THE ROYAL ENGINEERS JOURNAL

AUGUST 1988 VOL 102 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 but colour and transparencies can be accepted. Quality is essential. 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 RE Journal *should reach the Editor by:*

mid January for the April issue
mid May for the August issue
9 September for the December issue

Submissions before the deadline will be particularly welcome.

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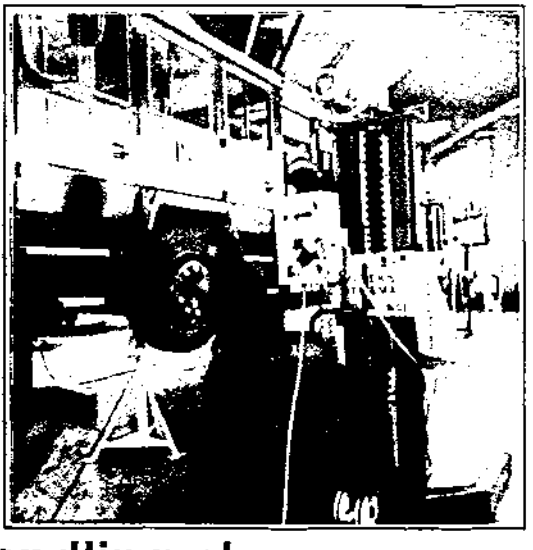

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2001 — An Engineer Support Odyssey

MAJOR A D THOMPSON RE

Major Thompson was commissioned into the Corps in 1977 and served as a troop commander in 51 Field Squadron (Construction), when it was still in the ADR role, in Northern Ireland, Canada and BAOR. He was also a member of the Commonwealth Monitoring Force on Operation Agila in Rhodesia during its transition to independence as Zimbabwe in 1980. A tour at the AAC Chepstow was followed by a posting to 21 Engineer Regiment as RSO/Training Officer for a year before appointment as 2IC 45 Field Support Squadron in 1983. In 1985 he spent six months as SO3 (PR) with the Multinational Force and Observers in Sinai, then attended No 5 Officers Long Plant Course, and is currently SI (Plant Training) PR&A Wing RSME.

THE battlefield of the year 2001 will require something different in the way of engineer support than that available at present. The current range of vehicles and equipment has its limitations and is unlikely to be able to move into a new century in its present form.

It is a question that has been exercising the minds of Sappers and design engineers for some time and the following is my contribution to the debate.

My proposals have been formulated on the basis of an in-depth study, undertaken as part of the Officers' Long Plant Course, and hours of consequent discussion. They are based on a 3-tier 'family' of tracked vehicles that should, between them, meet the demands of a wide range of engineer support tasks.

There is little doubt that circumstances in Central Europe will continue to dominate British and NATO defence policy for the forseeable future. The requirement for suitable vehicles and equipment to support, primarily, 1st (British) Corps must therefore be considered in this light. It is also clear that mobility, counter mobility and protection and survival will remain the principal roles for the Corps over the next 25-30 years and any developments in engineer support vehicles must reflect this.

The way the Corps is organised must also reflect the relative priorities and balance of its tasks at any one time. Current military engineer thinking favours close integration of the armoured and field engineer units. Field engineers need a more suitable vehicle from which to work than the ubiquitous FV432, the gap-crossing and minefield breaching capabilities of the armoured engineers need upgrading and many of the essentially 'civilian' plant vehicles currently in use need to be provided with better protection and mobility levels than they have at the moment.

In his article "Modernising Combat Engineering Capabilities" (*Defence Minister and Chief of Staff—No 2/1985*) John Reed discusses various aspects of this topic and points out that the "challenge facing army engineers is to come up with solutions which will permit the new combat systems and revised doctrines to be applied to maximum effect". Although perhaps stating the obvious, this view serves to underline one of the major problems of developing suitable vehicles for use by combat engineers—that of balancing all the desirable characteristics of such vehicles to produce a machine which it is possible to manufacture and which is effective in operation.

A British answer to this problem has been to develop the Combat Engineer Tractor (CET) to supplement a wide range of militarised commercial plant vehicles, to support Sappers working well

Major A D Thompson RE
2001 An Engineer Support Odyssey

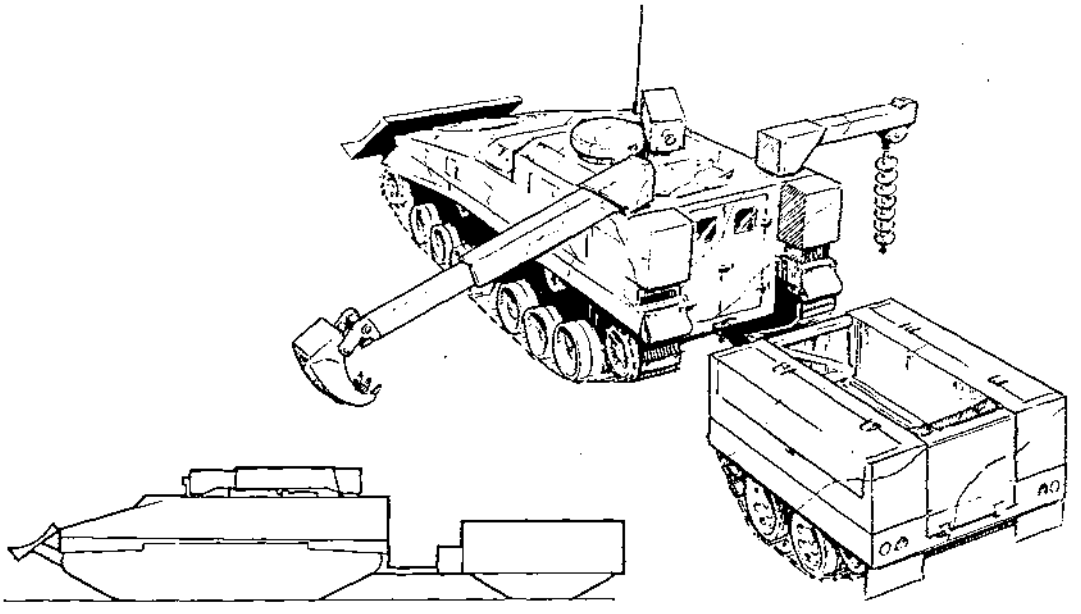

Figure 1. Engineer Section Vehicle and Trailer

forward on the battlefield and to complement the Armoured Engineers' AVLBs and AVREs. An American option is their Counter Obstacle Vehicle (COV), the West Germans are developing their Pionierpanzer 2 Armoured Combat Engineer Vehicle and the Soviets have their Inzhenernaia Mashina Razgrazhdeniia (IMR). Other countries have adopted different approaches, depending on their circumstances, but no country has yet produced a true, all-purpose engineer vehicle.

The design of a military engineering vehicle is complicated by the characteristics of many of the ancillaries and attachments which need to be incorporated. The task for the design engineer is to bring together all the basic components of the vehicle with the military engineering components in the most effective manner paying particular attention to their relative positions. For example:

Bridgelaying.

The base vehicle needs to be heavy enough, and the engine positioned far enough back, to act as a counterweight when the bridge is being launched.

Digging.

A more rigid suspension than that required for cross-country mobility is necessary to allow a bucket to dig effectively below track level. The suspension must therefore incorporate some form of lock-out facility as on the CET.

Dozing.

This requires a lot of tractive effort compared with that needed for other AFVs. The latter need only a low ground pressure and some traction to give them good cross-country characteristics. In general, the greater the mass of the vehicle, the better its tractive effort will be. This can be enhanced with suitably designed tracks to provide a good compromise between on-highway mobility, cross-country performance at speed and a good earthmoving capability.

Operator Position.

Any earthmover operator needs to be positioned high enough up so that he has a good view of his bucket and the hole he is digging. The operator of a combat earthmover needs to be similarly positioned and yet the vehicle should retain as low a silhouette as possible.

Engine Position.

The engine must be positioned so that it does not obstruct the operation of the front mounted attachments. Loader arms can be positioned round a front mounted engine and inside or outside the track frame but the adoption of either configuration is not desirable in an armoured vehicle. A better

solution is to mount the engine towards the rear of the vehicle where it can also act as a counterweight although, this in turn, makes it impossible to accommodate a full sapper section and an alternative crewing policy must be considered.

The development of a 3-tier family of vehicles such as I propose would be one practical solution to the problem. The vehicles would work in close concert with each other well forward on the battlefield. The main vehicle to be involved with combat troops would be a multi-purpose section vehicle with a combat earthmover in close support. A heavier gap-crossing and minefield clearance vehicle would be held back to support operations in the rapid advance or counter-attack phase of the battle.

The essential role of the engineer section vehicle (*Figure 1*) would be to provide forward troops with close, independent sapper support. The various tasks which the section, with its vehicle and trailer, would be capable of doing would include:

Minefield laying using a Barminelayer.
Demolitions.
Route cratering.
Minor defensive digging.
Stores handling.
Some route clearance.
Some mine clearance.
General combat engineering.

In conjunction with other sapper support the section vehicle and its independently powered trailer could be mounted with a scatterable mine (SM) dispensing system and a light mine-plough, tow a Giant Viper (GV) or barminelayer and carry a pipe fascine or roll of trackway.

When not working on site the vehicle and trailer would rapidly transport the sapper section and all its equipment and stores between tasks. The vehicle would protect the section from shrapnel and the effects of other battlefield weapons to the same degree as an APC. A machine or chain gun would be available for extra anti-aircraft or local ground defence and a hybrid NBC system would allow the occupants an adequate degree of protection where the provision of full NBC protection is not a feasible proposition.

It seems likely that a trailer would be required to help carry all the stores, tools and equipment needed by a sapper section. The trailer would be tracked and fitted with a small engine so that it could be manoeuvred independently on site. (The engine could also be used for power tools). In transit, however, the trailer would be powered by, and its motion synchronised with, that of the towing vehicle.

My proposed combat earthmover (*Figure 2*) would be the sapper workhorse. It would have many of the characteristics of the current CET but would incorporate an improved bucket and a backacter. Its prime role would be to carry out earthmoving tasks in support of the sapper section and forward troops on the battlefield where rapid defensive digging operations are essential. Its main tasks would include:

Digging vehicle and gun slots.
Excavations for buried command posts and communications complexes.
Digging personnel and small arms trenches and emplacements.
Disruption of routes by digging and dozing.
A variety of demolition and clearance tasks in FIBUA operations.
Breaching of obstacles such as anti-tank ditches.
Route clearance.
Stores handling.
Some mine clearance.
Recovering bogged-in vehicles.

Additional capabilities would include the transportation of a pipe fascine or roll of trackway and minefield breaching by fitting a mine-plough or towing a GV. It could also provide an alternative source of power for hand tools and be used as a command post during bridge demolitions. A desirable feature would be a defensive machine or chain gun and it would be possible to provide full NBC protection so the tasks could be carried out when the crew hatches were secured.

The main role of the heavier gap-crossing and mine clearance vehicle would be to provide a rapid, close support, gap-crossing and minefield breaching facility to forward troops in the advance or counter-attack. The vehicle that I envisage (*Figure 3*) would be akin to the current Chieftain AVLBs and AVREs. The chassis and integral components, however, would be based on the twenty-first century equivalent of Challenger, so

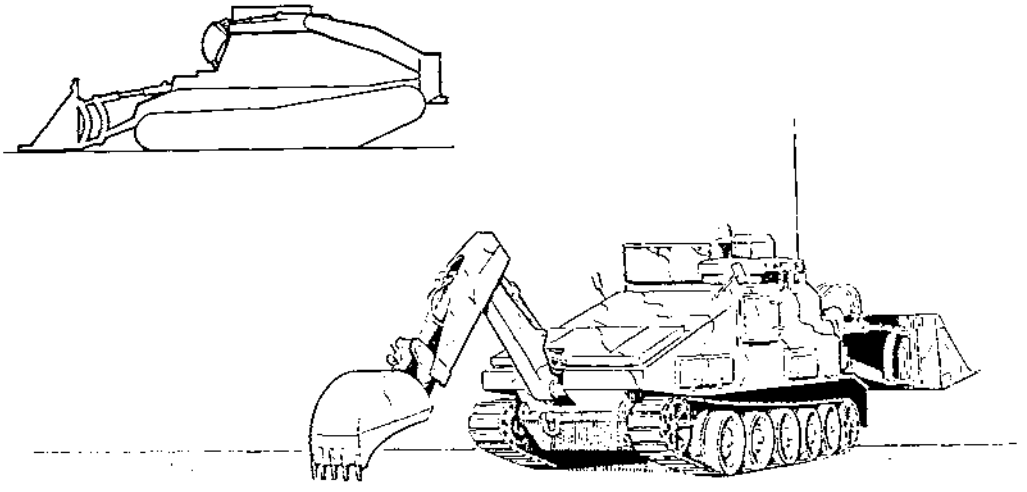

Figure 2. Combat Earthmover

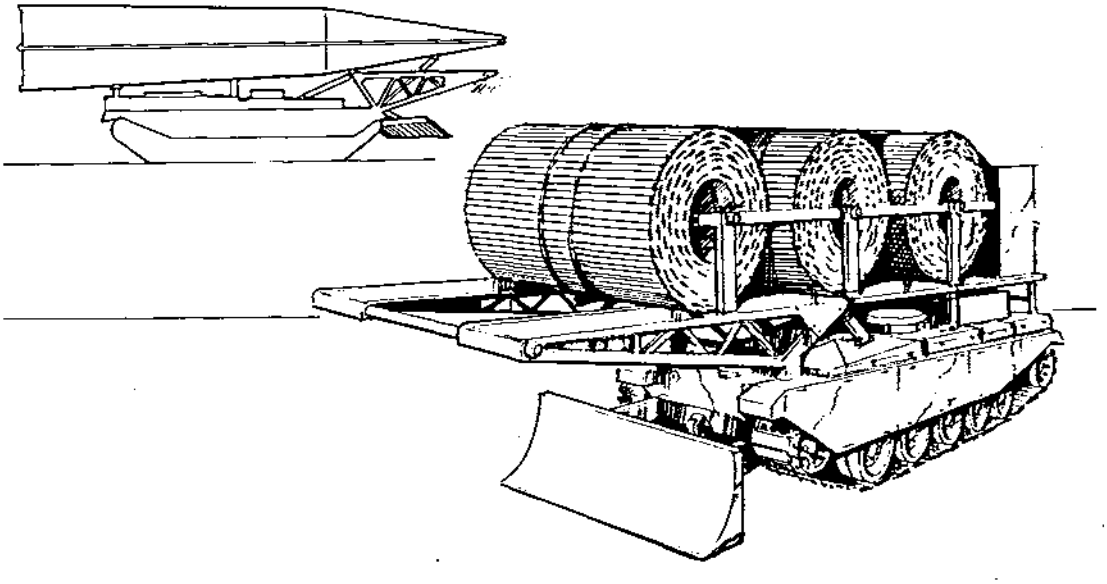

Figure 3. Gap-Crossing and Minefield Clearance Vehicle

making the major parts of the vehicle compatible with a modern main battle tank.

The vehicles would carry interchangeable bridges, pipe fascines or rolls of trackway according to their anticipated roles and tasks. It is likely that only some would carry a mine-plough whilst the remainder would be fitted with dozer blades. Those with mine-ploughs may not, initially, have anything mounted on top of them but they are likely to be towing a GV.

Several of these heavy vehicles would be kept in hides well forward on the battlefield but probably to the rear of the foremost defensive positions. It is likely that they would be supported by sapper section and combat earthmoving vehicles moving with the infantry units. Thus Sappers would be immediately available to provide additional support to the forward troops when called upon to do so.

One of the major problems for engineers on the battlefield today is the need to call on and use a large number of different vehicles to support a myriad of engineer tasks. Such vehicles include the LWT, LMD and MWT, which are all vulnerable to enemy fire and have limited mobility and flexibility in forward areas. Our present CVR(T)s and APCs are not much more than recce and troop carrying vehicles and they have little or no room to carry any useful quantities of engineer stores or operate independently of other, often wheeled, support vehicles. The CET concept is excellent but the vehicle itself has not, I believe, been developed to its full potential. The AVLB and AVRE have essential functions on the battlefield but the engineer equipment is mounted on outdated base vehicles which were not originally designed for, and cannot, in my opinion, fully cope with, the demands which are now placed upon them.

The three vehicle concepts that I have proposed are, essentially, new generations of the APC, CET, AVLB and AVRE. They would eliminate the need to have so many poorly protected, not very mobile and relatively inflexible vehicles in forward areas as we do today. Instead, such C-vehicles as the LWT and MWT could be more usefully and successfully employed in the equally important rear areas where their unique facilities can be more readily put to the uses for which, as commercial items of plant, they were originally designed.

The realities of defence procurement determine the need for pragmatism. It is more likely that adaptation of existing military vehicles for specialist roles will be encouraged rather than the development of equipment unique to a particular role. We, as Engineers, must therefore ensure that future armoured vehicles which are developed for use by other arms incorporate facilities which could be readily adapted to sapper needs. Where a special-to-role vehicle, such as CET, does exist it is likely that enhancement of that vehicle will also be preferred. The potential of such vehicles must therefore be fully explored and we should aim to develop the possibilities that it already embodies without being constrained in our thinking by the shortfalls and problems that the current generation of the vehicle might exhibit.

Prediction is never an easy task but I believe that the diverse demands projected for front line engineer support vehicles in the future could be met effectively by developing something akin to my 3-tier family. The base vehicles for each tier already exist or are currently being developed and are at a stage where input from Sappers could influence their design to suit military engineering requirements in 2001. Surely the Corps must not let such an opportunity slip by?

Engineer Aptitude Testing

(A copy of a letter that has recently come into our hands)

DEAR General

You told me years ago that I should write to you if I had a problem. Well, apart from the odd Christmas card request for money or advancement, I really haven't disturbed your retirement much but now I need a hand.

I have recently gone back to the Engineer-in-Chief's Recruiting and Liaison Staff, this time as ERLO. Shortly after arriving an ex-ERLO, who shall remain nameless, 'phoned me up and said "Glad you are back, you may be able to sort out the problem of engineering aptitude testing which we couldn't hack ten years ago!". He didn't exactly leave the country straight away but not far off!!

Just to remind you, the Corps recruits not just from those with a technical education or background but will take anyone with the minimum educational qualification who has the necessary "engineering aptitude". The first quality listed on the Pre- RCB boarding proforma is "engineering aptitude". Yet nowhere in a fairly lengthy selection procedure is engineering aptitude assessed. In spite of numerous reviews of YO training and job analysis no-one has ever defined what the Corps requires for "engineering aptitude".

Now fortunately, recruiting into the Corps over the last five years has remained fairly buoyant. However in the 1990s we will begin to feel the effects of the demographic trough. There will be fewer young people of the right age available. Competition with industry and commerce will become stiffer. There will be fewer candidates coming forward for selection. It may be necessary to attempt to recruit more widely from less traditional areas. The Corps will need to identify the right candidates early and target the recruiting effort accordingly. RCB will judge whether a candidate can be trained to become a competent officer but we must be able to identify the qualities required to make a successful Royal Engineer.

For years we have relied on our own judgement, and and let's be honest, prejudices but is that good enough? Can we not be a little more professional and modern (certainly not trendy) in our approach? Psychometric testing is now widely used in industry and commerce as part of their selection and recruiting processes. Intelligence testing has been used for officer selection since the War Office Selection Boards were set up in the Second World War. Although not in themselves conclusive these tests form an important part of the RCB. Personality tests are in use in parts of the Army to select candidates for certain specialist functions. Tests are available commercially to assess general engineering aptitude and there are specialist companies who would research, prepare and validate a series of tests for the Corps. It seems to me that this could be a most useful tool. Now please, at this stage don't concern yourself with how I will use it—I wouldn't dream of putting off a sound man with a good eye and a firm seat just because he didn't do well at this test, but it does raise a fundamental question and this is where I need your help; what do we mean by engineering aptitude?

The charter of the RCB is to "select candidates who should after training be able to command a troop/platoon in battle". Similarly our test should aim to select candidates who have the engineering aptitude to enable them after training to become successful RE troop commanders. In the same way that RCB makes no attempt to predict future staff officers, our test would not be suitable for the selection of future PQEs. The ability of a candidate to be trained as an officer is assessed at RCB; our test would be special-to-arm. The aptitude needed I believe is a blend of commonsense, practical skills, numeracy and the ability to conceive and solve problems in three dimensions. Most of these are innate qualities and can be tested psychometrically. So the questions for you to ponder are:

1. Can we define engineering aptitude?
2. Is engineering aptitude a necessary quality for a Royal Engineer?
3. Is the same aptitude relevant for all the disciplines within the Corps or do we need to be a little more discriminating?

I am grateful for your continued interest and if you can reply sometime in the autumn your annual card at Christmas may be accompanied by a case of reasonable port.

Yours ever,

Ian

Construction Engineering in BAOR

MAJOR N MUNRO MA C ENG MICE

The author was commissioned into the Royal Engineers in 1970 and read engineering and law at Cambridge University as an in-service degree. Before his PQE course, which took him to Australia, he was a troop commander in 26 Armoured Engineer Squadron, an instructor at the RE Wing Bovington, Adjutant of 74 Engineer Regiment (Volunteers) and SO3 Engineers at 4 Armoured Division. He commanded 6 Field Support Squadron and 522 STRE (Works) before moving to his present post as SO2(W) RARDE (Christchurch) in March 1988.

THE phrase "construction engineering" normally conjures up one of two images. The first is of a large, formal, overseas project undertaken by chaps in shorts, hindered by adventure training, preceded by more reports than the invasion of Normandy and followed by praise all round. The second image is of a muddy, dripping corner of Northern Ireland, surrounded by cover-from-view screens and wet concrete and waterproofs, the ink still wet on drawings and fag packets and three more helicopters to arrive before tea. But whether it is Canada or Crossmaglen that springs to mind, the underlying image of construction engineers is one of unusual activity, of out-of-the-ordinary sapper work, of combat engineering taking time off from their day job.

This article intends to highlight a part of the Corps which treats construction engineering, both consultancy and contracting, as normal day-to-day work and basic preparation for war. The theatre is BAOR; the cast are members of 40 Army Engineer Support Group and there are walk-on parts, and the occasional star billing, from other sapper units in Germany.

WORK TO BE DONE

THE works sub-units of 40 Group form a unique 600-strong design-and-construct organisation whose role is to carry out vital operational construction engineering during transition to war. The designers are 522 STRE and the constructors are mobile civilian engineer groups, both artisan and plant. In order to do this construction work quickly enough when it is needed, the units have to be in-theatre in peace. It makes sense to use them to full advantage as they train for their role. This training involves maintaining existing skills and picking up new ones so that the ability to take on any job with confidence and speed is developed. Variety of work is the key. Variety of technical content is needed to practise tradesmen and designers; variety of size to practise the command structure; and variety of urgency to practise general response capability.

And there is no shortage of work. The list of Works Services is endless (literally: rebuilding and maintenance is a constant cycle) and so any contribution Sappers can make is of benefit to all. Taking on Works Services provides Sappers with the projects they need while enabling the quartering staff to get more for their money. Savings are significant. Because quartering votes pay only for the cost of materials (and occasionally for the hire or purchase of non-military equipment) the effective cost of projects is reduced by anything up to two-thirds.

Major N Munro MA
Construction Engineering In BAOR

Photo 1. Haltern Range Road

The savings last year were DM15 million. Variety of work also helps to maintain the exciting construction environment in BAOR. Designers and constructors are busy doing the jobs they have trained for in an atmosphere of technical proficiency and considerable job satisfaction.

Some Recent Projects

To describe only a handful of projects runs the risk of giving the impression that only a handful are actually done. But to run through the full list would knock the stuffing out of even the most determined reader, so the risk of excluding many projects must be taken. If it is noted that each MCAG has between 10 and 30 tasks on its books at any one time and that 255 MCPG and 522 STRE are liable to support all those jobs, and more, then at least the few projects that are described here are set in perspective.

Haltern and Lavesum Range Roads

255 MCPG have had as their major task for some four years, the construction of 20km of road around the ranges at Haltern and Lavesum. This project, which has had to be dovetailed with support to other mobile civilian groups, has had the vital function of making the ranges accessible in winter, the existing tracks being quite impassable in wet weather. 522 STRE's support to the project has included the full design of the two-way metalled road, provision of surveyors for setting out and site control and CMTs for materials testing. As with all Works Services, the project manager was provided by the PSA, but in this particular case, much of the day-to-day running of the materials contracts was successfully delegated to Sappers. The savings to the quartering vote for this type of plant task are high, as the cost of materials compared to the total charge for labour, plant hire and fuel is small. The cost of this project will be DM3.3 million compared to a civilian estimate of DM8 million. *Photo 1* shows the road base being graded on the last section to be constructed, which will join the main circuit at Haltern to the training area HQ.

Soltau Canal Crossing Training Site

As well as acting as one half of the design and construct double act of 40 Group, 522 STRE is also the consultant to all units in BAOR. The canal crossing training site was designed by the STRE and constructed by units 1 (BR) Corps, principally 43 Plant Squadron, 44 Field Support Squadron and field troops from 21 and 26 Engineer Regiments. The facility to test canal crossing techniques consists of a 240-metre long tapering gap with a variety of bank profiles and conditions to copy the real canals which are likely to be met in anger. The banks have sections of sheet piles, reinforced concrete, reinforced earth and rip-rap. Some sections have bunds to complicate even further the bridging problem. Sadly, the price of a water-retaining structure was too high, but although a dry gap will have some effect on the realism of the training, many of the techniques of canal bridging are the same whether there is water there or not. Erosion of Soltau's sandy soil has been a problem in the construction. Even heavy geofabric reinforcement has not prevented some of the steeper slopes losing their surface layer before vegetation has had a chance to take hold. Interlocking concrete blocks have been used to stabilise these slopes and maintain their shape. The cost of the project was DM800,000; less than half the civilian estimate for the job[1].

Hamm Tank Storage Buildings

One of the biggest structural engineering projects to be constructed by an MCAG has been the new tank storage building complex for the Armoured Delivery Squadron at Hamm. Three large steel framed sheds with a total floor area of 6000m^2 and external hardstandings of another 7000m^2 provide the new home for over one

[1] *A full account of this project is given in this* Journal *see: Canal Crossing Training Site.*

Photo 2. Ham Tank Storage Buildings

hundred main battle tanks. With a requirement for in-situ tank maintenance there was a need for an extensive pattern of drainage and petrol interceptors below ground. (Anyone who has had anything to do with German fuel spillage regulations will understand the use of the word 'extensive'). *Photo 2* shows one of the three sheds with the full length sliding doors closed. Design of the sheds themselves was done by the supplier and fabricator of the steel, but to a detailed specification provided by 522 STRE, who did the rest of the design. As it was a Part I Works Service, the PSA provided the project manager. Unlike the Haltern project, when PSA successfully delegated some financial control to Sappers, project management decisions at Hamm were kept firmly in PSA hands. This highlighted the frustrations of working within very tightly controlled PSA rules, frustrations felt most keenly by very experienced officers and SNCOs who felt themselves well qualified to take a far more active part in the running of their projects. The work was constructed by 221 MCAG from April 1986 to August 1987. The cost of materials was DM2 million, compared to a civilian estimate of DM3.2 million.

The Marlborough Club

ANOTHER Part I Works Service, the work at Rheindahlen's Marlborough Club, consisted of completely gutting and rebuilding the interior of a large all-ranks club including a NAAFI shop, games room, bars and, as the centre-piece of the complex, a large state-of-the-art disco. This last feature apparently depends for its success on an overhead space frame incorporating revolving mirrors and lamps. The architect of this device has thoughtfully provided the clients of the club with this handy climbing frame inches above their heads; but hopefully the large steel beams embedded in the roof will prevent the ceiling joining the space frame, and the clients, on the floor every Saturday night. *Photo 3* shows work well under way in one of the bars; high quality carpentry is most in evidence in the completed work but air conditioning is an equally important, if unseen, feature.

This has been 217 MCAG's biggest task since work started in April 1986 and has also been one of 522 STRE's more complicated design challenges, requiring detailed construction drawings to be produced from scanty architect's plans in a very short time. Even though the facility has a social rather than an operational function, the project has been a particularly valuable one, as the type of work — fundamentally changing the interior of a building — does have a direct operational relevance. Using the PSA stores procurement system has proved to be frustratingly slow, partly because it has been impossible accurately to predict stores requirements until existing structural elements or services have been removed or exposed.

Photo 3. The Marlborough Club

Ptarmigan Installation

WORKS-FOR-WAR are occasionally funded in peace. One example has been the installation of Ptarmigan communications equipment into all the major HQs in BAOR. PSA were keen for 40 Group to take on as many of these HQs as possible because of the rushed programme of work and the savings that using military design and construction resources would produce.

Ptarmigan installation requires vehicle mounted equipment to be adapted for use in cellars by providing screened trunking and conduit, power supply units, filters, furniture and fittings. Minor structural work is inevitable but overall the technical difficulty of the construction is small. *Photo 4* shows one corner of one room of a 70-room complex and goes some way towards illustrating the main difficulty the task did have: fine detailing. Although each HQ was essentially the same, each had to be tackled quite separately in order to produce the detailed requirements for trunking, conduit and ancillaries. Time was tight and the rules for stand-off distances between secure and insecure cables seemed to change weekly. Each MCAG took on some of the HQs in the last 3 months of 1987 with the projects by 232 MCAG at Krefeld and 211 MCAG at Bielefeld being part of more extensive renovations.

Photo 4. Ptarmigan Installation

THE BENEFITS

CONSTRUCTION engineering in BAOR has the unusual attribute of producing all winners and no losers.

- Designers are kept busy with a full range of work including bridges, canals, roads, fortifications, buildings, electrical and mechanical services and a variety of structural steelwork and reinforced concrete.
- Constructors get the mixture of tasks they need to maintain their skills, learn fresh ones and practise their staff at project management.
- Quartering staff can stretch their budgets further than if they were having to pay civilian rates for every project.
- Operational planners are getting the reassurance that construction engineering vital to their operational plans will be done quickly and efficiently by well trained and experienced construction units.
- The customers — Army and RAF units and individuals — get the benefit of shorter Works Service waiting lists, quicker married quarters refurbishment and a more flexible response to their changing construction needs.

The traditional benefits of construction engineering to the Corps: technical training, good PI, a readily identified role and job satisfaction are all to be found in BAOR. Perhaps this can be the lasting image — where construction engineering *is* the day job.

Impact Moling: An Introduction

SECOND LIEUT R A C STEPHENS BSC (ENG) RE

Robert Stephens is at present on 94 YO course, having attended Sandhurst and after reading Civil Engineering at King's College, London. He joined the OTC while at University and spent summer attachments with the Queen's Gurkha Engineers and 35 Engineer Regiment, Hameln. 2nd Lieut Stephens wrote the attached paper as a submission to the Institution of Civil Engineers Medal Competition.

CIVILIAN FIELD OF USE

INTRODUCTION

SINCE the 19th Century when the first sewer system was built, the number of pipes laid underground has been steadily increasing. It has now reached such a level that there is little space for new services, and the replacement of existing ones is more difficult. Services which are now buried underground include, gas, water, electricity, telecommunications and more recently cable television.

Until recently the method of placing and replacing these services was by using trenches. In straight monetary terms this is probably the cheapest method. However, a large majority of the services lie under roads or other thoroughfares, and this raises the problem of the effects of the use of trenches on the local community.

When trenches are used for the purpose of obtaining access to a service, it is usual for one or more lanes of a road to be closed. This causes the flow of traffic to be disrupted. In addition to the disruption caused above ground, there is also the possibility of existing services being damaged during trench excavation (eg telephone ducts severed by 'stray' spade blades).

These are problems which until recently were rarely considered when planning projects involving trench construction. However with the increase in the number of road users, the effects of using trenches may soon have to be estimated. This is where trenchless construction techniques and equipment, such as impact moles, may come into their own.

Impact moles are self propelled, pneumatic soil displacement tools, usually powered by an air compressor. They are available in various sizes

GRUNDOMAT	45E	65E	75E	95E	110E	130E	145E	180E
Borehole dia. mm	45	65	75	95	110	130	145	180
Length mm	900	1220	1400	1600	1850	1760	1850	2150
Weight kg	8	25	32	68	96	140	180	290

Table 1. Table of physical dimensions of GRUNDOMAT range of moles (7)

Second Lieut RAC Stephens
Impact Moling An Introduction

depending on the diameter of the mole. The usual range is 40mm to 200mm, though some specialist firms manufacture moles of 300mm diameter. (*Table 1*, shows the various physical dimensions of the GRUNDOMAT range of impact moles). Their main use is for boring holes: horizontally, vertically, or at an angle.

The cost of an impact mole is between about £1500 for the smaller diameter version to about £14000 for the larger diameter version. This does not include the cost of the compressor.

The difference in cost between using impact moles instead of the more traditional trench excavation and subsequent reinstatement techniques, can be quite large. The following example is taken from a paper by Martin Scovell of T T UK Ltd (6). It illustrates the savings in both time and money which can be made using impact moles. The project involved boring a 38 metre hole across the A1 near Peterborough. Using a 130mm diameter mole it took two hours to bore the hole at a cost of £144. The estimate for the same job using open-cutting techniques, was £1500 and would have taken five men four days to complete, with considerable disruption to traffic.

Photo 1. The 45mm Grundomat

Uses of Impact Moling Equipment (see *Figure 1*)

Impact moling equipment can be used to place pipes or cables underground. How this is achegved will depend on the ground conditions and the length of bore being made.

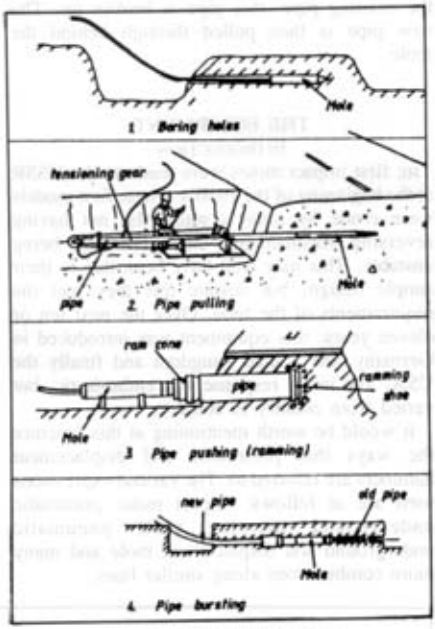

Figure 1. Uses of impact moles

If a hole bored through a soil is able to support itself, then the service which is being placed will usually be drawn through the hole once boring has finished. This is normally done by connecting the service to the end of the air hose and pulling the air hose back through the bore. If the pipe or cable is rigid enough, then it may be pushed through by hand.

However, if the hole cannot support itself, then either the method of *pipe-pushing* would have to be used or a pipe would have to be pulled through by the mole. This can often be a lengthy process as the pipe must be threaded on to the airhose and kept tensioned once boring commences.

To use the mole to push pipes, a special wedge head is attached in place of the chisel head and this fits into the end of the pipe. The mole is then used to 'hammer' the pipe into the ground. The soil left in the pipe is flushed out using water under high pressure.

Impact moles can also be used for *pipe-bursting*. In this role a special cutting head is fitted to the front of the mole, so that as it proceeds through the existing pipe, this pipe is broken up. The new pipe is then pulled through behind the mole.

THE EQUIPMENT

Introduction

The first impact moles were made in the USSR at the beginning of the 1960's. These first models were crude by today's standards: not having reversing mechanisms and generally being unstable. This may well have been due to their simple design, but despite this they met the requirements of the time. Over the next ten or eleven years, this equipment was introduced in Germany, the United Kingdom and finally the USA. The initial response was enthusiastic, but varied from country to country.

It would be worth mentioning at this juncture the ways that pneumatic soil displacement hammers are referred to. The various expressions used are as follows: impact mole; pneumatic underground piercing tool; pneumatic underground soil displacement mole and many more combinations along similar lines.

Description of Equipment

Impact moling equipment can be divided into two types; fixed head and moving head. Each type has its merits and its faults for different ground conditions, but the general opinion is that the moving head equipment is more stable.

The difference between the fixed head and the moving head machines is quite significant. As the name suggests the chisel head in the fixed head model is rigidly coupled to the body of the mole. In the moving head model the chisel head is able to move back and forth. An example of fixed head moles (*Figure 2*) is the ESSIG range of pneumatic piercing tools, and of moving head moles (*Figure 3*) the GRUNDOMAT range of pneumatic piercing tools. Moving head moles are spring loaded so that the chisel head is driven forward first and then the body is pulled forward in the second motion.

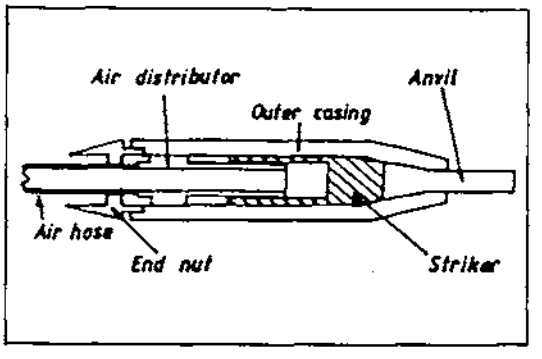

Figure 2. Fixed head impact mole

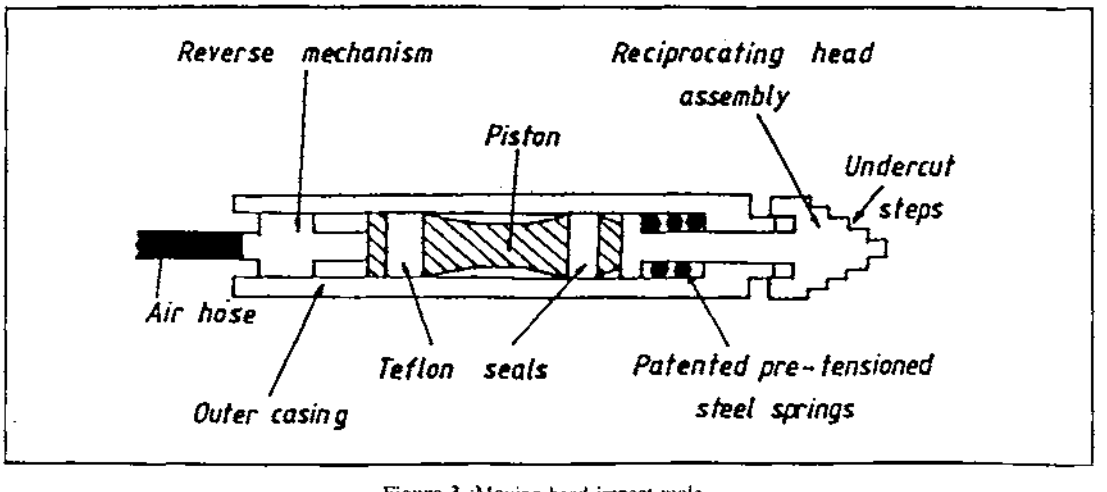

Figure 3. Moving head impact mole

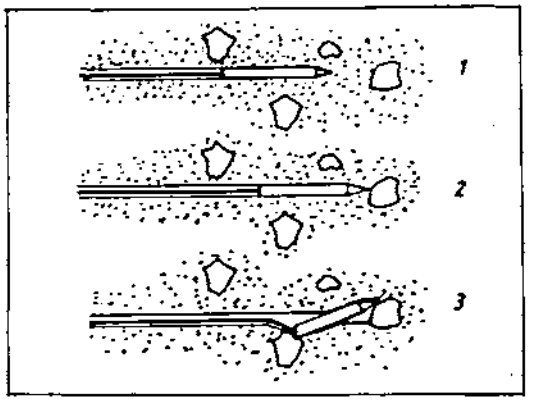

Figure 4. Sequence of movements leading to the deflection of a fixed head impact mole

The theory behind this difference in design is as follows:

> With the fixed head design each stroke moves the casing forward. If any obstruction or harder soil is encountered the whole tool will be deflected (see *Figure 4*). However, with the moving head version, if the head encounters any obstacles and cannot move forward, it will not draw the casing forward. This means that the main casing will remain on the original borehole centreline, until the head has either broken up the obstruction or broken through it (see *Figure 5*).

There has also been considerable debate as to the best design of head. There are two schools of thought, one saying a smooth cone is best:and

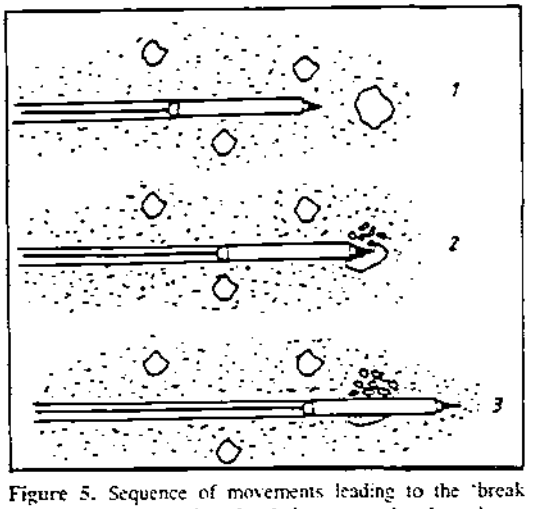

Figure 5. Sequence of movements leading to the 'break through' of a moving head impact mole through an obstruction

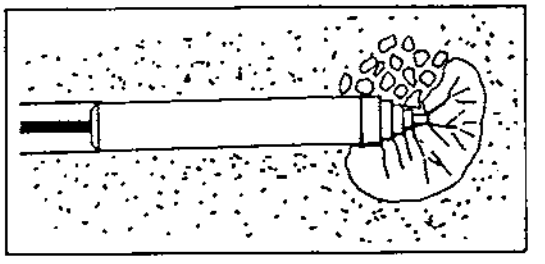

Figure 6. Chiselling effect of moving head mole with stepped head

the other saying a stepped cone head is more effective. They would both appear to have their own merits. The smooth cone is likely to give a much better penetration rate in uniform soils, where it is unlikely to be deflected. In soils where there are small rocks, the stepped head is probably better as it is less likely to be deflected, and more likely to 'chisel' away at any obstructions (see *Figure 6*).

Operating Procedure

The first requirement when using a pneumatic piercing tool, is an entry pit. Once this has been excavated, the impact mole is set up in the pit and lined up with either an exit pit, or the proposed centreline of the bore. The equipment is supplied with an aiming frame with an inbuilt level, which is sighted on a ranging rod in the reception pit. With smaller diameter moles, operators are quickly able to line the mole up by eye. However, with the larger size moles it is important to start the tool off on a level centreline, so use of a launching stand and aiming frame is necessary (see *Figure 7*). When everything is ready the air supply is connected and boring commenced.

Effects of Ground on Operation

There are various ground factors which will affect the operation of impact moling equipment.

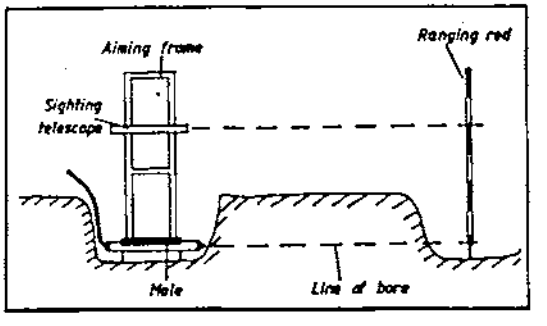

Figure 7. How the aiming frame is used

Photo 2. The airlubricator being linked up

Photo 3. 45mm mole in launch pit at start of bore

They are as follows; how compact the soil is; moisture content of the soil; type of soil; shape of land above proposed centreline of bore; presence of obstructions; and finally the critical depth of operation.

The first of these factors is probably the easiest to understand. It is much easier to push an object, which does not have a point, into a lightly compacted soil than into a dense clay. This is due to the fact that the material in the path of the mole is not removed from the borehole but pushed in front and to either side. In a loosely packed soil the extra material can be 'absorbed'. In denser soil there is less capacity to absorb this extra material and hence soil in the immediate vicinity of the mole is compacted even more thereby increasing friction between mole and surrounding soil.

The moisture content of soil will affect performance in two ways. As with loosely packed soil, a soil with a high moisture content will flow more easily and therefore deform more readily. However a soil or clay with a low moisture content will not deform as readily. This will affect the speed of the boring operation. In tests 'the highest speeds were obtained in moist sandy soils of 12 to 17 percent moisture while the least speed was obtained in clay and loam type soils of 4 to 6 percent moisture.' (1) However, if the moisture content is too high there may be a risk of slippage. This will occur because the friction between the outer casing and the soil is not high enough. Impact moles operate under the principle that the inertia generated by the piston (or striker) hitting the head (or anvil) drives the mole forward. The piston then rebounds, and unless the friction is high enough, the impact of the piston on the rear assembly (though cushioned by air), will drive the mole backwards. Therefore no progress will be made.

The type of soil and its homogeneity may have an unusual affect on the performance of the mole. 'As a general rule, homogeneous type soils of wet and/or hard clays cause the device to rise upward toward the surface; homogeneous sandy soils will

cause the device to run a fairly level course; and homogeneous sand and gravel type soils will cause the device to run downward'. (1)

If the tool runs too near the surface then there may well be the problem of the soil heaving up, or if the surface is not level then the tool may actually resurface. For these reasons it is important that a good site investigation is carried out and the initial setting up is accurate.

If the friction between the tool and the ground is reduced, eg when pockets of water or peaty ground are encountered, then problems with forward motion (eg slippage) will arise similar to those caused by a soil with a high moisture content. There might also be problems with the driven borehole collapsing, and in this situation it may be necessary to drive a rigid pipe into the ground first, with the view of leaving the pipe in the ground or replacing it at a later date.

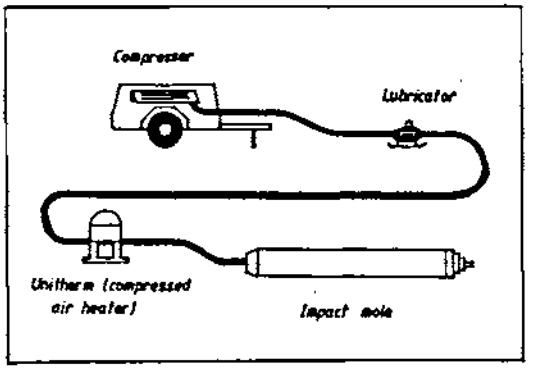

Figure 8. Connection sequence for general case

Portability

The portability of an impact mole depends on the diameter of the tool. Small tools are smaller, lighter and therefore less unwieldy than the larger ones. The small sizes of a mole can however be a disadvantage when it comes to accuracy.

Besides the mole itself, the other pieces of equipment required are:

air hoses
compressor
lubricator
unitherm (compressed air heater)

It is therefore possible to use a single vehicle to tow the compressor and carry all the necessary accessories. There are small 'hand portable' compressors on the market, how reliably they operate under the loading from an impact mole is not known. However, if a large, towed compressor is used there is always the possibility of powering more than one of the small moles from it.

Ease of Use and Time to Set Up

The equipment is extremely simple to use, being very much a case of pointing it in the right direction and letting it get on with the job. Its progress must however be watched, as this will give a good indication of the presence of any obstructions or any change in ground conditions. Companies, such as British Gas, have found that after a day's instruction, their new operators have got a grasp of what is going on, and then it is very much a case of learning 'on the job'.

It is worth mentioning at this point the maintenance side of equipment operation, as the majority of the minor everyday maintenance tasks can be carried out by the operators themselves. This is due to the small number of parts which make up impact moles. The only times that equipment need go back to the workshops are when any of the moving parts are worn, seals have gone, or when heads are worn down. To replace an air seal and head can take less than an hour. In fact the majority of repairs and maintenance take no more than an hour.

The time to set up the equipment, not including digging of launch and reception pits, is about five minutes. The time to dig the two pits will obviously be dependent on what the ground conditions are, and if there are any services which must be avoided. Setting up is extremely simple being a case of joining all the major components (mole, compressor and lubricator) up with air hoses (see *Figure 8*).

The time taken to bore a hole will obviously depend on the ground conditions and any difficulties which might have to be overcome. It will also be different for different sizes of mole, but a reasonable estimate of the range is 3 metres a minute in good soil, to 10 minutes for 0.5 metres in poor soil.

Problem Areas

There are no major problem areas relating directly to the impact moling equipment itself,

though there are a few minor considerations which should be borne in mind when operating such equipment. The main problems arise from ground conditions, and besides realigning the bore there is very little one can do about these. The possibility of losing a tool down a bore is one which must be avoided at all cost, as to dig down to find it is both expensive in time and money.

Some of the major problems that have had to be overcome are those produced by the operators, who have a habit of ignoring what is said in the operating manuals. Replacement of the air hose connected to the rear of the mole is one of the more common maintenance jobs. Operators seem to find it easier to carry the mole by rubber hose than by the casing, and consequently considerable wear to the hose occurs. It has also been known for a gang wanting to finish a job quickly when a mole has got stuck, to hook the hose to the rear of their vehicle and drive off in the hope of pulling the mole free. This usually ends up with the air hose breaking and the mole left in the ground, requiring a lengthy digging operation to recover the tool.

One of the more dangerous problems is that of underground power cables. On one visit to a workshop a gang brought their mole in to have the head replaced. The original head had been 'melted down' when it had hit a buried electricity cable. Luckily no one was in contact with any of the equipment at the time, but there was potential for a serious accident.

A problem which is really only encountered in the smaller size of moles is that of the outer casing flexing or being dented. To keep weight down at the lower diameter end of the range, most manufacturers produce outer casings which are very thin in relation to their length. Consequently the possibility of flexing, and for that matter buckling is quite high. If this happens the piston is likely to jam and the whole tool will seize up. Denting of the outer casing only normally occurs when a mole has to be dug up to rescue it. If the operators are not careful, there is the chance that a spade will strike the mole producing a dent, usually rendering the outer casing useless for further boring operations, unless it is small enough not to effect the movement of the piston.

A problem which has been encountered with the

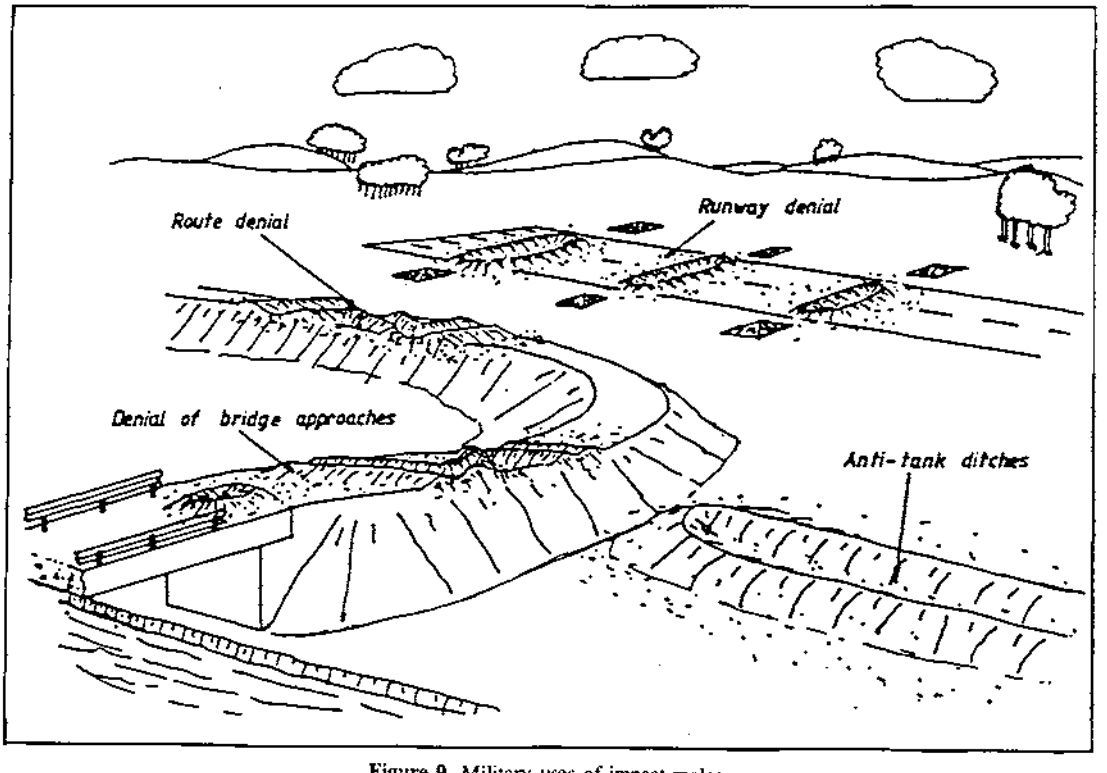

Figure 9. Military uses of impact moles

large diameter moles, is that of the head unscrewing. This is most likely due to the very coarse threads used and despite liberal application of Locktite the heads still unscrew themselves from the body.

Military Field of Use

Figure 9 illustrates some of the ways in which impact moling could be used in war but experienced combat engineers may well be able to suggest more. It is worth pointing out at this stage that despite differences in charge placement and quantities of explosives, the basic reasons for using impact moling equipment to produce charge chambers are the same as the historic applications of 'mined charges' namely route denial, runway denial, anti-tank ditching, camouflet charges in abutments and behind retaining walls. By boring a hole underground, into which the charge can be placed at a later date, the road, runway, field or bridge approach can still be used. This is probably one of the main points in favour of impact moling techniques over conventional methods.

A further, less obvious advantage of the method of impact moling, is that concealment is easier. Although it would not be impossible to camouflage the equipment from airborne reconnaissance during the boring operations, the only excavations that are required are at the beginning and the end of the bore. To conceal these excavations from discovery either from land or air, would be relatively simple.

The use of impact moling equipment in the military environment need not be restricted to purely military tasks. In fact the possibilities for its use elsewhere are numerous. One only has to look at the civilian applications to see what is meant. Besides stopping the enemy from moving, Sappers are tasked to help the army 'live and fight'. In this former task they provide water and electricity rather like a combined water and electricity board. It would therefore seem sensible to assume that impact moling equipment might be used rather along the lines that a civilian authority would use it eg for laying pipelines and ducts. The applications do not stop there however. To enable the Royal Air Force to 'move and fight', the Sappers supply them with aviation fuel. A method of laying fuel lines underground to protect them might well be a further application of this new equipment.

Conclusions

It may yet be a few years before impact moles become a common sight at road works in the United Kingdom. However, with the amount of traffic on our roads increasing, there is likely to be pressure from road users to find an alternative to trench construction when it comes to placing and replacing services. If this happens then impact moling equipment may well be able to fill the gap.

At present the relatively high costs of impact moling, compared with the more traditional trench digging, can probably be attributed to the specialist equipment. However, once its use becomes more widespread, the costs should even out.

The military applications of impact moling equipment are likely to be restricted to the placing of explosive charges, or pipes to carry explosives. In this role, they would probably be used during the period of tension leading up to the start of a conflict. This would mean that pipes could be placed under roads and other 'targets', and the explosives introduced into the pipes 'just before' the target is to be blown up.

Impact moles have the added advantage of having minimal manpower requirements. In an army where the services of Combat Engineers are scarce, any new method of completing a task quickly and with the minimum of men is worth considering.

BIBLIOGRAPHY

1. ETHERTON P T. "Development of Impact Moling Techniques in the UK: Design, Use and Cost Considerations", Proceeding of the First Internation Conference, London 16-18 April 1985, *The Institution of Public Health Engineers*, 1985 BRUCE F E. "NO DIG 85" *Ibid*

2. HAYLOR J B. "A Presentation on Pneumatic Piercing Tools — A Brief History of the Industry and Current *State of the Art*" Editorial for *Telecommunication Authority of India*, June 12, 1986

3. ESSIG (UK) LTD. "Essig Guide to Moling" October 1986

4. TT UK Ltd. "Grundomat E-Version, Operating and Maintenance Manual" Edition 3/86 E 2000-4000

5. BRITISH GAS CORPORATION, DD/MJB/DJB 14.4.80 "Distribution Codes of Practice (Draft)" Pneumatic Thrust Boring Machine (Grundomat)

6. SCOVELL M. "Developments and Techniques in Percussion Moling, Steel Pipes Ramming and Size-for-Size Replacement"

7. GRU INFO NO 69/08 86E "Grundomat, Theory and Practice".

Follow The Euro Nato Sapper
Part II — ENTEC, More Than A Bit Of Fun

LIEUTENANT COLONEL G D BAILEY MI PLANT E MIHT

Photo 1. Representatives of NORTHAG'S engineers study a joint problem on an ENTEC course

"SIR, I've learned more about why my country has sent me to Germany and what NATO is actually doing, during the last two weeks, than in three years previous service in Europe". This was the response of a US Army Engineer sergeant when asked if he had found his Euro NATO Engineer Course (ENTEC) worthwhile. What is more, he said it nearly ten years ago when ENTEC was in its infancy.

In 1987 ENTEC celebrated its tenth anniversary, and while few serving RE officers will not have heard of it, there are many who are not clear on its aim and role in the NATO engineer community. Perhaps some may even regard it as nothing more than an excuse for a fun excursion to Munich. Fun, yes because one meets one's fellow travellers from other nations and Munich is a fun city, but on the serious side, a whole new Pandora's Box is opened up for those who see for the first time what combat engineering from a NATO standpoint is all about.

It was recognised long ago, thirty-five years at least, when Exercise *MAKEFAST* was instigated by Chief Engineer NORTHAG, that combat engineers of different nations needed to be more interoperable. Standardisation of equipment and procedures was almost non-existent at a time when the infant NATO was still feeling its way. Even now it can fairly be said that this statement still holds good as far as engineer equipment is concerned, despite NATO's maturity. Engineer procedures are in a happier position and ENTEC has played its role in this.

To find the roots of ENTEC one must go back no further than 1977, when at a meeting of the Euro NATO Training Army Sub-Group in Rome it was decided that courses of instruction for the improvement of cooperation among allied engineers should be established. Belgium, Canada, West Germany, the Netherlands, United Kingdom and the United States agreed to contribute.

Lieutenant Colonel G D Bailey
Follow The Euro Nato Sapper Part II

Photo 2. A Practical field exercise

The Euro NATO Training Army Sub-Group decision to approve the commencement of engineer courses at the German Army Engineer School in Munich led to the setting up of a small international staff to run them. Germany agreed to administer the courses and provide classroom space and other modest facilities, plus contributing one officer and one SNCO on a permanent basis to prepare training aids and instruct. USAREUR pledged an officer and SNCO plus a full-time civilian secretary to help administration. MOD UK offered "thirty per cent" of their liaison officer at the school to make a British contribution. Belgium, Canada, Holland and again UK promised to send SNCOs to instruct when required. In order to make sure the needs of the contributing nations were met they formed a Working Group chaired by a German which would assemble annually to fix the course programme for the following year and provide direction as necessary. AFCENT, NORTHAG and CENTAG were also to be represented to provide additional guidance.

This was all agreed to verbally, and without further ado courses commenced in 1978. The only substantial changes that have taken place in the organisation of ENTEC since those early days were the establishment in 1982 of a Canadian Liaison Officer at the German Army Engineer School who was to provide a permanent Canadian contribution to the ENTEC staff, the upgrading to field rank of the German officer, and the addition of a Dutch WO to the full-time staff in 1987. In addition, French officers and NCOs in 1984 started to attend the CENTAG platoon leader courses and provide instructors and interpreters. In 1985 it was acknowledged that ENTEC would henceforward stand for Euro NATO Training Engineer Centre, and in April 1987 a Formal Memorandum of Understanding was signed between Canada, Germany, the Netherlands, UK and USA to establish it as such, these being the main contributing nations. Belgium might be able to sign later.

The first courses were aimed at two sections of the engineer hierarchy, namely platoon leaders, and commanders and staff officers. At these two levels of command it was considered that most good could be done, firstly by training instructors who could go back to their units and pass on their knowledge to Junior NCOs — the multiplier effect, and secondly by making sure that those officers who were most likely to negotiate the handover of an obstacle plan to engineers of another nation could be educated in how to go about it. With certain changes these two courses still run and the only way in which there has been a failure is that the multiplier effect of the platoon leader courses simply does not work. The main reason for this is that it is essentially hands-on training at this level, and within units there are no NATO training aids for other nations' equipment. ENTEC has not the wherewithal to produce them in the requisite numbers, but more about this later.

Nations select students for the Platoon Leader courses either from field units or schools. They must have recent knowledge of combat engineer skills and procedures and meet certain entry criteria. There are two variations of the course, one for NORTHAG, covering Belgian, German, Netherlands, UK and US munitions and one from CENTAG covering Canadian, French, German and US. Courses last ten working days with consecutive translation in German and English. The instruction time is broken down as follows:

Follow The Euro Nato Sapper Part II ENTEC, More Than A Bit Of Fun 2

Photo 3. 10 Apr 87 D/EinC Brigadier Bevan, signs the ENTEC Memorandum of Understanding on behalf of UK

Administration	2½ hours
Background Information on ENTEC and NATO	3½ hours
Organisation and Mission of National Engineers	4½ hours
Engineer STANAGs	2 hours
Demolition Munitions and Accessories	6½ hours
Live Demolitions	6½ hours
International Working Groups	6½ hours
Minewarfare Munitions and Equipment	10½ hours
GE and NL Peacetime Prepared Obstacles	16 hours
Terrain Documentation	1½ hours
Handover/Takeover of Obstacles	3½ hours
Warsaw Pact Engineers	2½ hours
Visits	2 hours

An evening social programme is included to foster comradeship and to overcome the natural inclination to stick to one's own. By the second week, nationality has become of little significance, and any language barrier has been much reduced.

The Commanders and Staff Officers course is aimed at battalion commanders, seconds-in-command, staff officers at divisional level and school instructors. The course lasts five working days and is in two parts. The first part is presentations and discussions to bring everybody to a uniform level of knowledge about engineer concepts and organisation in the Central Region, including those of individual nations. The second part is a map exercise to effect the turnover of an obstacle plan, one nation to another. In 1987 the map exercise was expanded to bring in new features in the Central Region concept of operations.

In 1982 it was recognised that a crucial level of engineer command was being missed by ENTEC, that of the company commander. In October 1984 a pilot course was run and in order to cater for the demand since generated, two courses will be run in 1987 and beyond. This five day course has features from both the Commanders and Platoon Leaders courses suitably modified for the level of knowledge and experience these officers have.

Fifteen weeks of instruction per year in the earlier days left time to build up a training aids room, prepare for courses and put together

Photo 4. Hands on Training in the Classroom

an ENTEC Handbook. The latter has taken years of work, is in three parts and in four languages — english, german, french and dutch. Part 1 is a staff officers handbook, a reference book compiled and produced by HQ NORTHAG engineer staff for commanders and staff officers. It has to be updated every two years. Part 2 is a squad leaders pocket book on all in-service munitions compiled by HQ CENTAG engineer staff and Part 3 is an instructors handbook, with detailed information on munitions, updated and reproduced each year by ENTEC itself.

Once all the essential groundwork had been done, ENTEC was able to respond to another demand that came in 1983 when it was suggested that courses should be exported to the United States. Thousands of American engineer officers and NCOs never get to Europe to come face to face with engineers of other nations. So in 1984 and again in 1986 a Mobile Training Team of all six contributing nations was despatched to Fort Hood with five tons of training stores to run a series of NORTHAG Platoon Leader courses. Smaller training teams have also gone out within southern Germany to instruct at US engineer battalions or brigades.

In ten years ENTEC had through its portals and passed back into the engineer community about 2000 officers and NCOs of the six contributing nations plus France. In addition it hosted officers and NCOs from Norway, Denmark, Portugal, Italy, Greece and Spain who have joined as observers. So it has become something of a NATO engineer melting pot, where views and ideas are passed back and forth and many are picked up by ENTEC itself. These in turn get passed on to AFCENT, NORTHAG and CENTAG where they contribute to the slow process of aligning the Central Region engineers into a more cohesive force. In a reverse way much of the direction for ENTEC courses comes from HQ AFCENT and the Army Group headquarters.

In 1981 ENTEC joined the Combat Engineer Working Party of the Military Agency for Standardisation (MAS) at HQ NATO in Brussels, and is now a major contributor to the ongoing engineer standardisation projects.

To many, ENTEC's involvement in NATO would seem no big deal because anything to do with NATO smacks of politics and procrastination where national sovereignty is more important than getting the act together. However, viewed over

a long period it is clear that one does progress, albeit in a pedestrian fashion.

What of ENTEC's future now that it is a firmly established training centre in the German Army Engineer School and makes a widely recognised contribution to the furtherance of engineer interoperability? The words NATO Engineer School are often heard, and although the need for a school could be fully justified this frightens people because it means more money. It could mean giving up a slice of the RSME's budget for instance in order to provide the additional infrastructure, with other nations making similar contribution towards the capital costs. However, if the nations really wanted it there is no reason why it should not happen.

Looking at things more within one's grasp, the continued use of mobile training teams is very much a possibility, with continental United States as a first priority. One-and two-day orientation briefings for US officers and NCOs newly arrived in Europe are gaining ground as well as ENTEC contributions to US officer training days. Badly needed is a combat engineer information centre where facts on current doctrine and equipment can be kept for all of NATO's engineers to contribute to and draw upon. This would also enable ENTEC staff to carry out studies and provide proposals for NATO-wide application, thus reducing the burden on engineer officers in national posts charged with the coordination of NATO projects.

A recent AFCENT initiative was to ask ENTEC to host a conference on engineer interoperability in the rear areas. This opens up a whole new range of subjects waiting to be examined, largely to do with ensuring a better coordination of engineer manpower and equipment resources throughout the Central Region RCZ and CommZ. ENTEC is interested in any possibility of furthering interoperability whether rear area courses are run or not.

There is a need for a small workshop where packs of training aids are produced consisting of texts, vufoils, slides, videos and models. With these despatched to units who have officers and NCOs recently trained on Platoon Leader courses the long sought after multiplier effect could begin. However, such capital expenditure is currently precluded, quite apart from the manpower problem.

For a permanent staff of two officers and three NCOs and a part-time staff of three officers there is more than enough to do. It would be of much benefit to have a Belgian member on the staff, so that all six Central Region nations are permanently represented. One or two extra Germans are hijacked from time to time to assist with administration, and without the administrative backing of the German school, ENTEC could not function at all. Besides that, the US Army contributes considerably to its running. The UK and Canada are also big contributors and indeed France and Belgium pull their weight. As a result ENTEC is a small, but essential establishment for the training of Central Region engineers. When one considers that on mobilization up to 200,000 engineers could be in the field, it is indeed a modest contribution, but the Euro NATO Sapper would have a vital role to play.

NICKNAMES

"Soldiers have a genius for choosing appropriate nicknames. In my first unit the Adjutant had a protruding stomach which endowed him with the nickname "Pregnant Percy". A subaltern named Chambers who had a speech impediment which made him pronounce "r" as "l" promptly became "Jelly"."

(From a recent letter to a national newspaper).

CAN *Journal* readers improve on this? A £10 book token is offered for the best nickname story received in time for publication in the December issue. Entries please, not more than 100 words, to reach the Editor by 16 September 1988. Committee decision on publication, and on the prizewinner if any, is final. Authors are responsible for the consequences of their own stories.

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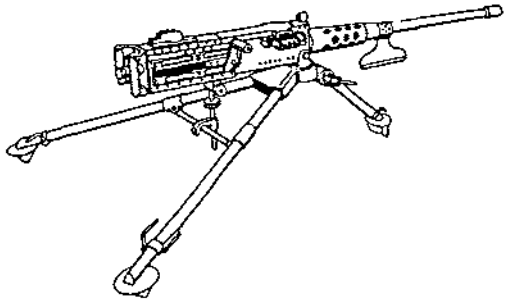

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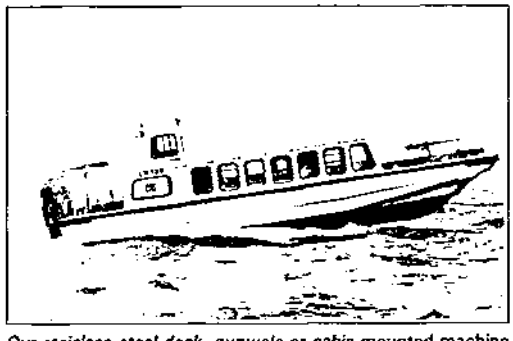

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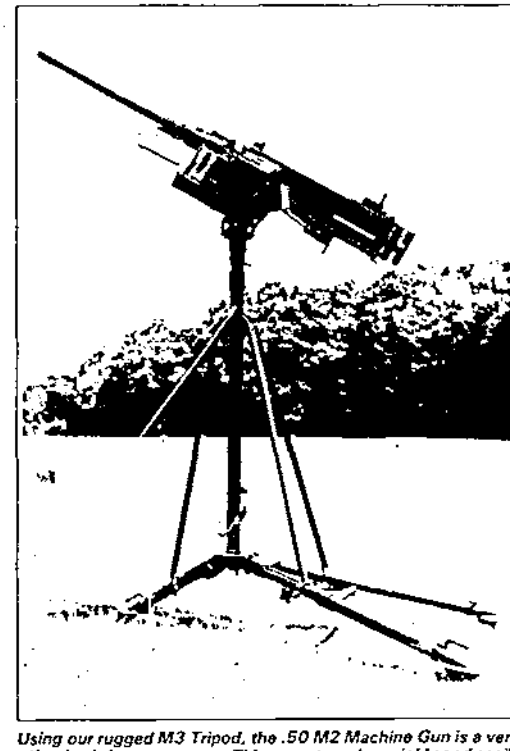

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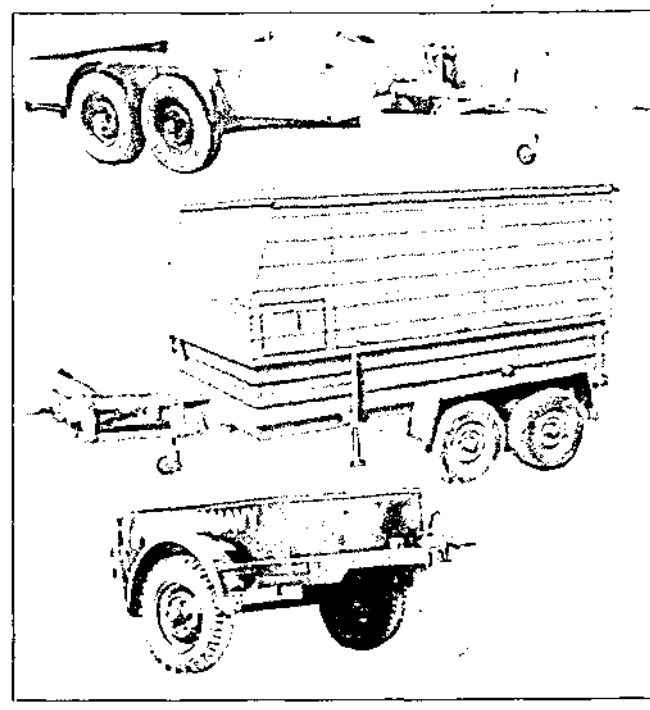

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Engineer Operations Out of Area

LIEUTENANT COLONEL I D T MCGILL RE Bsc (Eng) MICE FBIM

Lieutenant Colonel Ian McGill was commissioned into the Corps in 1967 from Sandhurst. He served as a Troop Commander in Thailand and Singapore with 54 (FARELF) Support Squadron, in BAOR with 12 Field Squadron and in the UK with 59 Independent Commando Squadron. He joined 9 Independent Parachute Squadron as 2IC in the mid 70s and, 3 years later after the long civil engineering course and Staff College, returned as OC 9 Independent Parachute Squadron. He was 2IC of 28 Amphibious Engineer Regiment and has just finished commanding 36 Engineer Regiment. He has been fortunate to have only had one staff job so far which he spent in Ottawa on exchange with the Canadian Forces. He has recently joined the Staff College as a DS.

Introduction

Since the Second World War the British Army has been involved in numerous operations outside Europe and the NATO area. Apart from the Falklands, other recent examples include the successful Ceasefire Monitoring Force in Zimbabwe in 1980 and the combined British and French force sent to Vanuatu, again in 1980. The Royal Navy evacuated a large number of British and other nationalities from Aden in January 1986 and, even now, are deployed in the Gulf with the Armilla Patrol and a small force of minesweepers. All three services frequently become involved in disaster relief all over the world.

Although our most serious military threat is the Warsaw Pact, few would deny that the next British soldier to be killed on active service, outside of Northern Ireland, will be somewhere outside of the NATO area. It is also certain that the next real operation will occur suddenly, probably somewhere unexpected, and within the service life of many who read this article.

Aim

The aim of this article is to outline the current organisation for tackling Out of Area (OOA) operations, identify the most likely engineer tasks in such operations and highlight the most obvious shortfalls.

Types of OOA Operations

The different types of OOA operations can be categorised as follows:

Disaster relief.
Services Assisted Evacuation (SAE).
Services Protected Evacuation (SPE).
Reinforcement operations.
Intervention operations.

The last three types of operations may involve the use of military force. They are also interlinked. What starts out purely as an SPE operation may develop into a more serious intervention; a simple reinforcement may necessitate evacuation of civilians and may later lead to an intervention operation.

The forces required for an OOA operation could vary from a company group, or a single ship, up to a major deployment of two or more brigades, together with Royal Naval and Royal Air Force support. Any large operation would almost certainly include ships taken up from trade (STUFT) and there might also be host nation support. Every situation will be different and the forces sent would depend as much as anything on what is available at the time and on the air and sealift. If the political decision to commit troops is taken soon enough a small lightly equipped force might sort the problem out before it develops. Once the force size grows larger than a

Lieut Colonel I D T McGill
Engineer Operations Out Of Area

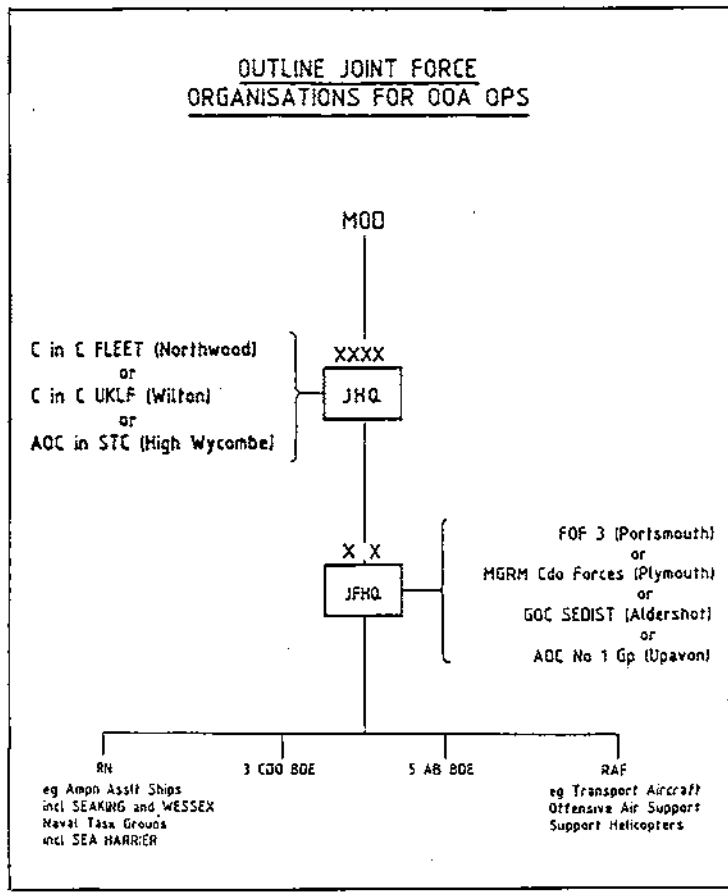

Figure 1

battalion group the logistic bill mounts very quickly.

Two certain factors affecting any tri-service OOA force are:

a. Command and control will not be resolved until the last possible moment.

b. Individuals and units will be operating for the first time with different people, different headquarters, different units, the Royal Air Force and possibly the Royal Navy. It will be a strange environment for many and there will be little time to iron out differences in procedures, or to develop an instinctive understanding of each other.

Command and Control

A possible organisation for a Joint Force in an OOA operation is shown in *Figure 1*. There is no "cast iron" template for all occasions and the Force sent might be thrown together at the last moment. The Joint Force Headquarters (JFHQ) would not arrive in theatre until at least one of the brigades was established.

The peacetime chain of command for the JFHQ is shown at *Figure 2*. The problems of liaison, continuity, and, above all, command and control are obvious. The JFHQ is manned by individuals who all leave other jobs, except for the Permanent Planning Group (PPG). The PPG are a small planning staff who co-ordinate the planning and control of all OOA exercises. They form the nucleus of the JFHQ, which expands rapidly as individuals "rush to join the war". All the PPG Staff have key appointments within the JFHQ and the Chief of Staff in the PPG is usually also the Chief of Staff of the JFHQ. What is in operation now might be an improvement on the situation prior to the Falklands but the command and control

arrangements are far from ideal. The Services should train in peace with the organisation and the people who will deploy together on operations, but they cannot afford a dedicated OOA Joint Force. They should at least develop a 2-Star JFHQ and cease the present typical "British compromise". There will be enough problems in any future OOA operation anyway, without the confusion engendered by a headquarters which is working together for the first time and which is further complicated by the needs of all three services.

There are, inevitably, different arguments concerning which headquarters such a dedicated 2-Star headquarters should report to in peacetime. This paper will not speculate on the relative merits of tri-service, or "purple" command, compared with single service command. Tri-service command at 2-Star level and above is difficult and as yet there is no clear, direct chain of command from the MOD, through a 4-Star headquarters to the JFHQ and further down. The problem needs resolving.

At present the CO of 36 Engineer Regiment is also the CRE of the Joint Force. Likewise, his Engineer Cell is made up of individuals who all have other jobs and who only form a team immediately prior to deployment. This results in a lack of engineer planning for OOA exercises and, more seriously, might also cause a lack of engineer co-ordination in the initial stages of any OOA operation. Efforts have been made to provide a Sapper permanently in the PPG for the last two years and it at last appears that an SO2 will be made available from HQ Engineer Support.

The key points to note are:

a. The 4-Star Joint Headquarters (JHQ) directs the operation, based on a UK HQ.

b. Headquarters Engineer Support plans the detailed deployment of engineers at JHQ. At present this is not practised, even on CPXs.

c. The CRE at the JFHQ is currently the CO 36 Engineer Regiment.

d. Forward sapper squadrons and troops must be closely affiliated to brigades and

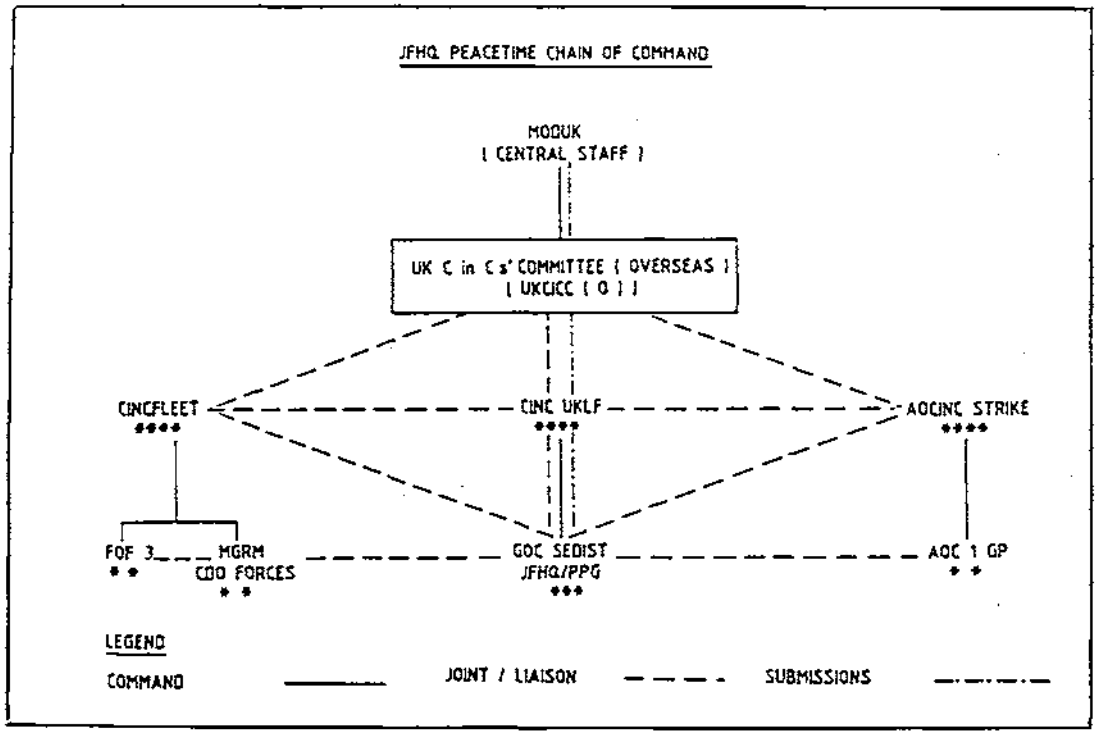

Figure 2

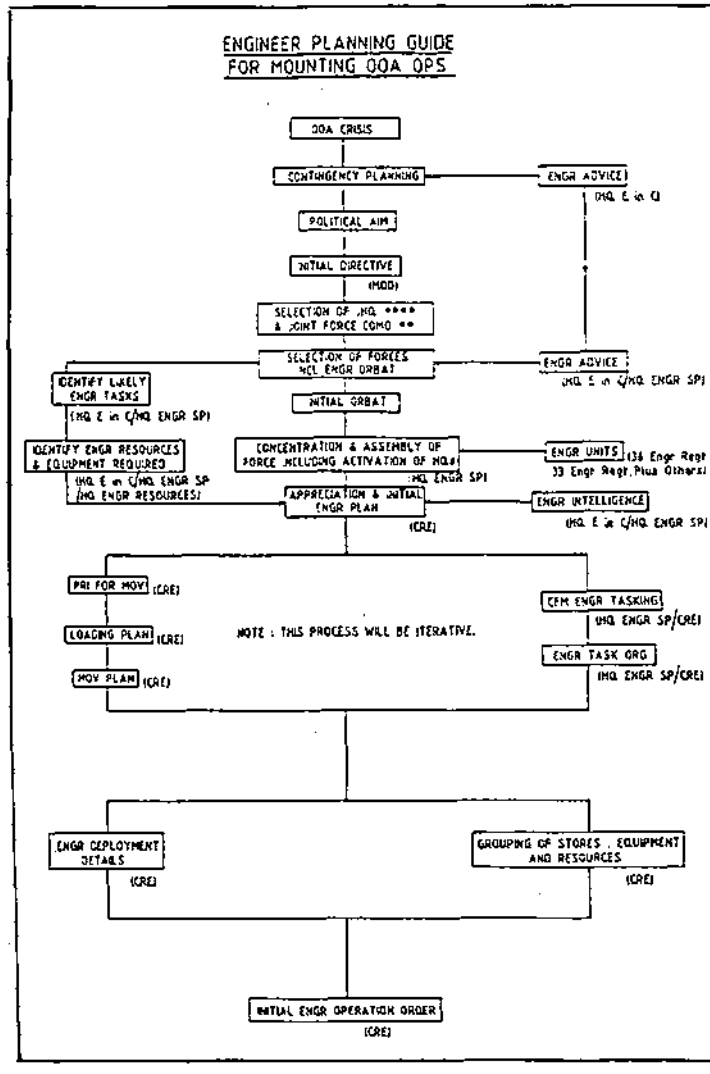

Figure 3

battalions, especially in the early stages of an operation. There is no point in grouping engineer assets centrally until there is also the means to move them around quickly in the operational theatre.

Engineer Deployment

A possible engineer planning guide for mounting an OOA operation is shown at *Figure 3*. It is stressed that this is only a guide; every operation will be different.

In any OOA operation the securing and development of an entry point, normally an airfield but it could also be a port, will be absolutely vital. The Force would then expand its operations quickly with reinforcements and logistics flown into this entry point, with the sea tail following on. Between the UK and the entry point in theatre there will usually be a Forward Mounting Base (FMB) to allow the JFC to balance his Force before final deployment and to allow stocks and reinforcements to be held as far forward as possible.

The order of deployment of engineers will depend on the detailed plan, *Figure 4* illustrates a possible scenario. In this, 9 Parachute Squadron

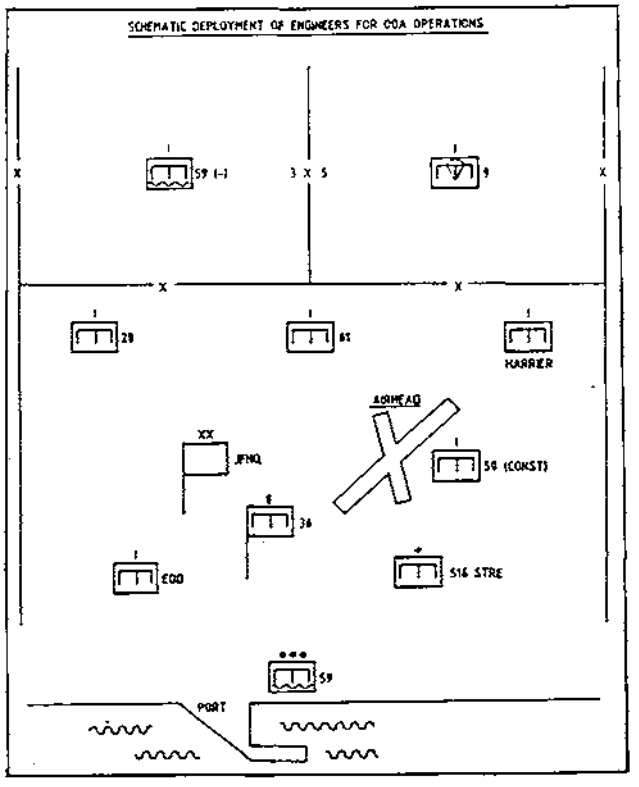

Figure 4

would support 5 Airborne Brigade; 59 Independent Commando Squadron would support 3 Commando Brigade; each of the OCs would advise their respective brigade commanders and the CO of 36 Engineer Regiment would be close behind with the JFHQ. A resources section from 61 Field Support Squadron would be detached to 9 Parachute Squadron right from the start of the initial deployment to help the Squadron Quartermaster with engineer resources.

Assuming that 9 and 59 Squadrons are fully committed forward, Force Engineers, commanded by RHQ 36 Engineer Regiment, will be needed further back. The exact task organisation will vary. 20 Field Squadron would be one of the first units deployed and much of the engineer support will be dedicated to the Navy and the RAF.

Harrier and helicopter support will be a high priority and the Force Engineers might include Sappers from 38 Engineer Regiment and bulk fuel specialists from 516 Specialist Team Royal Engineers. The repair and maintenance of the airfield will be a critical task and 50 Field Squadron (Construction) might be deployed. 33 Engineer Regiment (EOD) would provide EOD support and has its own parachute and commando sections. The Navy will need port facilities. Although the RCT now run ports it is likely that some engineer effort will be required. Certainly, divers will be needed for nearly all operations.

Implications

a. It must be remembered that, in the worst case, only the Leading Parachute Battalion Group (LPBG) troop from 9 Squadron may be immediately available to support 5 Airborne Brigade directly. This troop, with the LPBG, is permanently at five days' notice to move anywhere. In reality it may have to deploy much more quickly. Additionally, due to other overseas deployments, much of the rest of 36 Engineer Regiment may not be immediately available and other engineer squadrons may be used instead.

b. Little relevant engineer planning can take place until the aim of the operation is decided and priorities are allocated.

Photo 1. Men from 20 Fd Sqn building an APB raft prior to a night ferry operation, during a 36 Engr Regt exercise on Stanford Training Area.

c. Close contact between engineers and the operations, logistics and movements staff is vital, at all stages of planning. All engineer planning must be included in the all-arms plan and in conjunction with the RAF and Navy.

d. The build up must be progressive, based on priorities.

Likely Engineer Tasks

There are a wide variety of possible engineer tasks in an OOA operation. They will occur throughout the insertion, the build up and the recovery and could be grouped as:

Point of entry tasks.
Tasks in support of forward battalions.
Rear area tasks.

Point of entry tasks

a. Runway clearance and airfield maintenance, including taxiways and unloading areas.

b. Water supply for own troops, casualties, refugees and POW.

c. Fuel supply, initially from tanker aircraft and then developing a bulk fuel installation as soon as possible.

d. EOD clearance, and mine and booby trap clearance.

e. Field defences.

f. Mobility tasks, eg bridges and roads.

g. Counter mobility, eg demolitions, route denial and mines.

h. Infantry tasks.

j. FIBUA preparation.

Tasks in support of forward battalions

The tasks with the forward battalions will be very similar to the point of entry tasks. As mentioned earlier, the battalions will be supported directly

by their affiliated troops and there will be little centralisation of engineer assets in the initial stages. Once OCs and, later, the CRE are able to exercise properly effective control, the assets may be grouped differently.

Tasks in the rear areas

a. The beachhead.
b. Harrier support.
c. Bridge and MSR maintenance.
d. Provision of power, sanitation and shelter, for our own troops and for refugees and POW.
e. Defences for installations.
f. Additional fuel supply and the development of a ship to shore system.
g. Repair to port facilities.

Logistics

Most of the tasks outlined above are normal engineer ones but it must be remembered that, in the early stages, all equipment and stores would be flown in. Only if and when the sea tail arrives will it be possible to deploy the full range of engineer plant in theatre. Some of the tasks are complex. They all need stores and expertise and engineers would rely on the planners to identify the most likely tasks early, so that necessary resources could be earmarked in time to meet the loading deadlines. The resources organisation in the UK would be called on to issue the necessary material or it would have to be acquired locally. Many tasks would have a significant logistics bill. Stockpile REX, which is a collection of stores and equipment designed to meet the requirements of

Photo 2. EX PURPLE WARRIOR—Scotland Nov 87. The construction of the beach storage bunds, tanks and pipwork prior to fuel being pumped ashore over the beach via a pump raft fed by towed flexible barges filled from an RFA tanker offshore. The fuel system replenished Phantoms, Harriers, helicopters and vehicles during the exercise.

Engineers Operations out of area 2

an OOA force, would provide much of what might be needed but it is likely that additional equipment may have to be purchased suddenly.

Shortfalls

A major problem engineers have with all OOA planning, training and equipment is that OOA is only the official Priority 2 role for those units which are earmarked for it. Their Priority 1 role is Home Defence and the priority for other units, which may suddenly be tasked OOA, is their NATO role. There will always be anomalies over equipment which engineers need for OOA but which is not considered essential for Home Defence or NATO. However, in any OOA operation, especially in the insertion phase, volume and weight of equipment against airlift capability is critical. Units with equipment which they cannot take with them cannot be considered to be fit for their role.

Engineer support would normally be provided progressively with the immediate support coming from the LPBG troop and the rest of 9 Parachute Squadron, closely followed by the rest of 36 Engineer Regiment and the specialist support (eg EOD, Harrier, Bulk Fuel, etc). 59 Independent Commando Squadron would be supporting 3 Commando Brigade if they were also committed to the operation. Engineers need to ensure that they have the necessary training, skills and equipment to respond right across the whole spectrum of OOA tasks. 9 Parachute Squadron must have light-weight equipment to support the initial insertion properly. The Squadron is equipped as a standard UK field squadron with only some minor establishment changes. This establishment makes few concessions to the practical difficulties involved in attempting to support 5 Airborne Brigade effectively. Heavier plant and vehicles will have to follow on the sea tail and there is also an urgent need for 36 Engineer Regiment to hold combat engineer tractors (CETs) in 61 Field Support Squadron.

The structure of our squadrons is very sound and all sapper squadrons have proved to be extremely flexible over the years. There is no need to change their basic organisation. However, with only relatively few changes in 36 Engineer Regiment's equipment, the OOA capability could be improved significantly. These changes are:

a. *The purchase of two airdroppable bulldozers to improve 9 Parachute Squadron's ability to clear runways.* The airhead will be the Force's lifeline and it is absolutely vital to guarantee to open it and keep it open. At present the only means we have to do this are the Light Wheeled Tractor (LWT), which can be airdropped, landrovers and winches, explosives and hand tools. An airdroppable bulldozer would provide a significant increase in engineer capability to clear runways. Without a viable entry point no OOA operation is even feasible.

b. *The purchase of truly light-weight plant for 9 Parachute Squadron so that it can provide real effective support to 5 Airborne Brigade.* There is no need for the Squadron to hold its larger items of plant, such as the S26 Self Load Tipper, or the Volvo Medium Wheeled Tractor (MWT), or the Light Mobile digger (LMD), except when tasked in the UK. There is no good reason why it could not draw this plant from the Central Engineer Park when tasked for bigger plant projects in the UK. It is appreciated that it is not ideal for one squadron to have specialist plant of its own. However, the essential criteria for immediate OOA plant support are airportability and suitability for airdrop.

c. *The replacement of some of the 4 tonne vehicles by 1 tonne equivalents.* Currently engineer field sections attempt to carry a minimum of engineer kit in their bergens to support the infantry on the ground. This is unsatisfactory and they cannot provide adequate support until their equipment catches up with them. If this equipment is in the back of a 4 tonner it may be weeks before it is seen. A workable compromise would be for the section vehicles with the LPBG and Follow Up Parachute Battalion Group (FUPBG) troops to be small enough to travel on a Hercules aircraft and, ideally, to be airdropped. The 1 tonne, which is nearing the end of its service life un-fortunately, is suitable. Six of the 4 tonne vehicles should be exchanged with the new replacement for the 1 tonne; this would equip all the sections in the initial insertion with the capability of at least carrying some equipment to provide proper engineer support.

d. *The provision of some armoured protection, with the CET, for a limited amount of plant.* It is impossible to forecast exactly where the next OOA operation will occur, but many possible future areas contain forces with a significant armoured threat. Sappers must be prepared to support their own forces anywhere. Four CETs are needed and these could replace some existing plant, such as the D6s, the LMDs and one or two of the graders.

e. *The grouping of more engineer plant, while in the field or on operations, with the field troops.* Each troop needs ideally at least one LWT, or similar machine. More LWTs and fewer MWTs should be held. Each field section should contain at least one plant operator mechanic in case additional plant is found in theatre. Also needed, (by sappers and other arms) is a wider issue of up-to-date power tools with sufficient power take-off points from vehicles used and enough modern, light generators. Hopefully, the new issue of power tools will be a dramatic improvement on the now obsolete High-Cycle equipment, but power take-offs must be fitted on all new section vehicles.

The above proposals would result in very little extra costs as a substantial amount of plant and vehicles would be given up to improve all round OOA capability. Commanders and staffs would have to be prepared to be more flexible in their tasking of 36 Engineer Regiment on UK projects, or on Home Defence and they would also have to earmark specific pieces of plant from the Central Engineer Park when necessary. The present attitude that all UK field squadrons must be the same is unrealistic, when the most likely real operation will take place OOA. Nor does it recognise the problems inherent in OOA operations.

One encouraging sign is that staff work is now being initiated to identify some of the light-weight specialist plant on the civilian market and to clear this plant for air transport and air drop. The idea is that, should an OOA crisis develop suddenly, the right plant would be bought immediatly and issued to the tasked units. It is still too soon to see how thorough and how successful this staffing has been.

Conclusions and Recommendations

Recent experience has shown that there are a wide variety of possible OOA operations and that it is unlikely to be known where the British Army will be deployed next on active service, apart from Northern Ireland. The size and type of the next OOA force is never certain but there is an urgent requirement to resolve the current command and control arrangements. A dedicated 2 Star headquarters together with clearer direction from the MOD is needed. Sappers also need a permanent representative in the PPG.

The availability of nominated engineer units for an OOA crisis cannot be guaranteed, except for the LPBG troop from 9 Parachute Squadron. The Engineer Task Organisation for an OOA operation might contain a variety of units, including specialists.

It is essential for the engineers to establish close contact with the operations, logistics and movement staff, and the Navy and RAF throughout the mounting of any OOA operation. The engineer planning must be included in the all-arms plan, and priorities resolved soon enough to meet the loading deadlines.

The deployment of OOA forces, together with the significant logistic problems, needs to be practised regularly at all levels and by all headquarters which may be involved in OOA operations. Much of this training can be done on CPXs.

Some of the plant in 36 Engineer Regiment urgently needs to be reorganised in order that the Regiment can support the full range of OOA operations properly, right from the initial insertion. 9 Parachute Squadron needs to be equipped with light-weight plant and 61 Field Support Squadron should hold CETs. There is scope for giving up and reducing other items of plant in order to minimise the costs involved in any re-equipment.

The section vehicles with the LPBG and FUPBG troops should be 1 tonne equivalents, instead of 4 tonners, to enable these troops to provide more effective engineer support to their affiliated battalions right from the start of the initial insertion.

Above all, commanders and staff at all levels need a very flexible attitude to overcome the difficulties inherent in any OOA operation. Units earmarked for such operations might not receive a high priority for equipment to enhance their OOA capability. They all recognise, however, that their immediate needs are critical.

Canal Crossing Training Site

MAJOR J.M RAYNER BSc (ENG) and MAJOR N S GOULTON BSc (ENG)

Major John Rayner was commissioned into the Corps in 1968, and gained a Civil Engineering Degree at RMCS Shrivenham between tours as a troop commander in UK and BAOR. Fortunately this degree was broad enough based to allow time later to attend a long Electrical and Mechanical course at Chatham, which included an eighteen month technical attachment to the US Army Corps of Engineers at Portland, Oregon. He then spent two years in charge of the Technical Wing of the then newly formed HQ 12 Engineer Brigade (ADR) before commanding 45 Field Support Squadron. He is currently serving in the PQE (E&M) post in Berlin.

Major Neville Goulton was commissioned into the Corps in December 1972. Having served in BAOR with 10 Field Squadron RE supporting the RAF he completed a Civil Engineering Degree at RMCS Shrivenham. After a second troop commander's tour, this time based in the UK, he served as IO to 1st Armoured Division Engineer Regiment in 1 (BR) Corps and with 49 (EOD) Squadron RE at Chattenden before attending the Officers Long Plant Course. He then completed a tour as SO3 G1/G4 in HQ Wales before taking up his present post commanding 45 Field Support Squadron based at Nienburg.

INTRODUCTION BY CCRE

THE Northern Army Group concept of operations has given much impetus to the pursuit of new ideas on how to improve mobility support to armoured formations. The Chieftain AVRE and the proposed concept of close and general support engineers are notable examples of improvements in the offing. They are not the only ones. A Canal and Gap Crossing Training facility has recently been completed on the Soltau and Lüneburg Training Area (SLTA), which gives 1st British Corps the opportunity to develop new canal and gap crossing techniques and to practice all arms in crossing operations.

It was as recently as 1985 that the idea of providing a permanent canal crossing training site was first seriously mooted. Less than two years

Major J M Rayner BSc and Major N S Goulton BSc
Canal Crossing Training Site

later it was under construction, a year earlier than originally predicted. Apart from some welcome assistance from a friendly gunner regiment and the Welsh Guards, it was designed and constructed entirely by the Royal Engineers in BAOR, though PSA were the approving authority and controlled the funding. Sapper 'self help' reduced the rough indication of cost of DM6 million to less than DM1 million. How this was achieved is related here by two support squadron commanders who were closely involved with the project.

PART I — PLANNING AND PROTOTYPE

By Major J M Rayner

EXERCISE *LIONHEART* 1984 demonstrated very clearly that we, as an Army, had forgotten to a large extent the skills needed to cross the rivers and canals of Germany. This realisation gave rise to a series of studies and trials in 1985, mainly by the Sappers of 1st Armoured Division. 7 Field Squadron was given the task of examining the problems of, and testing some solutions to, assault river crossings, whilst 45 Field Support Squadron was tasked with the canals crossing side of the problem, and it is the latter which is the subject of this article.

The latest concept of operations in Germany envisages the possible deployment and re-deployment of reserve formations. These moves could involve the crossing of obstacles, including the extensive German canal network. Because of their size and types of bank, these canals pose some unique technical bridging problems. The German canal authorities will not permit any bridging training in peacetime, and it was therefore felt necessary to provide alternative facilities to allow such training to take place. These facilities are likely to grow in importance as new types of equipment bridging come into service giving a considerably improved gap and canal crossing capability.

I was tasked with making an initial study into this problem and seeing if the Royal Engineers could design and construct such a site. As a PQE (Electrical and Mechanical) this obviously meant a lot of careful thought — luckily I had been closely involved in ADR work in a previous incarnation, and had a fairly good idea of what our plant (and also the operators) were capable of doing.

I was also lucky to find that 25 Field Squadron had previously made an initial survey of the characteristics of the three major canals in the Corps area as part of a separate study into the rapid crossing of these obstacles. In general terms these waterways are used extensively by heavy commercial barges (typically 80m long, 8.2m wide, drawing 2.6m at a fully laden weight of 1150 tonnes). Typical sections of the canal network are shown in *Figure 1*. The Mitteland Kanal is the most important of these canals and has been improved along most of its length in recent years and it closely conforms to the standard profiles and widths shown. There are two main types of canal section, depending primarily on the type of bank used. Piled banks have an overall waterline width of 42m, whilst the sloping banks (up to 1 in 2) generally have about 53m waterline width. The minimum water depth is 4.0m in these canals, with a 1.0m bank height above water level. The canals themselves often have bunds along both banks, but improving the access for our plant and vehicles is another problem altogether.

As can easily be seen from these specifications, none of our current range of AVLB is able to be used for these tasks, even using combination bridges, because none is designed to be released from the launch mechanism with a difference in height between the plane of launch and—2.9m (No 9 bridge) and—3.0m (No 8 bridge). The trestle ended bridge is much better in this respect, and could be used, albeit the second and subsequent launches being some 0.8m under water! This equipment is still very much in its infancy and we hope that its performance will be improved. MGB can only be used to get tanks across these canals with some form of reinforcing, either a pier/span set or possibly the link reinforcing equipment for the piled profiles. The latter is much quicker to use and more economical from the manpower and transportation considerations as well. The next generation of bridge, ABLE, should be able to provide tank crossings over these obstacles without too many problems, but it is not due in service for some years yet.

The initial study into this matter was published in May 1985 and circulated to a variety of authorities for comment. It was generally agreed that battle groups were unaccustomed to crossing equipment bridges of any type, and that this also constituted a significant problem. It was agreed that funds should be obtained for such a training facility, based at one of the major armoured

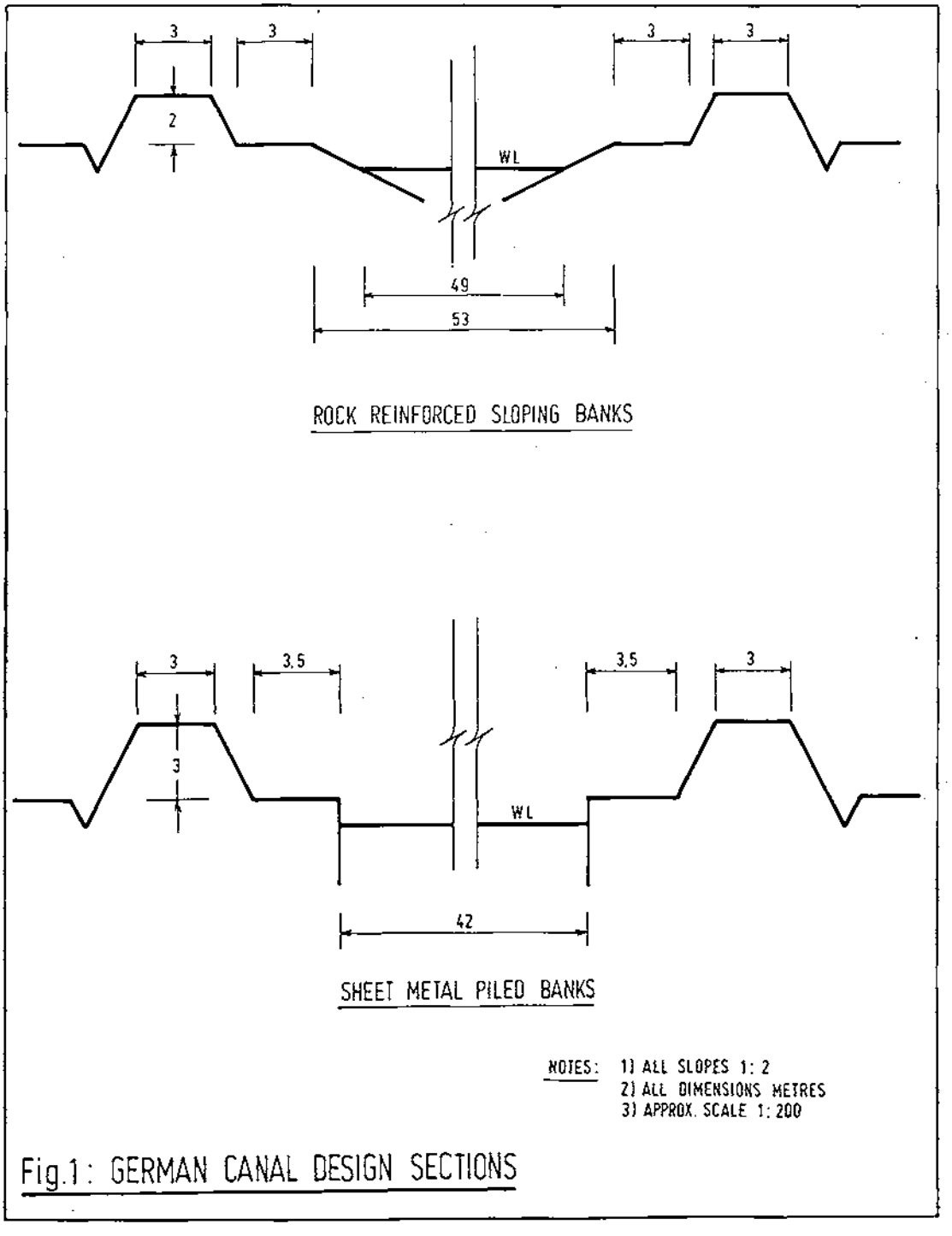
3
3
3
3
2
WL
49
53
ROCK REINFORCED SLOPING BANKS
3
3,5
3,5
3
3
WL
42
SHEET METAL PILED BANKS
NOTES: 1) ALL SLOPES 1: 2
2) ALL DIMENSIONS METRES
3) APPROX. SCALE 1: 200
Fig.1: GERMAN CANAL DESIGN SECTIONS

Figure 1

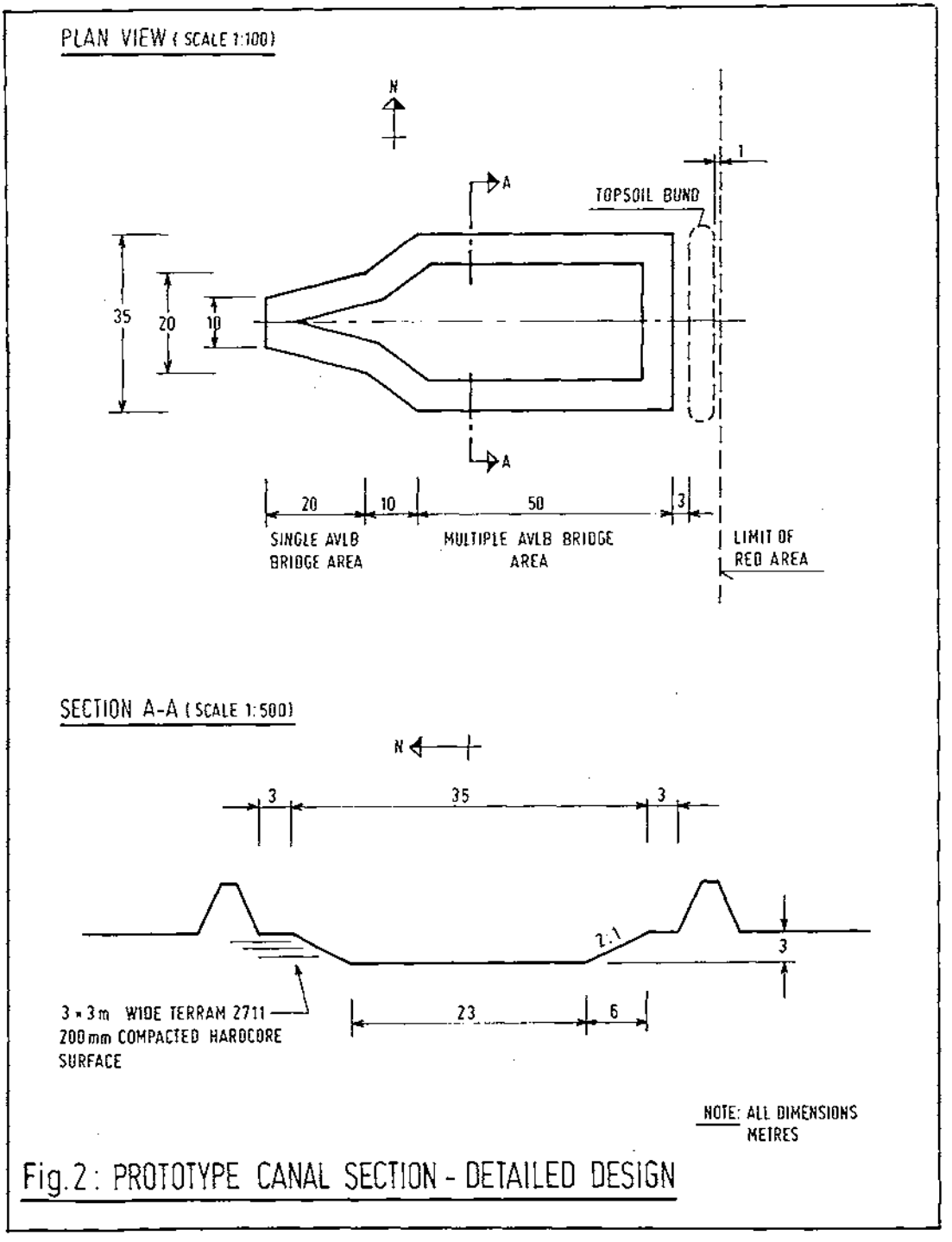
PLAN VIEW (SCALE 1:100)
N
A
A
TOPSOIL BUND
1
35
20
10
20
10
50
3
SINGLE AVLB BRIDGE AREA
MULTIPLE AVLB BRIDGE AREA
LIMIT OF REO AREA
SECTION A-A (SCALE 1:500)
N
3
35
3
2:1
3
3 x 3 m WIDE TERRAM 2711
200 mm COMPACTED HARDCORE SURFACE
23
6
NOTE: ALL DIMENSIONS METRES
Fig. 2: PROTOTYPE CANAL SECTION - DETAILED DESIGN

Figure 2

training areas in Germany — Soltau was selected as it had the nearest Sapper plant troop available to it, and also the major users, 32 Armoured Engineer Regiment close by.

It was decided that the Sappers should construct a prototype facility in order properly to establish the design criteria and confirm the usefulness of the proposed full scale training facility. 45 Field Support Squadron was given the task in August 1985, primarily to preserve a continuity of experience in this rather novel subject. At this stage various problems started surfacing for the Squadron and me.

On the squadron side of the equation, I had at the time only 4-6 trained plant operators available for this task, due mainly to a Corps-wide shortage of these tradesmen. As one of the aims of the prototype construction was to try out various types of machine on the actual site conditions, this shortage of trained manpower actually made life simpler for me as fewer machines of each type were then needed on site. I was lucky enough to have an experienced corporal available to act as site supervisor throughout the construction of this prototype. Incidentally, he was also available to command the repair teams that we needed later to send out to repair the damage caused by users and the weather.

After some discussion with the Armoured Engineers a simple design was agreed. A sketch of this is at *Figure 2*. The main feature of the prototype was that it *had* to be usable by current armoured engineering equipments, and so the depth and overall widths of the German canals shown in *Figure 1* were reduced to those shown. The tapering bottleneck was to give a variety of gaps, suitable for single armoured bridges, whilst the main facility could only be used by combination techniques. The bunds were included to increase the realism of the facility, but these were, in practice rarely used for this purpose, and remained as channeling devices for the armoured vehicles using the site.

The most significant problem, however, concerned the selection of the actual site to be used. The Services Liaison Officer (SLO) advised that very little of the Soltau training area was owned by the State. The vast majority of the training area (which in fact looks like a moonscape most of the year) is owned by people and organisations who are very keen on nature conservancy—the implications of such a facility to them would have been horrendous. The emotive subjects of possible fuel spillage, effects on the local water table, and effects on the local farmers (particularly some nearby trout farms) all had to be considered. Another factor was that this prototype facility would be the first constructed by the British on this training area since World War 2. We decided therefore to use an area of land that was actually owned by the Federal Authorities and were lucky to find a suitable location in Area 3A (for those who know this area well). The site is away from the main battle runs but could still be used in a tactical manner by combat team sized units. Furthermore some of the spoil was used to construct a low bund along the edge of the training area to prevent local surface water run off. The problem had been worrying the civilian and range authorities. Another was that this prototype was only designed to be a temporary feature, and agreement to continue using it would be sought on an annual basis, through the SLO and his normal range committees.

Having got the design approved and the site selected I sent up my small plant section to undertake the work. I had originally estimated that this work would take about five weeks to complete, and in the event it took a total of eight. We tackled the job in a fairly steady manner because we had (for once) no pressures of time applied and we were trying to amass as much information about applicable construction methods to enable the full scale facility to benefit from our experiences. We were expecting the funding procedures for the project to be quite lengthy as the piles alone would cost about £300,000!

The excavation lessons were fairly straightforward — wheeled plant was best suited for above ground level work especially the Terex Medium Wheeled Tractor. Medium crawler tractors (Caterpillar D6D) were used down to the approximate level of the water table, and excavators had to be used below this. We had retained an NCK 406 rig from a previous plant job and we rigged it as a drag line excavator. This, and our normal Hymac Medium Crawler Excavators worked well. *Photo 1* shows the construction methods used. As part of the longer term durability tests we strengthened one bank with three layers of Terram 1000 geofabric in the usual 200mm lifts. This (northern) bank was then topped with about 100mm of compacted hardcore to reinforce it further. The final part of the

Photo 1. Final Excavation Stages

construction phase was to emplace "out of bounds" posts and signs to prevent "accidental" exploration of the site by closed down armoured vehicles, especially at night.

The prototype site was finished on 24 October 1985 and advertised to the armoured and mechanised units with the Division. All the customers as well as the Armoured Engineer squadrons were required to complete special proformae about their use of the prototype, which included spaces for suggested improvements to this novel type of training aid. The reports gathered over the last year have been quite interesting at times. One unit thought that the gap was too deep and they didn't like the water in the bottom—I am not too sure how mobile they would prove to be if we went to war! In general, though, the facility was very well received by the users, thanks mainly to some effective selling techniques used by our friends in the Armoured Engineers.

We found that the site tended to be used quite often for demonstration purposes by the Armoured Engineers both to VIPs and armoured battle groups. This is liable to be a continuing requirement as we are issued with new types of equipment, and we included this requirement into the design specifications of the main facility. The experience of leaving the site to the tender mercies of the Armoured Engineer restoration crews has also been quite valuable. They have proved to be quite conscientious and well able to repair the damage caused by tracked vehicles to the surrounding area. Some of the plant operators have been very pleased to have had such a worthwhile task for their CETs!

The weather also produced some interesting problems for the prototype facility, mainly caused by surface water run off. We had to make some quite extensive repairs to the unreinforced bank, and also the end of the bottleneck, which tended to act as entry points for the surface water. Our friends from the plant detachment of 256 MCPG based at Rheinsehlen Camp helped repair the first of these problems, and also tried to control the ingress of surface water by constructing a small dam immediately upslope of the facility and by scarifying the surrounding area in order to increase the absorption of the water by the soil. Both of these measures proved to be successful, although the scarifying needed to be repeated periodically to maintain its efficacy due to the effect of traffic and normal weathering. We even encountered quicksand conditions in one of the alluvial fans, but apart from bogging in my MPF for a short while this was not a significant problem.

A year's extension was obtained for the prototype site during the summer of 1986, and I was quite surprised to be told that financial authority for this Part 1 Works Service (amounting to about DM1.1m to cover the cost of the raw materials—particulary the essential sheet piling) had been given to enable construction of the full scale site during the 1987-88 financial year. This news was greeted by a flurry of activity by all concerned.

As a PQE (Electrical and Mechanical) I had carefully included the requirement to have the detailed design of the full scale facility to be carried out by a PQE (Civil). This was not a case of jobs for the lads, but a very clear memory from my own technical course at Chatham of the problems experienced by our 'brothers' during the sheet piling design phase of their civil engineering course. The final site will be about 320m long and include some full scale canal sections to allow the problems of these waterways to be studied and overcome by our successors. It will also involve the excavation of over 27,000 cubic metres of spoil, making this one of the largest plant jobs tackled by the Sappers in BAOR for some years.

I was also part of the siting board convened to find a suitable location for this very much larger facility at Soltau. Due to the considerations mentioned earlier, this needed to be Federally owned land with reasonable access for the users but away from the main battle runs. We were very lucky to find a potential site meeting these requirements. The prototype has proved to be an interesting extramural job to have undertaken and

I am very glad that the importance of this canal crossing task has been recognised, and that we, as a Corps, have been largely instrumental in getting the Staff authority and financial resources to do something about it.

PART II — COMPLETING THE PROJECT
by Major N S Goulton

Introduction

When I took over command of 45 Field Support Squadron in February 1987 the requirement for the full scale site had already been agreed. Many of the lessons learnt on the trial site had been incorporated by 32 Armoured Engineer Regiment into the requirement for the new facility. The site was to consist of the existing major canal profiles, and various other gap widths, to enable crossing operations to be practised with existing equipments. 522 STRE had been tasked to produce the design for the canal gap and 43 Plant Squadron was warned off to carry out the earthworks, beginning in April 1987. The OC of 45 Field Support Squadron, now me, had been detailed the "Project Liaison Officer", a title which caused some confusion as the PSA also had a Project Liaison Officer. In civilian parlance, I was the Contractor. However, in the event almost all of the work was to be sub-contracted to other units.

Organisation

The Canal Crossing Training Site was being built for 1st British Corps by the PSA. However, the manpower was to be supplied by 1st British Corps. Thus effectively HQ 1st British Corps was both the client and the contractor. I was the HQ RE Corps representative and was tasked by them. HQ RE Corps allocated manpower to the task and the PSA provided the material and quality control.

Design

The design consisted of the two German canal sections described in Part I. The main part was to be a rock reinforced sloping bank section with 1 in 3 slopes, 53m wide, 5m deep and with 3m high bunds. One section of the bund was to contain 150mm aggregate between piled walls so that clearance of the bunds could be practised effectively. The sloping bank section, after 66m, gave way to a sheet metal piled bank section with a gap of 42m. After 25m the gap was reduced to 37m and the depth reduced from 5m to 3m. Throughout this first 114m the towpath was constructed of reinforced concrete.

Thereafter the gap reduced from a 37m gap to a 21m gap over a length of 100m. The banks, here, were reinforced earth at 1 in 2 slopes. The last section ran for 25m with a 15m gap reducing to a 11m gap, also with reinforced earth banks but now at 1 in 1 slopes.

The whole site was 319m long with a bridging gap along 229m of its length. This would require the removal of 27,420m^3 of sand. It had been decided, for reasons of cost, that the gap would not be designed to hold water.

Construction

522 STRE completed the initial setting-out of the site and 43 Plant Squadron RE began the earthworks in April 1987. 43 Plant Squadron also had the task of carrying out the piling of the sheet metal piled banks and the piled section in the bunds. Troops from 4 Field Squadron, 21 Engineer Regiment and 5 Field Squadron, 26 Engineer Regiment were tasked with constructing the reinforced concrete towpaths. 25 Engineer Regiment was tasked with assisting Plant Troop, 45 Field Support Squadron in completing the reinforced earth banks. Thus many sapper units in 1 (BR) Corps had a part in the construction of this task. In addition, men from 40 Field Regiment RA and the Welsh Guards were allocated to move and hand-emplace the 150mm rock on the rock reinforced slopes and to assist with hand battering the earth slopes.

Earthworks

The earthworks went well throughout the task. The bulk movement of spoil was carried out by a combination of Hymac 201 excavators from 43 Plant Squadron and 8-tonne tippers from 54 Squadron RCT. The 8-tonne tippers were a poor match for the excavators and had a high vehicle casualty rate in the soft sandy conditions. A far better and more reliable match was achieved later using the Scammell self-loading dump truck, which performed extremely well.

During the earthworks phase, work on site was halted for ten days due to a political wrangle amongst the German authorities. Although work was restarted, the problem was not fully resolved until almost the end of the project.

All the slopes were reinforced using Tensar SR2

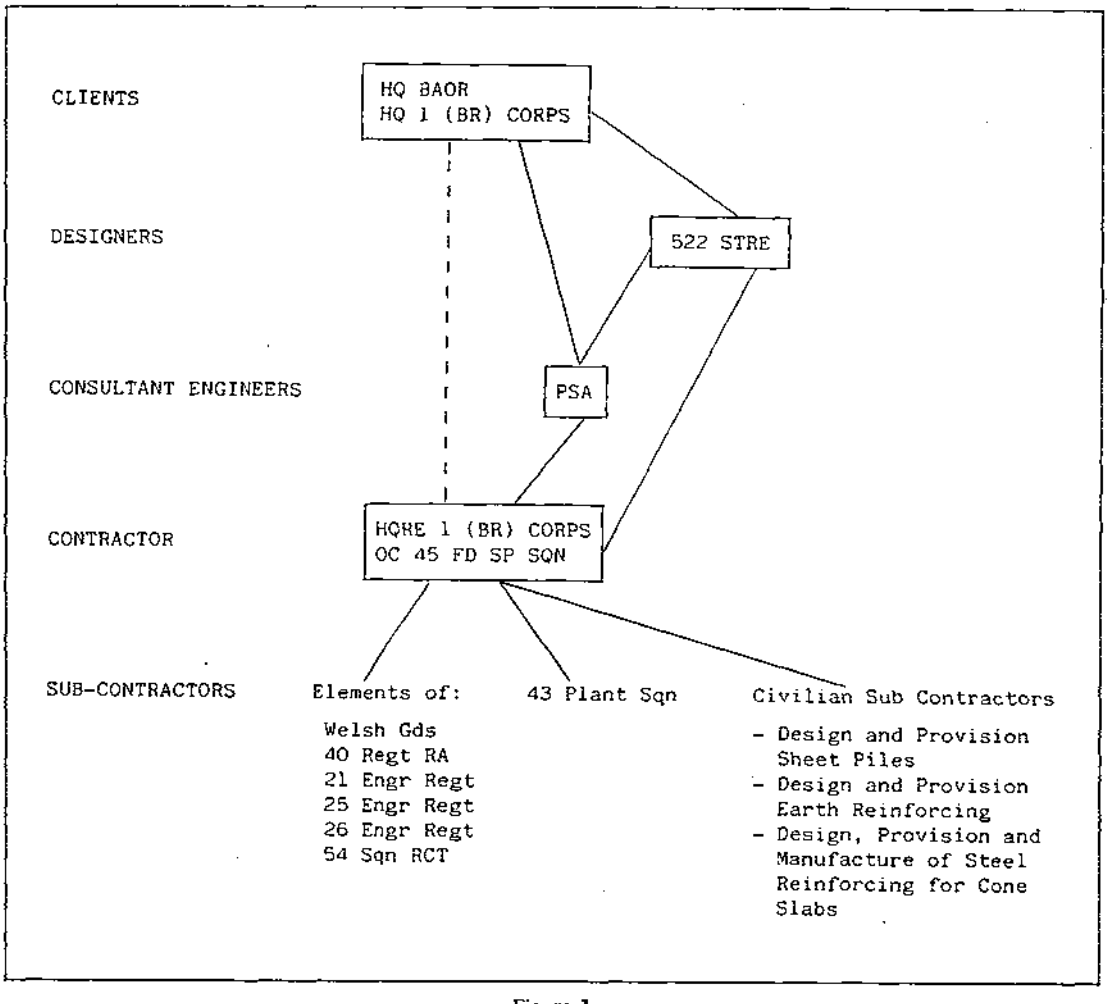

Figure 3

placed in layers with compacted fill in between. This was a slow process with the Tensar being cut and laid by hand and the fill having to be compacted in individual passes. The 1 in 3 slope and the 1 in 2 slope were quite easy to construct but the 1 in 1 slope caused some problems because it was over the natural angle of repose of the sand. To overcome this, the slope was built out well beyond the Tensar and then cut back to shape. The slope was then covered with a Terafix material. The design required that a soil and grass seed mixture should be brushed into the Terafix to bind it to the slope, thus stabilizing the surface.

The design was then modified and the Terafix covered with 4 inches of topsoil. Problems still remained and the final remedy was to cover the 1 in 1 slope with an interlocking brickwork surface.

Both the 1 in 3 slope and the 1 in 2 slope were completed with a hardcore towpath on the top and with grass seed being hand-sown on the slopes.

Piling

The metal sheet piling was designed and provided by a German sub-contractor named Hoesch. The piling operation was carried out by 43 Plant Squadron using, initially, a vibrating hammer supplied by Hoesch and subsequently a service 10 ton drop hammer. The vibrating hammer worked very well to start with but could not drive the piles beyond a depth of 5-6m, the frictional resistances of the sand proving to be too high. The 10 ton drop

Photo 2. Soltau and Lüneburg Training Area

hammer eventually managed to drive the piles to their full 7.5m depth. Anchor piles were dug in behind the walls to tie them back. Minor problems were encountered due to various items such as the tie-bar nuts and spacers and the pile caps being incorrectly manufactured by a sub-sub contractor. They were the wrong size and would not fit until modified on site.

Concreting

The reinforced concrete towpaths were laid by men from 4 Field Squadron and then 5 Field Squadron. It was unfortunate, because of other commitments, that the job had to be shared between the two sub-units as continuity was lost on changeover and lessons had to be re-learnt. The lack of manpower and the late addition of mass concrete slabs under the hardcore-filled section of the bunds caused some delay. Steel impact plates were bedded into the concrete to protect the edges from damage when trafficked by tracked vehicles. Underneath some of the impact plates, the slump of the concrete caused voids. To rectify this the plates were drilled and the voids filled with an epoxy resin.

Summary

The construction of the canal crossing training site, now named the Soltau and Lüneburg Training Area (SLTA) Canal and Gap Crossing Training Site, was a very interesting and worthwhile task. The plant and artisan tradesmen who took part in it gained a considerable amount of experience. Many lessons were learnt, and I am sure many were re-learnt.

Our employers, the PSA, expressed their satisfaction with the standard of work achieved, which is much to the credit of all the tradesmen who took part. The result is an excellent training facility, shown in *Photo 3*.

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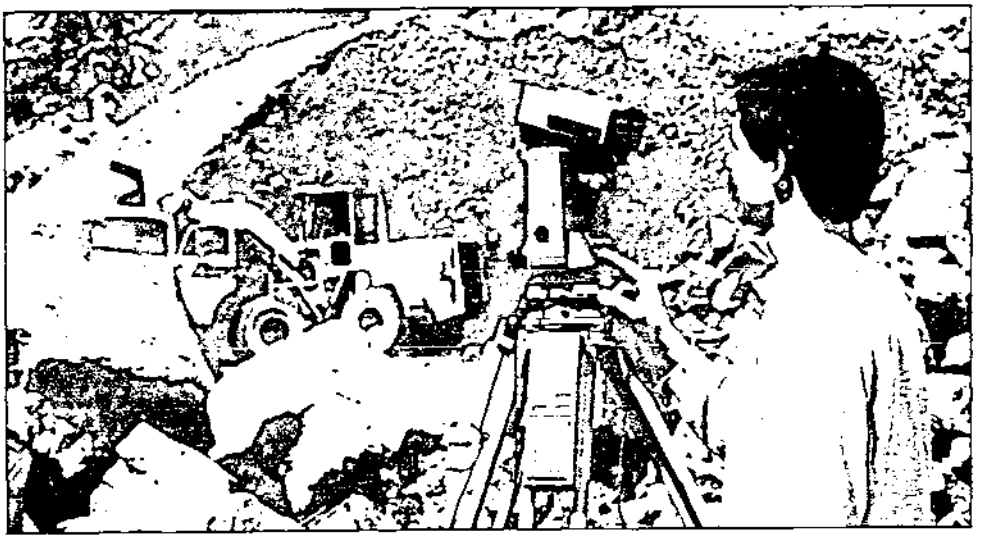

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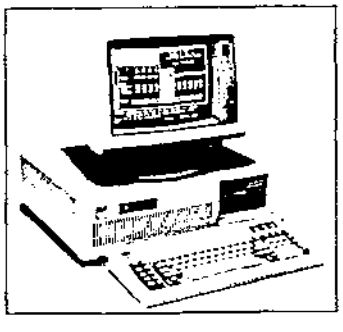

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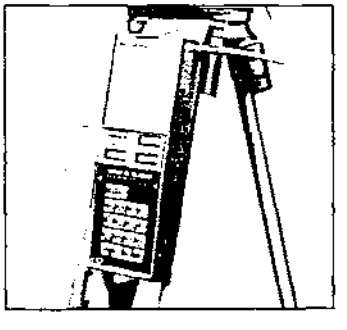

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To Split or Not to Split?

MAJOR D W TAYLOR BSc (ENG) C ENG MICE

Major Taylor was commissioned as a University Cadet in 1974, reading Civil Engineering at Birmingham. Two tours in 53 Field Squadron (Construction) — the second as Second-in-Command — were separated by a posting to 56 (MT) Training Squadron. Aside from the usual exercises, this early career included projects in Gibraltar and Belize, two EX WATERLEAP *road tasks and a tour in the Falkland Islands. Starting in 1984, his Long Civil Engineering Course included building railway bridges for John Mowlem, and planning trunk roads for Sir Frederick Snow and Partners. A short tour as DCRE (Wks) NI was followed by a PQE posting to the PSA (Germany) Regional Design Office. His intimate knowledge of Armoured Engineers is restricted to one day of an undergraduate attachment.*

THE question, to split or not to split, is provoked by the juxtaposition in recent editions of the *Journal* of articles on organisations, roles, equipment, man management and training. In the first third of this century the Corps gave birth to a new branch of the Armed Forces every decade. The rate then dropped to every other decade, and at that rate another split is a few years overdue.

This article attempts to treat nothing as sacred. As an aid to this, the cosy familiarity of military jargon is, wherever possible, discarded.

The Corps is the engineering department of a rigidly hierarchical medium-sized public corporation. The corporation has a major European subsidiary, some smaller overseas subsidiaries, and a cartel arrangement with two smaller, more capital-intensive corporations. The hierarchy resists corporation-wide revolutionary change, restricting this to subsidiaries. Evolutionary change is painstakingly slow, due to repeated careful analysis in lieu of actual market performance. The European subsidiary is so large that it distorts corporate decision making, and may even soon subsume the parent corporation.

The business of the corporation is killing enemies of the Crown. When business is slack it contents itself with threatening and practising to kill potential enemies. Historically, this business was shared by infantry and cavalry. Since precious few European Infantry (capital I) now march and fight on foot, they have, by dictionary definition, become cavalry (small c). The business is now shared with artillery — not here considered further — and army aircraft, easily paraphrased as air cavalry. *Plus ça change, plus c'est la même chose.* That we call dismountable cavalry "Armoured Infantry" (ie mounted foot) does not affect the continuing shift from a foot army to a mounted one.

Supporting the above used to be the preserve of the Quarter-Master and the Engineer. One paid out money for assorted civilian commodities, while the other used his brains and acquired skills (the Latin *ingenium* meaning talent). The supply business is now a little more complicated, but only to the extent that the RAOC has replaced local purchase and that the Wagon Train own ships, travel agencies and airline handling agencies. The predictable and steady demands placed on the supply department has always allowed staff (smalls) to be closely tied to the consuming units and formations. The Engineer, on the other hand, has had to adapt quite a lot since:

a. There is little call for trebuchets these days.

Major D W Taylor
To Split or not to Split

b. He has been expected to deal with any subject not the responsibility of infantry, cavalry or quartermaster.
c. His source of labour, the infantry, has dwindled to the point of unavailability, and has not been up to the more complicated tasks. He has had to train and administer his own direct labour organisation.
d. The pressure to produce rapid results has conflicted with the centralised control needed efficiently to cope with a variable and unpredictable workload.

An engineer is a soldier trained to design and construct military works *(Concise Oxford Dictionary*, first of six meanings). Following this simple definition, the Corps has traditionally divested itself of any responsibilities from 'b' above that:

a. Had been designed, constructed and simplified to the extent that mere mortals could cope. Guns, aeroplanes and submarine mining spring to mind, as do assault ladders, entrenching tools, port operating and movement control.
b. Threatened to grow so large as to unbalance the Corps. Wireless telegraphy and equipment repair are obvious examples.

This tradition has been broken. The construction and maintenance of capital assets was taken away, despite not falling into either of the above categories. Indeed, with the increasing fortification of airfields and some naval bases, and the amalgamation of the three separate armed forces' ministries, extra responsibilities might have been expected in this field, rather than fewer. (Since the Property Services Agency is now being broken up, perhaps the Corps should be lobbying for the return of this role). More importantly, much self-propelled pioneering equipment - AVRE, AVLB, and Bridging For The 90s - is 'pre-engineered' and simple to operate. Due to the rising requirements for battlefield mobility caused by a new concept of operations, more tank regiments, and 'Armoured Infantry', these equipments now represent a disturbingly large proportion of the Corps' workload. Making an allowance for the other roles of the AVRE's dozer blade, the main work of three squadrons in the 70s and 80s (say 10% of the BAOR total) has become the larger part of the work of nine (say 30% of the BAOR total) and is rising. If the amphibious bridging squadrons are added in, the figures are perhaps 25% and 45%. This essential task is taking a dominant position in the Corps, and distorting it. The task should long ago have been given to an existing or new corps.

Four factors are suggested for the failure to delegate the 'armoured pioneering' function.

Firstly and fundamentally, it is not possible to form a pioneering corps when that title has been hijacked. The title 'Pioneer' is used both by Minor Works sections of the Infantry and Royal Armoured Corps, and by the Army's unskilled-labour-and-second-line-infantry corps.

Secondly, in an era of retrenchment, there is increased competition between corporate departments (and cartel members) for shares of the turnover and workforce. Giving up responsibilities causes job-cutting and loss of departmental influence. The urge to split the Corps is suppressed. Paradoxically, there are no predatory departments trying to acquire the function, perhaps because Pioneers believe that engineers make the best pioneers.

Thirdly, the terrible twins of civilianisation and tail-cutting have been joined by privatisation. Warlike responsibilities are an excellent foil to enforced reductions. Needing tanks is more convincing than adding the word 'combat' (or its predecessor 'assault') to every imaginable job description.

Finally, situations are self-perpetuating in a hierarchical organisation. The route to the top in the Army is primarily through multi-disciplinary executive posts. The second eleven have fewer of those, but more in the corporate administration. Since the loss of Works Services, the Corps has not been markedly different from the rest of the Army: technical appointments are a hindrance to, not a prerequisite for, advancement for a majority of the Corps' officers. The Corps has been taken over from within by its own militant tendency.

Given these factors and the break with tradition, either the Corps or the dictionary requires amendment. The former is probably the easier solution.

Captain Smith has proposed (*RE Journal* Apr 88) a rationalisation of Young Officer training. The proposal is to replace a common, general course with a suite of shorter courses. Training would be restricted to the needs of the first posting, with the option of coming back for more later. This would be a blow to the concept of the all-purpose engineer, but is an economical approach

to training widely used elsewhere. His table of training needs is illuminating: the armoured pioneer and the UK field engineer have nine needs in common and eighteen not. The common training time can be cut by 55%. The armoured pioneers (or close support troop commanders) then leave to do their thing, leaving the field engineers to do the rest of the the current YO course (Field Engineer course?). Compared to that, offering a choice of a few weeks of AFV management or construction is uncontroversial. There will be problems with course sizes, since many of the labour-intensive tasks will be in the Field Engineer course; no lasting solution can be offered until Sandhurst ceases its quinquennial reorganisations. There will be problems with the course selection for the one or two YOs a year posted to amphibious squadrons: field engineers with a pioneer role. And the question of who teaches CET will continue; it is a common requirement and should be in the YO course, logically at Chatham. Here is a chance for the plant school to recover their birthright of battlefield as well as general and construction plant. A reform on these lines is inevitable one day: only the date and the details need to be decided.

Captain Ball proposed a parallel reform of soldier training in the same Journal. In essence, armoured pioneering would become a separate career stream in the general roster. It would have its own NCO management courses on a par with those for plant and transport. This would allow career flexibility for sappers and lance corporals but must involve overtraining. The armoured pioneer, like his troop commander, has no need of the full range of field engineer skills. Given the larger numbers involved the potential savings are greater. 3 Training Regiment already copes with three types of basic field engineer courses, assault pioneers, and advanced courses. Making provision for a quarter of their students to have less training is easy, at least in theory. The potential armoured pioneer must then proceed directly to his crewman course, arriving in his first squadron as a class 3 pioneer. For his second trade, he could choose from a restricted range of artisan trades, driver, plant operator, or field engineer. The last of these would of course require only a short course, perhaps at CETC. It would be quite wrong to put troop commanders in a position of ignorance of their soldiers' basic training; if the officer does not need to know about a subject then nor does the sapper. The field and armoured trades must be alternatives.

The consequence of these two propositions is that armoured pioneers will rarely leave Germany. Their lives will follow the Royal Armoured Corps pattern more closely than they do now. They will be equipment users (albeit intelligent ones) and will need no greater understanding of engineering principles than the average soldier. They will escape from the age-old dilemma of states of engineer command, being in direct support of their formation. They will be well understood by the Army as a whole, being an obvious part of it.

Officers with an armoured pioneer background will probably be better placed to compete for all-arms posts than their field engineer contemporaries. But more worryingly it will be difficult for an officer to gain experience of both parts of the Corps. There are precious few second tour troop commanders outside the training organisation, and which squadron commanders will allow their second-in-command to disappear for twelve weeks at RSME as well as ten at Warminster? By default, the UK/BAOR split in the Corps will be replaced by a field engineer/armoured pioneer one. And the Army will mistakenly think that the latter is the primary role.

The situation may be summarised:

a. Change is needed, but it must be evolutionary.
b. The Corps has chosen, for good reasons, to retain a function it would normally have delegated. This has tipped the balance to a predominantly non-technical Corps.
c. A semi-autonomous, non-technical, high-profile branch is evolving.

There have been no take-over bids for the new branch, and a management buy-out will not be tolerated. At the other extreme, the 'do-nothing' solution will allow the present tolerable imbalance to worsen, and field as well as construction engineering will fall by the wayside. Or rather they will fall further.

The intermediate solution is to recognise the developing partial split, and ensure that so does the rest of the Army. This requires a distinguishing mark firmly fixed to every armoured pioneer. The precedents are separate rosters for postmen and surveyors, and a highly visible badge for EOD. Some cross-posting will continue, so a separate roster would not work. Something on the lines of the armoured engineers' shoulder titles would do,

but is always vulnerable to removal on security grounds. A better and more fitting solution is a separate hat-badge. The Corps already has four (Engineer, Sapper, Gurkha and Militia) with few adverse effects. It could add a fifth, such as a bomb and mailed fist, or adopt the underused Corps Monogram. The latter has the advantage of including both mottos, although it does not have a royal garter as on the Sapper badge. The pros and cons of the many options are outside the scope of this article; suffice it to say that the chosen badge must be distinctive, easily manufactured and worthy. The Monogram is but a suggestion.

It has been suggested above that amphibious engineers, while not armoured, could be included by virtue of their role. This would ensure that both badges were represented at both divisional and corps level. This may or may not be a good idea. A suggested alternative is to keep the new badge at the lower level, and to offer it to the Assault Pioneers/Troopers as well. Thus all the military engineer support within armoured brigades would come from one hatbadge and one Commanding Officer.

The suggestion could be carried further. One badge for the armoured pioneers supporting armoured brigades, another (the current one) for field engineers supporting armoured divisions and infantry brigades, and a third (the Engineer bomb, perhaps) for general and specialist engineers at corps level and elsewhere. This three-way partial split is rejected on two grounds. Firstly it affects engineer units in UK needlessly. Secondly it would highlight the lack of regular units at corps level.

Thus the proposal is to rebadge everyone in support of armoured brigades. There are a number of practical difficulties, but all are soluble. The following are but a sample. Some soldiers will be posted to fill trade posts in armoured units despite having a field rather than armoured basic training: for uniformity they must rebadge, without retraining. The reverse is also possible. Officer postings will be more difficult, since they will be expected to acquire twelve or more weeks worth of special-to-role training during a one week handover: armoured units have the hardware to train in-house but field units do not, so a case must be made for at least some officers to sit in on young officer courses. The professional status of officers will be confused, and those without field engineer training will clearly not equate to Members of civilian Institutions: the desirable aim of obtaining recognition from the Engineering Council is best served by doing nothing until the effects of European harmonisation in 1992 have been identified, but may well involve awarding only Associate membership of the Institution of Royal Engineers to young officers thereafter.

In summary, the Corps has developed a large, high-profile branch that is not primarily concerned with engineering in the strict sense of the word. There are compelling reasons for keeping it in the Corps, but a grave danger that field engineering (by nature not well understood by outsiders) will be eclipsed. Training must be reformed to recognise this branch as equal to, but different from, field engineering.

Splitting the Corps is a non-starter, but some sign is needed so that other soldiers do not mistake practitioners of one field for experts in the other. A separate hatbadge is considered appropriate, and the Corps Monogram is suggested. The exact extent and the title of the new branch (while side issues) are neatly covered by calling all quasi-engineer units which support armoured brigades 'Armoured Pioneers'

BIBLIOGRAPHY

Finally, acknowledgement is paid to the following, from whom much of the above has been borrowed. All were articles in this *Journal*:

Major Seekings. Sep 78.
Lieut Colonel (now Brigadier) Addison. Mar 79.
Lieut Colonel (now Brigadier) Sheppard. Jun 83.
Lieut Colonel (now Colonel) McKeown. Sep 84.

Meeting The Challenge

CAPTAIN J F BATTY RE

Captain Batty enlisted into the Corps in July 1963. After initial training at Southwood Camp his early career started at 26 Independent Armoured Engineer Squadron, he then went to Junior Leaders Regiment followed by a tour with 31 Armoured Engineer Squadron as a Recce Sgt. He was Staff Sergeant in 8 Field Squadron, QMSI at the Engineer Wing, RAC Centre, Squadron Sergeant Major of 26 Corps Armoured Engineer Squadron in 1979 and RSM in 28 Amphibious Engineer Regiment in 1982. Commissioned in January 1985, he served as Second Captain, 2 Field Support Squadron and is now at Engineer Wing, RAC Centre as Training Officer. Almost 16 years of his career have been served in armoured engineer appointments.

CAPTAIN Ball raises some interesting points in his article on the subject of training for armoured engineers (April 1988). There has been much recent discussion on how to meet the challenge of training an ever growing population of engineers in tanks. HQ EinC(A) have the difficult task of sifting through the various options, proposals and counter proposals, all of which try to juggle the varying requirements for additional resources of manpower, equipment and accommodation in the ITO against the reluctance of establishing in-theatre training in BAOR. The plain facts of the matter are that by the year 1992 there will be the necessity to train 120 crewmen at Class 0-2 each year as opposed to the present number of 78. In addition there will be a corresponding increase in Class 1 training. Compromises will be necessary on all fronts if we are to meet this challenge successfully.

Rather than expound further on the likely outcome of that dilemma I propose to discuss an even more fundamental issue raised by Captain Ball. His principal conclusion was that specialization would provide the key for better training. This may in part be true but behind this whole subject lies the over complicated rules for the employment and promotion of soldiers below the rank of substantive Corporal. These rules affect all Career Employment Qualifications (CEQ) in the General Career Employment Group. Specialization alone is not the answer. I believe the key lies in simplification.

CURRENT SITUATION

SOME appreciation of the present situation is necessary to realise how important it is to change to a simpler structure. For the combat/artisan the path is relatively straightforward. A soldier, having completed CMS and Combat Engineer 3 at 11 Engineer Group is posted to a field unit – in most cases BAOR. The potential artisan is called forward for 0-2 artisan training after 24-30 months in that first unit. He is posted to the Depot Regt RE for his 0-2 course and is subsequently posted to another unit in a trade post. Before being accepted for 0-2 artisan training he must have passed class 2 Combat Engineer. After passing the artisan course he eagerly awaits his posting (probably to UK) where he knows he will be going to a unit to practise and train in his artisan skill. He has every hope and chance of gaining Class 1 qualifications as a combat engineer and artisan

Captain J F Batty
Meeting The Challenge

tradesman. By the time he is career streamed on being granted substantive rank as a corporal, he will already have all the necessary employment qualifications to take him to the top of his career.

For the armoured engineer the first two years are somewhat similar. He too, having completed CMS and Combat Engineer 3 training, will initially be posted to BAOR. He will complete his Class 2 training by attending a modularized course, part of which is held in UK and part in unit. He then remains in that unit and should also qualify as a Combat Engineer Class 2.

The impending second tour for the armoured engineer becomes somewhat worrying. He already sees that, unlike his combat/artisan counterpart, if he is posted to a UK unit he will not be able to gain furtherance in his CEQ. This is of particular concern if he is not already a Class 1 Armoured Engineer. He must therefore concentrate on gaining qualifications in another field. It is unlikely that he will be able to follow a straight combat engineer career in his new unit because the combat engineer posts in a UK Engineer Regiment are tied to artisan trades. If, as is likely, he is a signaller or driver he will seek upgrading in that particular direction. This is a situation forced on him by the circumstances of employment in his second tour and has three closely related consequences.

Firstly, it commits him to a specific career stream which, under the present rules for promotion, places him at a serious disadvantage to that of the combat/artisan. This is career streaming by default!

Secondly, he is placed in an employment in which he has had no previous experience.

Thirdly, he has no chance of furthering his career in this chosen CEQ and effectively becomes out-of-date as an armoured engineer. This has implications for his possible return to a unit with engineer tanks and subsequent employability. It also means that it is highly unlikely that he will gain the necessary employment qualification for promotion to sergeant until his third tour.

Statistics provided by RE Records indicate that within the Armoured Engineer CEQ there are 63 substantive corporals; of these 55 hold the Class 1 qualification. The average time taken to gain this qualification was after 7½ years service. This, despite the stated importance in the Career Employment Structure that armoured engineers should reach Class 1 standard in their first unit!

Adaptability is only achievable by the combat/artisan group. Adaptability for the junior ranks of the armoured engineer CEQ is only maintained superficially by forcing them to remain outside their chosen field prior to career streaming. Under the present rules an armoured engineer is in danger of becoming unemployable in units without engineer tanks. Only if he achieves a Class 1 combat engineer qualification (or another employment) will an individual be employable from the rank of sergeant outside armoured engineers. The only other posts open would be such as Recruiter, RP Sgt, Mess Caterer etc.

Simplification

Employment Structure

Simplification of the employment structure is overdue. Employment and training must reflect the changing demands placed on the Corps of Royal Engineers. The new concept of operations in 1 British Corps calls for the rapid movement and redeployment of formations during battle and in preparation for counter attacks. The decision has already been taken to increase the number of engineers in tanks to provide support for this new concept. It is now time to implement a simpler employment and promotion structure to meet this reality, otherwise promotion in the armoured engineer CEQ will become blocked by a surfeit of SNCOs unemployable except in an armoured engineer unit. There are three areas in which simplification can be achieved which will improve the chances of fruitful employment and successful promotion. These are:

Career Streaming.
Theatre Adaptability.
Operation Role Training.

Career Streaming

There is no disadvantage to the combat/artisan in being career streamed when promoted to substantive corporal — indeed, flexibility whilst a junior rank between the artisan and combat elements of the CEQ is entirely compatible. It is a different matter for the armoured engineer. If he is to be moved at the 3-4 year point away from a unit with engineer tanks, consideration must be given to his employability before he is posted. It is at this point, but preferably before, when he should be career streamed — this must be irrespective of his rank, because not all will have earned promotion to lance corporal. By

determining the career path much earlier, say at the 18 month point of service, positive preparation whilst in his first unit can be made to train him — rather than to leave it to chance as it is at the moment, with all the uncertainty that breeds. RE Records would still have the final say as to the career stream in which an individual was to be placed taking into account the needs of the Corps. Trade groupings could remain very much as they are now.

Theatre Adaptability

With the expected growth in numbers of engineers on tanks and the proposed re-organisation of 1 (British) Corps to a closer and more integrated close support regiment concept it is clear that the majority of engineers on the battlefield will become more combat/armoured orientated. Coupled with the desirability for a more stable army, probably individual soldiers will have the option for longer tours. These two factors will affect the current practical application of adaptability.

The present principle of linking employment qualifications for the purpose of adaptability and then using that as a factor in the rules for promotion will need to be revised. Providing career streaming occurs early it will become relatively simple to allocate individuals to a particular career stream and then train them accordingly. Employment adaptability would then be achieved within that career stream rather than over-complicating the issue by linking two or more CEQs as happens at present.

Operational Role Training

Operational role training should be carried out separately from employment and leadership training. At present all three are linked variously in different levels of employment and command skills training. By identifying those skills which are of an operational role nature and taking them out of the employments, training will become simpler, reducing over-training and this will provide a better basis for structuring employments. For example: the soldier in a close support regiment will require different training on minewarfare, demolitions and construction to a soldier in a UK field regiment or a BAOR general support regiment. In the same way an armoured engineer in a close support regiment will need some of the combat engineer skills of the field engineer in the same regiment. This will become even more important as tour lengths increase, specialization will be induced by virtue of soldiers remaining in the same theatre of operation for much longer. It will therefore become less valid to teach specialist combat engineer skills across the board. Operational role training could provide the answer and would allow for the combat engineer skills to be taught in a modular fashion appropriate for the theatre of operation at the time when the soldier needs new skills.

Command Training

An important part of this simplification would be to separate command and leadership training from employment. Section commander courses and troop sergeant courses would be of a rather more general nature than specifically aligned to an employment as at present. This would give all section commanders and troop sergeants command training to the same training objectives across the whole range of common duties they would be expected to perform. The syllabus and scope of such training would need to be carefully considered to achieve the correct balance.

Practical Applications for the Armoured Engineer CEQ

Tour Length

By opting for longer tours the armoured engineer would stand a good chance of achieving a Class 1 qualification in his CEQ during his first tour. Longer tours would also reduce the annual number of incoming soldiers for initial training in the CEQ (ie turnover would be less).

Early Streaming

If he were streamed at the 18 month point of service or earlier, a clear decision could be made on his secondary employment which would give time for him to be trained. The career streams could be: Armd/Cbt, Armd/MT, Armd/Sigs and Armd/BD.

Second Posting

The second posting would be for employment in the soldier's second trade, ie, driver, signaller, combat engineer, (probably in BAOR) or bomb disposal, as appropriate, depending upon early career streaming.

Rules for Promotion

A SIMPLIFICATION of the rules of promotion should reflect likely employability, particularly above the rank of corporal within the career stream.

SUMMARY

THE changing face of engineers on the battlefield with their increased mobility and protection will demand skilled and experienced commanders at all levels. Equipment husbandry of complex AFVs will become an ever increasing command responsibility and it is therefore vital that NCOs and warrant officers with the appropriate knowledge and background are available to be promoted into key troop and squadron appointments. Only by simplifying the rules for employment and promotion will potential be realised. The present posting and employment policies work against the armoured engineers. These must be changed and simplified to meet this challenge effectively. Command and leadership training should not be tied so rigidly to employment training. Earlier career streaming, coupled with longer tours, should be introduced and tempered with a realistic adaptability policy which allows the soldier advancement in his CEQ in whichever unit he serves.

The Revival of Grey Point Fort

CAPTAIN I B GAILEY TD

The author enlisted into Queens University Belfast OTC in 1952; from 1954-69 he rose to become Second-in-Command of 6th Battalion The Royal Ulster Rifles (TA) and after two years on RARO he became Company Commander in 5 (V) Royal Irish and subsequently its Second-in-Command. Appointed Brevet Lieut Colonel in 1975 he joined the staff of HQNI. In 1978 he was appointed Cadet Commandant (ACF) for Antrim and Belfast ACF in the rank of Colonel. He retired in 1985. He joined the RE in 1981 and is at present serving as PSAO of 112 (Antrim Fortress) Field Squadron in Bangor, Co Down. He has many interests including military history, architectural history and conservation. He is Chairman of SSAFA (NI District) and is a member of the Order of St John of Jerusalem. He was joint author of An Account of the Territorials in Northern Ireland 1947-1948.

For 112 (Antrim Fortress) Field Squadron RE (Volunteers) 9 May 1987 was the culmination of two years involvement in the restoration of Grey Point Fort. The fort that their lineal forbears, 188 (Antrim) Heavy Battery RA (TA) and the Antrim (Fortress) Company RE (TA), had been formed to garrison, fifty years ago, has been given a new lease of life as a tourist attraction within the Crawfordsburn Country Park.

The construction of the coastal defence fort at Grey Point, and its reciprocal fort at Kilroot on the Co Antrim shore of Belfast Lough, was begun in 1904, and two 6in breech-loading Mk VII guns were mounted in 1907. From that time it became the mobilisation role of The Antrim Royal Garrison Artillery Militia to garrison these fortifications. The Royal Antrim Artillery Militia had originally been formed in 1854 to man the guns of Carrickfergus Castle during the Crimean War. The Regiment became a Special Reserve unit in 1908, but because of Ireland's particular problems, it was not re-constituted following the end of the First World War. Territorial Army units were not formed in Northern Ireland until 1937, when 188 (Antrim) Heavy Battery RA (TA), the successor unit to the Antrim Artillery, and the Antrim Fortress Company RE (TA) were formed to man the defences of Belfast Lough. These sub-units were mobilised during the Munich Crisis in 1938, and again on the outbreak of war in 1939, when Grey Point and Kilroot Forts were manned on a permanent basis. Two days after the outbreak of war the steamship *E Hayward* of Liverpool failed to answer recognition signals and a plugged round was fired across her bows. The claim that this was the first shot in the war, and that, due to an error in laying, the ship was holed and sank rapidly, was hotly disputed amongst the veterans, but strongly believed by Sappers. This was not actually supported by the War Diary, though some allege that the entry must have been expunged. In 1940 the Heavy Battery was expanded into 525 (Antrim) Coast Regiment RA in order to man additional forts at Orlock, Co Down, Larne, Co Antrim, and Magilligan, Co Londonderry. Shortly afterwards the Gunners took over responsibility from the Sappers for manning the searchlights and machinery in the forts. The Sappers were moved into billets in Portaferry, Co Down and began training for their new role as a field company. The sub-unit was redesignated 591 (Antrim) Field Company and moved to England, where they were

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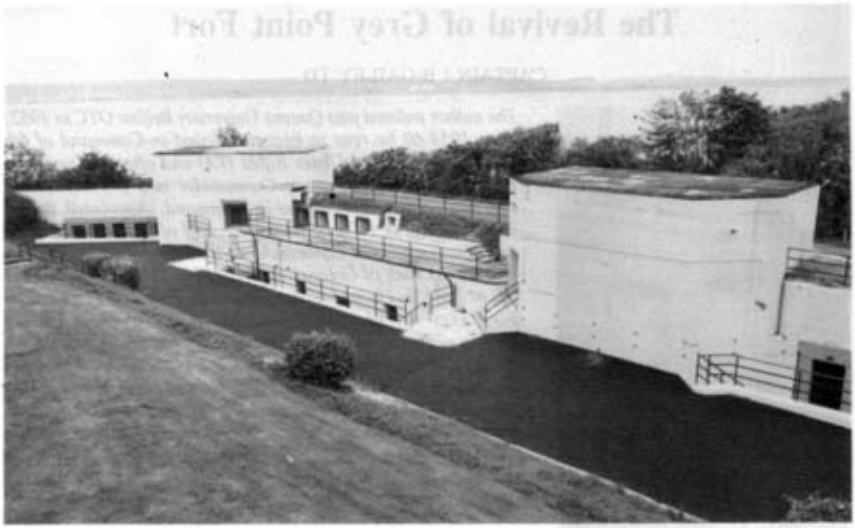

Photo 1. The gun positions viewed from the south east. One of the shelters for the gun crew is on the left, with the magazine and shell store in the basement in the centre

eventually converted into a parachute squadron, and joined 6 Airborne Division. The squadron served with distinction during the airborne invasion of Normandy, the Ardennes, the Rhine crossing, and subsequent battles to the conclusion of the war.

The Northern Ireland coastal defences were put on a care and maintenance basis in 1943, and Grey Point Fort became a Naval signal station, communicating with convoys assembling in Belfast Lough.

Both units were disbanded in 1945 only to be re-formed in 1947 as 429 (Antrim) Coast Regiment RA (TA), and 591 (Antrim) Independent Field Squadron RE (TA).

When coast artillery was disbanded in 1956, Grey Point and Kilroot Forts were dismantled, and guns and equipment sold to local scrap dealers. The adjoining hutted camp became home for Headquarters 39 Infantry Brigade until they moved to Lisburn in 1960. 429 Coast Regiment was converted to 146 (Antrim Artillery) Field Engineer Regiment RE (TA). On reorganisation of the Territorial Army in 1967, 146 Corps Engineer Regiment, and 591 Field Squadron were amalgamated to form 74 (Antrim Artillery) Engineer Regiment (Volunteers).

Grey Point Fort was subsequently incorporated in the Crawfordsburn Country Park and used as a store for tools and materials, while Kilroot Fort was demolished to allow for the construction of a power station. When the Territorial Auxiliary and Volunteer Reserve Association (TAVRA) for Northern Ireland felt that it might be appropriate to mark the formation of the first TA units in Northern Ireland, and the Association, it was decided to restore the fort. A committee was formed in October 1985, comprising representatives of the TAVRA, Department of the Environment Conservation and Wildlife Branch, North Down Borough Council, NI Tourist Board, Ulster Museum, 102 (Ulster) Air Defence Regiment RA (V), and 74 (Antrim Artillery) Engineer Regiment (V).

The Department of Environment launched a major works programme to repair the gun positions, battery observation fort, and searchlight emplacements, while 112 Field Squadron RE(V) re-surfaced the paths and built concrete steps leading to the searchlight emplacements on the

The Revival of Grey Point Fort 1.

Photo 2. A View of the eastern gun position covered by the Gun House erected in 1940. The Battery Observation Post, which contains the Interpretive Centre, is in the background

foreshore, gaining useful experience in basic engineering skills on the site where their predecessors trained for war in 1938. The contribution of personnel of 74 Engineer Regiment was recognised as the unit's project to mark RE 200. At the Public Record Office at Kew Major Ian Gailey, the Committee Secretary, traced the Fort Record Book, and the War Diary covering the period 1939 to 1945, and searched for details of the building's history and interesting events. Known veterans were contacted and an address list was compiled with the help of the honorary secretaries or the RA Association and REA.

The Master Gunner, St James's Park, General Sir Thomas Morony visited the site in February, and was briefed by the Committee Chairman and Secretary. He was impressed with the project, and promised support from The Royal Regiment.

Experts from the Ulster Museum arranged a display in the Battery Observation Post. Three figures were clad in battle dress to represent the Battery Commander, a Range Taker and a Signaller of about 1940. A good deal of ingenuity was required as boots, anklets and steel helmets had to be acquired, and the uniforms altered to suit the figures. Veterans came forward with a wide selection of photographs, depicting life at the fort among the Gunners, Sappers and ATS girls during TA camps just prior to the War, and in the early years of the conflict. These were mounted on display boards with captions and descriptions of the various buildings, and their functions.

On the day of the formal opening the ceremony commenced with the arrival of the GOC Northern Ireland, Lieut General Sir Robert Pascoe who inspected a party of twenty-one bemedalled veterans commanded by Colonel Donald Shearer, who had been one of the original subalterns in 1937. The General found them a most interesting squad, amongst them there was a husband and wife partnership; a man who had transferred to the RAF, escaped from enemy occupied Europe, and been awarded the DFC, and one of the few who served continuously with the FortressCompany right through to the Parachute Squadron and took part in the airborne landings in Normandy.

Photo 3. Colonel Norman Brann, Lord Lieutenant for County Down, accompanied by Lieutenant Jerry Stewart RE(V), inspects the Guard of Honour at the opening of Grey Point Fort

The Lord Lieutenant for Co Down, Colonel Norman Brann subsequently arrived and inspected a guard formed jointly by the Gunners and Sappers, and commanded by Lieut Jerry Stewart, RE (V). The Chairman of the Restoration Committee, Colonel Harry Porter and Mr John Phillips spoke, and the Lord Lieutenant unveiled the plaque to commemorate the event. The spectators were then divided into three parties and invited to accompany the guides for a tour of the fort. During this time three "Bulldogs" of the Queens University Air Squadron flew over in formation, to mark the fact that fifty years before the TA and Air Force Association had also been responsible for the Auxiliary Air Force.

To mark the occasion Colonel Michael McCorkell, President of TAVRA Northern Ireland, presented the Commanding Officer Lieut Colonel John Rogers, with a copy of a photograph taken in 1938, at that memorable first TA Camp in Northern Ireland.

The Corps was represented at the event by the Regimental Colonel, Colonel Danny Dennison, a local man, and also a former CO of 74 Engineer Regiment, who had shown great interest in the project from its inception.

Colonel Barney Filor, Chairman of REA and Mr Ken Moore, the Honorary Secretary, who as a boy soldier had assisted to distribute mobilisation notices to members of the Fortress Company in 1939, were among the assembly of guests from many ex-service organisations. Afterwards there was a reception in the colourful marquee while the Northern Ireland Staff band played in the background.

Everyone subsequently dispersed, well satisfied that the formation of the TAVRA and the first TA units in Northern Ireland had been effectively commemorated, and the committee members heaved a sigh of relief, pleased that everything had gone according to plan.

REME Support to The Royal Engineers or Bluebell Strikes Again

CAPTAIN D M BOWHAY REME

The author was commissioned into the Royal Electrical and Mechanical Engineers in 1976. After a tour as a troop commander in the Commando Logistics Regiment Royal Marines he went to RMCS Shrivenham to read a Mechanical Engineering degree. A period with 15 Field Workshop in Munster was followed by two years as OC 1WFR LAD. In 1984 he went to the Joint Air Transport Establishment as a project officer. He joined his present unit in November 1986.

WHAT on earth is an article written by a REME Officer doing in the *Journal* of the Royal Engineers? Well you may have heard of "alternative comedy", but have you ever considered alternative engineering?

Sometimes, albeit only rarely, solutions to problems are discovered by a crossflow of ideas over the boundaries of a variety of engineering disciplines.

Regimental officers reading this will probably say "Wot, Bluebell being useful, instead of moaning about vehicles?" I assure you it is possible, but for any doubters, I did say the situation arises rarely.

I am EME to 38 Engineer Regiment, based in Ripon. The Regiment is primarily interested in supporting the Harrier Force, wherever elements of it may be operating from. Briefly, this task involves a great deal of hard, back-breaking, toe-bruising labour which quickly swallows up resources of men and machines. Any description which I give of the awesome volume of work entailed in each Harrier site would of course, be totally lacking in civil engineering jargon. So I will not attempt this task, but I will mention my amazement when I saw my first site.

I tried to imagine the area as it had been just three days before, that is, an open green field used as grazing for sheep; now in its fully prepared state it was covered by taxiway, turning areas and runway. In the woods were "hides" and these too were fed by taxiway. Literally acres of the field and surrounding area were covered by strips of tin and a large array of other Sapper bits and pieces. It was only when chatting to my escort that I realised that hundreds of sandbags had been placed under the strip and taxiway, that many more had been used to rebuild broken culverts and that all these bags had been filled by hand. On questioning further, I discovered that some sites require *thousands* of sandbags in their preparation, and every single one filled carefully and lovingly by some happy Sapper using the Mk 1 shovel. They say great minds think alike because it was shortly after this experience that the Commanding Officer expressed concern over the amount of manual labour involved in filling sandbags. He therefore tapped into the marvellous "think tank" of the REME Workshop and tasked us to produce a machine to assist in sandbage preparation.

The result was a hopper-like manual machine.

Captain D M Bowhay REME
REME Support to the RE or Bluebell Strikes Again

Photo 1. ARFUR 2. Manufactured from 6mm mild steel plate and of welded construction. Sand capacity approximately one cubic metre. Only manpower requirement is to "waggle the paddles" on the rubberised chute. On trials, it was estimated that one sandbag could be filled every ten seconds.

Dry sand flowed reasonably well, though an Archimedes screw was required to "push" it down the chute. A simple guillotine was incorporated to stop the flow when the sandbag was filled. Wet sand was a different matter, as this stuck to the hopper sides and refused to move unless agitated. Thus a second device was added in the form of a simple spit with spikes, so that regardless of the condition of the sand, it could be forced onto the Archimedes screw, and hence down the chute. The whole machine was demonstrated to the prospective users who considered it was still too labour intensive. They very kindly named it for us as, "Another REME Foul-Up Under Review" or ARFUR for short. We also discovered that our technical expertise regarding the properties of sand was limited. For example, the "angle of repose" does not mean going to sleep on a comfortable bed! ARFUR 1 was not suitable for complete modification and so was retired early.

Undeterred, and better armed with knowledge, a second machine was designed and constructed. This time the finished article was much larger, and could be fixed onto the side of a suitable vehicle (we used a Scammell S26 self-loading dump truck) or placed on its optional stand. The top of the hopper was big enough to allow filling by the S26 scoop or by the back actor of a Muirhill A5000 LWT. The exit port was left large enough so that sand, regardless of condition, would fall through. The reinforced rubber chute funnelled the sand into a sandbag. It was still necessary to agitate the sand, but this time simple "push bars" on the rubber chute were sufficient. This second device, which was naturally christened ARFUR 2, was much more efficient than its predecessor. It is shown in *Photo 1* and its specification and performance figures are given below the photograph.

On trials, ARFUR 2 received mixed reviews ranging from "Brilliant" to "Rubbish"! The average seemed to be that it was worth using if more than two to three hundred sandbags were required. For smaller numbers, setting up time made hand filling easier. If any other unit is employed in filling sandbags, and has a simple machine which assists, please let us know![1] In the meantime ARFUR 2 is being modified slightly with a view to carrying out further trials in July 1988.

Naturally, other work continues while sandbags are being filled, and this normally entails general preparation and levelling of the site, erection of hides, construction of fuel bunkers and laying of runways and taxiways and so on. Indeed, anywhere an aircraft is expected to park, take off from, land or manoeuvre must have a hard surface. On the majority of sites the hard surface consists of aluminium planks which are joined together into the required configuration and then are pinned into the ground. As a true understatement this is nicknamed "kicking tin", but it is repetitive, hard labour. When the tin has been laid and positioned, the pins, which come in two lengths (1.2 and 0.7m) can be hammered into the ground. Fortunately pneumatic

[1] *Try the March 1984 Journal — Editor.*

Photo 2. A Simple Tool

hammers, powered by the high-cycle generating equipment are used for this but the pins are spaced in such a way that the high-cycle has to be lifted and carried at very frequent intervals. To overcome this problem a hand trolley was manufactured by my metalsmiths. Trials have proved this to be very successful. Its design is basic and rugged and it can easily be made by a competent tradesman. The use of pneumatic tyres gives good cross-country manoeuverability whether powered by one man, or towed (slowly) behind a Landrover. Interested units can obtain drawings from 38 Engineer Regiment. At present we have eighteen of these on order from EBW, Willich.

As on any military training, the time unfortunately arrives when the site must be dismantled and all stores recovered. Before this is possible the pins used to secure the tin to the ground have to be extracted, and the tool supplied for the job, which is similar in principle to a pair of shears, is basic and unsatisfactory.

The standard method of extraction is to attach the tool by chains to a fork on a Muirhill A5000: the head of the pin has wings. The forks are then raised, and by a simple mechanical advantage the shears grip the pin and pull it from the ground. This process often fails when the pin heads become rounded with use, and the tool provided slips off the heads. The simple tool shown in *Photo 2* has been designed to lift the pin by an inch or so. It is this initial movement which has proved to be the most difficult to achieve with the service supplied tool. Once the pins have been lifted by this amount with the new tool then the "old system" is adopted. The tool has been tested extensively and has produced varied results. Further development is essential, as the extraction points wear quickly and sometimes break when the pins are being extracted from compacted hardcore. However, from trials conducted to date, the concept has proven its worth and the tool is a useful time and labour saving device. Again, EBW are very kindly making more of these for us.

In summary, I hope to have shown that "Bluebell" can be useful, not only in maintaining vital equipment for use by your Sappers, but also in improving the lot of your soldiers.

Much of the work undertaken by Sappers is labour intensive, and any device which can make savings in this area should be actively sought after and developed. It is my view that REME Workshops should support units as fully as possible, but that the expertise of available tradesmen within them is often overlooked. Finally, we may soon be looking at designs for ARFUR 3: any ideas?

REME Support to the RE or Bluebell Strikes Again 2

Korean War Memorial

ON 24 April 1988 the Corps memorial to those who lost their lives in the Korean War was unveiled and dedicated in the Garrison Church at Brompton . The project had been launched in 1985 when the Museums Memorials and Library Committee of the Institution appreciated that no such memorial existed. The decision was taken to commission a stone in nabresina marble from the Sussex artist and sculptor John Skelton. John Skelton saw service during the Second World War in the Royal Artillery and on demobilisation studied initially under Eric Gill and, after the latter's death, under a pupil of Gill's. He has carried out a large number of such commissions including many of the relief portraits of World War Two commanders in the Army memorial chapel in St Paul's Cathedral.

The Korean War Memorial was unveiled by the Chief Royal Engineer General Sir George Cooper GCB MC, who had himself commanded a field troop in Korea including at the *Hook* battle. It was dedicated by The Reverend T H Robinson, QHC, Deputy Chaplain General. The address was given by The Reverend S J Davies, MBE, QHC, who had been padre to the Gloucestershire Regiment at the *Imjin River* battle in April 1951. We reprint below the text of his address.

What can separate us from the love of Christ? Can tribulation or hardship, persecution, hunger, nakedness, peril or sword? As it is written — For thy sake we are killed all the day long. Romans 8, 35, 36

THESE members of the Corps of Royal Engineers who made the Supreme Sacrifice during the Korean War, and whose memory we salute this morning, were involved in what were probably the most difficult, exhausting and demanding conditions Sappers have ever had to contend with and overcome. The ingenuity of your great Corps was exercised to the utmost because of the sheer extremes of climate in Korea; because of the very primitive roads — in fact mostly tracks — which simply could not sustain highly mechanised modern armies; and because of the rivers, such as the *Imjin*, which could rise in the summer rains some forty feet in just over twenty four hours and become a raging torrent sweeping away bridges, ferries and pontoons. And yet, in the depths of the fearful Korean winter rivers could freeze to a depth of two or even three feet.

What immense challenges the Royal Engineers faced! Bridge-building, air-strips, tunnelling, road building which in winter required blasting of the concrete-hard ground before bulldozers could work, and in the thaw coping with hard road surfaces which simply "boiled-up" and sank beneath the sub-soil. Thousands upon thousands of tons of stone had to be quarried for the roads by the Royal Engineers.

Sappers out laying mines on winter nights in front of forward positions could only carry out intricate detection work for a very limited time indeed, simply because their fingers would freeze to a dangerous numbness. I have only touched on a few of the problems which were faced. Add to this the fact that from time to time, as at the Battle of the River *Imjin*, in these late April days of 1951, and on the *Hook* in May 1953, Sappers fought valiantly as infantry, as well as having to repair and strengthen the defence works under terrific Chinese bombardment, and you begin to get an idea of the life of the Royal Engineers in Korea, which I saw at first hand as Chaplain to the Gloucestershire Regiment, and of their achievements, which called forth the admiration of the whole Commonwealth Division and of our American, South Korean, and United Nations allies. What a Korean War roll-call of honour it is: 55 Field Squadron first in the field (with 29 Brigade in 1950);12 Field Squadron; 64 Field Park Squadron (would it be possible to count the vast quantities of sandbags, barbed wire and all manner of defence stores they unloaded daily at railhead for the forward units, and the repair jobs to Engineer equipment far in excess of normal duty); 145 Works Section and Bomb Disposal, and the essential Post Services — all combined in 28 Field Engineer Regiment, HQ, Royal Engineers 1st Commonwealth Division.

These men saw the huge and redoubtable Chinese forces at close quarters and the fearful casualties inflicted upon them by superior firepower; they saw the tragic, terrible plight of the Korean refugees fleeing South, they saw at times their brother Sappers killed or maimed and

The Unveiling. Left to Right—Reverend D B Small, Senior Chaplain Brompton; The Reverend T H Robinson QHC, Deputy Chaplain General; General Sir George Cooper GCB, MC, Chief Royal Engineer

Korean War Memorial.

wounded; they saw the full horror of modern war between great powers in an underdeveloped country.

What can separate us from the love of Christ? said our 2nd Lesson from the New Testament this morning — *Can tribulation or hardship, persecution, hunger, nakedness or peril and the sword? As it is written — For thy sake we are killed all the day long.*

How painfully descriptive these words from the Bible must seem of the conditions these dead Sappers, of all ranks, witnessed in Korea thirty seven years ago.

But St Paul continues — *we are more than conquerors through Him that loved us, for nothing in death nor in life can separate us from the love of God revealed in Christ Jesus our Lord.* And that is the meaning and the message of all those crosses, line upon line, line upon line in the beautifully maintained United Nations war cemetery at Pusan, eleven thousand miles and more away, where our fallen lie buried.

Our Christian Faith is that the evils, the wickedness, the follies, the wars, the horrors of our world *Do Not Have The Last Word.* Our Saviour endured the cruel torments of the Cross on Calvary, and died in agony while the soldiers mocked Him, but *Love* won the Eternal Victory, which is our Victory too, over all the powers of darkness and evil and catastrophe. Christ rose in triumph from the dead that we might share His victory in and beyond the battles of this mortal life, the unceasing conflict between good and evil, in which we are all involved.

As the old Remembrance Day hymn says:

"Still stands His Cross from that dread hour to this,
Like some bright star above the dark abyss;
Still through the veil, the Victim's pitying eyes
Look down to bless our lesser Calvaries".

We are commemorating here this morning our fallen in battle in the knowledge that they are alive in Life Eternal, in one of those many mansions in the Father's House.

It is a wonderful thing that the Unveiling and Dedication of your Royal Engineers' Korean War Memorial should be taking place almost within a year from the unveiling by Her Majesty The Queen of the National Korean War Memorial in St Paul's Cathedral. On that occasion, as the only chaplain who survived, by God's strange providence, the prison-camps in North Korea, I had the great honour to preach. Little did I know that a year later I should again have the honour and privilege to preach here in the spiritual home of the Royal Engineers, in this great and splendid Church so full of historic memories.

These officers, non-commissioned officers and sappers who were killed on active service in Korea between 1950 and 1953 are part of that host of a thousand British dead, and thousands more from the British Commonwealth. This year, 1988, is a year when the eyes of the world are upon Korea, still a divided country, because of the significant political unrest in South Korea and the imminent Olympic Games in Seoul. And I think we should be grateful to the British Korean Veterans' Association, which has branches throughout our whole country, for continuing to stress the real significance of the Korean War and the importance of our links with the Republic of Korea.

What is the unique significance of the deaths of these men? It is that they died in the *First War* ever fought in the name of the United Nations against mighty powers who had made an aggressive bid for total control of the whole Korean Peninsula. Would the United Nations accept the challenge or would it act "merely with pathetic words of protest and not with deeds of decisive purpose"? The world watched and waited.

Suppose we had *not* acted, and the whole of Korea had fallen under a monolithic Communist dictatorship? Who can say what fateful results would have occurred for the balance of power; for the Pacific and the free world; for the freedom of Christian worship and teaching in South Korea and for Peace. The United Nations would have been totally discredited, and incalculable results would have threatened us.

The stirring for constitutional, democratic change in South Korea today and the Olympic Games in Seoul would not have been possible if these men had not fought and died in the Korean War, nor would the continued free existence of the Christian Church in South Korea (and we shall be welcoming the three Korean Bishops at the Lambeth Conference here in a few months' time) — for in North Korea still all religious organisation and teaching is absolutely forbidden.

In the unbelievably bitter Korean winters many soldiers were tempted to ask "What are we doing here"?

Let me end by quoting a poem written by a young major of the Royal Engineers with 55 Field Squadron in Korea, North of Seoul. It is called "Korean Christmas, 1950":

Just what are we doing here?
Ice cold on a ridge in a foreign land,
Chilled by winds from the ends of the earth,
Far, very far from the homes we love,
Just what are we doing here?

The Korean peasant, gentle but strong,
Is swept up in a desperate fight;
His livelihood smashed by land engines of war,
Whilst death seeks him out from the skies.
Just what are we doing here?

Refugees trudge southwards below us,
With faltering, shuffling steps.
Do they know we are here to protect them,
That we hope they've the strength to survive?
Just what are we doing here?

In a Muscovite palace a tired tyrant sits,
Whose words mean these people must die.
A few hours more and their breath will be stilled,
But he'll never know, never care.
Just what are we doing here?

Someone, someday, must face up to his power
And say 'no' to that tyrant's greed.
Then peasant and wife can enjoy their old age;
Those of us who survive can go home.
That's what we are doing here!

These Sappers we honour today were men like us of many imperfections, "of the earth, earthy". They would not want us to idealize them. They did not want to die in that remote, far away land. What prayers they said, what faith they had is known *Only To God*. But they died in defence of freedom, against ruthless aggression. They said "No" to the tyrant's greed. The merit of their sacrifice will remain with humanity, and God the Judge of us all, will "fulfil in them the good purpose of his perfect will".

May they rest in peace: and share in Christ's risen glory!

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1 Construction Engineer Unit

IN the article by Major S J Pearce RE in the April issue of the *Journal*, some paragraphs were printed in the incorrect order. The section starting on p.44 with the words "1 CEU production projects ..." and finishing in the second column of p.45 with the words "... numbered in its ranks", should have appeared at the end of the article as the conclusion.

We apologise for this mistake.

Museum Report

COLONEL G W A NAPIER MA, DIRECTOR OF THE ROYAL ENGINEERS MUSEUM

THE museum took another stride forward in its development on 29 March 1988 when the World War Two galleries opened. The ceremony was performed by Mr Ian Robertson, who has recently taken over as Director of the National Army Museum; he is also President of the Museums Association which is the professional society of the museums and museums people.

Work on this part of the museum has been in progress since mid-1986. Most of it has been done by specially picked Royal Engineer tradesmen and apart from anything else, the museum is now something of a show-piece for Sapper skills. The layout of the displays has been planned and supervised by Tayburn Design, a firm of professional designers with museum expertise.

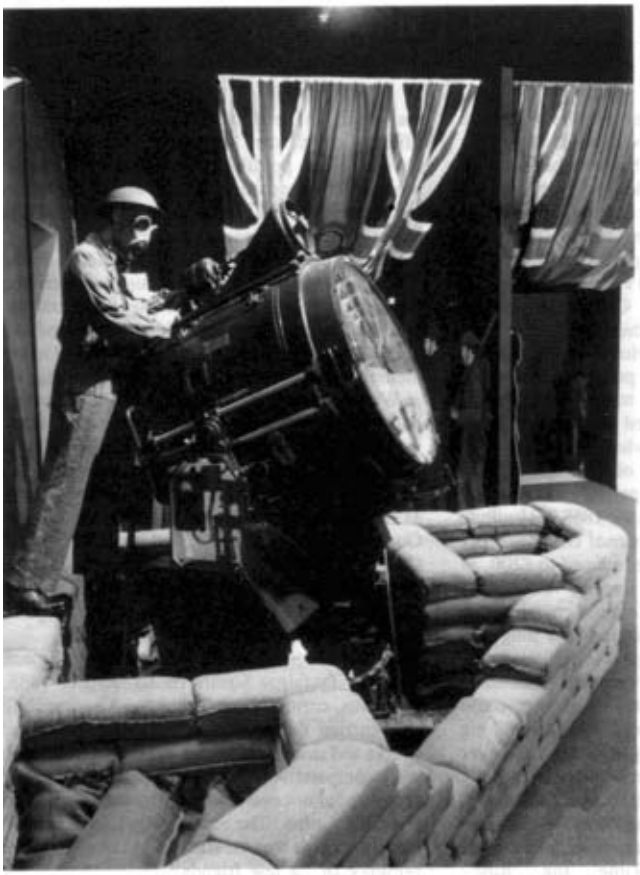
The opening of the World War Two galleries completes Stage I of the development plan and now offers to the public a very extensive area of galleries and a great variety of displays, many of them unique. Nowhere else in the world is it possible to see the map used by Wellington at Waterloo, a Brennan torpedo or some of the silk embroideries brought back by Gordon from China, all of which are in the section opened in 1986. The new galleries hold some very personal records of Sapper achievements in the war as well as presenting the better known highlights such as the Bailey bridge, Mulberry harbour, armoured engineering, bomb disposal and the great part played by Sappers in commando and airborne operations.

Planning for Stage 2 is well advanced. This stage will entail roofing over the courtyard of the Ravelin building to provide a great enclosed display in which will be recorded Sapper achievements since World War Two up to the present day. At the same time, the existing galleries will be enhanced with audio and video equipment to increase public enjoyment and appreciation of the displays. A tremendously exciting layout for the courtyard is planned which will entail, inter alia, installing some heavy items of plant some 1.8m above ground level, in the confined space available this is giving the project team some headaches.

Everything so far has been achieved from the donations made to the RE Museum Appeal fund launched in 1983. To pay for the developments beyond Stage 1, as many people will know, the RE Museum Foundation has been set up to attract support from individuals, from local authorities and from the engineering industry and other firms and organisations associated with the Corps. A highly successful start has been made towards the initial target of £750,000 and it is hoped that this will be achieved this year. The Chairman of the Foundation is Colonel P E Williams, TD, ADC, who presides over bi-monthly meetings of the Foundation's fund raising committee. Fund raising groups have been set up in various areas of specialization such as the construction industry (led by Mr H W A Francis CBE), the chartered surveyors (led by Mr Idris Pearce CBE), the consulting engineers (led by Mr P F Martin) and the City (led by Mr John Fitzmaurice and Lord Mais). Any Institution member who would be interested in being associated with this fund raising effort and in supporting the museum generally should get in touch with Colonel Williams through the Secretary of the Institution.

An Association of the Friends of the RE museum has also been set up to help the museum in practical ways. The Chairman is Colonel J E Kitching. Membership of the Friends entitles individuals to the free use of the museum on presentation of a membership card but it has also been agreed that members of the Institution will be regarded as Friends in view of the substantial contribution made to the museum funds from the Institution's subscription income. Therefore, all Institution members may use the museum free of charge and also bring a guest.

As to the future, a far reaching review has been launched to ensure that the results of Stages 3 and 4 of the development are not only going to meet the Corps wishes for its museum but will also provide for the necessary commercial activities to generate revenue to pay for future running costs. It is the firm intention that plans for capital development will take account of the need to cover all the likely costs of maintenance of buildings and support of the collection.



A Mk V 90cm Searchlight on Display in the New World War Two Galleries of the RE Museum

There is no doubt that the museum has got off to a flying start and is receiving much acclaim from many quarters both on the professional museum side as well as from the general public. Its future success is linked to the potential for tourism within the Medway Towns and the signs are extremely encouraging for potential growth in that area. But the RE museum is much more than a local tourist attraction - it will be a national museum of military engineering which will attract people countrywide. Its greatest need at the moment is for the word to be spread abroad as to what a magnificent collection there is and how rewarding a day's visit to Chatham can be.

Museum Report.

Early Days

MLC

THE sentence "Midsummer on the top of a Scottish mountain is not to be depended upon for any inconvenient amount of heat" rather sums up the 1888 *Journals*. The reader, of course, has to remember that the article, from which this sentence is taken, was written a hundred years ago (the subject was mapping Scotland by the Ordnance Survey in 1819, with particular reference to Major T F Colby). Style and presentation were different then and there is little virtue in poking fun now. However the *Journal* itself, both in content and presentation, would certainly not pass muster today! Perhaps the question which has been asked quite often in these 'Early Days' reviews—what on earth did contemporary readers think of their hotch potch publication—may have been partially answered by two speakers (both majors) at the 1888 RE Institute AGM. One said that the *Journal* cost £476 per year and this could easily be reduced to £200, as it gave poor value for money. The other commented that the *Journal* should contain more Corps news (and by implication less long and abstruse articles on all imaginable subjects), and that the *Professional Papers* were dull (he actually said they might be of more interest)! They could almost have been alluding to a series of very long and erudite articles, which appeared in 1888 over the initials JTJ writing from Beaumaris. A little research reveals that the latter was J T Johnston, Adjutant, Royal Anglesey Engineers. His subjects were 'Libel in Pencil' (an examination of the use of cartoons in the press), 'Time', 'Ink', 'Rust', 'Balloons' and 'Modern Advertising'. These must have taken much time and research, and despite being rich in latin and greek quotations did not seem to add significantly to the cause of military or any other engineering!

The AGM was much concerned with the need, or not, to have a base for the RE Institute in London and not just in Chatham. The base would consist of a reading room/meeting place and a library. Chatham, it was argued, was too far for officers to travel for semi-social occasions. As one speaker put it, it was a well-known fact that Chatham was "four times as far from London as London was from Chatham"! Since London clubs only served the few, the Corps, it was thought, was badly in need of a London centre where officers could keep in touch. The discussion covered the possibility of renting suitable premises. No decision was reached except to investigate whether, for an annual fee, the RUSI might offer the necessary facilities.

Gordon, as in 1885, figured prominently in the 1888 *Journals*. The occasions this time were the unveiling of memorials in Rochester Cathedral and in Trafalgar Square. The stained glass windows in the Cathedral included a group dedicated to the memory of those who served in the Peninsula and at Waterloo, as well as a group commemorating those killed in Egypt and the Sudan, the latter including Gordon. The remarks made by Lord Wolseley in August 1888 when unveiling the windows, and by the Dean in his sermon, were, as can be expected, dominated by the memory of Gordon. "That noble man, that great soldier and Christian, Gordon the soldier, Gordon the Martyr, Gordon the Saint." The Cathedral was packed and the Corps had clearly pulled out all the stops to stage a glittering ceremony.

At the unveiling of the ten foot high bronze statue in Trafalgar Square on 16 October 1888, there was, curiously, no ceremony. The unveiling was carried out by the First Commissioner of Works and since no publicity had been given, there were comparatively few people present. These, it seemed, did not even include any representatives from the Corps. The *Annual Register* for 1888 merely records that the statue was unveiled in the presence of "a few friends".

It is not everyone who earns a statue in Trafalgar Square and it is interesting to speculate on the contrast between the treatment of Gordon at the two ceremonies. Was Lytton Strachey's assessment already present in Government circles (complete with the brandy and soda image and the alleged disobedience of orders—to evacuate and not to hold Khartoum) and were Lord Wolseley and the Dean completely misled? In particular, why was the Corps not represented? Research is needed!

In support of these speculations, there is an account, in the October 1888 *Journal*, of the activities of the river steamers based on Khartoum during the Mahdi rebellion in the Sudan. In the

introduction the reader is reminded that, "except for General Gordon's defence of Khartoum, the actions of Englishmen form but a minor portion of the whole story. We know enough, however, of the actions in which no Englishman took part, to be able to realise that Egyptian officers and Egyptian soldiers did deeds well worthy of record. We give an account of an episode in which only Egyptian and Sudanese troops were concerned. We refer to the campaign of the steamers, which General Gordon sent to meet the English troops to give them a helping hand on the road to Khartoum". The article, in its preamble, also reminds the reader that the English Government played a dominant part in the tragedy in that "its deliberate abandonment of the Sudan to anarchy and its long delay in attempting to aid Gordon, had an important influence upon the chain of events." Perhaps the Government, even in 1888, felt that although public opinion had demanded national acknowledgement of Gordon's services, this did not necessarily mean that the Government itself need recall the events with any ceremony or favour, and consequently brushed aside the Trafalgar Square unveiling.

The RMA Woolwich got more than its usual publicity in the 1888 *Journals*. It may, incidentally, be of some interest to readers to know that the only school in 1887 to send more candidates to the RMA than to the RMC, Sandhurst, was Wellington College (18 and 17 respectively). Cheltenham sent the largest number to the RMA (19 and 20) while Eton apparently had no RMA candidates but sent 24 to the RMC! Marlborough figured fairly prominently (13 and 13) and to a lesser extent Harrow (6 and 8) and Winchester (0 and 7). The above list is not, of course, exhaustive.

The RMA was the main theme in extracts from a series of articles published in *Nature*, about the entrance examination and the relative weight given to subjects taught at the Academy. The *Nature* articles, strongly backed by the President of the Royal Society, concerned the mark values in the entrance examination, which seemed to penalise those with an interest in the physical sciences. In the new regulations 3000 marks were allotted to Mathematics, optional Mathematics, Latin, German and French (Group 1); and 2000 marks to Greek, English, History, Chemistry, Physics, Physical Geography and Geology (Group 2). Candidates had to take all subjects in Group 1, except that one subject in Group 2 could be substituted in place of one of those in Group 1.

The argument was that these regulations discouraged boys with an inclination to physical sciences, and was a retrograde step when compared with the old regulations, which allowed a free choice in all subjects as far as mark value was concerned. "But," as was argued in *Nature*, "with such a bribe as will now be offered for Latin and Modern Languages, we cannot think that it will often be worth while, even for boys of more than average scientific capacity, to adopt the study of science if they wish to enter Woolwich." Headmasters, too, it was alleged, were bound to encourage the study of languages rather than physical sciences by their Army classes.

The Secretary of State for War defended the changes by stating that they were intended to encourage subjects less easily crammed, and to give weight to those subjects which were likely to be of the greatest practical import to the majority of officers. This latter argument was swiftly demolished in a further *Nature* article, which pointed out that in their final year at Woolwich, those selected for the Sappers only studied Mathematics, Chemistry, Physics and freehand Drawing. For Artillery candidates in their final year, Chemistry and Physics alone of the subjects examined at the entrance competition were considered important enough to be retained. It thus seemed that in the overall education of the cadet, Experimental Science and Mathematics were the subjects held to be of real practical importance, and there was no logic in these seemingly unnecessary changes in the entrance examination. The only ray of hope seemed to be that the "frankness with which Mr Stanhope (the Secretary of State for War) admits other deficiencies in the system of our military administration, encourages the expectation that he will act in this matter also with an equal degree of practical sense." Politicians, please note!

Political influence on school teaching was not the only subject in the 1888 *Journals* to have a topical flavour. Lieut General Sir Andrew Clarke, who had recently retired from his final appointment as IGF, was reported in the *Broad Arrow*, the Civil Service Journal, as being of the opinion that the reason why Government shipyards could not turn out work as rapidly, cheaply, or as efficiently as private firms, was due solely to defective administration. Sir Andrew was

criticising the policy by which the Royal Dockyards were kept fully manned but on short time, while, at the same time, contracts were "poured into private firms." It is not quite clear whether Sir Andrew was in favour of wholesale privatisation or in discovering the secret as to how to make Government Yards more cost effective!

Many of us may think Orienteering is a comparatively new item for inter-unit competition. Not so. An article in the April 1888 *Journal* starts with the sentence "The chart and compass is a novel feature in soldiering, and the competition which took place recently at Mozufferpur .... deserves some special mention." The description of the race, in this case for men and horses, seems exactly to mirror modern orienteering, although it might be more difficult to find the modern counterpart of the competitor who, in order to pass the judges' initial inspection of rider and equipment, and having apparently lost his obligatory compass, had provided himself with the top of a brass inkstand!

One final thought about JTJ of Beaumaris and his disparate articles. Perhaps the editor in those days set out to help aspiring authors to be published, irrespective of their chosen subjects. An idea for today as well!

(Or perhaps he was more desperate to fill his space—Editor)

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Tunnellers

BRYAN FRAYLING CBE

This article is condensed from the memoirs of Bryan Frayling CBE, the World War One tunneller who died in 1986 at the age of 93. His full memoirs covering many aspects of his life as a mining engineer are lodged in the RE Corps Library. We are indebted to Derrick Vernon for this extract and to Mrs B E Frayling for her permission to use the memoirs.

BEING a member of the Institution of Mining and Metallurgy, and as a consequence of a War Office request to recruit their members for the new tunnelling companies of the Corps of Royal Engineers, I was transferred from the Signals branch with my fatherly batman driver to the 171st Tunnelling Company.

With armies entrenched face to face there was time to undermine an opponent. When World War I started the Royal Engineers had one siege company in which tunnellers were concentrated. The subalterns of this company were all promoted acting majors in charge of the new tunnelling companies. The outstanding of these, Major Hyland, was CO of the 171st Tunnelling Company. He went from subaltern to brigadier general in under four years, a remarkable advance. I was only in trouble with him once. He looked at the sky and said, "Isn't Venus marvellous." I replied, "Marvellous but surely it's Sirius." He flared up and said, "If I say it is Venus, it is. If your Commanding Officer says it is the Moon, the Moon it is." The next night he pointed at the sky and asked, "What is that?" "Venus, Sir" said I. "You damned fool it's Sirius" said he. The Regular Army being what it was that may have been a gracious way of telling me he had revised his astronomy or it was just a leg pull!

The company started with clay 'kickers', not miners. They had been taken from sewers in Manchester and underground railways in London, put into uniform and sent straight to the front without drill. Instead of a pick the clay kicker uses a grafting tool, a small spade with a sharp edge which he uses lying on his back or against a backrest at the clay face. Because we specialised in this work 171 Company was kept in the Western Flanders area where the subsoil was clay. Some companies tunnelled only in chalk areas of the front.

One factor made a sharp difference between the companies working in clay and those in chalk. In the clay it was possible to work silently. In the chalk the sound of work could always be detected often by ear but always by listening instruments. In the chalk both sides heard and often let off charges to destroy each other. If the charge was not intended to break through to the surface it was known as a *camouflet*. These left poisonous carbon monoxide gas in the shattered ground. These actions did not tell the other side much that he did not know already if it was a chalk area.

In the clay *Silence and Secrecy* was the motto. We wore felt shoes, had rubber-tyred trucks on wooden rails and spoke in whispers. The enemy was likely to suspect tunnelling if he saw blue clay on the surface. The little trucks we had underground took a filled bag of blue clay. These were either dispersed under camouflage or used well away from the shaft and where they would

Bryan Frayling CBE
Tunnellers.

not be seen. If the distinctive colour of the clay was seen by the enemy, directly at ground level, from observation balloons or aerial photographs, he knew we were digging down deep for some reason. The greatest care was taken to prevent the enemy estimating the amount of spoil from aerial photos. These photos were then primitive but most informative.

The simpler of the two kinds of listening instruments we used was called the geophone. It was small and could be put in a coat pocket. With the geophone one could hear earthworms crawl and ants walk. Listening to a pin drop shocked the eardrum. It was a great aid in reassuring infantry who heard noises. We would invite them to use the geophone to confirm there was no sound of mining. Hearing the background noise they would say it seemed to them that a dozen Germans were tunnelling just underneath. I would then tip an earthworm out of a tin and invite then to listen to it crawling around. To clinch the matter I would release the ant I had brought in a phial and tell them to listen to it putting its feet down. On the geophone it sounded like an elephant walking around in lead-soled boots. The other listening instrument was called the Western Electric.

Once one of our tunnels was so near a German shaft sinking operation that an officer who understood German took down a series of bawdy stories which the enemy NCO told his gang.

Most of the tunnelling in the clay area was planned to take from three to six months before being ready for blowing. When the Germans fired a counter charge in the clay we kept quiet and tested for carbon monoxide gas but were careful to give no indication that we were shaken or underground in that area at all. It was through these keep quiet and camouflage tactics that the series of mines under the Messines Ridge was completed and reserved for the great day.

Although the first draft to the company had been clay kickers the rest were coal miners. These came from all the coalfields of Britain. I soon formed the opinion that in a difficult situation underground one Geordie from Durham was worth two of any other kind. The Durham miner had had a hard upbringing in steep, narrow, wet seams. It was a Geordie who, on enlistment, was naked in front of the Medical Officer who asked, "Have you been circumcised?" "Oh no Sir," replied Geordie, "That's just fair wear and tear".

I have mentioned testing for carbon monoxide gas. This was a product of large charges exploded underground, particularly those which did not break through to the surface. Carbon monoxide is colourless, odourless, accumulative in combination with the blood, and fatal. Each tunnelling company had a team trained in the use of the Proto oxygen mine rescue apparatus. My new unit sent me to take a course at the Army's Mine Rescue School. The tunnelling companies had special Medical Officers who were directly under their own specialist Medical Officer at GHQ.

There was a period when a few civilians were clinging to Armentières. One was an elderly widow who ran a wine merchant's business under her name Veuve Dumez Phalempin. From her the Mess procured excellent Burgundy (Pommard and Volnay). One day she said the shelling was getting too much and offered the balance of her stock for a nominal price. She accepted my personal cheque and hundreds of bottles were put in the lorry. These were handed over to the Mess and I got credited on my mess account. When next on leave I went to Cox's to see what money I had if any, and a paternal clerk raised the matter of the burgundy cheque. He was not worried by its amount or that I had made it out for francs; he was concerned that one so young should be writing a cheque so large for a designing and obviously immoral French widow!

At first white mice were used to give warning of carbon monoxide. They are more sensitive to the gas than are humans but they have to be observed carefully to see if they become unsteady and one has to listen for a particular distress squeak. Our company was made the centre for distribution of mice to other companies. A sapper had about one hundred in his charge and bred them as required. He became quite a mouse fancier and got hold of fawns, piebalds and other colours.

In the trenches there was an outbreak of endemic jaundice, a disease transmitted by fleas from rats and mice. A Medical Officer at Base telephoned to say he had been told the Army's stock of mice was with us, could he have some quickly for research. I happened to take this call. I asked how many. He replied he really wanted a thousand but would be grateful for any. He gave his programme. The sapper in charge of mice stepped up the diet, encouraged the young females to be precocious and delivered in time batches totalling a thousand.

A very senior General suddenly turned up to inspect our behind-the-line quarters. After asking why we were cutting steel girders and so on he demanded to see our potato peeler. Unfortunately he had invented one and issued a circular about saving manpower with it. Our potato peeler, the cook's mate, whose trousers started below his navel and whose singlet stopped above it, ruffled the General considerably. Trying to deflect him from places where he would see worse, I asked him if he would like to inspect the white mice. He nearly exploded. Apparently he did not know we carried these animals officially. I managed to get him to the mice and then he realised my suggestion was serious and not whatever he thought it was. He complied with custom, came to the Mess and was genial.

Canaries replaced mice. They are more sensitive than mice and when affected by the gas fall of their perch. They thus give a definite and earlier warning than mice. To make sure they fall, the perch must be of appropriate thickness and the bird's claws pared. When gassed the birds were quickly taken to fresh air and they recovered.

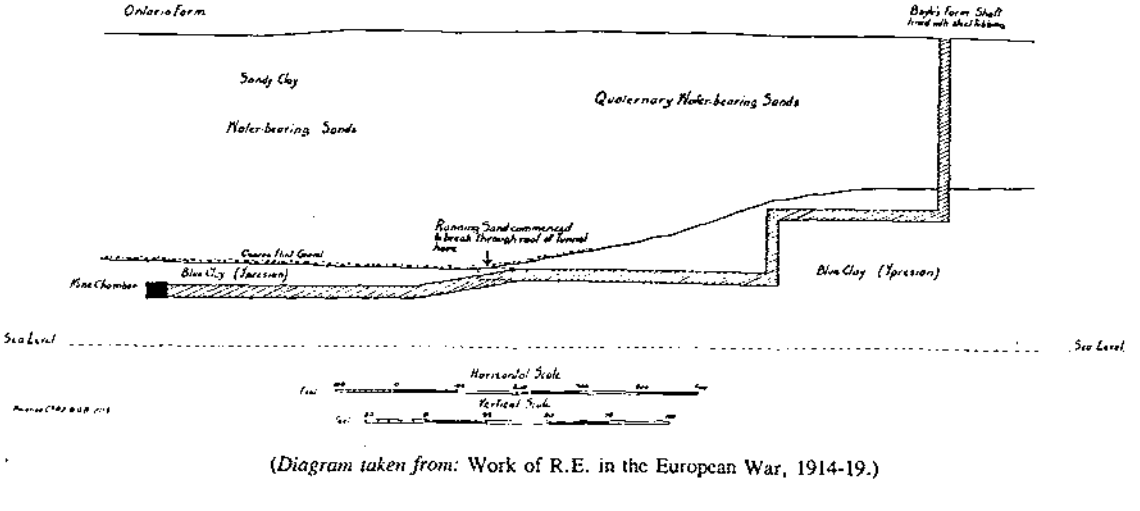
One of our canaries which had given such warning several times was pensioned off at the request of the men, who were sentimental about him or her. I cannot remember if it was cock or hen. I was very pleased when I saw the Tunnellers mice and canaries commemorated on the war memorial in Edinburgh.

The mine at trench 127, when nearly 700 feet out and at 70 feet depth, ran into an old bed of the River Douve. Nearly 100 feet of drive were lost before the rush of yellow quicksand could be stopped and a diversion started. I was officer in charge there.

The explosive used in the charges was ammonal. It had a slow lifting effect like gunpowder. It had not long been in military use. An indent for some brought the query did we want ammonal the explosive or ammonal the drug 'for the reduction of sexual pensiveness in males.' As we had asked for several tons we were flattered.

Some of the charges to be put in the Messines Ridge were much larger than any used formerly but infinitesimal compared with atomic explosions today. As the rate of detonation for ammonal is slow it was decided to ensure simultaneous detonation throughout the charge by having

SECTION SHOWING MINING OPERATIONS UNDER OLD RIVER CHANNEL BETWEEN ONTARIO FARM AND BOYLE'S FARM NEAR FOOT OF MESSINES RIDGE.



(*Diagram taken from:* Work of R.E. in the European War, 1914-19.)

electric detonators spaced at intervals. These detonators were to be inserted in sticks of dynamite, straight dynamite not gelignite. Besides linking the detonators electrically it was decided to link them with *cordeau détonnant*, which is TNT in a lead tube. TNT has about twice the speed of detonation of ammonal.

I was sent off in a lorry to collect the *cordeau détonnant* and a ton of dynamite. I had with me a subaltern from British Columbia and a driver. We reported to the Assistant Provost Marshal in Paris. The APM was Maurice Brett the husband of the well known musical comedy star Zena Dare. His riding boots had the highest polish I had ever seen. They were like glass. These boots were like a large poster telling us of the quite different military world which existed well back. He put we two officers in the Hotel Caumartin and arranged for our lorry to pick us up there the next morning. We had no pass to roam around that night so it was only from hearsay I learnt that the chorus at the Folies Bergere wore sporrans, in honour of *les Ecosses*, but behind.

Next day we went to Ivry (Seine et Oise) and collected the *cordeau détonnant* from French Ordnance. They did not have dynamite and gave us documents enabling us to collect it from an explosives factory in Honfleur. We had quite a business getting past check points. The chap in charge thought us three nonchalant young men totally unfit to go off with such a load and was obviously glad to get rid of us. Dynamite is a dangerous explosive to handle that is why it is converted to the safer gelignite form for commercial use.

I might as well dispose of the dynamite. This went into the mines under the Messines-Wytschaete ridge which were to be blown on the great night of 6/7 June 1917. I had hoped I would be allowed to push down the switch for Spanbroekmolen, the deepest and most overcharged of the mines and which I chambered and originally loaded. It was driven 1717ft, was the deepest and had the largest charge. I did not achieve this ambition as I was ordered to observe from Kemmel Hill. What I saw provides quite unique memories. Officially twenty-three mines went up. I reckoned I saw nineteen. In all nearly five hundred tons of explosive. Today we think in atomic equivalents of millions of tons.

At one end of Kemmel Hill camouflaged Forward Observation Points were enlarged and covered with steel girders as a hush hush operation. On the night 6/7 June 1917 one of these was used by the Commander-in-Chief and rumour said an important civilian, possibly French. The other was for war correspondents. When the mines went up the occupants of these FOPs must have been shaken like dice in a pot.

Some days in advance I chose my observation point in the open and well away from the grandees. I had two subalterns with me on the night. On our way to the point I challenged two figures in the dark. One was a war correspondent who wanted to be away from the crowd on his own; the other was a Chaplain. I told them if they liked to follow I could promise them a good view. First there was the tremor which travelled over twelve miles. As the glow of the mines lessened the Chaplain said "The Earth opened and swallowed them up". I said "about a million pounds of explosive". The newsman must have represented the *Daily Express* because on 8 June it carried the headline "A Million Pounds of Explosives Fired Under the German Lines" and a column was headed "The Earth opened and the Line Disappeared".

The overcharged mine Spanbroekmolen was like a white incandescent light darting high in the air. We had calculated the enemy here would go up as gas at over 3,000 degrees Centigrade. It left a deep crater and the largest piece of enemy I could locate there in daylight was a foot in a boot.

One of the other mines was a "common" mine; that is the charge was calculated to be just enough to lift everything, shake it and drop it back leaving little crater effect. This glowed orange red with black smoke. I duly reported there were two minor after-flashes a second or two after the main one in this case. A poker faced senior told me there was no such thing but I believe a few of our advancing infantry got burns. Here an officer of our company reported that some of the enemy lifted by the explosion and dropped again in the rubble were alive for a short time but dead before the stretcher parties got to work. All the mines went off though some had been waiting over a year.

My Notes on Observation of Mines from Kemmel Hill

> When time was approaching zero, Second Lieutenant Gethin was watching Spanbroekmolen, I was watching Cruistadt

group, and Second Lieutenant Walker was watching Ontario Farm.

At zero we had aligned on the requisite bearings but it was quite dark. The first thing I knew was a violent shaking of the ground. A very appreciable time elapsed before a column of flame went up where I was looking for Cruistadt group, what I took to be the remainder of the group going up in quick succession, but yet another went up in this group after the first ones. I had the impression that four separate explosions took place, the last being most southerly.

There were two or three quite big secondary explosions after the mines first cratered, they could not possibly be big shells many of which were falling in craters.

I found it impossible to check the seconds interval with my watch, it required all my attention to register the separate explosions.

While observing my own group I was able to note that Spanbroekmolen went up apparently a little before but practically simultaneously with Cruistadt.

The flame from this mine was distinctly forked at its full height. Second Lieutenant Gethin seems very uncertain as to what he saw, so was unable to say whether Spanbroekmolen was the first to go up or not. He did however see the forked effect.

While this was happening about ten or twelve other mines went up north and south. When they were all up in the air together it was very difficult to concentrate on one.

The last of all to go up was Ontario Farm. It was a long time after the others, though I could not state how long after in seconds. I know I was able to register in my mind details of the others and then wait for it. The explosion was of a very red colour and had none of the white incandescent appearance of the other mines. The flame did not reach more than half the height of some of the others. Second Lieutenant Walker corroborated all my account of Ontario Farm and Cruistadt. He did not attempt to observe Spanbroekmolen.

Junior officers and other ranks were not supposed to have opinions about very senior officers but we all knew when we were under General Plumer's Army Command, there was a clear cut plan and maximum efficiency. Any reference to a certain other Army Command were universally unprintable. Everything under General Plumer was successful, under the other a flop. The irony of the system is that the enemy, by having

Crater at Ontario Farm (*The photo taken from:* Work of R.E. in the European War, 1914-19.)

listeners in prisoner-of-war camps and by questioning prisoners as soon as they were taken in raids, would ascertain the collective opinion of the small fry and value it. On our side discipline and etiquette would keep it muffled.

Tunnellers were Army troops and so did not move when Brigade, Division or Corps moved. Through this the 171st Tunnelling Company was in the Passchendaele business for the whole of it, very likely the only unit to be in it from start to finish. In the Passchendaele salient our company had over one hundred casualties, noticeable in a small unit but not much against the three quarters of a million casualties on our side over the whole of the Passchendaele affair. Strain started the night the enemy killed over one thousand transport animals with their phosgene gas. For hour after hour, mile after mile, night after night it meant getting round the job in a gas mask. The donning of a gas mask seemed to take away a third of a soldier's efficiency. If the design of gas masks had evolved with the care given say to the design of machine guns it could have been a major contribution to the winning of the war.

Phosgene affected breathing and pulse. Fritz varied the diet with mustard oil gas, a skin blisterer affecting the lungs fatally and thermite shells, which were meant to burn holes in our steel helmets but didn't. It was dinned into us that gas casualties were unsoldierly slobs who had not used their gas masks. I was now a captain, slept in daylight behind the line and at night rode a motor cycle to the communication trench and then on foot round my jobs in the front line. If one could ride a motor cycle wearing a helmet on top of a gas mask and see in the dark the job was straightforward!

Dead transport animals had to be got off the road urgently so that the next night's transport could get through. After being dragged off the road they lay around unburied until someone could be spared to shovel earth over them. The Germans were much more methodical. They got their dead animals back to factories where the hides and fat were saved. During the final advance I saw one of their lorries labelled *CADAVERSWERTUNG*. I am sure only animal corpses went to them but our propaganda machine took advantage of the fact that the Germans were equally methodical in disposing of human corpses.

Whereas we buried the dead near where they fell, when we advanced we found German corpses bundled for transport back to organised cemeteries. Our Intelligence had known all this and the propaganda machine had managed to get rumours to the German troops in the line that their margarine was made from their deceased comrades. This put them off margarine when their diet was deficient of fat during the winter.

One night I was with two other officers sorting out supplies where the lorries had dumped them. A shell of the type we called whizzbang exploded as the three of us almost had our heads together. One of my companions was dead, the other severely wounded and I was only a bit deaf. When my brother was killed my mother told me that she felt she would lose him but confident I would get through. I had this confidence myself most of the time.

Sandbags often had the name and address of a factory girl pinned on them. As these jute bags were made in Dundee the notes were handed to the Scots in the unit. I did hear one satisfactory romance resulted.

One never knows how people are going to turn out in war. In my batch of subalterns there was a benevolent soft spoken undergraduate who wore glasses. At the front I found him peddling a new mortar he had invented himself, the Livens projector, which would drop on the enemy anything one liked, explosive, coal tar, canned sewage, the lot. This brings to memory the ruined farm. It was on no-mans land between the lines. Our company was detailed to tunnel towards it, rise up to it and make a concealed Forward Observation Post. They were rising step by step under the farm when the tunneller at the face sent for his section officer because the roof looked doubtful. The officer arrived just in time to share the unsavoury rush as they holed out into the bottom of the farm cesspool. While cleaning up and finishing the job the whole section found themselves pariahs.

Near our behind-the-line camp was an observation balloon. An enemy plane shot it up with incendiary bullets. As this frequently happened to these balloons we thought "what a ghastly occupation". The observer who had baled out, landed with his parachute, came into our mess and said "Tunnellers, what a dangerous jobs".

Most of us at the front thought Bairnsfather's cartoons exactly hit off front line humour. I did. I have two bound booklets of them. Many civilians thought them outrageous as belittling the

chivalrous knight in armour concept. My aunt Jay, so keen on waggling a sword vicariously, hated these cartoons.

As static warfare seemed at an end the high command started thinking up new roles for the tunnellers. I went to a storm-troop course. It was the longest of the courses on offer, four weeks I think, so being Adjutant by then I sent myself. Special sergeant-instructors told us what to do in close combat at night with ordinary weapons, special weapons, no weapons, nails, boots or teeth. One chap pleaded he had false teeth and was at once told to take them out and use them as knuckledusters. All the different forms of rough and tumble had the object of killing the enemy if possible or at least emasculating him. One had visions of the surviving enemy singing a Wagner opera falsetto. When I got back to the 171st I was told Adjutants were not expendable on raids by order from GHQ. I had had a good rest and come back very fit.

Soon the advance was on and the company was removing booby traps. These varied from charges that went off if one picked up a dropped fountain pen to those with time fuses in railway culverts. These could be delayed up to twenty eight days.

During the advance in the Lille-Roubaix area I found myself where everyone was dressed in velvet. A local factory made it and the people had no other cloth. It was somewhere round there that I opened my map and having been ordered to get to the *brasserie* unfortunately asked for the *brassière*. I do not think either breweries or bust bodices were discussed in school French lessons! In Lille, girls who had fraternised with the Germans were having their hair cut off in the street by sterner matrons.

Next we were on heavy bridging. While I had been stormtrooping others had been taking a course on bridging.

Relief on Armistice Day made us realise the strain of four years of war. The strain had not been so apparent before. To put it another way, we would have been a weary lot if we had had to start again.

A senior regular officer suggested to me I should stay in the Corps. I liked the idea but told him I could not afford to unless I could hang on to a captain's pay. At that time it was considered necessary for an officer in peace time to have six hundred pounds a year private income. I had nothing. As a subaltern I had started at one hundred and twenty pounds a year and as a captain only got about three hundred and thirty. My backer kindly made enquiries and I was told my substantive rank would go back to second lieutenant ranking after the batch of regular cadets currently at the Shop. To balance this I was told I could stay in the Army of Occupation and probably draw acting major's pay while that lasted. I just could not afford it so regretfully asked for leave. Perhaps the deciding factor was that I was told there would be no peace time tunnelling companies.

There has been much criticism of those who volunteered to fight in this war. There was no jingoism. We genuinely thought and probably correctly that the Germans intended to invade Britain after conquering France and that if they did they would treat women and children brutally. They certainly perpetrated horrors in Belgium and France.

Our generals have been blamed for the carnage. If the war had been fought in a desert or over some neutral country the casualties would have been much fewer. Our generals manoeuvred within the restricting brief that not a square inch of sacred French soil must be lost to the enemy. The French were not pleased when they themselves surrendered a part of France but they were bitter when their perfidious allies did. We being under this handicap the Germans succeeded over large areas in making us hang on to low lying ground which they overlooked.

On 4 December 1918 the Commander-in-Chief had issued an Order of the Day expressing his farewell to Tunnellers being demobilised. It included the words: "They have earned the thanks of the whole Army for their contribution to the defeat of the enemy. Their fighting spirit and technical efficiency has enhanced the reputation of the whole Corps".

BIBLIOGRAPHY

GRIEVE and NEWMAN "Tunnellers" Herbert Jenkins 1936

Tunneller's Diary

We are indebted to Brigadier C H Cowan CBE for this extract from a family diary which reflects the atmosphere of tunnellers work.

"...After the usual dinner in 'B' Mess I wrote my report which Gen Allenby signed, inquiring as usual when I meant to go on leave. There was no further development of Col Wilson's scheme, much to my relief, and so home to bed about midnight.

25TH AUGUST 1915

I couldn't sleep and felt that there was something coming and sure enough a Motor Cyclist arrived with the news that *Firebrace* had definitely located *Fritz* under our own trenches at a new corner on *Hill 60* and Brig Gen Kemp wanted my advice at once. I was very sleepy and was arguing the matter out with Harris when Col Philip Game, GSO 1 46 Div, rolled up in a car, duplicating the alarming news. A car is much nicer than a sidecar so we agreed I should come on with him, see Gen Kemp and phone to Firebrace.

We got on all right, and I had my talk, winding up with instructions to F. to put an 8 inch borehole down on top of the noises and await our arrival. Then Philip and I made record time from "Shrapnel Corner" along the railway and up to 60. On arrival we found that F. had only got down 7 feet instead of the 10 I wanted and that alas not over the very loudest noise which was in a dugout about 15 feet back from our front. I felt we had to *mak siccar* so we very soon had the roof off the dugout. Its funny how quickly men work when exposed from the knees upwards with Fritz about 60 yards away and dawn just breaking! Then we started the hole and were stopped like F. by a layer of flinty pebbles about 7 feet down.

Luckily we found an iron bar and were able to punch the pebbles loose and collect them with the boring tool, making enough noise to be heard in Berlin but it had to be done. When the hole was 12ft down I left them to put 50 lbs of stuff in, tamp and fire but to my horror nothing happened. It was a time fuze (which by the way I don't like). We pulled it out and found it had burnt to the end all right and the horrible idea forced itself on me that the Germans had found our charge and removed the stuff.

The only thing to be done was to remove the tamping and see so the borer was set to work again and at last we saw the upper end of our zinc cylinder. Query: was there anything in it or not? Once more our iron bar came in handy and we drove its point through the zinc and it came up covered with Ammonal to my relief. We then put 3 electric detonators in a 5 lb tin which we bedded down with about 20 lb more and replaced the tamping and withdrew about 30 yards round the corner and let her go.

And she did go — we were busy dodging earth and sandbags for nearly a minute and then had to creep back to see the result which was a hole about 30 feet across and 12 deep. Now 75 lb could never do that so the only conclusion was that our charge had succeeded in blowing up a much greater German one under our feet — luckily for us at our time of choosing not at his. It was a stroke of luck but all the same I don't think any of us exactly hope to have to do it again!

Philip and I walked slowly home to breakfast with the Brigadier after which I went back to Vimy and slept the sleep of the half dead. I wrote in a report later on and recommended 3 of the men for the DCM which I am glad to say they received while I was home on leave. I dined with General Kemp and it was a much pleasanter night than the one before. He fully agreed that we had got Fritz badly."

Ex Bluebell Bridge

LIEUTENANT S M CLARKE BSc (ENG)

Lieut Susie Clarke was commissioned in 1985. After completing the YO Course she went to 52 Field Squadron (Construction) RE, did a Falklands tour and a tour at RAF Bruggen during a major TACEVAL. Since May 1987 Lieut Clarke has served as a Troop Commander at 3 Training Regiment.

"THAT was a big bang!" That comment came from a TVS reporter and referred to the demolition of Ketches Bridge!

When I came back from leave I found that the troop project had changed from a potential children's adventure playground to the demolition of a bridge. The task was somewhat unusual as the request came from the Bluebell Railway Company, which runs a short stretch of line from Sheffield Park Station to Horsted Keynes in Sussex. Located about 600m along the line from Sheffield Park Station, Ketches Bridge is an old (over 100 years) masonry arch bridge, which used to carry a farm track over the railway line. Although the Company's aim is to preserve the stations, trains, and line in their original condition it was decided that Ketches Bridge should be demolished as the cost of repairing it was estimated to be £10,000 against £4,000 for demolition — half for the explosives and half for the plant hire.

Elements of 57 Training Squadron began preparatory work on Monday 5 October 1987 ready for the demolition to be fired as early as possible on Tuesday. The track had to be cleared of rubble in time for the 12.40 to Horsted Keynes on Wednesday and we all know that tide, time and trains wait for no man — or woman!

THE bridge had a span of 7.6m and an overall width of 4.3m and the railway track did not pass centrally under the bridge. The task given to us by the Company was to drop the arch and one abutment wall, whilst leaving the wall closest to the track standing. The Company would then clear the abutments out mechanically, in slow time. In order to prevent the one abutment from being blasted across the track it was decided to use borehole instead of mined charges. Three rows of six holes were drilled 0.8m deep, the centre row being offset from the others. After the first couple of holes had been drilled, it appeared that the brickwork was a little over lm deep. When all the holes had been completed it became apparent that behind the front 1.2m of wall there was a void of about the same depth and probably 3m wide. At very short notice several lengths of 38mm square timber were bought to block the boreholes which had been drilled through to the void. Each hole was packed with 5½ PE4 cartridges.

The arch ring was attacked on the springing lines with charges placed on the parapet walls, the spandrel walls and the arch ring. (The roadway had to be dug out to a depth of 1.5m before the brickwork was revealed). A total of 33 slabs were used on each cut and they were then tamped with sandbags.

Lieutenant S M Clarke BSc Eng
Ex Bluebell Bridge

Photo 1. Ketch's Bridge — Work Under Way

Once everyone had withdrawn the button was pressed ...

THE west abutment remained standing — as ordered; the arch was down and the face of the east abutment was down with the remainder severely loosened. (The void turned out to be three separate arched cavities). Damage was minimal: the brickwork had remained within a 75m radius and the trees still looked healthy.

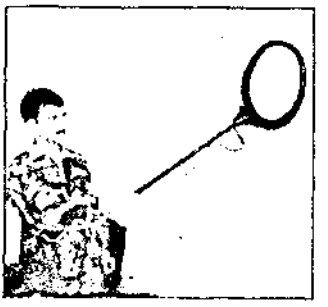
Once the site had been cleared for explosives, the volunteer work force from the Bluebell Railway Company descended like hungry wolves and had the track passable within two hours; the press retreated with their happy snaps; and the Sappers returned to Gibraltar Barracks satisfied with their handy work and with renewed confidence in ME Vol 2 Part 3 Pam 4.

THE result...

... a complete success.

Ex Bluebell Bridge 1







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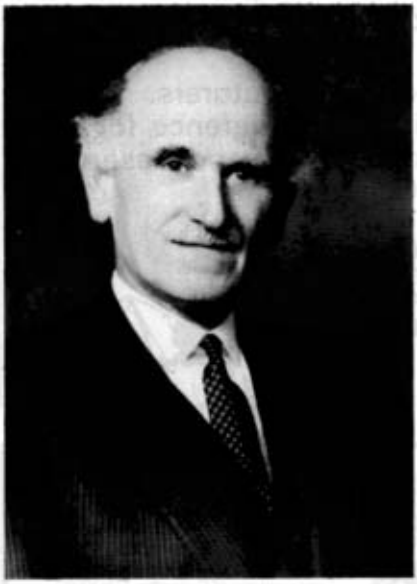
Memoirs

BRIGADIER C A LANGLEY CB CBE MC FCITBorn 23 August 1897, died 21 November 1987 aged 90



CHARLES ARDAGH LANGLEY was born in Cork, the son of John Langley, Under Secretary of State to the Egyptian Government. He was educated at Cheltenham College before going to the Shop and was commissioned into the Corps in 1915. The following year he went to France and served in 8 Field Company, ending the War on the Rhine. During his service in World War I he was awarded the MC twice, and was three times mentioned in despatches.

After returning to the UK, he went up to Emmanuel College, Cambridge for the one year special engineering course, before going to the Railway Training Centre, Longmoor, in 1922, to begin his long association with the Transportation side of the Corps. He was seconded to the Great Indian Peninsula Railway from 1927 to 1933 for work on the electrification of the Bombay-Poona line, which included power station construction, and he then returned to Longmoor for the next five years, becoming Chief Instructor Railways. Between 1938 and 1940 he served in the Transportation Branch in the War Office.

In June 1940 he was promoted Colonel and sent out to the Middle East as Director of Transportation, where he had the onerous task of developing the Port of Suez and handling the growing volume of troops, equipment and stores despatched to the Middle East. In August 1941, he was posted to India to form No 1 Transportation Training Centre for the Indian Engineers at Bombay for Docks and IWT personnel. He was promoted Brigadier in December 1943 and appointed DQMG (Mov & Tn) South East Asia Command. For his service in the Far East he was mentioned in dispatches and awarded the CBE.

In 1945 he returned to Longmoor as Commandant, retiring in 1946 from the Army to become an Inspecting Officer of Railways in the Ministry of Transport. In doing so he was following a long tradition since all his predecessors as Inspecting Officer, from 1840 onwards, had come from the Corps. He became Chief Inspecting Officer in 1958. During his time in the Inspectorate he was involved in many important accident inquiries including the terrible collision at St Johns, Lewisham in 1957. He retired for the second time in 1963 and was awarded the CB (Civil).

He then began his third career as a railway consultant, first with British Railways and then with UKRAS (UK Railway Advisory Service) a consultancy service set up by the Ministry of Transport. During his time with BR he was a member of the British Railways Board Industry Policy Committee, chaired by Dr Beeching. Moving to UKRAS he was involved, as Project Manager, in the electrification of the Pakistan Western Railways before becoming Managing Director, in which capacity he travelled all over the world. In 1972, at the age of 75, he reluctantly agreed to reduce some of his commitments but nevertheless continued as a very active part-time consultant, first with Transmark (the BR overseas consultancy service) and then with Kennedy & Donkin, the consulting engineers, until his final

Brigadier C A Langley CB CBE MC

retirement in 1982. In these last years of active work he made a valuable contribution to the development of plans for the Hong Kong Mass Transit Railway.

He lived for many years in Farnham, and after his third retirement he continued to help with various welfare organizations as well as being a keen gardener. He was twice married, his first wife having died in 1931 and his second in 1981. He is survived by a son, three daughters, eleven grandchildren and a number of great grandchildren.

Ardagh Langley was a Sapper in the best tradition of the Corps: a gallant officer in war, a skilled railway engineer with a widespread reputation, and an efficient staff officer.

He was saddened by the decline in the Tn branch of the Corps, resulting from modern methods of Army logistical support and was a regular attender at RE (Tn) reunion functions. He would have been equally sad had he lived to see the approaching end of the long tradition linking the Corps with the Railway Inspectorate.

JCW IKAMcN CFR

BRIGADIER K F DANIELL CBE BA

Born 22 October 1910, died 24 February 1988, aged 77

KENNETH FRANCIS DANIELL was born in India, the only son of Lieut Colonel F E Ll Daniell DSO, Seaforth Highlanders. He was educated at Malvern College, and Gonville and Caius College, Cambridge. Despite his mathematical ability and against all academic advice, he joined the Army and was commissioned into the Corps from RMA Woolwich in 1930. After initial service in the UK he saw service in Southern Ireland, then went to Malta where he commanded a fortress company RE. Having attended Staff College, Camberley 1940-41, he was appointed GSO2 HQ 9 Corps. In 1942 he was posted to the Southwest Pacific, but, since the Japanese got there first, he was diverted to India and assumed the appointment of SO2 RE(Ops) under the Chief Engineer HQ Eastern (later Fourteenth) Army. He had a special affection for 208 Field Company RE which he commanded up to and in the battle for Kohima.

As written in the book *Sussex Sappers*, he "endeared himself to the Unit as few other officers did. His interest in each man, particularly the welfare cases, was most appreciated. He made efforts to stay with the Unit but the CRE insisted that he should take the posting which would, and did, enhance his reputation in the Corps." This

posting took him as an instructor to the Staff College, Quetta, and then as SORE 1 (Ops) to Chief Engineer HQ Twelfth Army in Rangoon where he was mentioned in dispatches.

After attending the US Command and General Staff School at Fort Leavenworth, USA in 1946, he was posted to GHQ Middle East Land Forces, Egypt, as AAG between 1946-49, and then qualified at Joint Service Staff College, Latimer.

A spell of regimental duty followed, first as 2IC 3 Training Regiment RE at Cove, and then in 1951 as CO 9 Training Regiment RE, Southwood Camp, Cove, where RSG writes: "As Adjutant to Ken Daniell for 18 months, I could not have wished for a better CO. Firm but fair to all, always

Brigadier K F Daniell CBE BA

willing to listen, respected for his calmness with which he dealt with the daily problems a large national service training regiment produced. My wife and I will never forget the kindness Ken and his dear wife Doreen showed to us both before and after our marriage during our time at Cove''. Ken had met and then married in 1935 Doreen French, daughter of Canon French of Rushbrooke, Co Cork, when Ken had been serving on Spike Island, Southern Ireland.

From regimental duty he went to the TA Directorate in the War Office as GSO1 in 1953. This was followed by promotion and command of 27 Engineer Group TA in 1955; he then went back to the War Office as Colonel Q Equipment from 1958-1959.

Promotion to brigadier followed as Brigadier AQ, HQ 1 (BR) Corps, BAOR, until 1962 when Ken became Chief Engineer, Western Command, Chester, until 1963 when he retired. In 1962 he was appointed CBE.

After retirement, Ken became Director of Works, Commonwealth War Graves Commission from 1963-1971. During this appointment he visited Commonwealth war graves situated all over the World including those in Eastern Europe. His calm understanding of the many problems and his ability to get work done earned him the respect of many.

After final retirement, Ken and Doreen went first to live in Penselwood, Wiltshire, and then to Iwerne Minster, Dorset, where Ken died after a very long illness bravely borne.

For the whole of his service life Ken was a keen and consistently good rifle shot. He shot in the Army VIII and at one time or another has held all the appointments in the RE Rifle Association, from Captain to President. In retirement he maintained his interest and support for the Corps and the Army. He was the author of *The Services of Seven Generations* and assisted in compiling *Seven Sapper Generations*, both of which traced military and Corps family descendants. In Iwerne Minster he will be remembered for his skill, artistry and true perfection of the many tapestry items and rugs he made whilst enduring his debilitating illness.

Ken is survived by his wife, Doreen, their daughter and three sons, two of whom saw service with the Corps.

RSG FAFD

LIEUT COLONEL M E MÉNAGE MBE

Born 22 September 1901, died 28 January 1988, aged 86

MAURICE MÉNAGE served for more than 40 years in the Corps. He was, as a Senior Officer in the Corps wrote when he left the Corps, ''small of stature but large at heart, unswerving of principle but with a great sense of fun and humanity''

Maurice was born at Freshwater, Isle of Wight, the fifth of eleven children. His father was a conductor in the RAOC and two of his brothers reached the rank of lieut colonel in the RAOC and RASC.

At the age of 15, Maurice enlisted as a boy soldier, and sailed from Colombo with elder brother Hector to England via South Africa. He was stationed at Plymouth until at 18 he was old enough to join the regular Army. Next he was based at Chatham where he met and married his wife Eva in 1921. The couple lived later in Jamaica and Egypt, and three weeks after World War II broke out Maurice was sent to France with

Lieut Colonel M E Menage MBE.

the British Expeditionary Force. He was evacuated from Dunkirk and narrowly escaped travelling on a ship which was sunk on the passage home. His wife was told her husband had been posted missing, but he turned up on the doorstep on the same day the official War Office card arrived.

The next stop was the Faroe Islands where Maurice was made an MBE for gallantry. He and a colleague rowed out to rescue the pilot of a ditched plane when lifeboat crews said it was too dangerous to put to sea. He served later in North Africa where his jeep was blown up by a mine and his driver killed.

War service ended after pursuing the retreating German Army through Italy. He was mentioned three times in dispatches. Other postings after the War included the Gold Coast, Malaya and West Germany. He was also a CRE in East Anglia. JHF remembers him then building with great speed and efficiency in 1951, a camp for a whole infantry division, wielding a mixed task force of sappers, direct labour and contractors. The occasion was the call-up of the "Z Reservists" who were to train in the Stanford Battle Area.

Having come up the hard way, he was the scourge of idle clerks of works, garrison engineers and DCs RE — but he made great allowances for enthusiasm and initiative. He was a most kindly and considerate commander.

In civilian life Maurice worked as a civil engineer with the then Ministry of Public Buildings and Works. He and his wife lived in Highcliffe, Dorset from 1966 where Maurice became Branch Chairman of the Conservative Association for 8 years, Vice President from 1976 until his death.

As a younger man he was a keen sportsman, playing tennis, cricket and hockey. He was also a marksman — winning the Cairo British Rifle President's Cup in 1932, the Jamaica Command Rifle Championship 1936 and the Malaya Rifle Championship 1952.

Maurice was an active member of the REA Bournemouth branch and also a member of the Dunkirk Veterans Association.

He is survived by his wife, Eva and his daughter, Pat. Their son Geoff died aged 14 while at the Army Apprentices College Chepstow in 1938.

CRW JHF

BRIGADIER R E WOOD CBE

SMH writes: I wish to add a tribute to the late Brigadier R E Wood.

I first met him when he was doing a tour of RE units in the BEF when he stayed in my Company Mess. We showed him round the works and the fleshpots of Lille and he proved a delightful guest.

After Dunkirk, where CRE 5 Division was killed on the beach at La Panne, we were pleased to welcome him as the new CRE 5 Division. He was never ruffled and always understanding and considerate. In three years under his command I never heard him lose his temper.

April 1988 Journal Awards

THE Publications Committee announces the following awards for articles of special merit published in the April 1988 *Journal:*

THE LIFE AND WORK OF GENERAL SIR ARTHUR COTTON KCSI by Major General R M Rau AVSM, **£60**

AN AFRICAN INTERLUDE by Major A D Wilson, **£40**

TROOP COMMANDER TRAINING IN THE ROYAL ENGINEERS by Captain N H Smith, **£30**

HISTORY REWRITTEN - THE RE HQ MESS by Lieut Colonel A H Blanford, **£30**

MORE MECHANISATION - CAN WE MEET THE TRAINING CHALLENGE? by Captain A R Ball, **£20**

CONSTRUCTION ENGINEERING UNIT by Major J S Pearce, **£20**

Memoirs in Brief

Brief memoirs are published below on a number of distinguished men whose deaths have been notified recently in the national press and who served in the Royal Engineers at some stage in their careers.

JOHN MACEY CBE, FRICS, died in November 1987 aged 81; served in World War Two as a major in Burma. Distinguished authority on housing in a career which started as a rent collector in the East End of London and finished as Director of Housing for the GLC. Three times president of the Institution of Housing Managers.

GABRIEL WHITE CBE, died in January 1988 aged 85; artist and administrator for the arts who served in World War Two as a camouflage expert. He was a member of the Arts Council from 1945 and its Director of Art from 1958 until 1970.

THOMAS ROBERT GRIEVE CBE, MC died in December 1987 aged 78; was Vice-Chairman and Managing Director of Shell-Mex and BP 1965-71 and Deputy Chairman Hunterston Development Co since 1973. Served in the Corps in World War Two.

SIR WILLIAM RYLAND CB, died in February 1988 aged 1974; Chairman of the Post Office in the 1970s, including during the much publicised strike of 1971. Served in the Corps (Postal) during the War, including the Middle East, finishing as a Colonel.

MAJOR GUY TURRALL DSO, MC, died early 1988 aged 94; he was a geophysicist, working in the metal industry helping, among other things, with the geological survey of Tanganyika. Served as a Sapper in Gallipoli and in the Balkans and, in the Second World War, with SOE in Burma after operational tours in Ethiopia, Crete and the Middle East.

MR SIDNEY GEORGE HEARN CVO, OBE, died in February 1988 aged 91; a lifetime railwayman beginning his career on the Great Western Railway as a lad clerk at Totnes Station and finishing as Assistant General Manager, Eastern Region. He was appointed CVO in 1958 for his meticulous supervision of the timetable and security on the Royal Train over many years. Served in the Corps 1914-18 and became a Lieut Colonel in the Engineering and Railway Staff Corps.

MAJOR ALWYN BRUNO WATERS CBE, GM, died in January 1988 aged 81; distinguished bomb disposal Sapper and architect and arbitrator of high repute.

TOM ELLIS died in March 1988 aged 76; a pioneer in the architects firm of Lyons Israel & Ellis, which established a style which came to be known as the *New Brutalism*. Served in the Corps 1938-45 and became General Works Design Officer in Cairo, where he was responsible for the design of hospitals and factories.

SIR CLIFFORD DOVE CBE, died in 1988 aged 83; was Chairman of British Transport Docks Board 1970-71, after a distinguished career in port management in this country, and overseas in India and West Africa. Served in the Corps in World War Two retiring as a Lieut Colonel in 1946 but continuing in the Supplementary Reserve until 1956.

Correspondence

Engineer Aptitude Training

From Lt Col D I Reid MA, MICE, C, psc

Sir,—Thank you very much for giving me and my staff a preview of the letter on Engineer Aptitude Training and allowing comment on it at the same time as it is published. It is a subject of much concern to us especially as the letter landed on my desk at the same time as the marks of a short diagnostic test given to 94 YO Course prior to their construction engineering phase. The second question of this test was:

> "The capacity of an Aveling-Barford dump truck is ten cubic yards. What is its capacity in cubic metres?"

Copies of the REPB, which contains metric/imperial conversion data, were available for use. Of the 30 officers on the course, two found the question so difficult that they did not attempt it, while three others tried the question but got the wrong answer. Fortunately, the remaining 25 solved the question correctly, but I would expect all sapper officers to obtain the correct answer to such a simple problem without difficulty.

A Royal Engineer officer must be both an officer and, in its widest sense, an engineer. These are not alternative requirements and, while the essential qualities of both may overlap, they do differ in both kind and extent. They are not substitutable: excellence as an engineer does not counterbalance incompetence as an officer, nor the reverse. In selecting a potential sapper officer, it is necessary to ensure that the candidate has the potential to meet both requirements. The RCB system, as is correctly pointed out, adequately covers the officer requirement, while the engineering aspect is not covered to any real extent. While it is difficult to define engineering aptitude and all the qualities needed, it is essential that sapper officers do possess an engineering bent. I suggest that it is almost impossible to test for this objectively as the problem appears very complex. However, much of the complexity can be eliminated if it is assumed that the qualities required by engineers are fairly closely correlated and only those qualities that can be measured are considered. By eliminating those candidates who do not reach the minimum standard in these tests, there is a reasonable chance that the remainder have the aptitude to become an engineer.

I believe that, in outline, the necessary tests fall into five categories, as follows:

Numeracy

If candidates are not numerate, they do not begin to be engineers.

Mathematical Ability

While candidates can probably be taught to be numerate, even if "parrot-fashion", there is a need to test their ability to use and adapt mathematical methods. This was, in fact, the purpose behind the "Aveling-Barford" question.

Logical Ability

An engineer is faced with many problems that are made more complex by conflicting priorities and limited resources, such that he needs to analyse the issues logically in order to derive a workable solution. Tests for this particular ability can take many forms and there are probably many different types of tests already available.

Practical Problem Solving Ability

It is necessary to test a candidate's flair for engineering. This is probably best accomplished by having him (or her) solve a practical problem using experience and systematic trial. This is probably analogous with the RCB command tests, but without the command element. It may be that this aspect is best tested using a model.

Intellectual Stamina

The final test should be designed to test a candidate's ability to follow through a long and complex problem to its conclusion to determine whether he (or she) has the mental ability for engineering.

No mention has been made of communication. It is felt that this important aspect is more than adequately tested at RCB and should not be considered further. The pass mark in these tests could be the subject of much debate but it is suggested that it is better to exclude the obviously unsuitable candidate rather than try to find the exact level which separates the suitable from the unsuitable.

Not all candidates need testing. If a young man or woman has obtained a sound honours degree in engineering or a related subject, it is presumptuous to think that a few hours testing can judge more accurately than a university. Some university graduates will not make good engineers but their degree training and their officer qualities should ensure that they become at least adequate sapper officers.

Finally, the letter writer asks whether the same aptitude is relevant for all the disciplines within the Corps. With the exception of the Postal Branch, it is suggested that the answer is no. The aim must be to select candidates who have engineering aptitude and who, after training, become successful Royal Engineer troop commanders. Thereafter the present Corps' career system can take over to ensure that the many demands made on its officers—be it to become a member of the Army Board, a Brigade Commander, PQE, Survey, Staff etc—are met. Of course, this is not easy, but having all officers with an engineering aptitude can only help.—Yours faithfully, D I Reid (*Chief Instructor, Civil Engineering Wing*) *RSME, Chatham.*

Correctionization?

From Major C D Yule, MBE

Sir, — Whoever dares to use such an awful word as *contractorization*, (See *Supplement* to the *Journal*, July 1987, Page 56), should be made to write it one hundred times before breakfast each morning and at no other time! — Yours sincerely, David Yule. *Ash Tree Cottage, Mill Lane, Broxbourne, Herts, EN10 7AZ.*

Technical Expertise In The Territorial Army

From Lt L M Smith BSc, PhD, C Eng, MICE, FGS, RE(V), Capt R D Thomson BSc, PhD, C Eng, MIMechE RE(V), Capt C W Hodgson BSc, Dip Ed RE(V)

Sir, — The recent correspondence on technical expertise prompts us to remind the 60% of the Corps who are regular army of the remaining 40% in the territorial army. A glance through the RE List will confirm that many TA officers are highly qualified engineers, as indeed are many TA soldiers, but how often has the phrase "better brains than ours ..." been heard at study periods and lectures. In many specialised areas there are no better brains than are available to the Corps from within the TA. It must surely be possible to make better use of this wealth of expertise, which is largely untapped except in the STREs and ESP, perhaps by the secondment of professional engineers as well as professional soldiers to RSME and elsewhere.—Yours faithfully, R D Thomson, L M Smith and C W Hodgson, *71 (Scottish) Engineer Regt (Volunteers)*

Are We Playing At Being A Technical Corps?

From Major D W Taylor

Sir,—The correspondence generated by Major Campbell's article on technical ability in the Corps (Dec 86) has now subsided. Before the matter is finally forgotten, might I suggest a simple if incomplete remedy. Brigadier Bevan's detailed reply (Jan 87) argues away a conceptual proposition by breaking it down, and showing each part to be impractical. The logic is flawless, but serves only to side-step the issue.

Consider the corollary of the pivotal recruiting problem: ERLO cannot find enough engineering graduates with officer qualities because men (and women) with those qualities tend not to study engineering. They have the initiative to discover that civil engineering is among the lowest paid professions, so study something boring but well-paid. They have the enthusiasm to try new and, they think, exciting sciences. They are articulate enough for the Arts. They have charisma that is rarely suited to Public Health Engineering.

The Corps cannot wait for the construction professions to become popular again. If regimental officers are to be capable of engineering judgements and calculations then we must ensure that our potential officer studies a useful subject. For myself, I can see only one solution: offer at least 50 RE University Cadetships a year. If the Corps is not prepared to fight for them, then it does not really want to remain a technical corps.—Yours faithfully, D W Taylor *Regional Design Office, RHQ PSA, BFPO 140*

Troop Commander Training in the Royal Engineers

From Lt M Lodge RE

Sir, — Captain Nigel Smith's article on Troop Commander training was interesting and illuminating. There is no doubt that the present YO course is a motivation killer, the suggested module system has much to recommend it but the Royal Engineers is a Corps for "Combat and Construction" — as my recruiting brochure told me; it would be a shame to see the construction package go just because a YO is BAOR-bound. Versatility is the hallmark of the Sapper.

From my recent experience of the delights of Chattenden I felt two vital items had been missing when I arrived at my present post. Firstly, recce experience for the majority of YO's on exercise was minimal. Syndicated groups land rover mounted doing a round robin of recces, each with a different appointed commander (as per the Field Sergeants' course) would have been valuable. Secondly, as the present OC of one of the Corps anomalies: Boat Troop, QGE, I find that I have inherited a support troop in field troop guise. How many other support troop commanders arrived ignorant of basic vehicle mechanics, hydraulics and electrical systems? A civilian engineer is trained to understand the jobs his men perform, as is the field troop commander. Why then are support troop commanders left so woefully ill-prepared?

Thirdly, may I echo Nigel Smith's sentiments as to why we train officers for up to 18 months (including RMAS) when many leave at the end of the first posting — surely there are better ways of spending money (spares for my boats would help).

The originators of the present course are to be congratulated on one aspect — the 7 months at RSME make for an excellent social life and not even a report stood in the way of many a quiet drink in the Club Bar!—Yours, M Lodge. *QGE, BFPO 1.*

MInstRE

From Major R M Bend MI Mech E RE

Sir,—Recent correspondence (December 1987) has suggested that the *Institution* might seek membership of the *Engineering Council* and that military engineers might achieve chartered status. Such aims are neither practical nor entirely desirable.

Chartered status is indicative of an ability to apply scientific principles to some area of engineering activity, therefore it is restricted to engineering graduates. In general the application of scientific principles plays only a small part in military engineering. This and the fact that approximately one third of the regular officers in the Corps either have no degree, or a degree with no scientific content, makes chartered status inappropriate. For non-degree officers to become associate members of the Institution and second class citizens within the Corps or the Institution is unacceptable.

Lieut Smith goes on to suggest that experience gained during service with the Corps might count towards the post-graduate education required by the *Institution of Civil Engineers (ICE)*. The only training carried out in the Corps at post-graduate level is that on PQE courses. Other training is intended to be suitable for non-graduates and is unlikely to meet the requirements of the ICE.

The status of the military engineer arises from his professionalism within his own area of activity. This status is enhanced because some military engineers are also chartered engineers as a result of their special training and experience. The cross fertilisation sought by Lieut Smith is fostered by our programme of joint meetings with the professional institutions, four of which were advertised in the February supplement. — Yours faithfully, Richard M Bend. *HQ Engineer-in-Chief, Northumberland House, London WC2N 5BP.*

Book Reviews

SPRING IMPERIAL

EVELYN HART

(Published by Century Hutchinson — Price £12.95 ISBN 0 7126 1968 2)

WHAT a joy it is to read about India in the 30s and 40s as it really was. The pen name conceals the identity of the widow of a senior Sapper officer who knew it all and loved it. She recalls the rigours and excitements of travel by road and rail, of crossing the Indus in flood and trekking in the high Himalayas. The action takes us from the hectic life at Quetta Staff College in wartime to the misery of the Calcutta slums. We are reminded of the smell of the baking earth after the first monsoon rains and the scent of a shady Mogul garden festooned with bougainvillea and full of cannas and poinsettia.

Against this background the main characters are real and plausible people who are caught up in a searing romance with their tragic mistakes and misunderstandings. The denouement comes as a surprise but is wholly satisfactory.

This is a book to be enjoyed by all those who remember with nostalgia the India of the Raj, and for all those who would like to know more about it. *Spring Imperial* is on par with *The Far Pavilions* and like it would make a superb film.

WGAL

HAZARDOUS WORK

J D SAINSBURY

(Published by Hart Books, 8 Mornington, Digswell, Welwyn, Herts, AL6 0AJ — Price £7.50 ISBN 0 948527 00 5)

A WELL researched history of the Home Guard from formation on 14 May 1940 to stand-down on 1 November 1944 when the force mustered 1.7 million. Of particular interest are the individual citations of 137 awards for gallantry (including 2 George Crosses and 13 George Medals) far removed from the popular image of *Dad's Army*.

DRV

MAILSHOT

A HISTORY OF THE FORCES POSTAL SERVICE

(Privately published by the Defence Postal and Courier Services RE. Directorate DPCS MOD(A) BFPO 777 — Price £8.00 + 75p p & p ISBN 0 95 13009 0 3)

IT is one of those unexplained phenomena of every day life that certain vital public utilities are just taken for granted, without any thought as to the complexities of providing that service. It applies to many functions of the Corps of Royal Engineers, and this book illustrates a classical example, that of the Royal Engineer operated Forces Postal Service. The serviceman, irrespective of where he is stationed, takes for granted the daily arrival of a letter from home. It is only when it doesn't arrive that the service is called to immediate account. In this book, Edward Wells has produced a lively account of the Forces Postal Services in sufficient detail to satisfy the technical expert, and at the same time has skilfully interwoven a series of personal recollections and anecdotes by serving officers and soldiers. This brings a well balanced account, clearly illustrated, with excellent photographs from archives, of the hundred years of military postal history. The story traces the development of the service, in close partnership with the GPO, to aim at giving the serviceman overseas the same standard as he enjoys in the UK. Throughout the entire book the firm principle held by all the FPS staff is that — The mail must get through — despite the distance, the terrain, the weather, the enemy and in many cases the General Staff at HQs who held widely differing ideas on priorities. It is interesting to learn how the FPS always achieved their own way to get the mails through.

Wells traces the service from the Royal Posts of Edward IV (1491), through all the campaigns to the two World Wars and shows how many postal innovations, such as the first airmail service, the airgraph and the air letter, originated and are now in common use.

All the major and minor campaigns since World War Two are covered up to the final section on the postal services to the Falklands Task Force. The story records the successes and failures of the

FPS, the bouquets and the brickbats for, as a former Director comments: "It's a warts and all story and all the better for that". This volume will satisfy both military and postal historians as well as providing an interesting clear story for the casual reader and for every ex-serviceman who has ever waited for that letter from home.

AB

THE WAR OF INVENTION
Scientific Developments, 1914-18

GUY HARTCUP

(Published by Brassey's Defence Publishers)
(Price £24.00 ISBN 0-08-033591-8)

THIS is a wide ranging account of how the major belligerents of the First World War applied scientific and engineering resources to transform the nature of operations on land, at sea, and in the air. Attention is directed mainly to British efforts, but useful comparison is made with those of other nations. Some emphasis on how "the scientific layman came to the aid of executive ignorance" should not be taken as derogatory; the important point is that cooperation was effective despite the novelty and size of the problems requiring solution.

The book deals with the organisation and conduct of research, development and production of a wide range of war material, including shell propellants, fillings and fuses; naval gunnery fire control systems, torpedo propulsion, wireless communication and direction finding, detection and attack of submarines, and underwater protection of warships; aircraft armament, wireless and engines; war gases and protection against them; anti-aircraft artillery and sound location; and the many new trench warfare equipments and weapons, such as tanks, trench mortars and grenades, flame projectors, sound ranging, the wireless, earth telegraphy, secure speech telephony, listening devices for mine warfare, and means of moving war material across rough ground.

Readers of the *Journal* may find particular interest in the chapters on gas and trench warfare and army and aviation wireless. But although many 'engineer' officers are named, and some are identified as 'RE', it is not easy to discern the extent to which our Corps as the main scientific branch of the Army was involved as an organisation in introducing most of the innovations to service, or indeed that it deserved much credit for its work. This may be because The Institution of Royal Engineers seems to be remarkable for its absence from the list of those whose help is acknowledged by the author. Nevertheless, the work complements our Corps history and the several volumes also published by the Institution on 'Work of RE in the European War 1914-1918' in giving much well researched information on the vital contribution of civilian scientists and engineers to the introduction of the many new devices used in this first major technological war in history.

AHWS

BOOK NEWS FROM INSTITUTION OF CIVIL ENGINEERS

All books in this section are published by Thomas Telford Ltd and are obtainable from Thomas Telford Ltd, Telford International Bookshop, 1 — 7 Great George Street, London SW1 3AA

THE CIVILS — THE STORY OF THE INSTITUTION OF CIVIL ENGINEERS
J G WATSON

Price £14.95 UK, £18.50 overseas
ISBN 0 7277 0392 7

THIS well-illustrated book is a highly readable account of the oldest engineering institution in the world. It covers the history from the first meetings at the Kendal coffee house in Fleet Street in 1818 to the acquisition of numbers one to seven Great George Street and beyond.

Whatever aspect of the Institution life is being discussed, it is set in its wider context. After all, civil engineering affects everyone's life in obvious and direct ways, and the history of the ICE is inextricably bound with one of the greatest periods of British society. In many ways this book is the story of the men who shaped our world.

EARTHWORKS
PHILIP C HORNER

Price £6.95 UK, £8.00 overseas
ISBN 0 7277 1313 2

Earthworks describes the major factors to be considered when designing excavations and fills and selecting fill materials. The advantages and limitations of plant used in earthmoving and compaction are discussed, together with the planning and execution of earthmoving schemes and the theory and control of compaction. Also covers important aspects of safety. This second edition is thoroughly revised and updated to incorporate recent improvements in plant and techniques.

GEOTEXTILES HANDBOOK
T S INGOLD & K S MILLER

Price £12.00 UK, £15.00 overseas
ISBN 0 7277 1333 7

ALTHOUGH it is less than twenty years since geotextiles were introduced into civil engineering, their use and acceptance has already become widespread. This concise book, which is both a practical guide and a pocket reference, deals with the different materials available and how they are made, their properties and their measurement. There is a unique compendium of product data.

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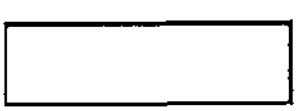

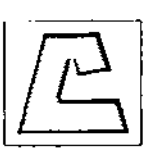

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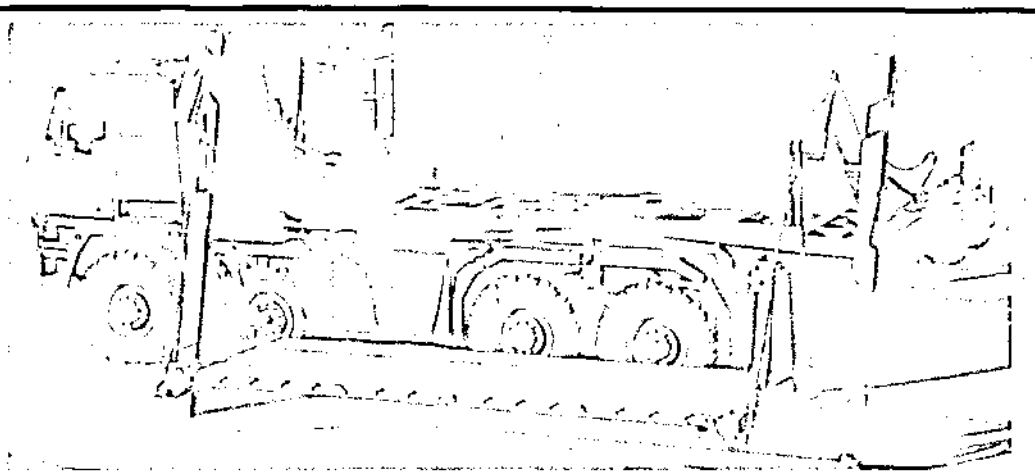

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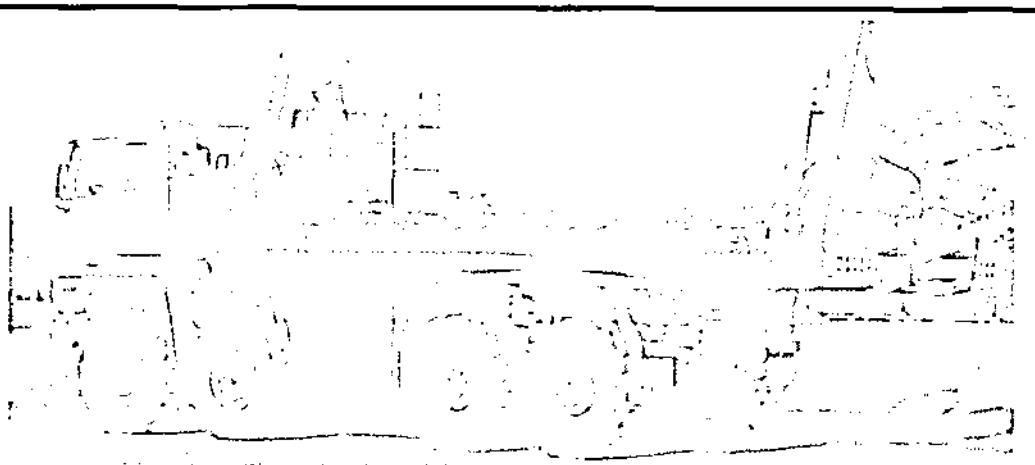

Above, flatrack loaded onto a D.R.OP.S. vehicle

EKA Limited

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