout his retirement.

On 8 January 1974 he retired, at the age of 52, having completed 34 years' service. He always maintained that he should have been allowed to serve till his 55th birthday, but accepted the immutability of records: he had beaten the system in 1940 and the Army lacked the flexibility to forgive.

He worked for Kent County Council after retiring from the Corps and after many years as Chairman of Maidstone REA was appointed President of the Branch. He was a member of the Dunkirk Veterans Association. When he died there was a memorial service which practically filled the Garrison Church, Brompton on 14 December 1989.

His interests included cricket, (he was a member of MCC), and he was a Freemason. Throughout

Major C R Wampach

his service and retirement he made many friends, as we all do; what distinguished Cyril Wampach was that he maintained those friendships throughout his life.

BWC RDR HPM JW RW GVJW

MAJOR GENERAL ARTHUR HENLEY DOWSON CB CBE

Born 7 December 1908,
died 15 December 1989 aged 81

ARTHUR HENLEY DOWSON was born in Alexandria and educated at Haileybury, The Shop and King's College, Cambridge. He was commissioned on 30 August 1928. His first posting was to 5 Field Company in Aldershot, followed by an appointment as Garrison Engineer, Woolwich. He then joined the Field Division of the Ordnance Survey, so beginning a connection with Survey in which he ultimately reached the highest position. On the outbreak of war he went to France as Staff Captain HQ 2 Corps, returning to England to form and then command 516 Field Survey Company. In January 1943 he took this Company to join First Army in North Africa. He was soon promoted Lieut Colonel and served successively on the Survey staffs of HQ 1 Army, AFHQ and finally HQ 5 (US) Army in Italy where he remained until the end of the war. In 5 Army his duties were to assist the Army Engineer by directing the operations of the British and South African Survey units, which were supporting the Army, and coordinating their tasks with those of the US Corps of Engineers Topographic Units. When the war ended he was posted to the War Office before taking over as Chief Instructor and, later, as Commandant of the School of Military Survey.

RCAE writes: "I first met Henley when I returned from India in 1949 and was posted to the War Office. He was then Chief Instructor of the School of Military Survey and my impression then was of a neat - even dapper - and unusually well organized man.

Later I got to know him well when I was put in charge of Geodetic Control at the Ordnance Survey with Henley as my Director of Field Surveys. The OS seemed at that time to be rather stuck in the mud, both as regards its organization and the technical methods it used. It was largely owing to Henley that it got moving again. This was not always popular with the entrenched establishment.

The need for Survey Officers to hold a recognized professional qualification, both to make their own position more secure and to enhance the standing of their profession in the Corps, had been recognized for some time. At the end of the Second World War the senior figures in Survey had taken the necessary steps, in cooperation with the Royal Institution of Chartered Surveyors, to establish a Land Survey Division of the Institution with its own rules for qualification as a Chartered Surveyor and with appropriate dispensations designed to accommodate the serving professional officers, military and civilian, of the Government Survey Services. In this Survey was a pioneer for the whole Corps. But, as was to be expected, this

Major General Arthur Henley Dowson CB CBE

outcome was not achieved without controversy and a certain amount of ill-feeling. Dowson, at one time, found himself in the centre of this. The dispute between the Institution and the Joint Advisory Survey Board, representing the Government Survey organizations, had reached such a pitch that the Director General of the Ordnance Survey, the Director of Military Survey and the Director of Colonial Surveys all resigned from the Institution. Dowson, at that time a Director of the Ordnance Survey, was in an extremely difficult position. He did not at all share the views of his superiors but felt he must resign from the Council of the Institution. But he did not resign from the Institution itself and was therefore able to rejoin the Council in due course and exert a great influence on the way the profession developed, to the great advantage of the military officers and other government servants within it.

As Director General of the Ordnance Survey, Dowson was largely responsible for the initiation of many measures of modernization. The methods of air survey were updated and its use extended; a new division of Training and Information was formed and the methods employed brought up-to-date; an outdated and impracticable mobilization scheme, under which the Director General was transferred to the War Office the moment war was declared, was scrapped; the unpopular plan to re-house the Ordnance Survey in Wellingborough - another war-oriented idea - was scrapped and a new building at Southampton, the home of half the staff, designed and started.

These measures were all put into effect with the quiet efficiency which was characteristic of Henley. Unlike some of his predecessors, he was never flamboyant but went about his duties with intelligence, industry, modesty and common sense. He was never a great sportsman although he played most games; he was a keen skier and also a competent golfer, which was recognized by his appointment as Captain of the Royal West Norfolk Golf Club in 1972. He was a great family man and, although he and his wife, Eve, were only blessed with one child, a daughter, he took the greatest interest in her career as a dancer and, when she married, in his grandchildren: he was especially proud of his two great-grandsons.

When he retired he remained actively employed: first, when he lived in Norfolk, as Chairman of the Broads Consortium Committee and later, after he had moved to the West, on bodies concerned with the preservation of Hereford Cathedral. He finally moved back to Norfolk where he and his family embraced the Roman Catholic Faith not long before he died.

He was appointed ADC to The Queen from 1958 to 1961 and Honorary Colonel of 135 Survey Engineer Regiment (TA) in 1960. He was awarded the Bronze Star of the USA in 1948. He married in 1933, Mary Evelyn (Eve) Savage, whose father and brother were both Sappers."

CLR writes: "I always got on very well with Henley, but he was a difficult man to sum up, perhaps because he was very modest. My memories of him in 20 YO Batch are of a highly intelligent, cheerful, athletic character, very reliable in any sort of 'flap'. In his work he was always very accurate and neat, and it was perhaps these attributes which led to his specializing in Survey, where he rose to the top.

We had a particularly happy day together in Italy in the war. After many months in an American environment, it was a delight to have such an old friend with me for a day, an imaginative and sensitive friend, who knew what I was thinking almost before I said it. We had a splendid lunch together in a lovely little restaurant in Ravello. After the war I persuaded him to join my wife and myself for a skiing holiday in Verbier. I knew he had been a keen skier in his youth but, on this holiday he unfortunately dislocated his back after a fall and had to give up."

CLR RCAE BStGI

COLONEL K du B FERGUSON DSO TD DL

Born 22 December 1917, died 10 January 1990 aged 72

Colonel Ken Ferguson died in January aged 72. He was awarded the DSO whilst commanding 77 Assault Squadron, which landed in front of 3 Infantry Division at Lion-sur-Mer on D-Day in 1944.

Ken Ferguson was educated at Uppingham and Clare College, Cambridge. He was a notable games player, representing Uppingham at rugby, cricket, and hockey. At Cambridge he concentrated on rugby and was unlucky to miss his Blue twice through injuries.

When war came in 1939 he joined the Corps at once and was soon out in the Western Desert, finishing as second-in-command of 1 Field Squadron in 1 Armoured Division, from Alamein to the end of the campaign. Returning to UK after attending the Staff Course at Haifa, he was appointed to command 77 Assault Squadron in preparation for the D-Day landings.

The German defences at Lion-sur-Mer proved strong and inflicted serious casualties on the Assault Engineers, including Denis Cocks, the CO of 5 Assault Regiment, who was killed on the beach. After D-Day and the days of intense activity that followed, casualties forced 1 Assault Brigade RE to reduce its organization from four troops in each of the 12 assault squadrons to three troops. During the coming winter, after the three sea-borne attacks to clear the Scheldt Estuary, casualties again enforced a serious reduction, this time from 12 squadrons down to nine.

Later, after leaving 77 Squadron, he was involved with 7 Armoured Division and 51 (Highland) Division in operations in the Rhineland, in the Rhine crossing and deep into Germany, until the fighting ended. Then he was posted as an instructor to the Staff College, Camberley, a rare appointment for a non-regular officer and a valuable indication of how highly he was esteemed.

In 1947 his father, who had won an MC in the Corps in World War One, handed over the family firm, Raine & Co, on Tyneside to Ken, who immediately found work there for many ex-soldiers. However, political interference in the steel industry led the family to sell the business in 1958. During this time he had joined the TA on its re-formation in 1947, being promoted to command a regiment in 1953 and to colonel as CRE 50 (Northumbrian) Division in 1956. Later, on moving south, he became Commandant of the Dorset Army Cadet Force in 1959 until retiring in 1965 and continued as Chairman of Dorset Joint Services Cadet Committee till 1984. He was appointed Deputy Lieutenant in 1977 and then High Sheriff of Dorset for 1986/87.

Much of the credit for the award of the freedom of Lion-sur-Mer to the Corps last year belongs to Ken Ferguson, who kept up a strong contact with the authorities there for many years.

In 1959 he purchased Knoll House Hotel in Studland and proceeded to built it into an award-winning hotel of the highest quality. In all this he was greatly helped by his wife, Pauline, whom he had married in 1943 and who survives him, with their two sons and a daughter.

AEY CF WCSC

Colonel K du B Ferguson DSO TD DL

BRIGADIER G A HARDY FRICS

Born 5 June 1923, died 18 February 1990
aged 66

GEORGE HARDY joined the Army during World War Two. He was awarded the Sword of Honour on passing out of Cadet School, showing early the qualities of excellence that he exhibited throughout his life. He later saw active service in North Africa and Italy.

After the war he was posted to the Survey of India where, during much travelling, he visited Ceylon and there met Olive, who shortly afterwards became his wife. In the late 1940s, after India's Independence, he attended courses at the School of Military Engineering and the School of Military Survey - where he was the senior pupil on the very first Army Survey Course. It was about this time that he organized and led one of the first British Schools Exploring Society expeditions, to Arctic Norway - a nice indicator to his future time with the Royal Geographical Society.

The 1950s were a microcosm of his whole future army career - service in Germany, the Ordnance Survey, and instructor in cartography at the School of Military Survey, before he was selected for command of, in turn, two independent squadrons: a very rare privilege. The first in 19 Topographic Squadron involved surveys, including boundary surveys, all over southern Arabia, and giving survey assistance to Kenya; the second was with 14 Field Survey Squadron BAOR. By now their daughter, Kim, was born and for the rest of his life he revelled in his family life, and was wonderfully proud of his daughter's later success as an actress.

Promotion then kept him overseas and introduced him more directly to NATO with service in Oslo, and many happy times, of which one little story might give a flavour. The mapping community in Denmark, part of his territory, is generously supported by the Carlsberg brewing company and meetings were well known for their liveliness. On one occasion the brewery was on strike and the Danish military host announced sadly that beer rations during this conference would be cut - to one per day; this became one CASE per person per day.

A spell in a staff appointment at Military Survey Headquarters at Feltham, strangely his only tour there and his first at home for very many years, provided but a short interlude from his international friends as he returned, on promotion, to NATO as Chief Geographic Officer at SHAPE in Belgium, the highest geographic appointment in NATO. His deputy there was an Italian, Santi Monaco, who by one of those curious quirks of fate was the man to whom he had been handed over as a prisoner by the Germans some 24 years previously, - and from whom he had then escaped to rejoin Allied Forces.

The last seven years of his military life were spent at the Ordnance Survey, first in charge of Cartography and then, on promotion to Brigadier, as Director of Field Surveys. It was a time of very great change in the Ordnance Survey - of the switch from the old and dearly loved 1-inch map to the metric 1:50,000, and of the Serpell Committee with all that that entailed for the future of national mapping in this country. George was in the middle of all this and, typically, put his heart and soul into the issues of the day. He was also a notable supporter of the Royal Engineers Association, that group of old Sappers with such strong and long links with the Ordnance Survey in Southampton. In 1976 he was appointed ADC to the Queen, in recognition of his great contri-butions to public life, and he was particularly proud of the day when, in this appointment, he escorted Her Majesty throughout her visit to the training establishment at Minley Manor.

Brigadier G A Hardy FRICS

George retired from the Army in 1977 and took up an appointment at the Royal Geographical Society, becoming its first Deputy Director shortly afterwards. This was a very happy time for him, as he busied himself with the multifarious affairs of the Society, of which the 150th anniversary celebrations and the commencement of the Central Asia map were just two. He played a very active part in the debate on the Government's ideas on making the Ordnance Survey more commercially competitive, holding that this was incompatible with its historic role of maintaining the national archive. Few who heard it will forget his comment during the broadcast on the BBC Today programme, when discussion took place between the Minister responsible for the Ordnance Survey and George. A very long rambling political waffle by the Minister was concluded by George's "Rubbish!" who, unlike the Minister, was speaking from very detailed knowledge of the issues.

Forthright, was a word very frequently used to describe him, and he was just that in all he did. But he was more than just that and though fighting tenaciously for what he believed, he never gave offence, disarming any possibility with his genial personality and robust sense of humour. His strongly held views led him to act as coordinator for the private sector mapping companies in the Publishers' Fair Trading Committee, which was entirely consistent with his view that the national survey archive at Ordnance Survey was too important to be undertaken by a trading company, as envisaged by the Government.

Sadly a heart attack, and a period in intensive care, in 1984 led to his early retirement from the Royal Geographical Society, much to the regret of all there and of its Fellows. For his great contributions to the Society he was made an Honorary Fellow, a very signal honour.

He recovered from his heart attack but in 1986 malignant cancer was diagnosed which, typically, he fought through several operations, leaving few to realize how ill he was. He continued to act as Secretary to the Publishers' Fair Trading Committee until quite recently, and to enjoy the wonderfully happy family life that had always meant so much to him until he died at home in Cobham, Surrey, on 18 February.

One, who served under him near the end of his Army career, writes: "Never did a young officer get such enormous encouragement and support; he was direct in everything he did, quick and decisive in action, demanding high standards, yet always aware of the need to alleviate the effects of difficult decisions, and full of tremendous compassion and support for others; he was also most generous and fulsome in his praise for work well done."

An abiding memory of George, a most warm-hearted, cheerful family man, always with a ready smile, is of his courage - exhibited in various ways all through his life - in fighting for what he believed in, and most especially in his battles through very serious illnesses right to the end.

PFF EWB BStGI FMS

BRIGADIER C E F TURNER CBE DSO

Born 23 April 1899, died 1 March 1990
aged 90

CHARLES TURNER's death on 1 March, a month before his 91st birthday, has left a big gap in the lives of his family and he will be much missed by the many friends he made throughout his long and very full life.

Charles was born on St George's Day 1899. His father who was a Sapper serving in India, died when he was three, so he was brought up by his mother and grandfather, General Sir Charles Scott, initially in India and then at his home in Cousley Wood, Sussex.

He was educated first, at Twyford Preparatory School near Winchester, and then at Wellington, where he was very happy. He became Head of the Picton and a school prefect. He also won the Earl of Derby's Gift as Best Foundationer of the Year.

He entered The Shop in 1916 and was commissioned the following year. In 1918, he was posted to 2nd Field Squadron RE in 2nd Cavalry Division. At the end of the war, after various jobs following a Survey Course, he was sent as a reinforcement to the Relief Force in Archangel, North Russia.

Early in 1920, he was posted to the 2nd Queen Victoria's Own Madras Sappers and Miners at Bangalore in South India, but within a week he found himself at Landi Kotal in the Khyber Pass with 14th Field Company Madras Sappers and Miners. He was later transferred to the 94th Company in Waziristan. He has described his 14 months on the North West Frontier of India as "a blissful time of real frontier active service soldiering".

After India, Charles did a two year Supplementary Course along with his contemporaries, to make up for their lack of peacetime education as regular sapper officers. The first year was at Christ's College, Cambridge and the second at Chatham.

Then followed over five years with Ordnance Survey, which included supervising the revision of the 25" to the mile maps of Northern Britain.

The news that he had achieved a competitive entry to the Staff College, reached him in York a week before his wedding "in that noble city", to Mary Swift. The years 1931 and 1932 saw Charles at Camberley. Many of those who were there with him, both Directing Staff and students, were to play big parts in the Second World War.

After Staff College, postings in Devonport and Singapore preceded an appointment as Staff Captain British Troops, Egypt, where Mussolini's threats in what was known as the Italian Emergency, gave him his first real chance to prove himself. He was, on and off, in charge of movements and with ever increasing reinforcements pouring in, he was kept busy. Upgraded to Deputy Assistant Quartermaster General and given the rank of Major, he became involved in a Palestine emergency, joining the staff of General Dill in Jerusalem for a short time. He was rewarded with a Mention in Despatches.

In 1937, he was back in England at the War Office. Early in 1939, he joined a very secret branch known as General Staff Plans, whose task was to plan the move of our Expeditionary Force to France including the organization of the Home ports. To quote him, "by Mobilization, in September 1939, we were ready, if exhausted!"

Two months later, he was promoted Lieutenant Colonel and posted to Aldershot to take over Movement Control there. This included the arrangements for the arrival of 1st Canadian Division at Glasgow in 1939. Then at three days'

Brigadier C E F Turner CBE DSO

notice, he was sent to Cairo as the Senior Movements Staff Officer at General Wavell's GHQ. In this job, his previous experience in the Italian Emergency and in Palestine, proved invaluable, both in knowing the terrain and many of the characters. For his work in this appointment he was awarded the OBE.

In 1941, Charles went as Assistant Quartermaster General (AQMG) British and Indian Troops in the Sudan with Headquarters at Khartoum. Among his responsibilities was the planning of reinforcement routes to the Middle East for both stores and personnel. While he was on the Kaid's staff, he was twice Mentioned in Despatches. The Eritrean Campaign was drawing to a close, but troops from the Sudan were operating on the flank of the Eighth Army where his fortunes were to take him next.

In September 1942, he was appointed AQMG of 7th Armoured Division which was then commanded by Major General (later Field Marshal) John Harding. He was with the Division at the battle of El Alamein and all the way to Tunis, when he was transferred to the staff of General Sir Brian Robertson as the Senior Staff Officer of a large Administrative HQ which was involved in the planning and organization for the landing and subsequent operations in Sicily. For the Desert Campaign, he was awarded the DSO and for his services on General Robertson's staff, the CBE.

The late autumn of 1943 saw Charles back in England after an absence of three-and-a-half years. Then followed several jobs which to him were rather an anticlimax after the Desert, although they were not without interest, as they included the arrangements for the repatriation of British Prisoners of War and later, with the acting rank of brigadier, as Deputy Director of Manpower Planning in the War Office, the problems of demobilization.

Charles' last job before retirement was as Deputy Chief Engineer Malaya District at Kuala Lumpur, during the anti-bandit campaign. His service had spanned 33 years, including two World Wars and some of the most interesting events in which the British Army had been involved in that period.

After leaving the Army, Charles returned with his family to his home in Sussex from where he did various jobs for the National Council for Social Services, later becoming Fund Raiser for the Institute for Rural Life and the Iona Appeal, and subsequently giving considerable assistance to the Gurkha Appeal.

Other activities in retirement included research into his family history which involved travelling widely in England. His interest in people and his ability because of his excellent memory, to find some connecting thread of mutual interest, was an outstanding feature of his life.

At his 90th Birthday Party, he announced his intention to start an Open University course in Modern History. Sadly, he was only able to complete a few weeks of it before his death.

To Charles, his wife Mary, who died in 1985 and his family including his grandchildren and great grandchildren, were all important. They responded to his interest and delight in their activities, with their love and affection.

He was enormously proud of having been a Sapper and in recent years many friends and relations were treated to a visit to the Museum at Chatham and lunch in the Mess. His great interest in everyone he met, his kindness and sense of fun will be sadly missed by all who knew him.

MT

Correspondence

PROFESSIONAL QUALIFICATIONS FOR MILITARY ENGINEERS

From Colonel D Whitaker

Sir, - Brigadier Stephens seems finally and foreseeably to have laid to rest any idea of a professional qualification for Sapper Officers and WOs, based largely on their having been Sappers. I suggest, however, that we could get halfway towards a 'qualification' by making more use of the letters RE after our names. Our forbears appear to have kept these after their names well after they were promoted above lieutenant colonel and went on to higher command or the staff, or retired. They appear after Gordon's name on statues and the like and, for instance, in an Indian Army list of 1914 which I happen to have, there are a number of entries such as 'Field Marshal Viscount Kitchener of Khartoum, KP, GCB, OM, GCSI, GCMG, GCIE, RE, Lieutenant General C A Goodfellow, VC, RE, and the like. It shows how much they were valued but I understand that it was in fact because they were as individuals Royal Engineers as well as being members of the Corps of Royal Engineers, an arrangement unique to ourselves then and I suspect applicable now. Officers of other corps and regiments have never enjoyed this distinction - for example a Gunner officer is not a Royal Artilleryman in his own right; he is simply a member of the Royal Regiment.

My suggestion is that the letters RE would become more familiar and be seen to mean something if they were universally used by red-hatted and retired officers, and jealously guarded as a privilege. Perhaps they could be given more credence if they did, in fact, signify certain basic standards of competence; for instance on first commissioning, officers (and on appointment WOs), could be limited to using CRE after their names, being promoted to the use of RE only after, say, three years in a post requiring Sapper skills and the acquisition of a first degree.

We lucky military engineers have this singular distinction amongst the numerous kinds of engineer there are today of being Royal; why don't we show our pride in that by retaining the letters for life? And for those thinking in terms of qualifications let their philosophy be that if a potential employer does not know what it implies he is probably not worth working for. - Yours faithfully, David Whitaker, *The Dower House, Chawton, Nr Alton, Hants, GU34 1SB.*

THE CORE BUSINESS

From John Richardson

Sir, - I read Colonel Ayling's article The Core Business, a very apt title, with great interest. I consider the subject of the professional future of the Corps as of paramount importance for consideration by members. I should like to express some views, even though this could be seen as somewhat presumptuous from a National Service Officer of close on forty years ago. However the viewpoint of an observer outside the wood can be useful to those heavily engaged chopping down trees in the wood, albeit that that observer does not have intimate experience of the activities currently being undertaken.

Colonel Ayling put the problems pretty clearly on the table, though perhaps more analysis is needed to identify specific strengths and weaknesses.

I do not feel easy with his comment that the technical/non-technical split in the Corps is a red herring, as I feel the subject must be looked at within the total organisation of the Corps. An equivalent civilian organisation with an engineering design and execute base would not get far without its essential support departments, marketing, commercial, accounting, training, resources and the like. The Corps must surely have some such parts to be a total effective organisation for military engineering.

The subject of military engineering professional qualifications is a difficult subject. It needs much effort applied to its development, and probably development of "outside" recognition. This will take time. Is there anything to be learned from other armed forces?

The only one with which I have had a slight brush, is the US Corps of Engineers whose style of operating I have found appealing with the synergy opportunities given by significant cross-involvement in civilian engineering. However when chatting after JPM's, I have found some of the Corps' present professional engineers at the captain/major level to be against this on the basis of the danger of diluting military engineering strengths.

I see total military engineering as a combination of very specialist assault engineering and the application in other activities, as found appropriate, of civilian engineering techniques. (In the main civil, mechanical and electrical.) Both aspects involve the best use of all equipment and techniques available, including sophisticated ones, and when these run short, a high capability for improvisation.

I will try a short definition of the objectives of the military engineer:-

> Someone who is able to appreciate existing natural and man-made features and has the capability to enhance them by man-made additions to make fighting more difficult for the enemy and easier for our own forces.

In differentiating specialist fighting techniques from others, one must bear in mind that for military engineers time will be more of the essence than cost, fairly the reverse of civilian engineering.

Colonel Ayling also refers to the level of activity of more junior officers of the Corps in outside positions

of heavy responsibility in years gone by. Does the Corps strive today to develop such opportunities? At a lower level I am able to look back on some of the levels of responsibility given to me as a National Service Officer and realize that they were greater than those I had as a site engineer in the era before and shortly after my service.

I would support Colonel Ayling's proposals to develop the ethos of his arguments by setting up a committee reporting to Council to develop a military engineering business plan. The freedom it was given by its terms of reference and its composition would be of paramount importance to its possibilities for success. It would need to be small, with committed membership and have the ability to coopt particular expertise from time-to-time. It would need funding and/or provision of appropriate support services and would have to rely on massive amounts of "free" man hours.

I make these comments as someone who admires the work of the Corps and sees it from a main experience of the civilian profession. I hope they may serve a purpose in stimulating constructive reaction to Colonel Ayling's article. - John Richardson, *Elm Cottage, 22 Salmons Lane West, Caterham, Surrey, CR3 5LT.*

From Out of "The Blue"

(The name by which the Western Desert was known by those who served there)

From Lieut Colonel G E P Mulhern OBE

Sir, - It was in the Wrexham Public Library in late July 1987 that a chance glance took me back forty-five years to an office tent in the Western Desert a few miles back from Alamein and a few weeks before the Battle.

I was about to pass some shelves on which were the UK Telephone Directories when one of these - "Taunton" caught my eye.

I had never been to Taunton nor did I have any association with the locality but I remembered that a Major Clem Toy, one of three other RE Staff Officers, who shared that tent with me at Rear 8th Army HQ, had said that before the war he had been a Taunton architect and an officer in the local TA.

The other two were Major Bill Vivian, ex Supplementary Reserve and Lieutenant (later Major) George Thomas, a regular like myself and with whom I still keep in touch.

We all went through the North African Campaign with 8th Army at the end of which I returned to UK and, apart from George I lost all contact with the others.

Therefore, it was the barest chance that I would find Clem Toy in that Taunton directory, but no! - there he was - not "C Toy" nor "Clement Toy" but "Clem Toy". With some excitement, I took down his address and telephone number.

Replacing the Taunton directory, I saw the one next to it was Cornwall. Another inspired guess was that wherever you find a Vivian or Vyvyan (the ancient version) you may be certain that his origins were in Cornwall - it is a Cornish name!

The odds of finding Bill Vivian seemed very much greater than those of Clem for we knew little if anything about each other's background but, you've guessed it, there he was, bold and clear - "Major W Vivian" with his address in Fowey. Of course, it simply had to be him.

I hesitated for over a week before I telephoned them; firstly Clem Toy. His voice, instantly recognisable, cultured and as gentle as he never failed to be - a gentle man. His immense pleasure and surprise at my being able to trace him were quite heartrending, the more so when he said that, at 82, he was very frail and had trouble in swallowing food. Meanwhile he was awaiting a medical report. With his family, he had every comfort.

After North Africa he went on with 8th Army to Sicily and Italy and did not know what happened to Vivian or George Thomas and was taken aback that Bill was living in the next county. I gave him up-to-date info about George.

I said I'd keep in touch and if ever I found myself in his locality he could be sure I'd not pass his door.

When I called Bill Vivian, he was equally astounded and, of course, pleased.

I told him that since our parting I'd often wondered how the war was treating him and Clem and it was after 21 Army Group's successful Rhine crossing that I was given some pretty vague rumour that tragically, he, Bill, had had one, if not two of his legs blown off. "Now Bill" I said "Tell me it wasn't true".

Very hesitantly he said "Er - no, it wasn't exactly so but I did get one God-awful thigh wound after the Rhine crossing".

The trouble was that he was left on the ground as a pocket of some thousands of Germans had staged a last-ditch surprise attack and he was made prisoner. It was three weeks later before our troops overcame this hiccup and Bill was brought back. For Bill this three weeks was critical for gangrene had taken hold. This complication generally could prove fatal, unless amputation was carried out.

Miraculously Bill's leg was saved but he vehemently regrets this for he has suffered abominably ever since with many periods in hospital and walking only with sticks.

He said, and his doctor agrees, that a stump with an artificial leg would have left him better able to cope.

Nevertheless, he has faced up to his disability with fortitude over the years, and has many interests including his Presidency of the local branch of the Royal British Legion.

I told him of my chat with Clem and of George Thomas and he was delighted with my promise to give him the occasional phone call.

It was a year later that I had the opportunity of calling on Clem at his home in Taunton. We spent a couple of

hours in his lovely garden in bright sunshine reminiscing on our time together during that exciting campaign.

In forty-five years Clem had not aged appreciably except that his admitted frailty had him seated in an electrically operated wheel chair. Most tragically however, his devoted wife, Peggy, confided to me that Clem had cancer of the oesophagus.

In fact, Clem died in February last year - he was eighty-three. With heavy heart I informed the others.

I suppose it is quite something that we all survived the war and even more so that we all had become octagenarians. Yours sincerely, George Mulhern, *5 Yew Tree Court, Gresford, Wrexham, LL12 8ET.*

Reviews

MILITARY PLANNING FOR THE DEFENSE OF THE UNITED KINGDOM, 1814-1870

MICHAEL STEPHEN PARTRIDGE

Published by Greenwood Press, Eurospan, 3 Henrietta Street, London, WC2E 8LU - Price £44.95 ISBN 0-313-26871-1

INVADING England is difficult, Julius Caesar and William of Normandy succeeded, but in their time the English had no navy, William of Orange took his chance when a "Protestant" wind trapped the English fleet in quite the wrong place, Philip of Spain, Napoleon Bonaparte and Hitler, having assembled many hundreds of troop-carrying barges for the purpose, called off their attempts because they could not break the hold of the British navy on the invasion routes. How strange then that throughout the nineteenth century, at a time when Britain was the foremost economic power in the world, controlling the largest empire the world has ever seen, military planners in London were preoccupied above all else with fear of being invaded. This fear was wholly illusory; an example of worst-case planning gone literally mad. The French, who were supposed to be the ones intending to invade, simply did not have the resources to do it. No doubt much of the alarmism was self-serving. As Richard Cobden pointed out "nine tenths of all the clamour for more defences ... had a professional origin". Sir John Burgoyne, Inspector General of Fortifications in 1851, professed himself "utterly surprised at the apathy on the defence question of the country in general, standing as it does on the brink of a frightful precipice. ... The melancholy thing is the indifference of our statesmen to the question". What really surprises is the way this obsession with a non-existent precipice did infect so many politicians. Lord Palmerston, for instance, believed to his dying day that the key to the defence of Britain lay in the construction of large and expensive fortifications *around the naval arsenals* - including to landward. Those who had to build such things knew better. Colonel G Cardew, CRE Portsmouth in 1845 wrote "I cannot contemplate that the power of England will ever be so reduced, as to admit the probability of an Enemy's Force laying siege to Portsmouth". Gordon, building forts along the Thames near Gravesend twenty years later, told the War Office that they were quite useless - and was proved right.

Michael Stephen Partridge gives an admirably detailed account of this curious phase in British Defence Policy. The book is his doctoral thesis, only slightly re-worked, and has the strengths and weaknesses of that genre. He tells the story fairly and in good order. He has consulted the private papers of every mid-Victorian peer you can think of. The apparatus of bibliography and notes is magnificent, running to one quarter of the book. He explains how naval confidence collapsed with the almost simultaneous arrival of steam power, screw propulsion, armour plate and shell ordnance. He has chapters on the re-jigging of the central organization for defence; on the failure of the regular army and reserves to recruit; on the militia, yeomanry and volunteers; all fairly standard stuff. The heart of the book is a long chapter on fortifications. While certainly not an easy read, this is well constructed, informative, interesting and sensible. The conclusion is best expressed in words by the Chaplain General to the Forces, the Reverend G R Glieg, in 1851: "The piling up of fortifications one upon another would be so much money sunk, for we neither have nor are likely to have, soldiers to man them."

Nowhere was this more evident than at Portsmouth. Over a twenty year period from 1861 and 1880 three forts were built on sandbanks off Spithead at vast expense. The only purpose they have ever served is as shipping marks, or more plausibly as obstructions. Which leads to one final word of criticism. The seven maps in the book are disappointingly amateurish, and the one of Portsmouth so gravely distorted that it should carry a health warning "not to be used for navigation". In all other respects the book is commendably free from errors. This reviewer could find neither misprints nor inaccuracies. It was a pleasure working on it.

HWB

EVERY END IS A BEGINNING

JOHN HAMMOND

Published by Merlin Books Ltd, 40 East Street, Braunton, Devon, EX33 2EA - Price £3.95 ISBN 0-863-03498-5

THIS is a quirky little autobiography written by John Hammond, a retired REME Brigadier. It's style is bright and breezy, but gives interesting insights into various aspects of the author's life. At £3.95 it is better value than many paperbacks on the bookstalls.

REJ

THE LAST OF THE REGIMENTS, THEIR RISE AND FALL

PETER DIETZ

Published by Brassey's Defence Publishers Ltd, 24 Gray's Inn Road, London WC1X 8HR - Price £29.95
ISBN 0-08-034761-4

I WAS most excited when given the chance to review this book. Brigadier (Retd) Peter Dietz served in the Royal Marines between 1943 and 1946 ending his commando service as an instructor at the Commando Mountain Warfare School. From 1951 until 1980 he held a number of appointments in the Royal Army Education Corps ending his service as Commandant of the RAEC at Beaconsfield.

The dust cover of the book contains the appetising quote, "Armies are conservative institutions, organized and preconditioned to resist change, or at least to adapt to change very slowly indeed ... the Armed Forces are threatened with isolation from their parent society and are in danger of ending up as the defenders of an anachronistic, outdated and obsolete way of life". Wonderful stuff, how true I thought to myself, and how relevant to the current situation the Army finds itself in today. Why then, given the chance to examine such a contentious, interesting and controversial subject as the myths surrounding the British Regimental system is the book a little disappointing?

Dietz examines the history of the British Army tracing the origin of the Regimental system. The first chapters lead the reader through the origins of the British Army, from the discipline of the Romans through to the golden age of the Regiments during the Napoleonic Wars. There is no doubt that a great deal of historical research has gone into this work, which is impressive in its breadth and accuracy. Unfortunately the author has a tendency to concentrate in too much detail on activities which are of interest to him but add little to the general development of his thesis.

The period of history between Waterloo and the Crimea is covered well. Dietz brings out how the British Army failed to develop over this period. How the officer Corps became less professional, "the way of life (of the officer) was that of the country landowner, with its emphasis upon horse racing, hunting and other country pursuits and sports, usually of a cheerfully Philistine nature." He quotes amusingly and sharply from official regimental histories such as the History of the British Cavalry, Volume 4, "British cavalry officers talked more and knew less about horses than anyone else on earth". Not much has changed. He points out how the British Army was organized and equipped to fight the last war, took little notice of what was happening in other countries resulting in the debacle of the Crimea.

His section on the British Army in India is one of the most interesting and coherent in the book. He expertly debunks the "martial race mythology" and cogently presents fact after fact to prove that soldiers of all nationalities fight for their fellows and their personal honour when properly led. The brave deeds of Indian troops from all regions and casts are well documented and make first class reading for those interested in military history and why men fight. This impressive section is followed by a history of the Childers, Cardwell reforms which effectively marked the beginning of the end of the Regimental system. He points out that reform of the British Army was greatly assisted by Russell's dispatches from the Crimea, "exposing the military buffoonery going on there".

The next section on "The Aberrant Corps", the Royal Artillery, Engineers and Marines is of considerable interest to any Royal Engineer officer. These Corps were considered "aberrant" because officers were not required to purchase their commissions and appeared to be promoted on merit, a concept foreign and threatening to the rest of the Army. These Corps had an organizational structure and a history of military professionalism that Dietz understandably admires. It is unfortunate that Dietz spoils this section by delving into far too much detail on the siege of Gibraltar. Interesting though it is to read about General George Elliott and his Chief Engineer Colonel Green, it does not greatly forward the arguments, once made.

It is intriguing how Dietz links the extravagance of uniforms with the inefficiency of various military organizations. For example, "Perhaps also significantly, the mess kit of the officers in the Royal Tank Regiment was changed in the early 1970s from the rational, comfortable dress of the post war era to the more glamorous but archaic model ... It is nevertheless a little odd that the backward-looking, consciously archaic fashions of the élite regiments should seem to triumph over the rational, utilitarian preferences of what was once the trend setting, progressive spear point of the modern army. In any civilian business or organization the signs surrounding the Royal Tank Regiment would indicate that it was ripe for disbandment". Good fighting stuff!

He deals with the inter-war period, in particular Fuller and Liddell Hart briefly and well. His argument develops and runs logically into World War Two and on to today. The references to the Falklands War could have been much more effective had he been in possession of the concealed facts that the old élites failed to come close to the fighting power of the commando and parachute units.

It is in his recommendations for the future, other than privatizing public duties battalions, (an eminently sensible idea!), that he goes badly astray. In many ways he was unlucky. The book was written before the current momentous changes in Europe which would have greatly assisted his thesis and conclusions. It is all very well to point out that the officer Corps of the British Army is class ridden and selects its senior officers from a narrow social base, it is another to come up with a solution to cure it.

He draws too heavily on Ruth Jolly's "Military Man - Family Man" and confuses the reform of systems and structures. It would have been more meaningful to have looked at the Childers, Cardwell reforms, drawn parallels to today, where the British Army could be said to be some way out of touch with modern society, and then proposed the sort of organizational and systems changes that would be required to make the Army (and the other services) a more effective and efficient fighting force. It may have been worth pointing out that any change to, what Dietz calls, "a new model Army," is most unlikely to be carried out from within. It is never in the interests of a self-perpetuating oligarchy to reform itself.

This is a significant book that could have been made into a fascinating and important document with some ruthless editing, an easier style and a more intellectually coherent conclusion. It is a useful contribution to the debate on the future of the Army and is worth reading, not least for laying to waste much of the comment being made today about the Regimental system, what it stands for, what is was and what it contributes or fails to contribute to the British Army today.

RM

FORTRESS BRITAIN:
Artillery Fortification in the British Isles and Ireland

ANDREW SAUNDERS

Published by Beaufort Publishing Ltd, P O Box 22, Liphook, Hants, GU30 7PJ
Price £20.00 ISBN 1-85512-00-3

This is the definitive work, long awaited - a remarkable coverage of the period dating from the introduction of gunpowder as a powerful force in British warfare. The book describes all the important examples from the modification of medieval castles to the steps taken to counter the threat of invasion in the Second World War. Events of history intermingle with detailed descriptions of forts and useful information on the actions and activities of military engineers.

In the changeover from the medieval castle there was little bold innovative thinking on plan form, rather there emerged a collection of ill-fitting devices added to existing structures. As so often with the introduction of new technology, the new product was usually thought of in terms of the familiar - a round hole added to a traditional arrow slit made it a gun loop. If Queensborough Castle (1360s and now destroyed) was an example of the latest in military thinking, it is difficult to see how it was affected by gunpowder firing cannon. Probably more important was Cow Tower at Norwich, forerunner of the English gun towers. The author emphasizes the importance in development of now long lost earthworks and detached bulwarks, especially in lines of circumvallation which changed the nature of war.

But real innovation was soon to appear, certainly in British practice, with the introduction of the fully developed caponier at Craignathan Castle (c.1530), pure Francesco di Giorgio. Also in the three-dimensional forms of Henry VIII's coastal forts, no two exactly alike. Germanic sources have often been quoted as inspiration for the piled-up concentric designs of casemated gun positions, their parapets curved back to deflect shot. But inspiration could as easily have come from Venetian work in the colonies, from Rome and, most likely, from Rhodes, brought back after the siege of 1522. Whatever the origin, the results have been well described as 'massively beautiful machines designed for the maximum emission of balls and bullets' (Hale).

Saunders emphasizes the interesting separation of the two aspects of defence in Henry's forts - close defence armament and counter-bombardment guns - a development surely implicit in the bastion trace with its use of frontal fire from the faces and enfilade fire from the flanks. It was to become a clearly established maxim in the ring forts of the nineteenth century.

Rightly, de Gomme features in the book, described as England's Vauban, but surely the comparison should lie with Menno van Coehorn? Schooled in the practice of the English Civil War, de Gomme was fortunate to be available just when Charles II needed to retrench his authority with coastal works against the mercantile power of the Dutch, and the splendid citadel at Plymouth built to overawe his subjects who might harbour rebellious thoughts. Although competent and experienced, de Gomme, like certain other foreign experts, was inclined to underestimate his costs, laying foreigners open to vindictive criticism from writers like Sir Jonas Moore (1673) who referred to it being more 'use to a prince to have an engineer that is knowing in the measures of a country and in the rate and value of works than in one that can vapour and talk of the forms and lines and be ignorant otherwise'. Moore was a mathematician but he had reported on the defences of Tangier in 1663, so probably his criticism was of the Swedish engineer, Beckman. Anyway Moore's book may have helped his grandson to attain a distinguished position as a *British* military engineer and soon native-born career officers would begin to evolve a corps of competent professionals which was by the nineteenth century highly innovative.

In this book one learns that there were few years when some part of Britain or the British Isles was not threatened by foreign raids, fears of invasion, actual landings, or rebellious insurrections. The introduction of martial gunpowder did not herald peaceful centuries and, although the threats tended to precipitate sporadic counter actions, the erection of forts to contain a restless population, to concentrate defensive garrisons, and batteries to safeguard threatened estuaries, there were, in addition to the bold strategic policy of Henry VIII, other periods of concentrated activity conceived to an overall plan. The frantic chase to keep up-to-date in an era of expanding technology caused costs to escalate at a time when Britain had incurred worldwide obligations to defend her empire. The most important

threats were, of course, Napoleon's Grand Army which shifted Britain's preoccupation with the defence of the royal naval harbours to the vulnerable landing places on long lengths of coast, and Hitler's victorious, overpowering army which stood braced for an all-out invasion in 1940. Against this last possibility the steps taken, although often interesting, were assembled with crisis haste to a scarcely perceptibly strategic plan because of shortage of equipment and trained troops.

The book traces all these events with a lucid text, often gripping in its intensity, illuminated by numerous excellent illustrations, aided by a gazetteer of the most important examples of fortification open to the public and a short glossary to assist those readers new to the subject. It is an essential purchase for anyone interested in forts and castles, useful both for its comprehensive descriptions and as a source of constant reference.

QH

BOMBS GONE

WING COMMANDER JOHN A MACBEAN AND MAJOR ARTHUR S HOGBEN

Published by Patrick Stephens Limited, Thorsons Publishing Group, Wellingborough, Northamptonshire NN8 2RQ - Price £16.99 net
ISBN 1-85260-060-8

BOMBS Gone provides a history of British air-dropped bombs of all sorts, including torpedos and mines, from the early days of military aircraft up to the present. The research involved is praiseworthy.

This introduction implies a rather dry, technical publication with little interest to anyone but the specialist, but the book is far from that. It encompasses the history of bombing by aircraft and livens the story with mention of a number of individuals and exploits. With the value of hindsight, it shows the error General (later Field Marshal) Jan Smuts' prediction made in 1917 about the probability of an air service becoming an independent means of war, based on the assumption that when bombs were dropped they was hit the target and explode. Even by 1943, a bombing raid on Essen, acclaimed as the most accurate to date, achieved only 37 per cent of the bombing payload falling witnin three miles of the aiming point. The percentage of unexploded bombs within this 37 per cent is unknown. Undoubtedly things have improved since then, but the Falklands war showed the difficulty of closing Stanley airfield runway and how casualties to HM ships were reduced by bombs which did not go off.

The whole development of bombing techniques is included, target finding, marking and operational control. A number of less conventional ideas for air-dropped weapons are mentioned, including some which could not be lifted by any known aircraft, or which required aircraft modifications for use. It illustrates clearly the need for comprehensive thought and realistic acceptance trials for aerial delivery of explosives as a complete weapons system, so that the delivered weapon functions properly when so much effort has been made to place it correctly.

This book thoroughly merits the comment in the first of the Forewords as "an invaluable contribution to the history of air warfare".

ITCW

April 1990 Journal Awards

The Publications Committee announces the following awards for articles of special merit published in the April 1990 *Journal*:

THE CORE BUSINESS by Lieut Colonel L J Ayling TD - **£100**

STANDARD MILITARY RAILWAY BRIDGING 1939-45 by Lieut Colonel A W McMurdo MBE ERD - **£40**

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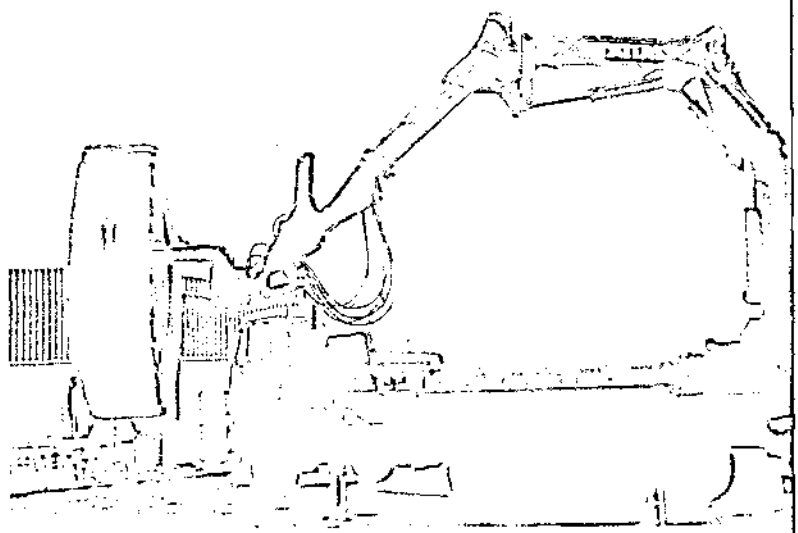

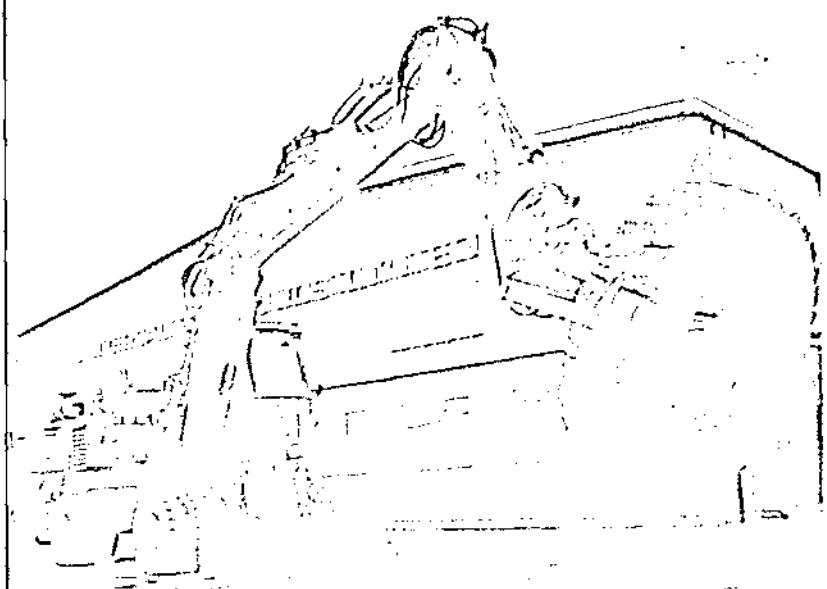

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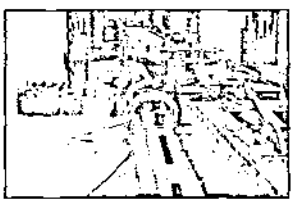
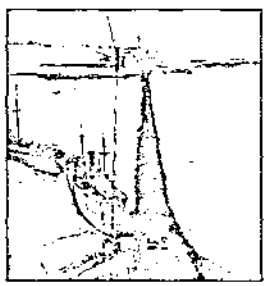
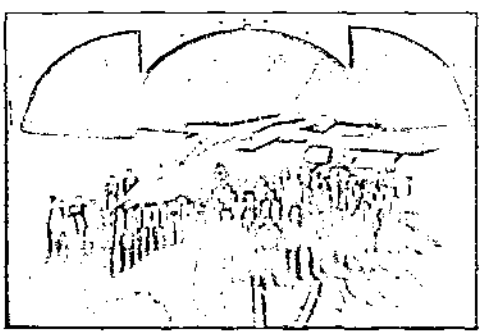


Mulberry Harbours crossing the Channel



Part of the causeway during construction in the Orkneys



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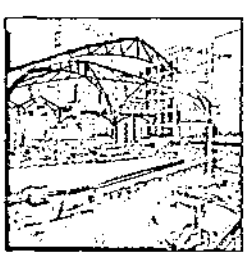

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