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ISSN 0035-8878

THE ROYAL ENGINEERS JOURNAL

Published in April, August and December by The Institution of Royal Engineers, Chatham, Kent ME4 4UC. Telephone Medway (0634) 42669 or Chatham Military Ext 2299.

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

Volume 103 APRIL 1989 No. I

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4,250

1988 Corps Annual General Meeting

ADDRESS BY ENGINEER-IN-CHIEF

INTRODUCTION

In his introductory remarks, the EinC explained that his report would start by discussing all aspects of four particular subjects, Northern Ireland, BAOR, Support to the RAF and EOD. He would then cover other matters generally, including his plans and hopes for the future.

NORTHERN IRELAND

"As far as anyone locality has dominated our attention this year, it is Northern Ireland. It has brought the Corps much prestige and praise in private but, because of the nature of the work, not much can be said in public.

"You will know that in addition to 33 Independent Field Squadron, which is permanently stationed there, we now have at least a full roulement field squadron from Germany in the province all the time. The roulement squadron provides the search troop with the remainder of the squadron in support of 3 Brigade.

"At the moment we have a third field squadron and we get 'one-off tasks like the Prison Guard Force at the Maze from time-to-time. Two traditional sapper specialist tasks have dominated the activity of the squadrons, search and construction.

"So far in 1988, search operations have discovered more terrorist weapons and ammunition than were found in the whole of 1987. We cannot take all the credit for the search successes; but we do lead and we train all the others: Police, Infantry and so on. We must now ensure that this success continues in 1989 by placing greater emphasis on the procurement of search equipment and by refining operational techniques.

"Construction has been of two sorts. In the first case, the provision of mortar-proof and other secure buildings for use by the security forces as bases or accommodation, or making existing buildings mortar-proof. In the other case it has been normal construction or maintenance work on buildings, in areas where PIRA have succeeded in intimidating the local contractors to the point where they are unwilling to tender.

BAOR

"Switching now to BAOR: Last year my predecessor dwelt at some length on the reorganisation of Engineer Support to 1(BR) Corps. I do not intend to cover the same ground again. Suffice it to say that our thoughts have been developing and that the new concept will be put to the test on Exercise Iron Hammer next month. The results may take some time to analyse.

"Away from the 1st British Corps, the MCAGs and MCPGs in BAOR seldom receive in public the credit they deserve. So this year I would like to mention three projects they have recently completed.

"211 MCAG completed a community centre at RAF Giitersloh which was opened by Lady Tedder, Lord Scarman and other prominent members of the Malcolm Club Group. Sad to say Major Stan Collett, who had masterminded the project, died the very next morning. We all miss him, not least those of us who had known him for many years as an outstanding Corps cricketer.

"255 MCPG built from scratch a black top road on Haltern Ranges and 217 MCAG have just started refurbishing the buildings for the move to RAF Bruggen of 52 Squadron which I shall mention later.

SUPPORT TO THE ROYAL AIR FORCE

"Our role in supporting the Royal Air Force is developing most satisfactorily, and growing steadily. This subject has not been neglected in past Reports, so I will only give some recent examples. Though perhaps I may remind you that our main tasks in support of the RAF are Airfield Damage Repair, Support to the Harrier Force, Crashed Aircraft Recovery and engineering support to the Special Safety Organisation. Last week I attended a joint RE/RAF Exercise at RAF Wildenrath, which was also attended by CinC BAOR and CinC RAF Germany. As well as attracting a high level of interest this exercise demonstrated close integration between the Corps, in this case 53 Field Squadron, and the RAF particularly in the Wing Operations Centre.

"It is not always appreciated that the primary role of the Falkland Islands Field Squadron is Airfield Damage Repair. We now send a troop from a field squadron (construction) with the roulement squadron, in order to ease the initial learning curve.

Hedge searching in Northern Ireland

"At Waterbeach in April there was a very successful ADR Study Day including demonstrations of ADR Equipment and techniques, which was attended by the Deputy Commander-in-Chief of Strike Command, the Commander UK Field Army and many senior RAF Officers including most station commanders.

"Planning for the forthcoming move to station 52 Field Squadron at RAF Bruggen permanently in peacetime is progressing well. This in my opinion is a great step forward. Not only will it lead to still closer integration with the RAF, but will at last allow us to make an immediate response to airfield damage with an 'in-theatre' capability at the Clutch airfields. Until now, and unlike our Allies in the Central Region, we have lacked this ability.

"In the United Kingdom, where as you may recall, we rely on the TA for Airfield Damage Repair, four more squadrons have been declared operational: and on schedule! This makes seven out of the eight whose establishment has been approved.

"Co-operation with the United States on ADR matters will be further improved by the USAF officer joining HQ 12 Engineer Brigade, matching the Sapper (now Major Zimmerman) who is based at the USAF Rapid Runway Repair Centre at Tyndall. The Americans showed considerable interest in the RARDE trials (in June) of the new version of the Dynamic Compactor — they even paid for some of the cost of the trial!

"38 Engineer Regiment have kept up their active contacts in support of Harrier forces. There were three major exercises with the Harrier Force in Germany, and they also exercised with the Harrier support to SACEUR's Strategic Reserve in Denmark.

"In addition, they contributed to the rough terrain trials for the Harrier GR5 which should enter service this year.

"A welcome sign of RAF recognition of the importance of RE Support, and more than just a 'sign', has been the establishment of a Royal Engineer lieut colonel's post in the newly formed 'Survive to Operate' Cell in the Airforce Department.

Explosive Ordnance Disposal

"The last twelve months have been demanding and rewarding for our explosive ordnance disposal squadrons.

"The importance of EOD in both peace and war continues to grow, and I thought it right that I should give the subject a section on its own in my Report.

"The quickening pace of both urban redevelopment, and the services alienation of property and training areas, has increased the need for battle area clearance and brought more EOD problems from the past to light, and this at a time when attention on the environment has never been more acute. And the terrorist threat has raised yet further the requirements for specialist searches, both numerically and in their technical sophistication. These searches are vital for the protection of members of the Royal Family, the Government, the Armed Services and many many others. I saw their work in this field for myself when I visited the Grand Hotel in Brighton ten days ago and saw clearly the pressures and demands involved.

"I was most impressed by the quality of our young men.

"33 Engineer Regiment have responded magnificently to the operational requirements given to them in the United Kingdom, in the Falklands and elsewhere abroad, but there are problems and I shall return to these.

Harrier landing on a road during exercise in Germany

A bomb disposal officer wearing an NBC suit, fuel suit and breathing apparatus while engaged in disposal of chemical munitions

"You will know that we have formed another regiment. Because of the pressures on 33 Regiment we, in effect, divided it into two — a regular regiment and a TA regiment — on 1 June this year. The four TA Squadrons became 101 (London) Engineer Regiment EOD(V) and an RHQ was formed to command them. This is already working well and the Regiment has a fine history to build upon.

"The potential and rising EOD threat in war is giving all three Services considerable cause for concern, and it is clear that more resources are needed to tackle it than exist today. Fortunately we have been able to raise the profile of RE EOD in the right places and working closely with RAOC EOD we should be able to achieve some of the extra men and equipment we require for this vital area in the future.

"More specifically, 33 Engineer Regiment needs to be expanded in peace to cope with the operational demands and to have time to train properly to tackle the range of weapons and devices against which they are pitted.

"They also need to be properly accommodated at Lodge Hill. 101 Regiment needs to be bigger in General War and both regiments need to have the armoured vehicles and other vehicles and equipments necessary to do their job. Much remains to be done, and both in my HQ and at UKLF, we shall be giving it the necessary priority.

"The work done by our EOD officers and soldiers has been handsomely recognised in the last year. A SNCO received the Queen's Commendation for Brave Conduct for dealing with dangerous WW2 anti-tank mines on the East Coast, the chemical clearance operations at Bramley led to one MBE, one CinC's Commendation and five GOC's Commendations. Two large, difficult and dangerous German bombs, one in a gasometer in East London, the other close to Tower Bridge, brought five richly deserved Queen's Gallantry Medals for the two officers, a SSgt and two Cpls who tackled them.

"Though much is classified and therefore unseen, our bomb disposal and search work brings us much favourable publicity and recognition and equally, for those who serve in the regiments, unrivalled job-satisfaction and tremendous responsibility.

Operations and Projects

The EinC then illustrated with slides something of the large variety of exercises and projects being undertaken worldwide in Canada, Kenya, the Falklands, Gibraltar, Norway, Cyprus, Lebanon, Malta, the Far East and in the UK itself.

"The latter included two well publicised tasks in support of the prison authorities. Considerable design and planning effort had been contributed by the MWF, preparing contingency reports on converting army camps to temporary prisons. Two such conversions were implemented by 69 Independent Gurkha Field Squadron at Alma-Dettingham, and by 3 Field Squadron at Rollestone.

Disaster Relief

"Now a few words about disaster relief. An officer from the Military Works Force deployed to Vanuatu in September 1987 at the request of ODA to plan rehabilitation work on Tanna island following cyclone damage.

"As a result, a management team of five Royal Engineers deployed in April 1988 to supervise a road and bridge building project. They were replaced by a second team to complete the supervision of the year long project. I am pleased to report that the officer responsible and his clerk

Rollestone temporary prison — conversion by 3 Field Squadron

51 Field Squadron practising helicopter drills as part of their new role with 24 Air Mobile Brigade

of works called to see me, glowing with health and greatly rewarded by the unusual experience they had been given.

Pakistan

"You will also be interested to learn that a small team under Lieut Colonel Cedric Sloan (who is the CO of 3 Training Regiment) has gone to Pakistan to give advice on mine clearance in Afghanistan.

Jamaica

"And moving back to the Caribbean, OC 34 Field Squadron and twelve soldiers deployed from Belize to Jamaica to carry out repair work on emergency power and water, in the aftermath of Hurricane Gilbert. They later moved on to restoration and work and returned the Princess Margaret Hospital to working order. I have received a signal from the High Commissioner which speaks in glowing terms of their professionalism, dedication, cheerfulness, enthusiasm and sheer hard work, all of which created an excellent impression.

Organisation and Reorganisation

"On Organisation and Reorganisation matters, agreement has been reached between the MOD and the States of Jersey on the formation of a RE TA Squadron based on Jersey. Jersey has agreed to pay the full cost of setting up and running the unit, which we expect to be about two million pounds a year. The full title of the squadron will be 'The Jersey Field Squadron, Royal Engineers (The Royal Militia of the Island of Jersey'. The formation of the unit is going well. About sixty recruits have so far come forward, and the interest shown by all concerned is very encouraging. The Minister of the Armed Forces is to attend a ceremony to mark the signing of the agreement and appropriate celebrations on the Island on 29 October, to which I have been invited by the Governor.

"51 Field Squadron in Ripon have had a change of role, as part of the new 24 Air Mobile Brigade. They are at present undergoing intensive training for their new role including helicopter drills, with the rest of the Brigade. You may have seen them on television on the recent large exercise on Salisbury Plain.

"As part of the same reorganisation of the Army, 19 Brigade has converted to Saxon Armoured Personnel Carriers with 34 Field Squadron, who support them, following suit. They will be issued with fifteen Saxons when they return from Belize at the end of this year.

Doctrine and Weapons

"Now a few words on Doctrine and Weapons. Last year the emphasis was on *Mobility*. This year, with the mobility projects all going well, I would like to start with some significant progress with mine warfare. The ACEATM (Aimed Controlled Effect Anti-Tank Mine) which underwent stringent scrutiny last year survived its ordeal and is now more secure as a result. This project had overwhelming support from the General staff, which it most certainly needed, or we would have lost it. The Vehicle Launched Scatterable Mine System, VLSMS, is also well supported. Recent concept papers and studies re-emphasise the need for a completely new family of mine systems.

"Our investment in Operational Analysis Studies is paying dividends.

"The DOAE (Defence Operational Analysis Establishment) mine studies, the RARDE Divisional War Game and study into the survivability of bridges, for example, support our requirements for new equipment and raise our profile amongst those branches of the staff

A Saxon armoured personnel carrier

concerned with the development of new concepts and the allocation of priorities for research.

Government Financial and Management Initiative (FMI)

"The MOD continues to implement measures in response to the Government's FMI and the Quarter Master General's area is now in its third year of corporate planning. The Corps is directly involved through the Director of Engineer Services (who is one of QMG's eight functional directors). Brigadier John Drake now has his own functional planning unit which produces regular reports on a wide range of engineer support activities. These reports include details of targets, budgets, performance indicators and a wealth of statistics. We are expecting this approach to management to extend quickly to the rest of the Army in the next few years and plans are already in hand for a significant extension to the budgetary regime. The latest acronym is PROSE — Performance Review and Object Setting Exercise.

"Much progress has also been made over the last two years in the fields of Engineer Intelligence, Terrain Analysis, and ADP Assisted Manoeuvre Control Systems.

Training

Individual Training Organisation (ITO) Study

"The ITO is again under examination, perhaps it is not surprising as it costs £819M annually and is a large consumer of manpower (8% of the Army's military, 21% of the Army's civilians). The 'Groom' proposals have been implemented as far as possible, and salami slicing has gone as far as it can. ACGS has set in hand a general staff study to suggest a long term plan which gives value for money and improves operational efficiency.

"The consequences for the Corps (and others) could be considerable. ECAB has already indicated to the Study Team that it sees a need for centralised recruit training. This is a large step with many implications not least for regimental spirit and I will report on the outcome next year.

Armoured Engineer Training

"The introduction of close support squadrons will increase the number of armoured engineers to be trained by about 40%. To some extent this will be offset by the eventual demise of Centurion — we plan to cease gunnery training in April 1989 and to reduce the number of armoured engineers trained to drive both Centurion and Chieftain.

Manning, Recruiting and Retention

"As to the really vital linked subjects of manning, recruiting and retention, the Corps remains a family of people who are armed and equipped. If we lack the manpower we cannot bring new kit into service, or even continue to operate what we have. Despite all the splendid efforts of our 'recruiters' and 'manners' we are threatened in every direction you care to glance, by that monster the 'Demographic Trough'.

"I will give this trough a few dimensions. The number of 15—24 year-olds in the population will decline by about a quarter (24%) between the high point of 1982 and the projected nadir in 1999. If nothing is done to recruit a higher proportion of those available the Army could be short of 200—400 Officers and 21,000 Soldiers (against current Manpower Planning Targets) by 1999.

"Although officer recruiting, in general will not be as badly affected as soldier recruiting the competition for the engineering and science graduates we need will probably get worse as commerce and industry expand. Current officer recruiting is good: and the YO courses are full.

"At the troop commander level, officer manning is very satisfactory, but the 'Black Hole' now spans twelve years; covering dates of birth 1948 to 1960. This will cause difficulties in selecting squadron commanders, regimental commanders and releasing officers for E2 employment. There will soon be undermanning of units with soldiers. We will be offering careers beyond 22 years to an increasing number of soldiers of all ranks and also allowing junior ranks to serve beyond the twelve year point.

"Premature Voluntary Retirement is of course our enemy within. PVR amongst officers is showing two opposing trends: a significant and welcome decline in the numbers of applications

A Galloway footbridge constructed for the civil community on the Isle of Skye, mentioned by the EinC in describing the many projects undertaken in the United Kingdom

from officers aged between 27 and 31, the most vulnerable age; but an increase in the category we used to call Quartermasters: very experienced gentlemen. We also have the strange counterflow of three officers applying to rejoin after PVR.

"PVR amongst soldiers is rising, but quite slowly. It does not seem that decreasing unemployment is dramatically affecting the issue at least until now.

REGIMENTAL AFFAIRS

"A few words on Regimental Affairs:

Silver and Paintings

"We have had rather an expensive time in recent years in expenditure on silver and paintings. The Chief Royal Engineer's Committee has directed that next year we should take a pause from new commissions, and ensure that what we have is in good order. Nevertheless I think the Corps can take pride in what it has commissioned or been party to, in the last year or so. I would like to mention:

- The Diving Centrepiece to commemorate 200 years of Diving.
- The Devlin centrepiece to commemorate those campaigns since 1945 which have not otherwise been commemorated.
- A silver bear, now with 38 (Berlin) Field Squadron.
- A magnificent Survey centrepiece, which consists of a crystal column, topped by a silver theodolite, on a base surrounded with engravings of survey activities, now at 42 Survey Engineer Group.

  A silver South China Junk which has gone to Hong Kong marking the 40th anniversary of the Gurkha Engineers; and also the Queen's Gurkha Engineer's Association has presented a fine Kothimora Kukri to the Corps.

"Finally, on the matter of paintings, one of Major J R M Chard VC has recently been completed by Mr Michael Leslie, who restored the paintings of Gordon and Kitchener after the 1975 fire in the Mess. He has very kindly donated it to the Corps. We have also received, on long loan from the Royal Naval Hospital Haslar, a painting of Major Liddell CMG DSO RE, by Frank C King.

Freedom

"The Corps is being increasingly recognised abroad as well as at home. The Chief Royal Engineer will receive the Freedom of Spandau on 28 October 1988 on behalf of the Corps, and next year on 10 June, General Cooper will travel to France to receive the Freedom of Lion sur Mer, with its strong links with the Armoured Engineers.

Headquarters Officers Mess

"I believe that the radical changes now taking place in the Headquarters Officers Mess are almost a subject on their own. On 8 October the Depot Regiment started on a full catering and cleaning contract. Fortunately we are able to keep Leslie Smallman as Mess Secretary. He becomes a direct employee of the Corps and will now take on a number of other duties on our behalf. The Mess Manager, Mr Wilson, who is an employee of the contractor, comes to us with an excellent reputation and all the suitable qualifications. There are many advantages in the new arrangements, not least that the contractor is obliged to maintain standards and is not restricted by manpower ceilings or subject to the sort of arbitrary cuts and savings which affect public employees. I am confident that the Mess will continue to offer the dignity, comfort and general excellence we have grown used to, but perhaps by other means.

Military Secretary

"I am pleased to report another highly satisfactory MS year for our senior officers. Very recently we have had confirmation of two further and well merited promotions to major general for the officers currently holding the important posts of DMO and DASD. Whilst we forfeit these two, it is most encouraging that Sapper brigadiers are shortly to fill the posts of Director Army Plans, Director Defence Programme and DMS(A) - all of them most influential and highly regarded appointments. Also, for the third year running one of our Colonels has been selected for an all arms brigade command - the Berlin Infantry Brigade. At the next level, it is good to report that once again we are about to hold the posts of College Commander at Sandhurst and Military Director of Studies at Shrivenham, after gaps which seem to me, in view of our position in the Army, to have been far too long. There is no room for complacency, of course, but I believe that our present position is excellent, providing proper reward for the talented officers we have attracted to the Corps.

Report

"You will not be surprised to hear from one who has had so much enjoyment through active participation in sport, that it is with great pride that I can report the Corps' successes over the last year. Summarised, w~ are:

Army champions in minor units football, minor units rugby, major units swimming and major units squash; inter-unit water polo, skiing, canoeing, fencing and rifle shooting; inter-corps parachuting, sailing, and tetrathlon; and individual game angling.

"In addition to these (who are also UK or BAOR champions on the way to the higher level) we are:

UK champions in alpine skiing and major units basketball ;
BAOR champions in major units football, rugby and hockey;
Inter-services champions in game angling and rowing;
National champions in bosun class dinghy, boxing ABA bantamweight and canoeing

"For a Corps whose units are amongst the most heavily committed in the Army, this is a truly magnificent set of achievements.

"We continue to support major expeditions and you will all be pleased to know that the British Services Everest Expedition 1988 included two Sappers, Colonel Henry Day, the Deputy Leader, and Captain Andy Edington who both made strong attempts on the summit from the West Ridge and reached well over 8000 metres before being defeated by savage conditions.

"Selecting one or a group, for pride of place is never easy. But my choice goes to our biathletes. The manager, the coach and four of the seven man team in the British Olympic Biathlon squad were Sappers. All four team members raced in each of the three events. Lcpl Dixon in particular put in some brilliant performances and established himself as the best ever British biathlon prospect. He finished 13th in the 20 km Biathlon, becoming the first ever Briton to break the one hour barrier. Any Sapper who saw him interviewed on television that evening would have been filled with pride.

CONCLUSION

"I am conscious that I have not covered everything in this review - it would be impossible to do so without occupying this spot for far too long. It is not that those I have not mentioned have not deserved it, but rather my own desire to cover those parts of the Corps' responsibility with which I had little previous personal experience. My own visit programme has given priority to this area, so that I am better equipped to represent the whole Corps as the EinC.

"Similarly it would be impossible for me to summarise all I have said, so I will leave you with a few personal impressions:

"I have travelled extensively in the United Kingdom and Germany this year and I have been most impressed with the young people, officers and soldiers, whom we are attracting into our Corps. They are very well led and have enormous pride in their squadron, regiment and Corps. Commanders speak in glowing terms about their standards, and I have in mind particularly the words of the last and the present Commander Land Forces Northern Ireland.

"On my arrival interview with CGS in January he said, amongst several other things, 'that the Corps of Royal Engineers is in outstanding order' . Coming from one who is widely regarded as our best post war CGS, this is high praise indeed. The challenge facing all of us is to make sure that we maintain these standards, and to do so we must give proper priority to recruitment, and the retention of our fine young men who invariably rise to the challenges they face."

(:()~lllj\rr STRESS

Nqwadays, thIS Squadron Leader crles

Squadron Leader R.. G..n, OSO, OFC, was one of the first of the 'few'. Without him and his Spitfire the fires of London would have been much worse.

After the Battle of Britain, G..n fought with Monty up through the Western Desert into Italy. Here his plane was hit by a German '88' shell. He spent the rest of the war in a prisoner-of-war hospital.

A brave man, a very brave man. Not the sort to burst into tears, but yet he does so, cowering i.nto a corner at any unexpected noise. For G..n the war is not and never will be, over.

The Ex-Services Mental Welfare Society exists to look after and to help people like R.. G..n. Men with minds damaged in the service of their Country. Men who need our help with day-to-day living. Men who need a sheltered place in which to live. Men who, at the very least, need our help in getting their correct entitlement to pension.

We cannot work for these men without your help. The debt is owed by all of us, so please send us a donation, or arrange a covenant, or perhaps, a legacy.

70 YEARS OF CARING 1919 1989 COMBAT STRESS

"They've given more than they could- please give as much as you can."

To protect those concerned, thiS IS an amalgam of several such case histOries of Patients In our care

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The Profession Of The Royal Engineer

Last year the President initiated a paper to define the profession of the Royal Engineer, foreseeing the need for such a definition as a background to establishing the future policy for the Museum and for the professional qualification studies. The topic was widely discussed by Council members and the text of the final paper follows:

"Not a mere pioneer, not a poor imitation of an infantryman and apology for some civilian specialist, but a member of a distinct and time-honoured profession."

INTRODUCTION

ALMOST fifty years have elapsed since we entered the Second World War. Apart from a few units which participated in the Korean War and the Falklands War, the British Army has not encountered an enemy using the entire gamut of weapons to wage war. Fortunately the legacy of those who fought in the Second World War was thoroughly embedded into our training institutions and their ethos, standards and professional skills survived. However, those in authority today mostly have only study and second-hand knowledge to guide their decisions, apart, that is, from a useful but limited experience gained in the occasional emergency either in Northern Ireland or in low-intensity operations out of the NATO area.

The Corps is re-examining the status within the whole engineering profession of the qualification of its commissioned officers as members of their autonomous professional body: the Institution of Royal Engineers. Thus it is necessary for the Corps to define its profession in terms of an ethos and a body of knowledge and skill with a set of standards. The detailed description of the standards, training and experience expected of the officers and men is obtainable from official sources but that needs setting in the context of a statement of the ethos of the Royal Engineer.

Such a statement must itself also today be set within the context of a technological revolution encompassing the change in micro-electronics, the impact of the ubiquitous microchip, the embryonic intelligent computer and the potential for the genetic manipulation of living organisms. The nature of the modern officers' responsibilities is evolving rapidly and we are in a world of high-technology.

AIM

THE aim of this paper is to define the ethos and characteristics of those in the profession of the Royal Engineer.

SCOPE

THE framework will be that set by the Chief Royal Engineer: "... our particular expertise is military engineering, a much broader and, in many respects, far more complex discipline than other specialties. It demands very special talents and no little courage, especially in war. It demands combat engineering expertise based on a sound engineering background ... It demands initiative, common sense, drive and leadership. It may need extra technical expertise at times. ". Above all, we need a multi-purpose Corps."

THE SOLDIER

OF course, by definition every military engineer is a soldier first and foremost. He must be able to survive on any battlefield whether in the jungle, desert or arctic in the environment of a nuclear and chemical war, or in the scenario, often urban, of low-intensity operations. He has to be skilled at moving, by land, air and sea; skilled in basic military duties; able to defend himself and his unit. The Royal Engineer in particular has to be quite capable of attacking - as part of that defence - in concert with the other combat arms: The Royal Armoured Corps, Infantry and the Royal Artillery.

As a soldier any military engineer must thoroughly understand the science of war and the Royal Engineer in particular has to be skilled in the practice of the art of tactical warfare; to achieve this he must train for war during peacetime with maximum realism, simulating where necessary but concentrating on the development of his engineering ability through the execution of actual works - real engineering projects. In addition, those responsible for support to the Logistic Services of the Army and for support to the RAF, must also appreciate the arcane business of logistics with its multi-faceted engineering needs.

Normally, superimposed upon the work of all military engineers is the danger of being killed by enemy action, and adverse physical conditions caused by lack of sleep and food, bad weather and terrain. On top of all this there is the requirement to fight as an infantryman, move vehicles tactically

on the battlefield and maintain and repair equipment. Thus the Royal Engineer must regard himself first as a soldier but with additional special talents.

SPECIAL TALENTS

THE greatest practical problem that always confronts the Royal Engineer in the field is to complete all the essential processes, in the way of reconnaissance and survey, the assessment of engineer intelligence, design and calculation, and the provision of stores, that must be done before the engineering task can begin; and to do so quickly enough to keep pace with operations, the tempo of which is getting faster all the time.

It has been written of the late Brigadier Kisch, Chief Engineer, 8th Army: "the skill of the Chief Engineer lies not so much in technical brilliance (though Kisch had this to the full) but in correct and timely military appreciation, before he is given any orders." The military engineer needs a power of anticipation verging on second sight. His tools are large machines, specialist equipment, expedients and individual skills which must be positioned on the battlefield so that they can be brought to use in a timely, balanced and economical way.

It is a peculiarity of the Corps that every RE officer, however junior, whether commissioned or non-commissioned, is liable to find himself in the position of trusted engineer adviser to some commander in the field. He must think big, often "two levels up". He must be ready to put forward the engineer point of view, sometimes without being asked! He must be of high quality to do this.

It is essential too for the advice he gives to be good, founded on a base of knowledge cemented by a wide variety of experience. For this reason the Corps has always paid very serious attention to the technical training of its officers, beginning by giving them an engineering education on the broadest foundations, and including when possible, a university course reinforced with instruction at the RSME and at the RMCS. This has been consolidated by practical experience in several fields of engineering but rooted in what is today termed Civil Engineering. By this means it has usually been found possible to fill appointments in war, including senior ones, with officers who have been well equipped with the necessary technical knowledge and experience. Since in war, much rests on innovative thinking and improvisation, the Royal Engineer must be a broad thinker, not afraid to explore the eccentric or the obtuse and prepared to improvise using all manner of expedients; he must be ingenious.

And having done his reconnaissance, appreciated the situation, examined courses open and devised a plan to fulfil the aim within the constraints of available resources, what then? The military engineer needs to be decisive. Time is of the essence and whatever the battlefield scenario, the essential engineering task of supporting those fighting must go on. Orders must be formulated and given with clarity. The military engineer must have a bias for action.

But, in addition to being a quick planner, having the power of anticipation, being ingenious and decisive, the sapper must have courage - particularly in war where moral and physical courage is needed by all soldiers.

A SOUND ENGINEERING BACKGROUND

IN turning now to focus on engineering the initial point is that, as with all engineers, the military engineer is concerned with First Principles: those immutable laws of the Sciences.

As touched on earlier, the essential difference when carrying out an engineering task in a military environment is that the allocated resources are often less, and the time for planning and completion of the task shorter than for the civilian engineer. Therefore, the task facing the military engineer, in many ways, is more complex than that facing his civilian counterpart; the Royal Engineer must be skilled in the ability to trade off resources and economy against time.

As for the particular environment of the battlefield, the Royal Engineer needs to understand too the impact of chemical and biological weapons, radiation and nuclear firepower; they are likely to do more to enlarge the tasks of engineers, and hinder their efforts, than help. The Royal Engineer has too to appreciate the power and application of explosives and of machines, often operating under adverse conditions. He has too to develop a feel for the stress of climate.

He needs to be a technical specialist, equal in ability to his brothers-in-arms in the Corps of Royal Signals, the Royal Electrical and Mechanical Engineers and the Royal Army Ordnance Corps. The Royal Engineer has to be a technical specialist in the use of ancient and modern materials with mechanical and electronic devices for:

- The making of obstacles, such as anti-tank defences, fortifications and minefields and, qf

course, in the destruction of routes across existing obstacles; and on the opposite side, a specialist in the surmounting of obstacles, both natural and artificial. Much of this work involves bridging rivers and gaps using the variety of armoured, amphibious and structural equipment bridging available for use in the assault on the lines of communication or in the rear zones of a theatre of war. But too he must overcome obstacles by the undermining of walls, by breaching and blasting and by the gapping of minefields and the demolition and dozing away of obstructions to movement. He has to be, too, a specialist in bomb disposal so as to free choked and blocked routes and clear airfields for repair work after attack. And he must deploy when needed the search-lights to aid movement across obstacles and advise on the use of camouflage techniques to assist our own forces or confuse the enemy.

- Carving out routes and roads, usually through a series of topographical obstructions, and constructing (and repairing) airfields.
- Repairing and opening ports and installing the facilities necessary for the supply services to operate them. The Royal Engineers even, on occasions, have to deploy specialists to create ports.
- Building accommodation for troops in the field with all the building services they demand. Constructing logistic installations needed to support fighting units, including those to supply fuel oil for the Army and the RAF, and for the generation of electrical and mechanical power.

Thus the Royal Engineer needs a sound technical education to do his work and manage the advanced equipments now coming onto the scene - and confound their use by the enemy. But the unexpected will inevitably occur; then sappers will need to draw on their engineering wit, knowledge and experience to improvise a solution. And to grapple with this great engineering challenge, he, as with all military engineers, must exercise leadership.

LEADERSHIP

IT will be trite to encapsulate an essay on leadership into a few sentences: the quotation from the Chief Royal Engineer has explained the context. It is clear that the military engineer must have the right temperament to get on with the units he is supporting, to gain their trust, whilst at the same time be determined and strong enough to drive through decisions that he knows are required, from his knowledge as an engineer. Yet he must also lead his men and inspire those around him: in the words of Field Marshal Lord Montgomery: "I would define (leadership) as the capacity to rally men and women to a common purpose, and the character which inspires confidence. "

CONCLUSION

THE profession of Royal Engineer demands that he has the characteristics firstly of a soldier, secondly a sapper and, thirdly, a specialist. His mental approach to his profession needs to be conditioned by an ethos derived from a deep appreciation of his role as a military engineer.

As a soldier he must survive on the battlefield and be able to fight as infantry - as many did in the Second World War. He must so understand war that he can be a trusted adviser to commanders and be able to appreciate a situation, create a plan within available resources and then act decisively with ingenuity. A man of high quality, the Royal Engineer officer whether commissioned or non-commissioned, must possess moral and physical courage and be able to exercise leadership. He must have a bias for action using the tools, resources and manpower available to him to execute his task in a timely manner.

His skill as a Royal Engineer rests on the clear understanding of the immutable laws of nature and scientific principles. He must have a genuine 'feel' for engineering principles. But he must couple this with foresight and the capacity for lateral thinking and innovative thought (often on a big scale) which inspires improvisation and the use of expedients to achieve the aim.

As a specialist, the Royal Engineer must, as a matter of routine professionalism, use ancient and modern materials with all (or any) of the mechanical, electrical and electronic devices that technology can offer to aid the execution of normal tasks. His guiding maxim must be that he must ensure the mobility and survival of our own forces and deny mobility to the enemy; he must contribute to the defeat of the enemy through the application of engineering techniques on the battlefield.

The Road to Khartoum - Part II

ANNE CAVENDISH

PREPARING FOR THE FINAL STAGE

AFTER Atbara, the Anglo-Egyptian army went into summer camp at various sites on the banks of the Nile between Berber and Atbara, to wait for the river to rise sufficiently to be navigable by gunboats and steamers.

The Khalifa waited at Omdurman with 50,000 Dervishes.

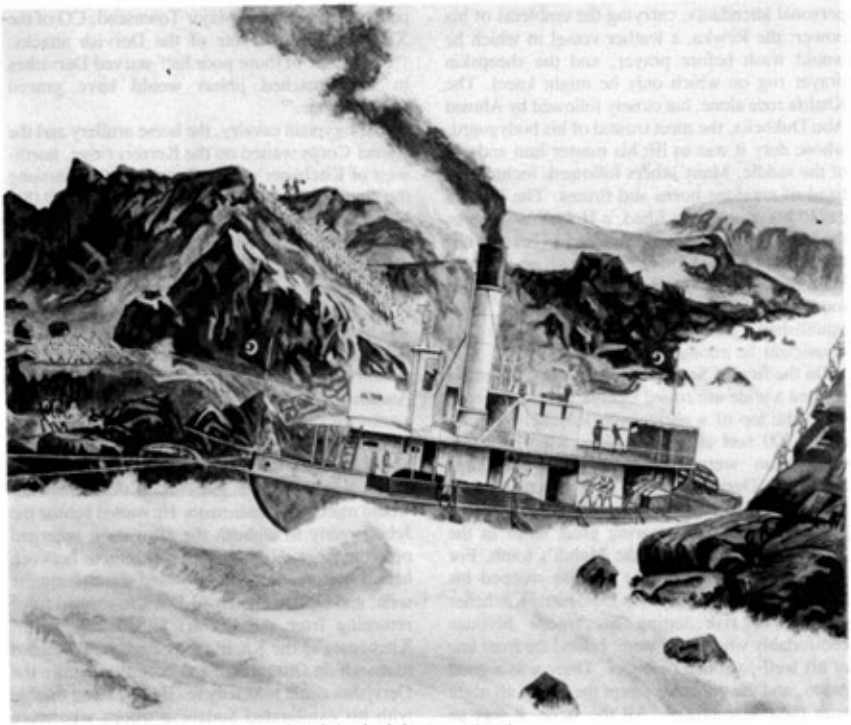
For Girouard there was no summer rest. The railway must reach Atbara before August. With stupendous effort in the ever-increasing heat, this task was completed by the beginning of July. Then Girouard was able to hand over the charge of the Sudan Railway to Lt Macaulay RE, and return to Cairo to take up the appointment of President of the Egyptian Railway Administration and to continue an increasingly distinguished career as an engineer and as a colonial administrator, culminating in his appointment as Director General of Munitions at the War Office between 1915 and 1917. No assessment of Kitchener's Nile campaign should underestimate the contribution made by this handsome, brilliant, ebullient Lieutenant of Engineers.

The British brigade was camped at Darmali and Selim where a mixture of heat, boredom and sickness took its toll. Huge and persistent flies were everywhere, scorpions crept into blankets, and enormous hairy yellow spiders infested the camps. Eight-inch-long asps whose bite could kill a camel were permanent residents. Nile boils, apoplexy and enteric (fifty men died of enteric) joined together to make life in camp hellish. The food was adequate, but monotonous and nasty, and a particular grievance was the disgusting tea made with muddy Nile water. With no beer, tea took on an immense importance. The soldiers spent all their money on supplies brought from Cairo by enterprising Greek and Syrian traders who set up shop beside the camps almost before the tents were pitched. In June three new gunboats arrived in parts and were put together in readiness for the advance up river. A new force of about 2000 "Friendlies" was recruited and put under the command of the imperturbable Major Stuart-Wortley, with Lt C Wood, son of Sir Evelyn Wood, as his second in command. The "Friendlies" proved to be a jolly force, if rather frightening. They continued to provide enthusiastic support until the end of the campaign. Reinforcements arrived from England: a second infantry brigade, the 17th Lancers, and a brigade of field artillery, plus a few medical units.

Early in July Kitchener moved his reinforced army to Wadi Hamad, a village on the left bank of the Nile, about sixty miles north of Omdurman. On the 24th August they began their march up the west bank in a double line of brigades, the British closest to the river. Their front was protected by cavalry and horse artillery, and each brigade was followed by a battery of field artillery. Baggage columns brought up the rear. Kitchener took two months' supply of ammunition and food on camels and on boats. The "Friendlies" careered happily along on the east bank. A flotilla of ten gunboats and five auxiliary transport steamers, under Commander Colin Keppel RN, was on its way up the Nile. Extraordinarily, the Dervishes made no attempt to harass or prevent the progress of the boats through the cataracts. They abandoned the batteries and fortifications which they had set up on either bank. It was generally believed that, had they used these, they could have caused considerable damage and delay to the little fleet. The Khalifa, apparently, had decided to conserve all his forces for the fight for Omdurman. By August 30th the army had reached Egeiga, about six miles from Omdurman. Here, on the 1st September, an entrenched camp, backing onto the river, was prepared. Its front faced the desert, on the west. The gunboats moved up the river, clearing the villages on the east bank. They landed a howitzer battery and shelled Omdurman, causing heavy losses among the Dervishes and silencing their guns.

Kitchener's army numbered 8200 British troops and 17,600 Egyptian and Sudanese regulars. Gatacre's two brigades were commanded by Wauchope and Lyttelton. The 21st Lancers, under Colonel Martin, and a brigade of field artillery and sapper and medical units brought the British contingent to a nice compact little army.

Hunter's four brigade commanders were Maxwell, MacDonald, Lewis and Collinson, and their cavalry was commanded by Colonel Broadwood. The Anglo-Egyptian artillery on land



A gunboat being hauled over a cataract

consisted of 44 pieces of field artillery and twenty Maxims. On the boats were 36 guns and 24 Maxims. Kitchener's superiority was overwhelming. On August 30th he despatched a message under a flag of truce to the Khalifa, advising him to remove all women and children from Omdurman. He told the Khalifa that he proposed to destroy the city by bombardment, and to overthrow the Dervish throne and government "in order to save the country from your devilish doings and iniquity."

Two days later, on September 1st, the Khalifa's great army, now numbering 60,000, was spotted by the cavalry as it advanced swiftly across the plain of Kerreri, only six miles north of Omdurman. Lt Winston Churchill was sent back by his CO to inform the Sirdar, who rode alone, ahead of his staff, with two standard-bearers carrying the Union Jack and the Egyptian flag. "The heavy moustaches, the queer rolling look of the eyes, the sunburnt and almost purple cheeks and jowl made a vivid manifestation," Churchill wrote in *My Early Life*.

The Battle of Omdurman

On the 31st of August the Khalifa ordered his army to parade on the open plain west of Omdurman, where he would inspect them and deliver his final exhortation. At dawn the thumping war drums and the wail of the Ombeya, the Sudanese war-horn, signalled the Khalifa's departure from his palace for his ceremonial arrival at the parade ground. It was a picturesque procession. First came an escort of Mulazemen, foremost warriors of his own tribe. Six men followed, each in turn blowing the great Ombeya, which might only be blown in the Khalifa's presence and at his command. Twenty or thirty buglars followed, and then came the Khalifa's

The Road To Khartoum Part II.

personal attendants, carrying the emblems of his power: the Rewka, a leather vessel in which he would wash before prayer, and the sheepskin prayer rug on which only he might kneel. The Khalifa rode alone, but closely followed by Ahmed Abu Dukheka, the most trusted of his bodyguard, whose duty it was to lift his master into and out of the saddle. Many others followed, including a band of antelope horns and drums. The Khalifa called his people to a Jihad, a Holy War, to turn the infidels forever from their land. For the last time in our history this dramatic scene was set. With the defeat of the Dervish, the superiority of modern weapons over the "savage" was established. Never again would heroism and fanaticism be enough.

On the first of September the Anglo-Egyptians formed a wide arc round Egeiga. Kitchener rode up to the top of a rocky hillock, Jebel Surgam, about 700 feet above the Nile. Khartoum and Omdurman were a backcloth to the huge advancing Dervish army. The gunboats were at their deadly work, bombarding Omdurman and its protective forts, and tearing great holes in the gleaming white dome of the Mahdi's tomb. For some unknown reason the Khalifa stopped his advance and settled down in the desert. Kitchener decided to risk letting his troops bivouac comfortably where they were: behind the front line of his well-patrolled defences. There was a good moon, and the gunboats swept the desert all night with their searchlights. All the same, it was an uneasy night, and to the sentries and patrols every thorn bush seemed to be on the move. At 3.30 am on the 2nd, Kitchener' s army stood to arms. They were deployed in close order and in line, the front rank kneeling, the second line standing. Thus had Wellington aligned his soldiers at Waterloo. As the Dervish army advanced, the confused shouting became distinguishable: "LA ILAHA ILLA LLAH WA MUHAMED RASU ULLAH" ' "There is but one God and Muhammed is the Messenger of God".

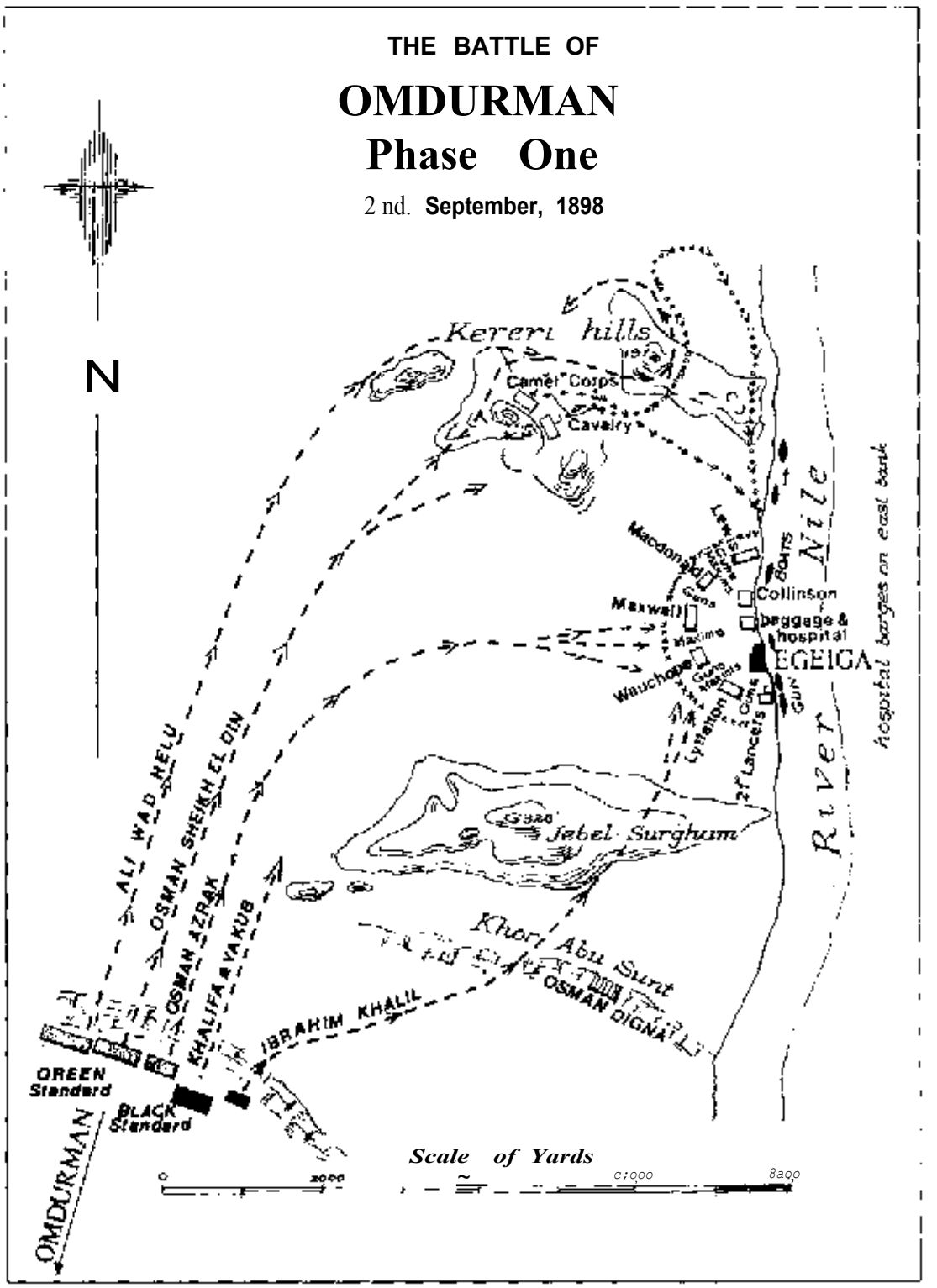
Banners appeared above the sand hills, and the Dervishes formed a semi-circle round the centre and the southern edge of the Anglo-Egyptian camp. At 6.45 am the field artillery opened fire. Following the white banner of Osman Azrak, 10,000 Dervishes threw themselves against the zariba again and again. The attack ended only an hour after it had started. The survivors withdrew, leaving the field heaped with their 2000 dead, among them Osman Azrak. Not one Dervish had penetrated the camp. Major Townsend, CO of the XIIth Sudanese, wrote of the Dervish attacks: "The valour of those poor half-starved Dervishes in their patched jibbas would have graced Thermopylae. "

The Egyptian cavalry, the horse artillery and the Camel Corps waited on the Kerreri ridge, north-west of Kitchener's right flank, and there among the foothills they met and fought about 20,000 Dervish cavalry, led by the Khalifa's son. The Dervishes did well but were driven off by gunboat and artillery fire. The cavalry returned to camp in high spirits.

The Khalifa, with 20,000 of his finest warriors, was hidden behind Jebel Surgam. He had intended, if the attack on the zariba had succeeded, to advance and finish off Kitchener and his army. Another 8000 men were concealed below the south-east ridge of the JebelSurgam, guarding his communications with Omdurman and ready to join him if necessary. When it became obvious that his attack had failed, he felt certain that Kitchener would march on Omdurman. He waited behind the Jebel, ready to ambush the army as it emerged onto the plain. He hoped to crush them between his own large army, which would attack from the west, and Osman Sheikh-ed-Din's re-formed force returning from the Kerreri hills in the north. Kitchener, as the Khalifa expected,-now decided to march on Omdurman and occupy it before the Dervishes could return there. He had some trouble with his exhilarated Sudanese troops who were busily shooting wounded Dervishes. The voice of the Sirdar could be heard raised in anguish above the hubbub: "Cease Fire! Cease Fire! Oh, what a dreadful waste of ammunition!"

At 8.30 am, the 21st Lancers were sent to reconnoitre the route between the southern flank and the city, and to prevent any retreating Dervishes from reaching Omdurman. Half an hour later, Kitchener ordered his army to leave Egeiga in echelon formation of brigades from the left, with the British brigade leading. He knew that the Khalifa, with the bulk of his army, was concealed somewhere and was ready for him to attack at any time. The second phase of the Battle of Omdurman had begun.

Meanwhile, the Lancers, after crossing the eastern slopes of Jebel Surgam, met a body of Dervishes hiding in a dry wadi. The regiment was thirsting for action. They formed into line of squadron columns and continued along the ridge until they were within 300 yards of the small party


THE BATTLE OF
OMDURMAN
Phase One
2 nd. September, 1898
N
Kereri hills
Camel Corps
Cavalry
Macdonald
Lewis
Guns
Maxwell
Maxims
Wauchope
Guns
Maxims
Lyttelton
2 Guns
2f Lancers
Guns
Collinson
Baggage & hospital
EGEIGA
Nile
River
hospital barges on east bank
Jebel Surghum
Khor Abu Surt
ALI WAD HELU
OSMAN SHEIKH EL DIN
OSMAN AZRAK
KHALIFA & YAKUB
IBRAHIM KHALIL
OSMAN DIGNA
GREEN Standard
BLACK Standard
OMDURMAN
Scale of Yards
0
2000
4000
6000
8000

of Dervishes. The Dervishes dropped to their knees and opened heavy fire. Lancers and horses fell. The colonel ordered .. Right Wheel" ˙ and "Into Line" to be sounded. The trumpet could barely be heard above the commotion of rifle fire and horses' hooves. The troops wheeled and formed in a long galloping line. Bullets hitting the ground sprayed gravel into the air, and the Lancers tilted their helmets forward to protect their faces. They rode fast and the distance was soon covered, but not before a deep crease or Khor in the ground was revealed, from which arose, with a wild yell, a swarm of Dervishes ready to meet and repel the charging Lancers. Nothing could stop the charge. The Lancers increased speed. The riflemen, still firing, were swept into the Khor. With a great shout, the Lancers, at full gallop and in close order, met the massed Dervishes. The impact was shattering. Thirty Lancers, men and horses, and at least two hundred of the enemy were brought down. The impetus carried the Lancers through, and, at walking pace, they scrambled out of the Khor on the other side. A short and bloody fight ensued. In two minutes, five officers, 65 men and 119 horses out of 400 had been killed and three Victoria Crosses had been won. It was magnificent, gallant, wild, and to be compared with the action of their brother 17th Lancers at Balaclava. It was totally irrelevant to the campaign. The casualties were unacceptably high, accounting for 40 per cent of those suffered in the Battle of Omdurman in all its phases. The Sirdar was deeply displeased. To his chagrin, in the years to come, this was more often remembered and admired than any part of his victorious campaign. (The painting of the scene by R Caton Woodville, which hangs in the Army Museum, is familiar to many today).

The Khalifa hoped that the formation of the Anglo-Egyptian force would be spoiled as they advanced; and it was. Gatacre was eager for his two British brigades to occupy the ridge running eastwards from Jebel Surgam to the Nile. He moved them almost together instead of keeping to the regular echelon. This opened a gap between Wauchope and Maxwell. Hunter wanted to guard against a Dervish attack from the Kerreri hills. He distrusted Lewis's brigade and moved MacDonald's from immediately behind Maxwell. to the position previously held by Lewis on the right of the echelon. MacDonald, strengthened by three field artillery batteries and eight Maxims, moved west a short distance into the desert to give Lewis room to pass. By 9.30 am, the two British brigades were ascending the ridge. Kitchener had just sent them an order to halt for a short time while the gaps in the rear were filled when the Khalifa moved. He left his position on the west of Jebel Surgam and attacked MacDonald who was separated from the rest of the army by a distance of about 800 yards. MacDonald faced west and stopped conforming with the movements of the rest of the Egyptian brigades, which were wheeling south as fast as possible. He faced the enemy and sent a galloper to Hunter to ask for support. His brigade continued to fire at the enemy. Hunter joined MacDonald and sent an ADC to tell Kitchener, whose view was blocked by the Jebel, what was happening. Immediately, Kitchener began to fling his brigades about, issuing his orders, as was his custom, with complete disregard for his staff and for chains of command. (Battalion commanders would be executing orders of which their brigade commanders knew nothing). Kitchener's superiority in weapons was so huge that the Khalifa's second attack was repulsed as easily as the first; the only problem was to bring the full weight of the artillery to bear as thoroughly and as quickly as possible. He ordered his three leading brigades to face the enemy, and then, as MacDonald became fiercely engaged, he ordered Wauchope to double back across the plain and to fill the gap between MacDonald and Lewis. While Wauchope carried out this order; Lyttelton and Maxwell advanced to relieve the pressure on MacDonald by attacking the Khalifa's right flank. Kitchener, watching with Lyttelton, saw the Khalifa's attack collapse under steady, accurate fire. The attack, as always, was pressed with wild courage, but Wauchope's leading battalion had not yet arrived on the scene when the surviving Dervishes melted away into the desert, leaving thousands of dead on the field, including Yakub, their commander, brother of the Khalifa. The second phase of the battle was over, and immediately, the third phase began.

The Khalifa had hoped to co-ordinate Yakub's attack from the West with an attack by his son, Osman Sheik-ed-Din, from the Kerreri hills in the north. Had the attacks been simultaneous, matters could have been serious for the Anglo-Egyptians. When Yakub's attack failed, MacDonald found himself in danger from Osman, advancing from the north. MacDonald moved his battalions, one by one, from a line facing west to one facing north.

(This right wheel, perfectly executed under fire, was long used as example by lecturers at the Staff College).

Kitchener had sent Wauchope into action on MacDonald's left. He then ordered the CO of the Lincolns to go to the assistance of the Xth Sudanese, who were under great pressure. The Lincolns, the 10th of foot, had adopted the Xth Sudanese as an honorary battalion of Lincolns, and their arrival at a crucial moment gave much pleasure to both regiments. While Lewis enfiladed the Dervish attack on MacDonald's left, the Camel Corps and three batteries of artillery came into line between the Lincolns and MacDonald. The battle was over. The last Dervish attack had been driven off. They were retreating in their thousands across the plain, pursued and slaughtered by cavalry. The Khalifa, having seen Osman, his favourite son, killed in the battle, made his escape, mingling with the hundreds of refugees leaving Omdurman for the south. The Sirdar, surveying the dreadful battlefield, told his staff that the Dervishes had been given "a good dusting". The Khalifa's black flag was found planted in the desert, the bodies of the Dervishes who had defended it heaped around it. Kitchener had the flag carried behind him as he resumed the march to Omdurman.

There was very little resistance in Omdurman. The advance guard pushed into the open space between the Khalifa's palace and the Mahdi's tomb. The XIIIth Sudanese, under Smith-Dorien, waited beside the tomb till the Sirdar, on his white charger, passed through the gateway to the centre of the square. Here one of the gunboats, seeing the Khalifa's flag fluttering beside the Mahdi's tomb, sent three shells in quick succession screaming over the Sirdar's head but killing several Sudanese. The rest beat a hasty retreat from the square, but not before a fourth shell had killed Hubert Howard, *The Times* correspondent. They rode on to the Khalifa's prison, a barren compound providing neither shade nor shelter. The prisoners were shackled with heavy irons which allowed little and painful movement. A pitiful group of European prisoners was clustered together; it included Henry Neufeld, a German merchant who had been a prisoner of the Khalifa for thirteen years and Sister Teresa Grigolini, a mother superior who had been captured with a Father Chrwelder seven years before, together with about twenty Greek traders. All were haggard and emaciated.

The wretched Egyptian cavalry, already exhausted from their pursuit of the Dervishes after the battle, were sent off, hot foot, to capture the fleeing Khalifa. This enterprise failed and had reduced them and their horses to the brink of death by the time they hobbled back into Omdurman.

THE AFTERMATH

IT remained for the Sirdar to dig up the bones of the Mahdi and throw them into the Nile. This was a necessary act to bring to an end a dangerous legend, but Kitchener retained the unusually large skull. He toyed with the idea of having it mounted in gold as a drinking-goblet or an ink-pot, but rejected this in favour of sending it to the Royal College of Surgeons where, he believed, the intestines of Napoleon were already preserved. However, the Queen, reflecting, as always, the reactions of the general public to such distasteful behaviour, insisted that the skull be decently buried. This was done with dignity and in obscurity in the Moslem cemetery at Wadi Haifa.

Ten thousand Dervishes lay dead on the battlefields of Omdurman, and nearly 20,000 wounded were scattered unattended in the desert sun. Three-quarters of these must have died. There were not even enough medical resources to care for the 382 Egyptian wounded. The sun and the vultures did their work.

The Sirdar was given a peerage and a grant of £30,000, and eventually became Governor General of the Sudan as well as Commander-in-Chief of the Egyptian army. Various other minor campaigns were fought of which one must be mentioned. The Khalifa was ruthlessly hunted down and, at the battle of Urn Dibaykarat, on the 24th November 1899, was brought to book. He chose, despite all his previous experiences, to attack from the front. Rifle, machine gun and Maxim brought the attack to a terrible end. Seeing his men retreating, and being unable to rally them, he knew that all was lost. He and his Emirs dismounted and, following the custom of Arab chiefs who distain to surrender, the Khalifa seated himself on his sheepskin and, with his Emirs around him, awaited inevitable death.

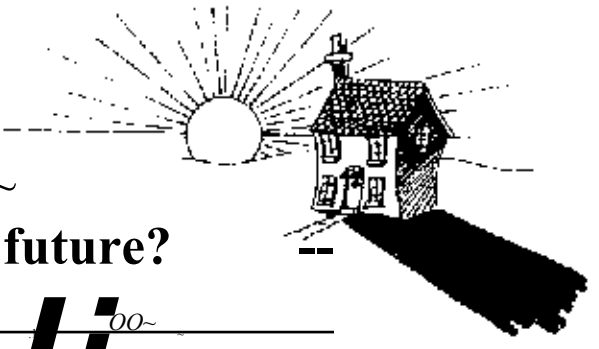
It was over. The cruel domination of the Dervishes which had brought about the deaths of millions of Sudanese since Wolseley's departure in 1885 was at an end, and the Sudan could settle down to a period of peace and rehabilitation. Queen Victoria could write in her diary: "Now, surely he (Gordon) is avenged."

What most deserves to be remembered of this campaign: the determined inspiration of Girouard which enabled the army to be supplied; the wild gallantry of the 21st Lancers; the discipline of the Lincolns; the brilliance of Hector MacDonald; the proving of the Egyptian army? All these, together with the patience and endurance of the Anglo-Egyptian troops, drinking their filthy "Nile tea" under almost unendurable conditions. Also not to be forgotten is the dazzling courage of the enemy. Kitchener's campaign was neither brilliant nor imaginative, but it was adequate. There was never any doubt that he would win. Perhaps if the wily old Mahdi had been in charge, the victory would have been more hardly won, for the Khalifa, though brave in the extreme, was no strategist, and repeated his mistakes to the end. In any case, the modern artillery and the gunboats on the Nile made his defeat inevitable. It was a war waged without generosity, without mercy and without humanity. Parsimony was its guiding light, and we are left with a feeling of depression.

Acknowledgement

The illustrations in this article are taken from a book called *A Good Dusting* by Henry Keown-Boyd, and are reprinted by kind permission of Mr Leo Cooper, of Leo Cooper Ltd, London.

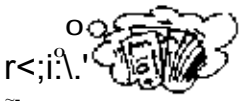
Thinking of buying a hom~ now or in the future?



If so read the tale of Toby the tortoise

Once upon a time Toby decided to buy his dream home. He thought that having found the property it would be plain sailing. But alas, this was not the case. He needed a mortgage but didn't know how to proceed. Suddenly, everyone was trying to advise him, until he didn't know which way to turn.

He was told he needed a solicitor, which frightened him a little. The world had suddenly become a *very* confusing place. He seemed to be needing lots of money for surveys, indemnity premiums, solicitors' fees - the list seemed endless.



Wobody wanted to talk to him anymore it appeared. He didn't know what was happening to his mortgage and the solicitors said they were searching for something but still the home wasn't his. He seemed to be coming up against a brick wall. He was totally in the dark and *very* frustrated. Of course this fairy story has a happy ending. Toby did acquire his home - eventually - but decided never to move again'

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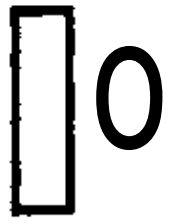

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A Fuel System To Support Exercise Purple Warrior

MAJOR M D COOPER

Major Mike Cooper was commissioned into the Corps in 1968. He served as a Troop Commander in Canada and Ulster with 22 Engineer Regiment, was in Singapore with the ANZUK Field Squadron and then commanded a troop in 57 Training Squadron at Cove. He joined 42 Field Squadron as 2IC in 1974, moving from there via Civil Engineering Wing to his long mechanical and electrical engineering course in 1977. He was attached to TEREX Division of General Motors after his course and then moved to 520 Specialist Team at Barton Stacey in 1979. After commanding a squadron he returned to Barton Stacey as ACRE of 64 ACRE (Works) before moving to 516 Specialist Team RE (Bulk Petroleum) in December 1984. He moved to Engineer Branch UKLF in February 1989.

This article follows on from Lieut Colonel Ian McGill's article in the August 1988 Journal *about* Engineer Operations Out of Area. *It deals with a specific part of the task, which is the supply of fuel, and describes the planning and execution of the Force Fuel Plan for Ex* PURPLE WARRIOR, *held in November 1987 in South West Scotland.*

Following the Falkland Islands campaign in 1982, the Chiefs of Staff decided that a Joint Force Headquarters (JFHQ) would be established to take charge of any future out-of-area type military operations. Command of the JFHQ would be exercised by one of the three UK 4 star headquarters under overall direction of the Ministry of Defence.

Exercise *PURPLE WARRIOR* was the first major tri-service amphibious exercise of Joint Force procedures and was held in the Irish Sea and the Dumfries and Galloway area of Scotland over the period 4-21 November 1987. It depicted the deployment of an amphibious force to an imaginary mid-Atlantic state in order to protect British interests and to carry out a service-protected evacuation of British nationals. The exercise involved the mounting, deployment, support and recovery of a two brigade force consisting of 3 Commando and 5 Airborne Brigades with Force Troops and supporting Naval and Air Forces.

During the early phases of the planning of the exercise, Commander-in-Chief (CinC) Fleet, the 4-star exercise commander, expressed a desire that the deployed forces be supported as realistically as possible, including the supply of fuel. To this end it was decided, subject to shipping, political and environmental constraints, that the deployed ground and air forces would be supplied with ground and aviation fuel from an ocean going tanker, across a beach to an airhead using in-service emergency fuel handling equipment (EFHE).

In November 1986 a working party was established consisting of Joint Force Headquarters (JFHQ), Engineers, RCT, RAOC and the RAF which was tasked with producing a solution to the CinC Fleet's requirement. An outline plan was formulated in December 1986 and an initial reconnaissance took place in the Luce Bay area South of Stranraer and within five miles of West Freugh airfield. This reconnaissance concluded that the use of EFHE to support the exercise was possible but there were some technical difficulties to be overcome. 516 Specialist Team RE (Bulk Petroleum) (STRE (BP)), the only regular army fuels engineering unit, was then earmarked to provide technical assistance with planning the fuel system and then supervising the technical aspects of its construction; in civilian terminology to be the consultant.

Major M D Cooper
A Fuel System To Support

Following this, a reconnaissance was mounted in 1987' at which the exercise planner (the Permanent Planning Group (PPG) of the JFHQ), the contractor (36 Engineer Regiment), the clients (the Royal Air Force and Royal Army Ordnance Corps), the consultant and various other interested sub-contractors such as those responsible for unloading ships across the beach and for providing military boats and tugs, were represented.

Once the reconnaissance had been done, a clerk of works (mechanical) was detailed for full-time planning of the exercise. He had access to all the technical support that the unit -could provide, as well as receiving advice from the only member of the STRE who had done this type of amphibious exercise before. It was he who drafted the report within guidelines set by the OC of the STRE (the consultant engineer) and then carried out all the liaison with the multitude of agencies involved with a project such as this which, as well as being a military exercise, had so many political and environmental factors to consider.

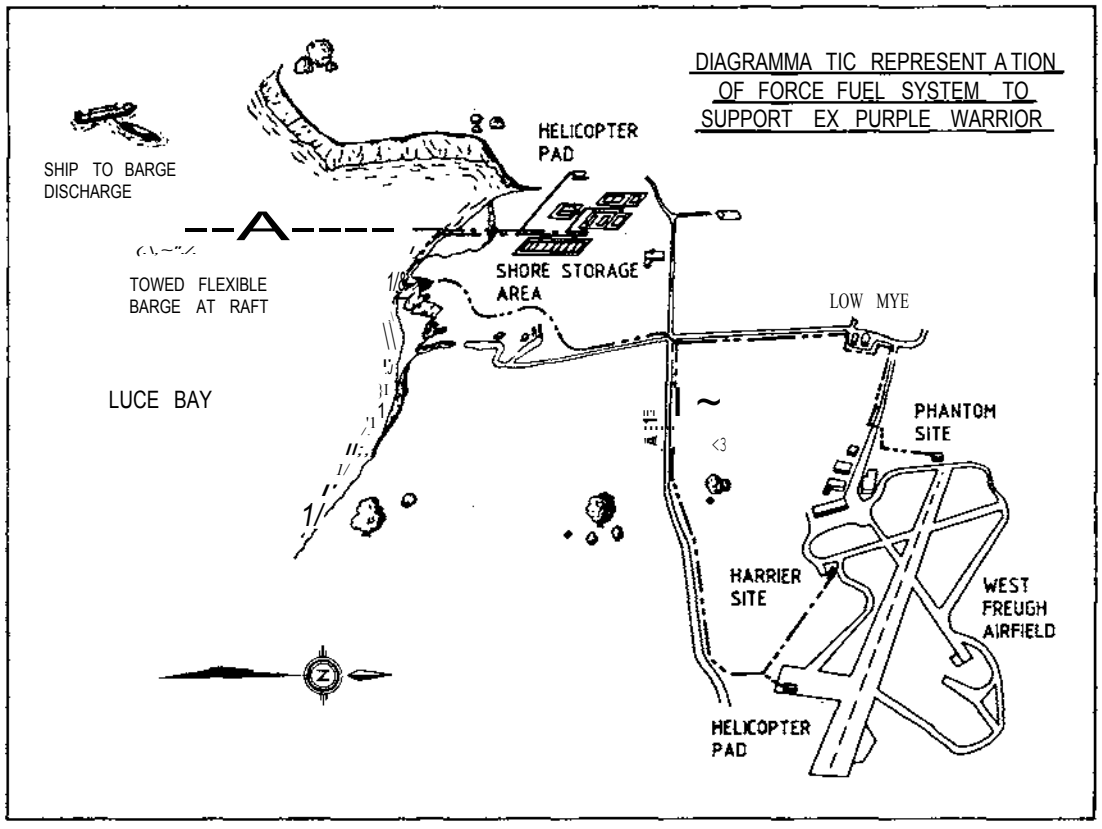
The major factors to be considered during the planning of the force fuel system were:

Climate

Although the maximum, minimum and average daily temperatures do not prove a great problem to well equipped military personnel, the effects of high rainfall in the area influencing construction, coupled with adverse sea states giving a 30% possibility of delay to landing of stores, construction and operation, made the successful completion of the construction phase within the allocated time a potential problem. Non-availability of fuel because of weather delays would obviously have affected the build-up operation and the provision of air support.

Topographical

In general the area was low-lying with West Freugh lying about 16m above sea level. The beach was composed of compacted sand and had a gradient of 1 in 300. The distance between high



300 tonne towed flexible barge being unloaded at the pump raft

The shore storage area showing tank farms storing all three fuel natures (8 tank for aviation, 3 tank for ground)

and low water mark was approximately 1000m which made operations very tide dependent and ensured that the mooring for the pump raft had to be a considerable way from the high water mark. The area surrounding West Freugh was mainly marshy peat with a high water table and it was not considered suitable for engineer construction plant. The dunes were gravelly sand overlaid with peat and covered with coarse grass and heather.

Timings

Because of exercise constraints the installation had to be built and commissioned within six days.

Equipment

All equipment had to be in-service, or proposed for service EFHE and had to be transported to theatre by ship. The majority of the equipment would be landed across the beach.

Technical

A minimum quantity of 1060m^3 of fuel of all natures, including 760m^3 AVCAT, was to be landed across the beach, with a shore storage requirement of three days reserve at operating rates.

It took about two months, punctuated by other deployments and exercises, to produce the Force Fuels Plan which was the overall design and construction report. Almost immediately this had to be amended when a final check of the engineer logistic assets for the exercise showed that not enough key items were available for the systems envisaged by the consultant. Amendment 1 was issued on 31 July 1987 and this became the Force Fuel Plan that was used on Exercise *PURPLE WARRIOR*.

The Force Fuel Plan called for fuel of three natures (aviation kerosene, gasoline and diesel) to be taken in towed flexible barges or dracones from a Royal Fleet Auxiliary tanker lying in Luce Bay, and then towed to a pump station mounted on a raft situated about 1.5 km from the high water mark. From here fuel would be pumped ashore along a single multi-product floating line into shore storage. The shore storage consisted of three tank groups storing separate fuel natures up to a maximum of 1500 tonnes of fuel, a densitometer and slop tanks for handling interfaces, and quality control and dispense equipment for ground fuel. Ground fuels were dispensed to bulk tankers, unit vehicles and jerricans in the shore storage area. Aviation fuel, after settling, would be pumped by a main line pump station along an 8 km cross country pipeline to aircraft dispersals at the airhead. At the dispersals it was receipted, via filter water separators, into RAF operated storage tanks. There was also a helicopter landing site within the shore storage area.

The contractors were 9 Parachute and 20 Field Squadrons of 36 Engineer Regiment. A troop from each squadron was responsible respectively for the cross country pipeline and the shore storage area. Elements of 59 Independent Commando Squadron were responsible for the beach discharge system which included the dracones, the floating pump station and the ship to shore pipeline. 61 Field Support Squadron was responsible for the provision of engineer construction plant and the handling of all stores within a beach material park. Once the construction had been completed and the system pressure tested and commissioned, it was operated by a petroleum platoon of 91 Ordnance Company with the Tactical Supply Wing RAF actually delivering fuel into aircraft.

A Fuel System To Support

The Force Fuel System took four and a half days to construct, which was well within the six day limit set in the exercise plans, using 200 tonnes of stores which occupied about 1000m³ of shipping space. The good construction time was assisted by very good weather and the smooth unloading of stores from the logistic support ships, the majority of these stores coming ashore across Luce Bay beach. It then took a further 36 hours to pressure test using air, and on the cross-country pipeline with water, pig clear and dry and then commission in fuel.

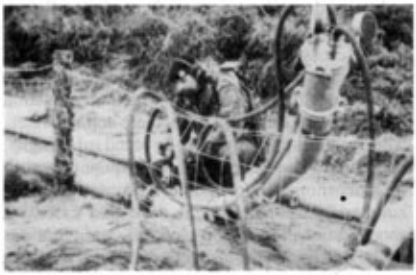
Once fuel unloading operations started, the long distance from pump raft to beach storage was handled quite adequately by the floating hoseline and a new hydraulically driven submersible pump, and initial fuel inloads were achieved with only minor problems, mainly with coupling the dracones to the pump raft. However as the exercise proceeded the weather deteriorated to the worst conditions in twenty years and damage to the raft, the sinking of two combat support boats, the inability of the tugs to tow dracones from the tanker and the system operators to handle them on the raft meant that fuel became a crucial commodity because it could not be inloaded. This real problem restricted both vehicle movement and flying.

The standard emergency fuel handling equipment in the British Armed Forces, known as EFHE, was used for this exercise. The equipment is a relatively simple 150 and 100m victualic coupling system using both rigid and flexible hoselines, flexible tanks of 135m³ and 45m³ capacity, and 125m³/hr pumps capable of generating heads of 14 bar and 5.5 bar. In addition valves and various pipe configurations allow a large number of ancillaries such as manifolds, route crossing and expansion loops to be constructed. Finally filter water separators are capable of filtering fuel, and particularly aviation fuel, down to 5 micron particulate and no water. The system is usually built to standard designs, particularly in storage areas. New equipments such as a densitometer for monitoring interfaces, the submersible pump, layflat hose and extensive modifications to the nose and tail configurations of the dracones were also tested under very trying conditions.

One of the major problems in the peacetime exercise was the pressure testing of the system prior to commissioning. The complete system had been constructed by the contractor with consultant supervision, but the majority of construction troops had little experience in fuels engineering on this scale and there was some doubt on the quality control of the pipework construction subjected to 14 bar working pressure. On operations engineers would probably not pressure test because speed rather than safety or environmental considerations are paramount, but in an area of outstanding beauty and special scientific interest, this somewhat cavalier attitude was obviously not acceptable. It is usual military practice to air test to 3.5 bar but again this was not high enough, particularly on the cross-country pipeline, and so it was decided to test with water. The problems of introducing water into a fuel pipeline, particularly aviation fuel, are obvious, the two are completely incompatible. The pressure test was no problem, introducing water, pressurizing to 21 bar and leaving the system for

The shore storage splitter manifold. This handled fuel from the raft-mounted pump station and also fuel storage to the airhead

RAF Phantom at readiness at airhead dispersal. All deployed aircraft used fuel landed from RFA *Olwen*



Sgt Joyce, 516 STRE(BP) fitter, checking fuel pipeline prior to compressed air pigging

Aviation fuel tank manifold in shore storage area

six hours whilst checking for leaks, but how to remove 80m³ of water? The answer was in a 'pigging' system which the consultants developed especially for this exercise. Soft foam 'pigs' were introduced at one end of the pipeline, which had been divided into convenient sections, and then pushed forward by applying 600 ft³/min of compressed air. This easily ejected all the water ahead of the 'pig' and the 'pig' also cleaned the pipe. Any water left in the coupling seals was easily dealt with by the pipeline filter separators prior to issue to the RAF storage tanks on the aircraft dispersal areas. Once the pipeline had been made viable, filling with aviation fuel was easy, introducing product slowly and allowing air to escape out of the system drain points and storage tank breathers.

Assessment

Was the exercise a success? Results indicate that it was. A system was designed and planned and the stores transported from the mounting port of Marchwood to Scotland and unloaded across a beach. The system was then built by troops in the main unfamiliar with the equipment and finally operated in some of the worst weather in twenty years. The system handled 1.5 million litres of fuel of all natures and worked exceedingly well within its design constraints proving the Royal Engineers capability to be able to deploy such a system to support ground and air forces with fuel.

Finally it proved invaluable experience to the consultant who had designed, planned and supervised the construction, and to the construction troops who did such an excellent job.

What lessons are learnt? As with the Falkland Island operation a lot of lessons which had already been known and then forgotten because of lack of practice were relearnt. Probably the major lesson was that a deployed force is almost completely dependent on such a fuel system, and the design and construction of such a system and then its operation is largely dependent upon the expertise of the consultant, the capability of the contractors, the weather, the topography and the equipment. Nothing here is really new in engineering terms. Some equipment shortcomings were exposed and the need for a more efficient bulk delivery system from a tanker was highlighted. One of the major points was that in an operation, reconnaissance could not be done on the ground in the way it was for this exercise. Although some topographical details would be available from intelligence sources such as satellite surveillance, the design would largely be done from a map reconnaissance, air photographs, computer modelling and local knowledge (if any). However, the Royal Engineers have no doubt of their own ability to be able to do the job again, if necessary for real.

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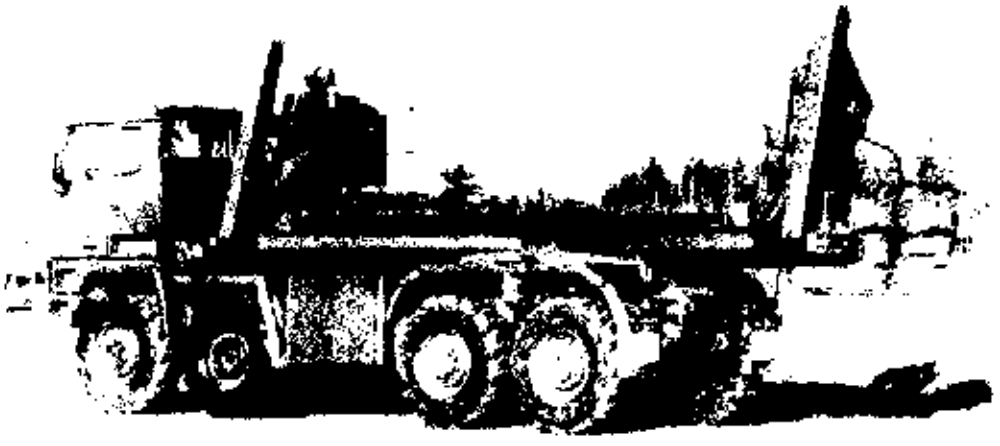

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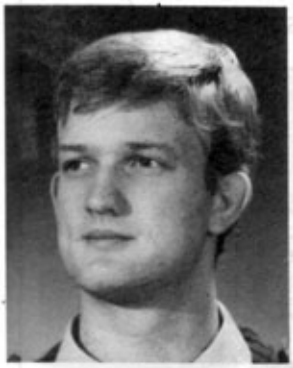
Watermanship Of The Athenians

LIEUTENANT A J MACHIN



Lieut Machin was commissioned into the Corps in August 1985. He has since commanded both a support and field troop with 16 Field Squadron, 25 Engineer Regiment. During his time with the Regiment he accompanied them on a five month tour of the Falkland Islands. He is presently reading a degree in civil engineering at the Royal Military College of Science, Shrivenham.

In July and August of 1988 the Trireme Trust undertook its second period of sea trials with a replica ancient Athenian warship, the trireme *Olympias*. A crew of 170 oarsmen is required to spend three weeks with the trials team in Poros, Greece, the home of *Olympias*. As part of the Trust's recruiting campaign an invitation was forwarded to the Rowing Club of the Royal Military College of Science, Shrivenham. Lieutenants Bill Lang, Gary Jackson and myself decided that the opportunity to take part in such a unique historical study should not be missed. The following article does not attempt to give a full and detailed technical appraisal of the design and capabilities of the trireme, but rather a personal account of the experiences and problems encountered whilst rowing this extraordinary machine.

Background

For those who did not see the excellent programme of the 1987 trials, shown twice on BBC, a little background information on the ship, the Trust and the trials is included.

Following 25 years of dedicated research by J S Morrison, *Olympias* was designed by John Coates, a leading maritime architect. The ship is a wooden construction, hand built in Greece and commissioned into the Hellenic Navy in summer of 1987. The liaison between the Greek and British parties involved in the research, development and construction of *Olympias* is carried out by the Trireme Trust. This is an organisation dedicated to investigating the capabilities and historical importance of the trireme. It is also the organising body that managed to bring together over 200 rowers from ten nations with seemingly little difficulty.

The trireme seats 170 oarsmen operating in triads — a group of three rowers. *Photo 1* shows that the three sit next to each other at different levels. The uppermost rower is called a thranite, the middle rower a zygian and the bottom rower a thalamian. This seems simple enough, yet it was remarkably easy to lose ones identity when zygians were told to be thranites, thalamians zygians and thranites thalamians; but the now present thalamians were in fact still thranites, the old zygians were also thranites and the true thalamians were zygians awaiting their turn as thranites etc etc! Personally I considered myself a thranite wherever I was!!

Selection

Although the Club had been invited to apply by the Trust, competition for the places was strong and a guarantee to be included in the crew was by no means certain. The process of attempting to become an ancient Athenian oarsman was not an easy one. If your physical stature was suitable then you were permitted to proceed to the fitness examination. This involved rowing an Ergometer at a minimum set rating for a given period of time.

Lieut A J Machin
Watermanship of the Athenians

Tall people stood less chance of being selected as they could only be put in the thranite position and of course the number of these was limited. Likewise a ship full of midgets could not be accepted as they would clearly not be able to produce the required power. Being 5' 8" was a definite advantage.

The Crew

THE final "perfect" crew was selected from applicants from ten different nations including America, Australia, Canada and from Europe. The Americans had attended a training camp and practised on a shore-based model section of the trireme. This, we thought, was extremely organised and sophisticated and so I did not mention that I had only ever rowed for one hour in my entire life!. Of the fifty-three Americans twenty-seven were whaleboaters familiar with the fixed seat style required on *Olympias*. The remainder tended to be experienced sliding seat rowers from some very well known and prestigious clubs.

THE TRIALS

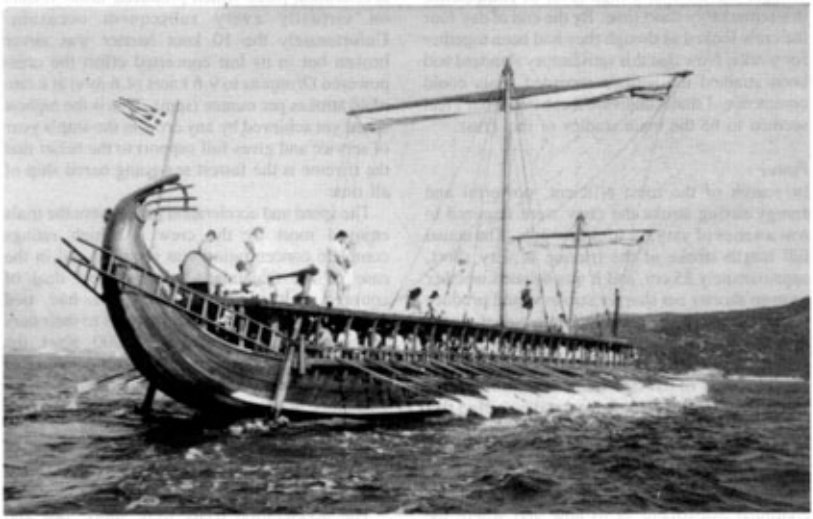
THE trials were run and supervised by Tim Shaw, a well respected member of the Trust who has helped to assess the capabilities of the trireme. The co-ordination of the trials was decided in Greece by the Committee for the Programme of Experimental Archaeology for the Athenian Trireme. This body exists to monitor and evaluate the trials carried out by the permanent Hellenic Navy crew throughout the year.

Aim

THE Committee had decided that the main purpose of the Trust trials should be "to gather information about the probable performance of ancient trieries both in battle and cruising under oar".

Preparation Period

THE crew was divided into six teams — an aft, mid and fore section on each side. Each of these teams was allocated a coach responsible for teaching the required style. Working alongside the team coaches were the rowing masters who took command of the outings and strove to get the crew operating as a single effective unit. Initial progress was slow and deliberate. Whilst still moored each tier of individual teams went through the motions with air strokes. This developed into the whole thranite and zygian contingent similarly imitating



The Trireme *Olympias*

Watermanship of the Athenians

the strokes as a single body. Eventually, with a little apprehension and much excitement, *Olympias* was released and the multi-national crew slowly and carefully manoeuvred her into the sheltered waters of Poros harbour.

Once in open space the whole process of team and tier practise started again, only this time with oars in the water. Problems were numerous but I shall discuss these more comprehensively later. The first objective was to have all three tiers rowing with a reasonable stroke, which was surprisingly achieved at the end of the first day. Then came the interesting part. Thranites and zygians rowed together as did the thranites and thalamians and the zygians and thalamians. A satisfactory standard was reached incredibly quickly and it was thus time to have the triads attempt to row together. This was when the rowing in teams was particularly useful as it allowed the thranites to concentrate on synchronising their triads without having to worry about the overall timing along the length of the ship. Initially it seemed as though the crew would never perfect the art of rowing together with oars regularly interlocking and colliding, but patience and hours of fine coaching by masters of rowing such as Boris Rankov, a legend at Oxford University, brought the crew to a high level of competence in a remarkably short time. By the end of day four the crew looked as though they had been together for weeks. Now that this satisfactory standard had been attained the serious recorded trials could commence. I shall subdivide these into what I feel seemed to be the main studies of the Trust.

Power

IN search of the most efficient, powerful and energy saving stroke the crew were required to row a series of varying stroke lengths. The actual full length stroke of the trireme is very short, approximately 85 cm, and it was debated whether an even shorter but sharper stroke would produce more power and thus also enable a higher stroke rate. Consequently, a series of rowing pieces with half and three quarter length strokes and with finer catches (entry of oar into water at start of stroke) were tried. However, it was soon discovered that the limited extra power achieved was not sufficient to warrant change as the whole process was far more exhausting.

Over the whole trials period it seemed that a continual assessment as to how and where the maximum power is produced was being carried out. The crew regularly changed positions in order that comparisons could be made between varying statures occupying the various tiers. For example, the thranites would row a piece at a specific rate over a given time. The zygians would then do the same, as would the thalamians. Zygians and thalamians were then given the chance to row in the thranite position and the same test carried out. Similar trials were carried out to compare team performance and thus try to determine whether for some reason any particular section produced more power than the others.

The power trials produced some interesting results. The maximum power generated was 50 **HP** (37 KW) or 220 watts per oar although the average effective propulsive power over the whole period was 175 watts per oar. More surprisingly, the thanites working by themselves had been able to generate 200 watts per oar which leads John Coates to believe that if this was equalled by the rest of the crew the trireme can be propelled at speeds of over 10 knots.

Speed

ACHIEVING 10 knots was certainly a major objective within the scope of the trial's aim. Consequently most outings involved a speed or acceleration piece which produced faster results on virtually every subsequent occasion. Unfortunately the 10 knot barrier was never broken but in its last concerted effort the crew powered *Olympias* to 9.6 knots (4.6 *m/s)* at a rate of 46 strokes per minute (spm). This is the highest speed yet achieved by any crew in the ship's year of service and gives full support to the belief that the trireme is the fastest sea-going oared ship of all time.

The speed and acceleration pieces were the trials enjoyed most by the crew. At high ratings complete concentration was required and in the case of the thalamians, also a great deal of courage. Although all thalamians had tied restrainer ropes from the ship beams to their oars (minimum breaking strain of 900 Kgs) the experience of 'catching a crab' (losing control of the oar) was still very unpleasant. On one occasion *Olympias* was travelling at 8.6 knots when a thalamian 'caught a crab'. The force on the blade was such that it required two men to stand on the oar and a third to push before it was released from the poor girl's neck.

The acceleration trials were short, fast and exciting. Starting from rest a speed of7 knots was

The Triads concentrating before an acceleration trial

reached in 32 seconds with a starting rate of 28 spm and finishing at about 36 spm. Some impressive results were also achieved in the longer speed pieces. During one such trial 2000 m was travelled in 8 mins 37 secs at 38 spm, a sustained speed of 3.90 m/s.

Manoeuvrability

OLYMPIAS may not be the most powerful ship in the Hellenic Navy but it is certainly one of the most manoeuvrable. The Trust engaged in a series of studies into ship tactics based on a variety of moves carried out by the crew. Initially this involved turning the ship through 180, 350 and 540 degrees and backing down (moving backwards) at different speeds and numerous crew combinations. With one side of the crew rowing at full pressure the rate of turning was found to be 2.6 deg/sec in a turning circle of diameter 95m, with the rudder at 67 degrees and with a 27 per cent loss of speed in the turn.

The purpose of these turning trials combined with the acceleration and backing down pieces became more apparent in the 'ramming' trials. These studies attempted to simulate the method by which ancient Greek triremes dealt with enemy ships. Once our imaginary prey had been spotted the crew rose to ¾ pressure, turned the ship through the necessary angle as quickly as possible and then immediately accelerated to ramming speed. After successfully hitting the target a rapid backing down took place to withdraw *Olympias* ready for another ram if required.

The final trial that falls within this section is concerned with the crew's efforts to move the ship sideways. In smaller boats such as a canoe a series of back and forth motions with the blade in the water produces a sideways movement. This was not achieved with the trireme and an alternative title was deemed necessary and so by addressing this manoeuvre as 'station keeping in line abreast' the exercise was far more rewarding.

Distance Rowing

THANKFULLY the trials were not restricted to the safety of Poros harbour for the whole period. Half way through the trials the Commander of the Aegean visited the crew. This was as a result of numerous excellent reports of the rapid progress being made given by our resident Greek Captain, Commander Papadas. The Aegean Commander was so impressed by the efficiency and ability of the crew that he was inspired to invite us to row the trireme to Pireaus, the port of Athens, in time

for the start of the Olympic Torch journey. As it happened this superb opportunity never materialised due to insufficient administrative support and unpredictable wind conditions. However, the offer did give rise to approval for two other long trips, a days outing around Poros Island and a row to Methana and back (30 kms).

For such journeys in the open sea continuous rowing is necessary as the light trireme drifts very quickly. It is also necessary to bring the thalami an oars inboard and to close their low oarholes with leather covers. This leaves the thranites and zygians to power the ship and the thalamians as fresh rowers to be rotated in. These changes were made at regular intervals to keep people as fit as possible. It involved well rehearsed changing drills which moved zygians to thranites, thalamians to zygians and thranites to redundant thalamians in under a minute. In order to improve drills and stamina a few evening practise sessions were introduced.

Finally prepared, we took plenty of water and biscuits and ventured on to the high seas. It took time to adapt to rowing in waves but once settled we maintained steady speeds of 3.5 knots against headwinds of 35 knots and waves I m high.

The highlights of these distance trips were the occasions we cruised by townships. The locals and tourists flooded to the quaysides to admire a piece of Greek history as it passed elegantly by. They were so overcome in Methana that the Mayor boarded the ship and made a long and emotional speech before distributing locally made sweets amongst the crew as a show of appreciation.

Sail Trials

THE trireme is equipped with removable main and fore sails. However the sail trials were not as comprehensive as would have been liked due to limitations of opportunity and unfavourable wind conditions. The restricted amount of data collected added little to that already assimilated by the Hellenic Navy.

To give the sailors amongst the readers some indication of the sail power of such a vessel the trireme travelled at 8.4 knots *in* a wind of 13 knots at 100 degrees off bow using just the mainsail. Using both sails in similar wind conditions but 140 degrees off bow the trireme swept along at 7.3 knots.

Other Trials

EXTRA to the trials already mentioned a number ofless enthralling but equally essential tests were carried out. Such tests were to assist studies into factors such as the water resistance of the hull and rudders, wind resistance, the ship's mass, the mass of retained water and directional stability. This was achieved in a number of ways from allowing the ship to drift to having it towed by two Zodiac power boats. Although not as thrilling as the acceleration pieces these tests were welcome breaks from the hot and sticky rowing sessions.

Instrumentation

To keep those at Hermitage interested I shall briefly describe how the trials were recorded with the help of a Geodimeter. The instrument operated with an infra-red laser beam and was fitted with an automatic tracking device. We were informed that it was accurate to within 5 cm, a standard more than suitable for the purpose. This accuracy diminished quite considerably at ranges in excess of 1000 m and was thus a major factor in restricting the locality of the trials. All data was automatically stored in a computer, linked to the Geodimeter, to be used later to simulate the manoeuvring of the trireme on a computer screen. This will enable historians to study ancient naval tactics on a realistic basis and thus may help to answer a number of questions relating to the use of oared warships.

Problems

DIFFICULTIES encountered throughout the three weeks were numerous and varied from the usual rowing injuries to a complete breakdown of communications within the ship.

Injuries

PRIOR to arrival in Greece comprehensive details of possible medical problems had been forwarded to all crew members by the Trust. However, in some instances the warnings had been ignored and in others no preparation could have avoided the resulting illness or injury. In the early period blisters and upset stomachs accounted for many of those attending the twice daily surgeries held by the Trust's doctor., As time went by the incidence of back injuries and mild exhaustion increased. At times some of the coaching staff had to row to fill the seats left empty even though the crew had thirty spare rowers.

Space Restriction

THIS was the first problem faced by everybody. Most of the rowers were used to having plenty of

space to execute their well practised strokes and the restriction to 85 cm certainly cramped their style. Experience from the 1987 trials assisted enormously in teaching the crew quickly the art of body swing. However, only after receiving and giving many knocks in the small of the back did the crew learn that it was in their interests to 'do as teacher said'. It also saved a lot of aching of the arms.

Timing

It will come as no surprise to anybody with any rowing experience that getting 170 oars to row in time was no easy feat. Those with no experience will have to accept the fact. At first each rower took the timing from the person in front which resulted in a ripple effect down the length of the boat. Having this on both sides, neither of which was in time with the other, produced awful results.

This problem was compounded by the triads also being out of time. Because of the angle and closeness of the oars, interlocking occurred easily, which in turn threw the whole triad out of time with the rest of the crew.

We experimented with several instruments in search of a suitable time-keeping device. The noise of 170 oars crashing through the water made hearing a drum very difficult. A horn was tried but could not be blown fast enough for the higher stroke rates. Eventually the investigators provided a flute which performed the task ideally but by this time we were half way through the trials. I am not sure whether in fact it was not the crew's efforts and natural development that made the flute a success rather than the instrument itself.

Communication

There were two major pieces of equipment used in the trireme that distracted somewhat from its claim of being an exact replica of an ancient Athenian warship. One was the steel wire rope running down the centre of the boat used to keep it in tension and vital both for safety and the long life of the ship. The other was in fact removable and was a speaker system installed along the ship. Initially this proved to be invaluable but it inevitably broke down and chaos reigned. Each time this failure occurred, everyone was so busy complaining that they could not hear the rowing masters asking for quiet and control of the ship

Early days - port and starboard not quite together

Watermanship of the Athenians (3)

was lost. Only after several pleas from the organisers and a heartfelt speech from a Royal Navy Petty Officer about ship discipline was order eventually kept.

One must also remember that it is only the thranites who can see anything outside the ship, thus the volume of noise produced by in-triad coaching was substantial and helped to make the rowing master's life a difficult one.

THE FUTURE

THE Trust feels that it has presently exhausted all worthwhile trials and thus will not be holding further trials in 1989. It will, however, continue its investigations once it has raised £30,000 required to manufacture a new set of lighter, better designed oars made of spruce. The designers believe that this is the necessary refinement required to enable all tiers to develop their full power capability and propel *Olympias* to over 10 knots.

While we wait for this opportunity to prove John Coates right the trireme may be coming to England in 1989. It will probably be rowed on the Thames during some prestigious event such as the Henley Regatta and is certainly worth a viewing for those with the time and interest.

CONCLUSION

ALTHOUGHhis article is lacking in the customary engineering detail normally found in the *Journal* , I nevertheless felt it worth writing in order to share the experience of twenty superb days. An excellent team spirit rapidly developed and enabled us to operate like no other crew and to power *Olympias* to a remarkable and not previously attained 9.6 knots. For those who may wish to read more deeply into the subject a list of publications is given at the end of this article. Summer examinations permitting, I hope to have the privilege of rowing the trireme again, if and when it comes to England later this year.

PUBLICA nONS

1. The Athenian Trireme by J S Morrison and J F Coates Published by Cambridge University Press, 1986.

2. Building the Trireme by Frank Welsh Published by Constable, 1988.

Nicknames

ONLY four entries were received for the Nickname competition set on page 122 of the August *Journal.* Sadly none was adjudged by the Publications Committee to have improved on the one republished from the national press. The prize money will be retained for the next suitable occasion.

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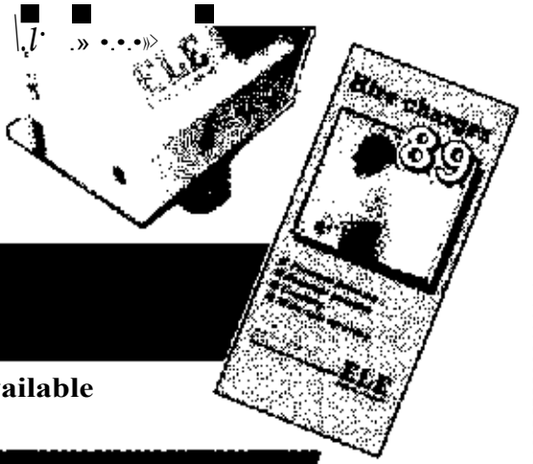

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Tanna Road Project Vanuatu

MAJOR R SYMONS

The Author was commissioned in 1983 after graduating from University College London with a degree in Civil Engineering. After Sandhurst and the Young Officers course he served for two and a half years in 35 Engineer Regiment in Hameln; firstly as a troop commander then as operations officer in 42 Field Squadron. He was then posted for four months to the Falkland Islands as Aide-de-Camp to the Commander British Forces, before his appointment in March, 1988 as Officer Commanding Tanna Roads Project in Vanuatu.

Introduction

THE Island Group of Vanuatu, formerly the New Hebrides, lies roughly five hundred miles west of Fiji and two hundred and fifty miles north-east of New Caledonia in the Pacific Ocean, *Figure 1*.

Tanna is a small island in the south of the group, approximately one hundred miles south of the capital of Vanuatu, Port Vila. Although only thirty eight kilometres long and eleven kilometres wide, Tanna has the largest island population of twenty four thousand.

In February 1987, cyclone Uma swept across Vanuatu leaving a trail of destruction in its wake. Tanna was particularly badly affected with a total of four hundred and forty six millimetres of rain falling — two hundred and fifty six millimetres of which dropped in only three hours. This was the heaviest rainfall ever recorded in such a short time, and the results were terrible.

Run-off and erosion severely damaged several of the main roads on the island, and all bridges except one were washed away by rocks, trees and other debris carried on the massively swollen rivers.

Emergency work started almost immediately, with the Queen's Gurkha Engineers providing a team to work in Tanna on essential services.

The British Overseas Development Administration (ODA) undertook to fund a longer-term aid project to rehabilitate the road network of Tanna, and requested the Army to provide a team of Royal Engineers to manage the work for one year. Major A A J McLean RE visited Tanna for an initial reconnaissance in August 1987 and recognized the need for a five man team to undertake the job successfully. In fact, two teams would deploy, each for six months. Meanwhile, the Snowy Mountains Engineering Corporation (SMEC) of Australia, was hired to produce a detailed study of appropriate upgrading measures and a detailed cost estimate and economic analysis. The SMEC engineers spent two months on the island and produced their report in late February 1988. One month later the first team of five Sappers stood in Port Vila airport, appropriately enough on 1st April, in the steamy heat of the Vanuatu summer having flown half way around the world, lost (or is it gained?) a day and two suitcases, but eager to start Phase One of the Tanna Roads Project.

Objectives

THE aim of the project was to manage design and reconstruction of roads and bridges on Tanna.

This was to include training the Public Works Department (PWD) staff in construction, plant and workshop management, and encouraging the necessary maintenance techniques which would be required after the project. Because of time restrictions, most of the training aspects of the project had to be "on the job", but were important if this was to be more than a construction task with benefit ending when the project finished.

Control

TECHNICAL control rested with PWD in Vila, military control with the Ministry of Defence in

Major R Symons
Tanna Road Project Vanuatu

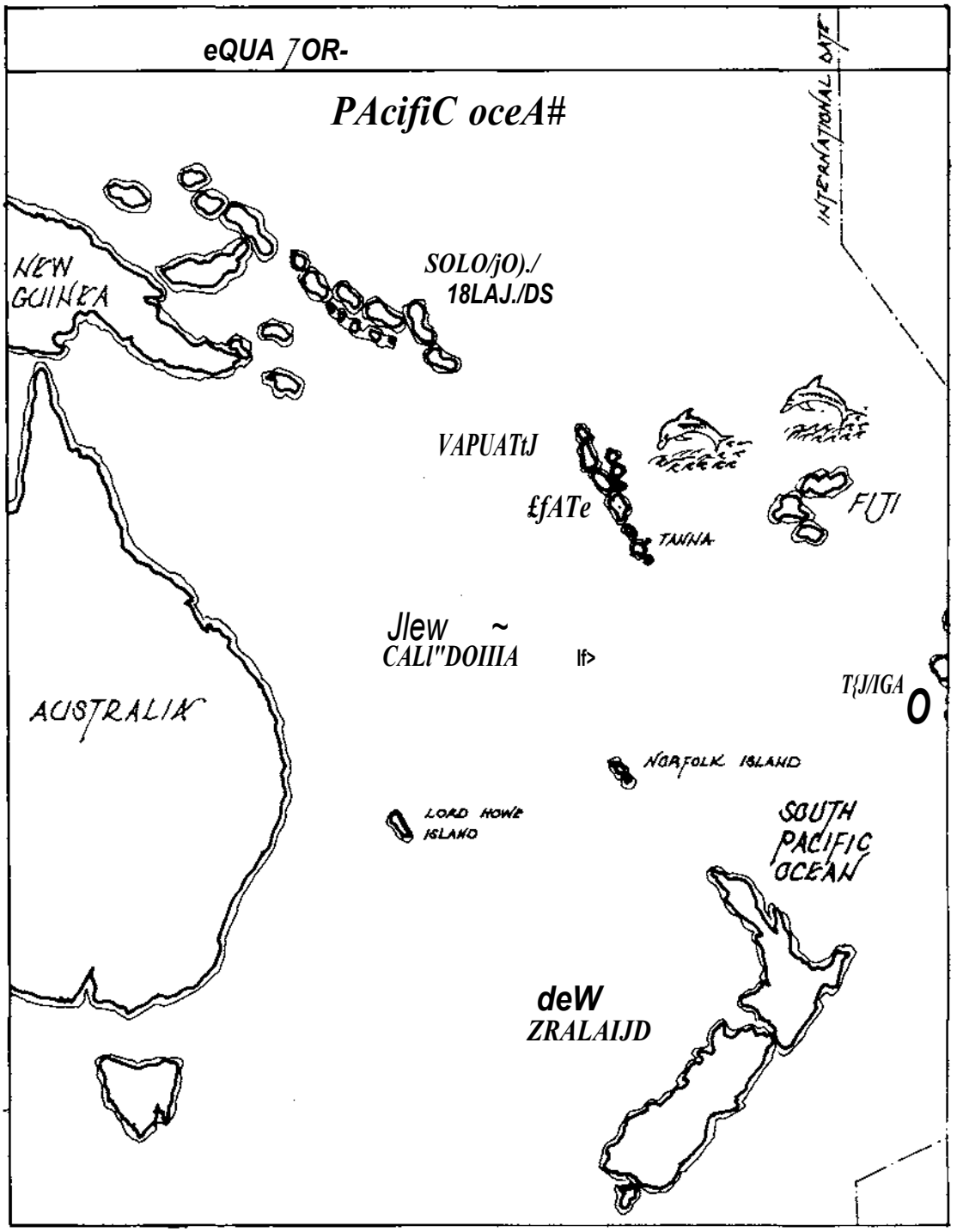
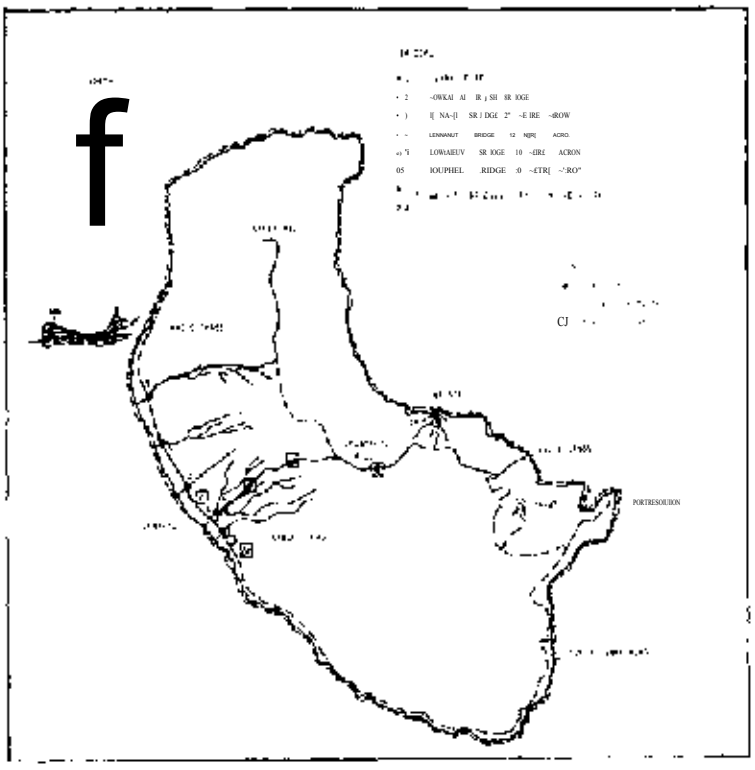


Figure 1. Island Group of Vanuatu



.'igure 2. Roads and work sites

London, amloverall financial and project control with the British Development Division in the Pacific (BDDP - part of ODA) in Fiji. This apparently complex structure worked well in practice, with the majority of decisions being made in Vanuatu on the ground. Each man took more responsibility than would be the case in a normal Sapper project because of the small number in the team, and the wide scope of tasks both technically and geographically. A PWD foreman was attached to each team member in order to extract maximum training value during the works. At the end of Phase One, from August to October, a twenty man platoon from the Vanuatu Mobile Force joined the project to gain experience in the construction of emergency bridging.

PLANNING AND PREPARATION

PLANNING for the project began in earnest in February 1988, and before deployment Team A spent three weeks at Chatham to prepare for Phase One. This time was well spent, the objective being to get the team to Vanuatu having been as fully briefed and prepared as possible. It was the first time that a combined ODA and Army project of this sort had been set up, and this proved to be a great challenge in itself.

There were many details to work out, with the differences between ODA and military methods of work posing a few problems. They found our letters and signals impossible to decipher, and we found their organisation hard to understand. Nevertheless, things were quickly sorted out and a sense of humour proved to be an invaluable asset.

Training at Chatham concentrated on the many different makes of plant and equipment which were known to be in Tanna.

At the same time there were survey, abutment design and imprest accounts to be tackled in detail. Meanwhile arrangements were made to transport the team to Vanuatu with the project freight via Los Angeles, Honolulu and Fiji.

SCOPE OF WORK

HAVING taken the appropriate recommendations from the SMEC consultants' report, ODA settled on the scope of work for the project. **In** outline, we were to construct six bridges, two fords and fifty four kilometres of road. *Figure* 2 shows the

roads and work sites. While planning the work for Team A, it quickly became obvious that weather would be a major factor in the success of the project. Team B would be working mainly in the wet season, while we would hopefully get the drier weather. Therefore, Team A had to tackle first of all the tasks which would be impossible during wet weather, and get as much as possible done. This would need good planning and maximum use of plant and equipment. As if to confirm our fears, the first weeks of our time in Tanna were rendered almost useless by cyclone Dovi, a fairly normal tropical downpour during which all work stopped and much damage was done to existing roads and fords. We realised that drainage was the key to success in Tanna.

ROADS

THE roads mainly consisted of upgrading existing dirt and gravel roads, improving drainage in particular, and coral surfacing. Weathered coral was extracted from quarries close to work sites. A typical roadcross-section is shown in *Figure* 3. Limited sand/bitumen sealing was to be undertaken on some stretches of steep, heavily trafficked sections.

In addition to this there were three major realignments to be constructed. The first two were to avoid steep gradients in excess of twenty per cent on the main Lenakel-Whitesands road. These were both completed by Team A, with a total of twenty thousand cubic metres of earthworks. After careful examination of the first realignment it was decided that the suggested route had become too difficult to attempt in the time available and that cement stabilization using a Howard Rotovator should be undertaken instead. This proved to be most successful, although expensive in cement.

The team then moved to Loanialou Hill. The existing road around the hill skirted an area of intense instability, and was subjected to considerable erosion during cyclone Vma and the subsequent wet season of 1987/88.

The track was eroded to two and a half metres width on a precarious ledge above a one hundred metre sheer drop to the valley below. Twenty major slips and gullies cut across the route, rendering it impassable in wet conditions. Soil conditions on the hill comprise highly erodable volcanic ash overlying more stable agglomerate, and the eastern side is exposed to continual sulphurous emissions from an active volcano, Yasur, about five kilometres away. This has caused defoliation and increased instability. ODA hired a soils expert to visit Tanna in April 1988 to produce a detailed report with recommendations for a new road around the hill. It was decided to re-route the track around the western slopes of the hill, which are less steep and much more stable, and then to descend a promontory of the hill by hairpin stack to rejoin the old road. Team A aimed to reach the start of the climbing stack before leaving, and achieved this, leaving the daunting

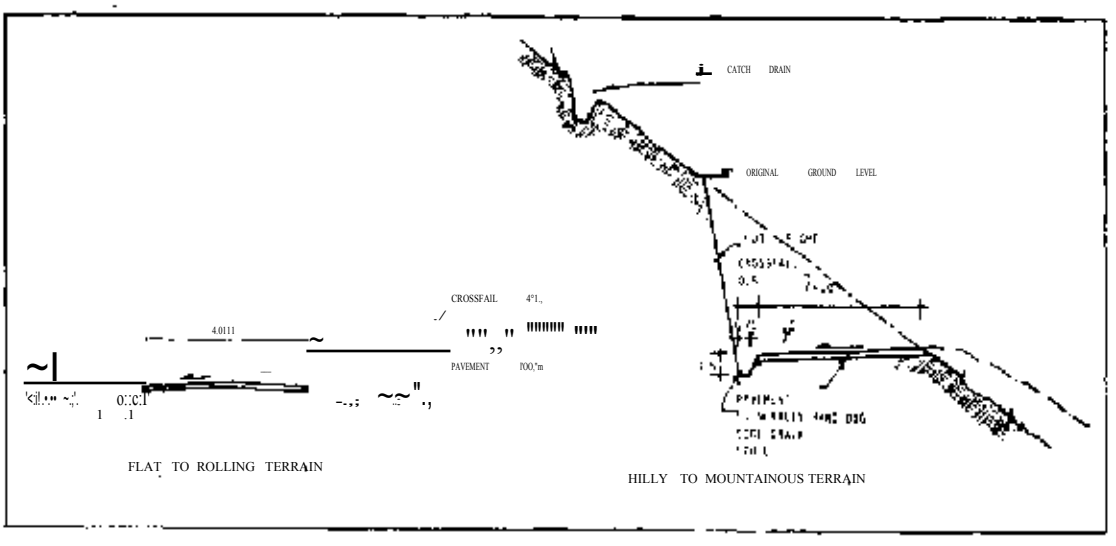


Figure 3. A typical PWD road cross section

Photo 1. Local labour filling gabion baskets by hand

task of the stack itself to Team B. These major plant works were carried out by the PWD mobile road team under S/Sgt Stone. Meanwhile, he had the local Tanna road team working hard constructing bridge approaches and joining up realignments which the mobile team had finished.

In addition they completed sections of bitumen and sand sealing on the steep hospital access road at Lenakel, and on the first realignment. Once the plant and equipment had been repaired and looked after, it was found that work could be finished in good time, and the operators' skills quickly improved.

Structures

At the same time, WO1 Burroughs was working hard to complete as many bridges and fords as possible. The priority was to open the main island roads before the 1988 wet season, and his objective was achieved by the time Team B arrived. SMEC had completed a detailed hydrological study of the rivers in Tanna, to determine the necessary dimensions of the bridges and fords. All of the bridges needed to be raised above the level of the previous structures on their sites meaning extensive earthworks.

The main building medium was to be galvanised steel gabions filled with basalt river boulders won

Tanna Road Project Vanuatu (1)

from sources in the south of the island, so road teams had to improve haulage routes first.

The PWD and local labour were organised into a construction team, and started by learning how to fill gabions correctly (by hand) and how to mix concrete. A basic ford at Lenami was chosen as a training site, and after a month of hard work, the team was ready to move onto a more complicated structure at Loukatai, a simple cross section of which is shown in *Figure 4*.

Work started on the gabion bridge abutments after this. The bridges themselves, constructed by the VMF Engineer Platoon, were all standard width Acrow Panel bridges with heavy steel decking. Most were 10 metre spans, but the large double single bridge at Lenakel was 26 metres long. A typical bridge profile is shown in *Figure 5*. Concrete for the abutment caps and fords was made using coral sand and crushed coral aggregate, and cube strengths of up to 35N/mm2 were achieved. Soon, the PWD foreman was competent enough to be left for longer periods, and the team achieved some excellent results. A PWD piling team from Vila stayed on Tanna for two months to drive piles for the Lenmawut site, needed because of the required six metre height of the abutments. Piling at another site, Loanpakel, had to be abandoned due to extensive coral bedrock. A reinforced concrete cantilever retaining wall was designed for this site instead.

Equipment

The equipment available to the project came from two sources: project — supplied machines from ODA, and existing PWD machines already on Tanna. In total there were three dozers, eight tippers, two graders, two rollers, two loaders, a JCB and a small mobile crusher. On arrival, most of the PWD plant was unserviceable with many machines having been off the road waiting for simple repairs for months. This was mainly due to inexperience and lack of supervision in the workshop and yard in Tanna, and bad stores ordering and supply. S/Sgt Denman remedied the situation quickly by setting up a regular maintenance and servicing schedule for all

Photo 2. Armco culverts for an Irish bridge

Tanna Road Project Vanuatu (2)

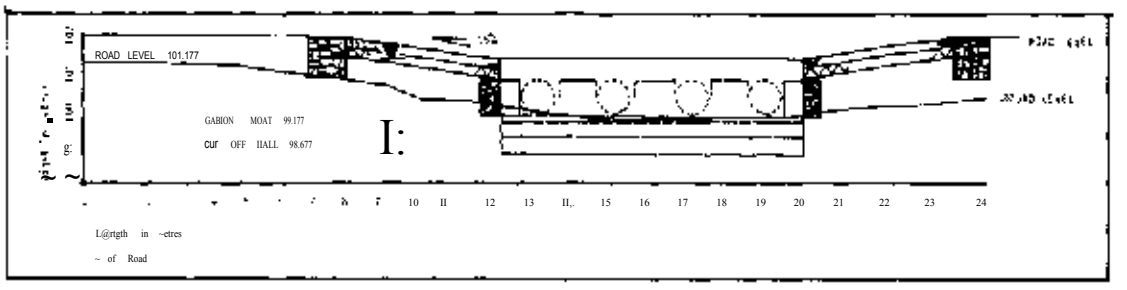


Figure 4. A simple cross section of Loukatai bridge

equipment and enforcing it. He had a total of ten fitters in the workshop, but not all were on call to the project because work had to be carried out on hospital and police vehicles at the same time. Tools were a continual problem, with only one toolbox between two men at best. However, new tools and workshop equipment is due to arrive soon as part of the project. Despite well-mannered scepticism from Vila, he proved that PWD in Tanna could be trained to keep the maintenance going, and will continue to do so after the teams leave. Much patience and forethought was needed to defeat the still ponderous PWD spares supply chain in Vila, but the battle was won.

MANPOWER

TOTALmanpower for the project varied, but was about eighty men including PWD and local labour. I<'orpractical reasons, it was necessary to employ at least one man from any village close to a task site, but these people were keen to work and quick to learn. This helped in the land acqUlsltiOn problems encountered during phase one. Vanuatu means "our land" and is an expression of the importance of land ownership in the country. After independence, all land was returned to its "custom" owners, who now exercise complete control over it. A complicated system of compensation exists when land is needed for public projects, but when the owner is unhappy about a job he cannot be forced to give his land up. By tactful discussion and persuasion, most of the land needed for the project was obtained.

RESOURCES

ADMINISTRATIONand resources were looked after by Sgt Taylor. The stores supply system started by being ponderous and inefficient. He set about organisinga quick, effective method of producing stores demands in good time, and instructed the PWD store man to do the same. Stores began to appear, and despite a completely unpredictable

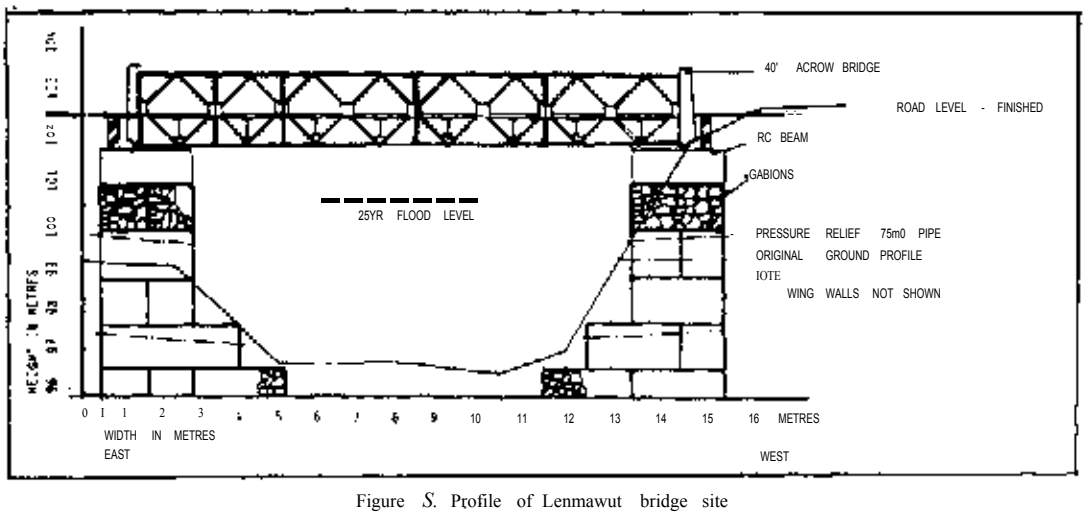


Figure *S.* Profile of Lenmawut bridge site

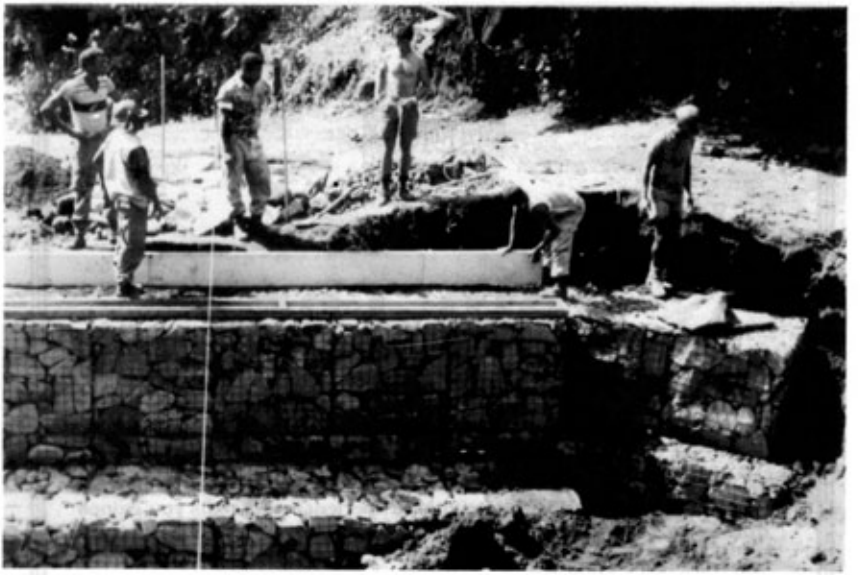


Photo 3. Vanuatu Mobile Force build a bridge at Waisisi

island shipping service, most construction materials arrived on time. A weekly trip to Vila by island plane was always necessary to pick up mail, send signals at the British High Commission, and to chase any late stores. He also monitored project costs and reported these to BDDP.

Conclusion

At the end of phase one of the project, Team A had completed all tasks originally planned for them, and enabled the second team to take over a project already well off the ground and running smoothly.

The team had all benefited greatly from the range of tasks, new experiences and constant challenges posed by the project and the isolation of Tanna. The PWD had greatly improved in organisation, plant operation and construction skills. Overall, the project has been a great success so far, and will continue to thrive during Team B's deployment from October 1988 to March 1989. It is strongly recommended that similar projects be undertaken in the future.

Tanna Road Project Vanuatu (3)

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Alternatively, if you do not live close to an Independent RE TA unit, you can join the RE TA Specialist Units who recruit on a UK-wide basis and who have a lower obligatory military commitment of 19 days annually. The units consist of a Combat Engineer Regiment (Regimental Headquarters. 120 Field Squadron, 130 Field Squadron and 198 Engineer Park Squadron) and ten specialist teams (Works, Bulk Petroleum, Railways and Well Drilling). Further details can be obtained from CVHQ RE, Minley Manor, Blackwater, Camberley, Surrey, GU17 9JU. Telephone Yateley (0252) 876622 Extension 3378.

We trust that you will give enlistment into the TA your earnest consideration as there are rewarding opportunities for the right man.

Defensive Search

MAJOR J R WYATT MBE MIExpE MBIM

Major John Wyatt, having joined the Corps as a raw recruit direct from South Africa in 1965, was commissioned from Sandhurst in 1967. He has served in the Middle East, Kenya, UK and BAOR where he commanded a Field Support Squadron. After completing his SO2 tour in the Ministry of Defence he was asked to form and command a new regular EOD squadron, which involved a number of specialised operational roles. The busiest role was Search in the post-Brighton bomb period and saw the development of procedures discussed in this article. It also included a five week trip as leader of the Army's improvised Explosive Device Disposal and Search teams in support of the Royal Bahamian Police for the Commonwealth Heads of Government meeting in Nassau. He was awarded the MBE for work in counter-terrorism in 1985. Having completed a tour as Senior Instructor in Minewarfare and Search at the RSME, he left the Army to continue his work in counter-terrorism and security with International Military Services, a Government owned organisation. He has also accepted a TA post as the SO2 EOD in SE District.

Introduction

In all internal security operations it is vital to deprive the terrorist, urban guerilla or insurgent of his arms, documents, equipment, munitions and other material for use against the civil population and the security forces. Offenders against the law must be sought out and detained. Devices such as IEDs must be found and dealt with as well as documents and other items of intelligence interest. The techniques for doing this are known as search. Searches are one of the few operations in internal security operations with which the security forces have the initiative and can decide when, where and how the operation will take place. Search operations also force the terrorist to move his armouries continually and this, in turn, leads to a greater likelihood of discovery by the security forces.

There are three general categories of search operations:

Offensive searches
Deterrent searches
Defensive searches

The first two are usually carried out in an internal security situation such as persists in Northern Ireland at present. Techniques, procedures and organisation current in Northern Ireland have been modified for the third category: Defensive Search, which is discussed in detail in this paper.

The Threat

The terrorist adopts tactics designed to erode the morale of the security forces and prick the conscience of the public and in particular the politicians with the aim of inducing a climate of collapse. At this stage he anticipates either that the government will capitulate or be provoked into adopting repressive measures. Against such repression, he proposes to offer an alternative and appear as the people's protector.

The chief weapon of the terrorist is indiscriminate terror, by which he can induce the situation of general insecurity, nervousness and fear. He has the advantage of surprise and exploits this by concentrating on pin-point attacks like assassinations, ambushes, kidnapping, sabotage and raids on banks, prisons and army and police installations.

Modern society is vulnerable to terrorist tactics not only because of its complexity, but also because of its high technology. The terrorist can exploit the vulnerability of aircraft, trains and the easy access of vehicles to make extravagant demands linked to the threat of causing spectacular disasters or as a means to commit his act of terror.

Major J R Wyatt MBE
Defensive Search

With the sort of publicity which modern communication has made inevitable, one such act of terrorism can make an impact on the whole world eg The Grand Hotel, Brighton 1984. The terrorist knows this, and is equally well aware that no modern society can protect itself completely against such a threat which could quickly produce a saturating requirement for guards and cost beyond the capacity of any security force. The terrorist is, however, dependent on publicity inducing a favourable public response, which will only come about as the people turn away from the legitimate government. They will seldom do this while they still have confidence in its ability to preserve law and order.

Certain features from the characteristics of revolutionary movements influence a government's concept of operations, in particular, the slow and continuous process by which revolutionary movements grow from small beginnings and the inevitable strain on democracy which arises both because of the pressures brought on it by the movement, and paradoxically, because in the campaign to defeat this, the threatened government may itself come under pressure to suspend some of the democratic processes which it is the aim to defend.

The options can be divided into three phases:

- Minimum Commitment - The period before full military commitment when the threat is evolving and such civil measures as can be designed to meet it become progressively less successful, to the point where military assistance may be requested.
- Full Commitment - The phase which is of greatest military concern as it is at this stage that the armed forces take an active part in supporting the civil government and police in the maintenance and restoration of law and order.
- Withdrawal - The phase of military disengagement, which may be prolonged or attenuated.

THE ENVIRONMENT

Northern Ireland

Being an internal security situation,the pattern is in the full military commitment phase in which the armed forces take an active part in supporting the Royal Ulster Constabulary (RUC) who have the primary responsibility for Ulster's security. However the profile varies as the threat changes and force levels reflect this. People in Northern Ireland expect limitations and restrictions on their day to day existence and both the police and military have extended powers under The NI (Emergency Provisions) Act 1978. Examples of these restrictions are plain to see: vehicle check points, security checks particularly in high risk areas and restricted route choice. The high profile display of arms and armoured vehicles is also obvious.

UK Mainland

As in most Western societies the life ofthose living on UK mainland should be as normal as possible. Freedom of movement, speech and access within the law should not generally be limited. The existing provisions of the law are directed towards the prevention of crime and, as such, do not fulfil all the requirements of counter-terrorist operations. However, acts of terrorism do take place either as an overspill from Northern Ireland or as a result of international terrorism, hence the permanent renewal of the Prevention of Terrorism Act. Military assistance is kept to the minimum necessary and is normally given as Military Aid to the Civil Powers (MACP).

DEFENSIVE SEARCH

Background

Unlike the offensive and deterrent searches carried out in IS operations, defensive searches carried out on mainland UK are used as a prophylactic measure to provide protection for a particular event such as a royal visit or party political conference. In these instances the search is for an lED as opposed to weapons and documents. However deterrent searches are occasionally carried out as a result of intelligence with some successful results eg Salcey Forest 1985, Macclesfield & Delamere Forest 1987. These skills have also been used successfully in the search for drugs, forensic evidence and the proceeds of crime as the police have become more involved and have seen the benefits of the search procedures.

In an internal security situation manpower and time are not necessarily the most important factors. Searches are selective and teams will be allocated individual houses or areas and the time allocated will be the time necessary to carry out the task properly although the vulnerability of the teams or the cordon may be a limiting factor. Providing reasons can be substantiated there are few limitations on the searches although recent

You need help searching this type of setup — BBC support caravan

The Blackpool Conference Complex. How much can be searched and to what degree?

legislation in Northern Ireland has required modified procedures.

In defensive searches, large complexes such as hotels, conference centres or community facilities, often including commercial interests, are involved. The environment discussed earlier encourages low profile and small inconvenience. Manpower and time are important factors and increasingly cost is driving operations. The time, effort and cost can be likened to an insurance policy. The benefits are intangible, but the implications of not having one are unacceptable. The problem is how to decide how much of a policy one needs for a particular event.

The Threat

To determine the extent of the insurance policy, the most important factor to consider is the threat. The overall threat is taken and orientated to search operations with particular regard to likely targets and organisations that might be involved.

This threat is then analysed by applying it to all the events and venues involved.

Planning Stages

Having analysed the threat, identification of vulnerable areas should then become apparent. This helps answer the question "How much can be searched?" ie all the vulnerable areas are searched. The next question starts the detailed planning process "To what degree can the vulnerable areas be searched?" — The vulnerable areas need more analysis.

A simple system for analysing the vulnerable areas is then used to make best use of the resources that are available. This should not be a priority system in terms of what is done first but to what level of search should be applied to areas in terms of time and resources. General terms such as thorough, comprehensive and meticulous search should not be used as all the searches are carried out to the best ability of the person searching. The variance is created by his level of expertise and the equipment available to him.

During the vulnerability assessment an appreciation is made of the courses open to the terrorist. Some of the factors to be considered are:

- What size of bomb eg pantechnicon, car, beer barrel, briefcase or lunch box.
- What is the effect of different sizes of bomb using home-made explosives or commercial explosive on all the different areas to be searched.

Having assessed the vulnerability of all the areas and given them a grading, it will then be necessary to do an appreciation of the time and resources available. The questions are:

- How long will it take to search the vulnerable areas?
- How many men, teams and how much equipment will be needed?

The officer in charge of overall security needs to be consulted next to be able to make an outline search plan. He will be able to give his outline plan and limitations, particularly on time and resources. This should provide sufficient detail to prepare the plan covering:

- General outline — how the job is to be done.
- Manpower to tasks.
- Allocation of resources.

In making the outline search plan one also needs to be fully aware of the plans of the organisers, and any special arrangements being made by other agencies (SB, emergency services, security firms etc). All these will influence how the search operation is carried out. It may be that the limitations of searching a particular area make its use impracticable, and the organisers need to be told, and a decision on an alternative site made.

The outline search plan covers what should be done, how long it will take and what resources are required for the job to be done to the agreed vulnerability level. The next stage is to go back to the overall security plan and tie in the search plan and resources. If there is insufficient time or resources it may be necessary to review the vulnerability assessment. However a compromise will be normal but its implications and effects on security must be fully understood by the overall security commander.

The final stage is the preparation of the adjusted plan for the operation order.

Limitations

Defensive searches can impose limitations that are peculiar to their situation:

— *Finding Nothing*: In the majority of defensive searches nothing is found because there is nothing there. This can cause disillusionment and lack of motivation and can lead to:

— *Lack of Concentration*: Defensive searching is boring and if one has to search a large number of similar areas such as hotel bedrooms it is very monotonous. Searchers lose their concentration and either miss searching areas or do not use the equipment effectively. Command and control is particularly important for this aspect and close supervision of the searchers is essential. Instilling variety assists greatly in keeping concentration.

— *Disruption*: The concentration of the searcher can be eroded further by disruption. To interrupt a searcher in the process of searching for other than technical reasons can lead to areas being missed. Visiting senior officers or VIPs keen to see the operation at first hand must be dissuaded from 'talking to the men' until there is a natural break in the searching. Attractions such as female staff should also be reduced as far as possible to avoid distraction.

— *Fatigue of the Searcher*: Due to lack of manpower and time as discussed earlier, searches are generally intensive and extensive thus putting great pressure on the individual. Fatigue creeps up gradually and one is often not aware oneself of the falling-off in efficiency. Again the command and control

Dogs can get distracted!

Equipment can be useful. Hydrogenous Explosive Detector being used on panelling

Defensive Search (2 & 3)

Aircraft/ships/trains are movable buildings — failure to find a device is more catastrophic as recently seen on Pan Am Flight 103

Vehicle search takes on a new meaning with HGV

function is important in combating this problem. Regular monitoring, particularly during breaks or change of search areas or equipment, is again essential.

— *Public Awareness*: Public perception of the threat varies considerably depending upon terrorist incidents, their proximity and their horror factor and is in direct proportion to what they are likely to tolerate. This is of prime concern to the conduct of the search operation. If the threat perception is low the tolerance level is low and such things as cost, time delay and individual inconvenience can assume disproportionate importance. Adversarial briefings are very useful in these circumstances.

Documentation

Without going into too much detail, the need for comprehensive documentation in defensive search is essential. The following factors should be considered:

— Accurate plans/drawings of the building/ship/plane etc.
— Updating plans including checking of numbers used (eg hotel bedrooms). This must be carried out prior to the search.
— Search Form covering at least the following:
- Definitive area — rooms are relatively simple, but corridors and peripheral outside areas are not so easy to define. As long as the searcher can easily recognise his boundaries on the ground, areas will not be missed.
- Searchers details ie name and initials.
- Details of the equipment used in the search including dogs.
- Timings.
- A remarks/comments paragraph so that peculiarities may be noted.
- Check system for inclusion on central chart and filing system.

— Damage Report Form.
— Central chart for quick reference of search situation and allocation of tasks.
— Register for a complete record of the search. This is important for any subsequent investigation if an incident occurs.
— A simple system for processing the documentation and speedy retrieval.

The system must also be capable of controlling the search. This generally means that searchers should not be tasked with more than one or two areas at a time. This ensures regular visits by the searchers to the Operations Room so that tiredness and equipment serviceability can also be regularly monitored.

Action on a Find

As discussed earlier in this paper, defensive searches can be long and boring so when something of interest or suspicion is found great excitement is generated. Keeping this excitement under control is important not only for safety reasons but also for psychological reasons for the searchers — the disappointment of a potential highlight can lead to a new low.

A practised routine must be developed. Forces will differ in their operating procedures, but confirmation by the Search Adviser is essential if one is not going to keep calling out the IEDD operator.

Defensive Search (4 & 5)

Training

In addition to initial training, formal continuation training is extremely important for defensive search. As time is always short, efficient and comprehensive procedures put into effect with little preparation are essential. This can only be achieved with well trained and regularly practised men and equipment.

A lot of the search equipment needs to be operated on a regular basis to achieve the best results. Also much of the basic equipment contains attractive tools which if not set aside and used regularly will slowly dwindle and not be available when operationally required.

Training and operations go hand in hand and for a lot of forces there may be insufficient time to separate them. However, one must be wary of confusing them and the searchers must be certain at all times on which they are deployed. It is extremely dangerous for instance to hide a training device or real explosives on an operation. Effectiveness of a capability can be checked if necessary by using an adjacent area which is known to be outside the operation area.

FUTURE

COMBATING terrorism is not easy as generally the terrorist holds the initiative and one has to react to his activities. However, by sound research and development of procedures and equipment one can remain one step ahead, although one should never underestimate the terrorist. Unless research and development produces tangible results, its direction can be changed into other subjects. Defensive search requires a lot of time, effort and expense without necessarily producing an apparent benefit.. It is only catastrophes such as the Grand Hotel that concentrate our minds for a requirement to be able to deal with a terrorist situation and subsequently provide time, resources, and most importantly, money. As incidents recede in our memory so the willingness to tolerate the extra security measures and provide money from central funds lessens. In reality that is when it is most needed as our guard is naturally released.

It is important to think ahead in defensive search to pre-empt the terrorist's next move. The following areas are worth further consideration:

- Analysis of future terrorist weapons and devices eg what explosives and detonators is he likely to use particularly with the more common use of bulk and site-mixed explosive, slurries, gels and emulsions. Is tagging a viable answer?
- Analysis of how modern technology can assist the terrorist eg more sophisticated initiation devices.
- How can security forces use industry to assist in combating terrorism eg the now common use' of fibre-optics in search.
- The multiple approach in search ie the use of different techniques eg in explosive detection use gas chromatography, mass spectrometry and neutron and gamma backscatter. Do not rely on a single technology.

CONCLUSION

THE difficulty of defensive search is to strike the right balance between an effective search and disruption to the normal way of life yet at the same time making sure that the insurance policy is correct and keeping the equilibrium between time, resources and cost. There must, therefore, be some system which can be followed to ensure that the time and resources are used most effectively and the search concentrated in the right areas. A colour coded system has been found to be useful by some but may not necessarily fit into existing procedures and therefore a parallel system should be adopted to meet the requirement.

Defensive Search is a vibrant art which must continually move to counter the limitations that are necessarily part of it. It must move to keep one step ahead of the terrorist and ensure our society has a safer future.

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Memories of World War I

JOHN M CORDY

The author of this article, John Cordy, is now aged 91 and lives in Wymondham, Norfolk. He joined up as a sapper in December 1914 and served in France until he was wounded on the Somme. After recovering he was sent to Salonika and, in 1919, to Russia on the Archangel expedition. His full memoirs have been presented by his grandson and are lodged in the Corps Library. This article is a short extract taken from the period 1915-1916.

CHAPTER THREE

WHILST at Dickebusch, the company had the use of a builder's yard, and used materials from the piles to make what we called knife rests. A length of wood with two cross pieces at each end and barbed wire stretched from end to end. We also made duckboards there, these were taken as near to the front line as possible, just behind the canal bank, where we had a light rail track laid to take materials along passed Sanctuaire Wood. Jerry had blasted a hole through the bank and he had a machine gun trained on the rail track and every little while at night bullets would come spitting off the track. I had a working party of four infantrymen with me, taking stuff along the track and they would all push on the side away from the bank. I told them what would happen, and it did. They pushed the truck off the lines and right opposite the hole in the bank. Out came the bullets, one chap got hit, two of his mates made off, and the other helped me out of the mud and water. We carried the injured chap back to the other dugouts where he was stationed, took down his trousers, and the bullet had gone through his legs and privates and stood out like a big pimple on the other leg. A first aid attendant eased it out with a pair of scissors, put it in his dressing bag, tied it round his neck, and off they carried him back to the first aid post and he had a souvenir for life. Several of the infantry came along and helped me with the truck, and we got going again.

I must have caught my toe on a piece of barbed wire and it pulled the sole from the upper. I went to the Quartermaster and he told me he had no boots to fit me, I would have to make do. The sole came right away and I had to tie it back on with a strip torn from a sandbag. Next day, I showed my boot to the duty corporal and he told me to go along with him to the quartermaster and if he wouldn't give me a pair we would go and see the officer. Corporal knocked on the hut door, "Who is it, come in". The QM lay on his bed which was just inside the door, he raised himself up and at that very moment a dud anti-aircraft shell came straight through onto his bed. If he had still been lying there it would have gone through his chest. After all this I got a pair of boots, a new shirt and pants. I could have had anything there was. Later, when he and a sapper were putting up a hut down on the Somme, Jerry had a direct hit on the hut and blew them to pieces.

My company were given a fortnight out of the line and we marched beyond Poperinghe to a place near the railway line. Here we went into bell tents. It was very cold and snow was on the top of the wall of the tents. We were given small tortoise stoves, the smokepipe went through the flap of the tent. To keep the fire going we had a small ration of coal, but not nearly enough, so we had to pinch some off the coal waggons going along the line. As the trains were so heavily loaded they could only move slowly, giving us time to get on and

Memories of WW1 John M Cordy

off. The old guard chased us with his shunting prop.

Marching back, we rested at Poperinghe, dumping our kit in the square. The Norfolk Regiment were stationed there. Five of the fellows were leaning against a lamp standard talking, and three of these had worked for my father before enlisting. We all went and had a drink, some of them were stationed at the brewery, and we had a happy hour together. This was the first, and I think the last, time I saw anyone I knew from home in all the time I was in the Forces.

Back to the mud and wet again, we were told we were eventually to move to the Somme, but had to complete a trench through a very wet part. We had materials delivered to the road end, and three of us worked together, two putting in stakes, bearers and duckboards, and one bringing up the materials, which was my job. The Germans had been shelling and had blown a hole out of the parapet, almost up to the place where we were working. Every little while the pop-pop of machine bullets came through. I would stop until the pop happened and then pop across. A corporal came along' 'Cordy, you know we have to get this done". My reply to him "This is my job sergeant, you get on with your own job!". Just then, one of the working party who were filling sandbags shouted "I'm hit, I'm hit". Corporal stepped up to him and down he fell, a bullet through his head. As we were laying him on the back of the trench, my pal poked his head round the trench, "Jack you must come and help me, poor old Scotty has been hit".' Sergeant told me to stop with Youngs, and he would go to Scotty. They brought him out, both were as dead as stones.

When it was time to go, someone wanted to carry Youngs' body back to bury him at Dicki. I asked about Scot, and was told that if we could find another stretcher we would take them both. I went along to the infantry chaps, over the open ground. I'd lost my best pal, and at that moment I didn't care if I got hit, and there were plenty of bullets flying about.

That same morning I had received a letter from my Hingham Rector, he wrote to me once a month and always put a quotation in the letter. The one in that letter was "Yea, though I walk through the valley of the shadow of death I will fear nothing, for Thou art with me".' I could not find a stretcher, we tried carrying Scotty on a duckboard be he fell off every yard or two, so he had to be left to the burial party.

There was a bend in our front line at St Eloi which gave the Germans a crossfire advantage, so it was decided to have our miners mine under the German front line trench and take it away. There were terrific explosions and a heavy bombardment, but our Canadian allies went over and took the first crater. My section spread out to dig the communication trench.

The next afternoon we were loaded up and in line at Kemmel when the Padre came along, the Reverend Mellish. He tapped my steel helmet with his walking stick telling me to keep my spirits up as it would soon be over. How wrong he was. We got up to complete the trench we had dug the night before, it was almost filled with dead and wounded. We rolled them out, and if one of them gave a groan someone who was crawling about on top dragged them to the low place in the trench and a couple of mates would take him to the first aid post. That someone crawling about on top was the Reverend Mellish. A rat could not have lived out of that trench for rifle and machine gun bullets. The Holy Spirit was with him. He was awarded the VC and later the MC, and my word he deserved them. He had no need to be there, it was not a part of his duty. What a brave man he was.

Later, the Germans came over. We had pulled a coil of barbed wire over the trench, leaving the end open. Our corporal, Otton by name - a Suffolk fellow - shouted "Pass the bombs along", and he flung them at the Germans. Another fine fearless soldier. The next night one of our craters had not been located. Our officer had an aerial map of it and his job was to find it. He told me to go with him, and he got two infantry Mills bombs, two riflemen and their corporal, and off we went crawling through our barbed wire, but no crater between the two wires. "Well, we must go through Cordy" said my officer. The corporal could wait for us. We found the crater, it had blown up just short of the German front line trench. I picked up a German helmet and it must have rattled, for as we climbed up the side of the crater some Germans in the crater said "Comrade, comrade". We didn't move, but stayed close together for a while and then crawled under cover of the German front line parapet and back through the wires to our trench, where the Commanding Officer was waiting for our report. I was completely shocked and shaking in every limb. He told my officer to leave the sergeant in charge and he would take us back and drop us off on his way to headquarters.

CHAPTERFOUR

IT was getting near to Christmas 1915. We were still making duckboards, etc, in the builder's yard. This place was infested with rats, so we would cut off short pieces of fuze cable and push in the hole on one side of a pile of bricks or wood, put a brick over the hole and wait for the smoke to drive the rats out the other side. We were in the yard one day, when a German spotter plane came over, and three or four of our fighters went up to intercept him. They got the Ypres side of him and started firing, we could see the stream of bullets like a silk thread, going from the machine guns in the sunlight. The German plane toppled sideways and a shout went up "They have got him". Our despatch rider started up his motor bike thinking the plane would crash, but no luck. The pilot straightened up and flew away under our fighters and back over Ypres to Germany. This was the first time we had seen a plane topple.

One night we had all got to bed after a tot of rum, and I awoke choking. All the others were standing at the hut door with their gas masks pulled over their heads. Jerry had launched a gas attack and it was blowing right over the farm. It was quickly gone, and we were back to bed again.

Shortly after the gas attack, the Germans put over a bombardment, :;ome of our fellows were going up to the front line when a shell burst over them killing one and wounding two others. Two days later an officer and four of us went up to do a repair job in the front line. Gas still lay in the shell holes and low places. We got to the support trench and stayed there. Jerry was putting over so many shells it would have been madness to have gone further. It had been raining all day and we were soaked to the skin. As we got into the wood the shelling started again. We found an old hut with the roof blown off, but we made a dash for it, only to find it full of water and three dead bodies. So we stood up tight to the stumps of the trees.

We were just leaving the wood and noticed lying on the bank our fellow who had been killed two nights before. The officer turned to me "We ought to bury him Cordy, what do you say?" The fellow behind me, who had always been a good friend, kicked me in the leg and gave me a push to go on. After this he wouldn't speak to me again, as I stopped to help. The officer went to the infantry officer's dugout and borrowed a prayer book. We found an old soaked blanket, and after taking our friend's passbook and identity disc, we rolled him in the blanket and put him in a shell hole and threw some soil over him. It was jolly hard luck for him, he joined the Army to be a servant to his civilian life master who had joined up as an officer. From France he was sent home sick, and then returned to our company. He was an old man and had no training. He left a wife and older children. My section all felt very upset at the way he had been treated.

The day before Christmas 1915, we were in dugouts in the canal bank. Two of our mates were told to go back to headquarters for our rations. We all put together for them to buy some pork for our Christmas dinner. Whilst waiting in the store for the quartermaster they helped themselves to a bottle of rum. Loaded with our rations, they arrived back at the dugouts. They could not wait until next day, Christmas Day, they opened the stolen bottle and both got so drunk they fell into the canal and we had a job to get them out. They left some rum in the bottle and this we had with rations and pork, which we cooked over an open fire. The fireplace was dug into the side of the bank with a curtain made from sandbag covers to stop the Germans seeing the light at night, which was when most of our cooking was done.

Time was passing reasonably well, and things were quiet. We had two weeks in the dugouts and two weeks at headquarters, working in the line at night, with a march to Poperinghe for a bath. There, the room had two rows of half beer barrels with a shower over. We gave each other a good wash down and some would play the fool with the water, first too hot and then stone cold, but it was lovely to be free of lice for a day or two. After our bath we were given clean underwear.

Back in the dugouts, and Jerry started shelling. Everyone ran out across the open end of the road, that is everyone except Billy Parton, a pal from Winterton near Bournemouth. He shouted at me "Don't be a bloody fool Jack, come with me across the plank and over the other side to some disused French trenches". From there we could see Jerry hitting our mates with most accurate and clever shelling, three or four high explosives, then shrapnel a few yards from the ground to catch those running away. There was not a whole dugout left when the shelling finished in the late afternoon and we went back to get what we could of our belongings. One chap had his legs on his bunk bed and his head on the ground. How many more were killed we did not stop to see, and we walked off back to Dickebusch. One of our heavy batteries

was dug in beside the road, and the sentry on guard called out to us "We have given those buggers hell today". "Yes, you caused what we got" was my reply.

Our stay at Hemel was almost at an end. Our stores and pontoons had gone, and we, in full marching order, fell in to march down to the Somme, it was now the summer of 1916.

CHAPTER FIVE

IT rained for two or three days out of the four it took us to reach the Somme. We slept out in fields, and were given extra groundsheets, one to sleep on and one to cover over us. I could not keep up with the marching, I was far from fit. Our sergeant major, a fine fellow, took my pack and rifle and put them on a waggon, and I struggled on, eventually arriving at the Somme. Another sapper and myself were put in charge of the stores, some distance away from the company. In the stores were bales of sandbags, timber, steel and wood stakes, picks and shovels. We called it the "dump", and I think it is still there today and still called the "dump". We made a shelter with bales of sandbags and two lengths of sheet on top, high enough to sit up in. Each day we had to go to headquarters for our rations.

I woke up one morning to feel something on my face. I brushed it away, only to find it was a rat, almost as big as a cat. I sat up quickly and flung my boot at it. My mate had gone for rations, and I lay reading a magazine when there was a thump and the ground shook. It was a German long range shell, but a dud. I found the hole a few feet from my hut. I pushed a six foot steel picket down and away it went out of my reach. I wonder if that shell is there today? I know, though, who stopped it exploding.

Returning to headquarters I had to pick up two Mills bombs, putting one in each pocket. I also collected a pick and shovel. My section went up to the front line somewhere not far from Baigentin-Ie-Petit, and this village we were to attack the next morning. Our artillery started shelling during the night. Dawn came, and the shelling ceased. We had a tot of rum and over the top of the trench we went. Dead and wounded were lying all around. One of our infantrymen was kicking a wounded German, crying out "You may be the bastard that killed my brother".

We got into the buildings which were one side of the street in the village. It was an old brewery, half of it below street level. The Germans had made a first aid dressing station here, and German wounded lay in bunk beds both sides of the room. We moved them from the street side bunks and put them all together on the other side, so we were able to stand on the beds and open up the air vents in the walls for our snipers to get rifles through. In my working party I had five pioneer infantrymen and I sent them to dig a trench passed an opening between the houses. I left them, and went into the cellar to see how the fellow was getting on cutting the holes. I thought I would have a shot and went to step up on a bed, but spotted a sniper lying dead the other side, a bullet through his head. As soon as I got outside again I saw an observation balloon go up over the houses and after a few moments over came the shells, one burst right near and a piece of shrapnel took the top off a fellow's shoulder. The first aid chap with the bandages and dressings was very frightened: "What shall I do?" he cried. "Get the fellow in the cellar and dress his shoulder" was the quick reply. Another shell exploded and the shrapnel knocked me down with pieces hitting my leg and shoulder, and a piece piercing the middle of my knee. This was 16 July 1916, and I still have the medical card which was pinned to my tunic.

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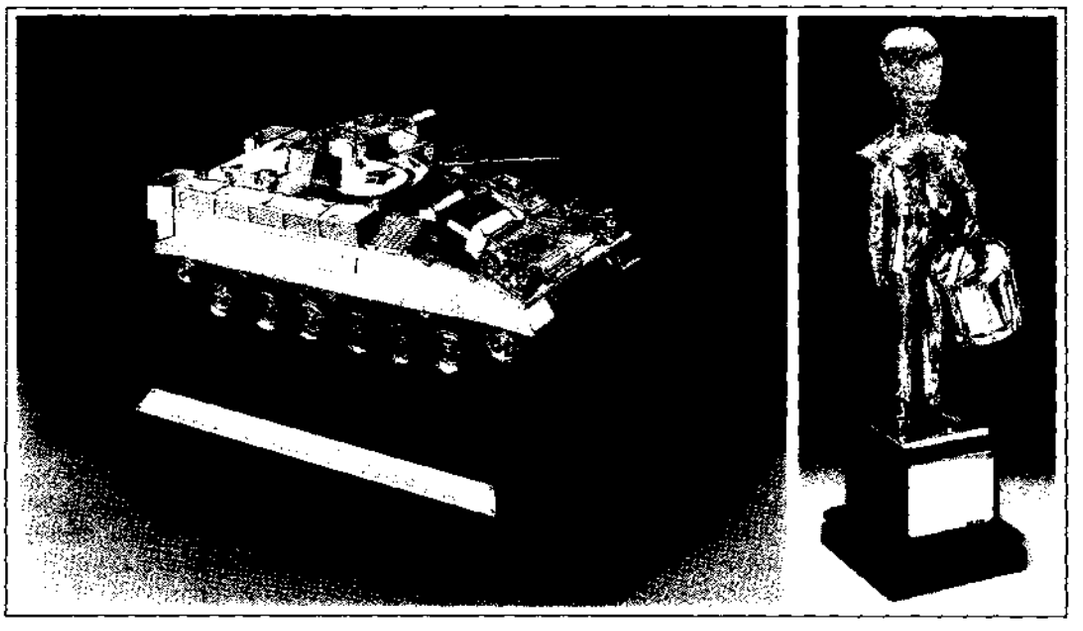

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Directional Drilling - Another Alternative to Trenching as a Means of Installing Services

LIEUT COLONEL M G LE G BRIDGES C ENG, MI MECH E, FRGS, RE

Lieutenant Colonel Bridges joined the Corps in 1966 *and, after a first tour as a troop commander in Aden, attended a degree course in Civil Engineering at RMCS Shrivenham. Some years and climbing expeditions later he attended a long E&M course in* 1978/79, *training with the Hydro-Electric Commission in Tasmania. Further experience in both E&M and Civil engineering construction came with tours as Officer Commanding* 1 *STRE in Gibraltar, as Officer Commanding STRE Falkland Islands soon after the war, and as Officer Commanding Military Engineer Services Works Hong Kong (supported by 500 Chinese speaking Chinese). Currently he is serving as Chief of POL Infrastructure Section at HQ AFCENT, with responsibility for the whole of the Central Europe Pipeline System.*

INTRODUCTION

SECONDLIEUT STEPHENS' interesting article on *Impact Moling* in the August 88 edition of the *Journal* prompts me to introduce another state-of-art technique for trenchless pipelaying and hole drilling, namely: Directional Drilling.

Direction Drilling has been evolving for a number of years as a means of trenchless pipelaying, which application is primarily for the bypassing of obstacles such as rivers, motorways and railways. Only recently has it reached a point of development where it can compete in economic terms with conventional excavation methods in the majority of cases rather than only on an exceptional basis. It is therefore rapidly becoming more widespread and this seemed to be an appropriate moment to highlight it in the *Journal.*

Unlike Impact Moling, Directional Drilling is a much more deliberate operation. The equipment is heavier and less portable, but equally the capabilities of the system are considerably greater. Directionally drilled ducts have to date been constructed in lengths of up to 1.8km and with diameters of over 40in. (There is a certain appeal in the eccentricity of metric minded continentals' insistence on measuring pipe lengths in metres and diameters in inches.) The equipment necessary to do this is all portable, and breaks down into a series of semi-trailer units which all fall within normal road transport load limits, being 1204m by 204m. The equipment is also entirely self contained and needs only a plentiful supply of water such as a stream or river.

THE PRINCIPLE

THE most significant feature of Directional Drilling is that throughout the drilling operation, the 'drill bit' can be guided and thus, for example, can be persuaded to pass from the surface to beneath a river and back up to the surface on the other side. The secret is contained in the combination of using a 'cutter' which is offset from the line of the drill pipe, and installing a position transducer in the pipe behind the 'cutter' which feeds information to the operator. When the offset of the 'cutter' is to the right, the line of drilling diverges to the right and so on.

The words 'bit' and 'cutter' are enclosed in single quotes up to this point because different types are used by the different firms specializing in this field. Primarily there are two systems in use: the one uses a rotary cutter and the other utilizes an extremely high pressure jet of Bentonite drilling mud, both offset at an angle to the drill pipe. Since both systems lubricate the drill tube and clear away the excavated material with liquid mud, and in most other respects the method and equipment are identical, the discussion will henceforth specifically centre on the jetting technique since this is the more unusual of the two. The cutter of the jet drill is illustrated in *Figure 1.* It can be seen that essentially this is a very simple concept, consisting of a nozzle of special grade steel from which issues a jet of mud under a pressure of several thousand psi, and which is offset at a small angle from the drill pipe. The drill string is pushed forward with a force of up to 270 tons and the jet blasts a passage for it. Excavated material is carried back along the outside of the pipe with the mud returning to the surface. From *Figure I* it is also apparent how a partial rotation of the drill nozzle will alter the plane of its divergence from the drill tube centre line.

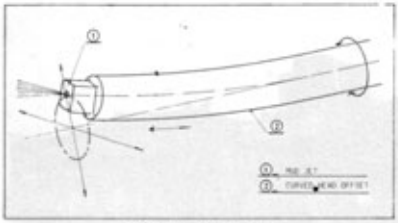


Figure 1. Cutter head

Figure 2 shows the assembly of the complete pilot string. At the front is the nozzle with its curved offset, and behind this is mounted the directional transducer, carried in a non-magnetic casing. This transducer monitors the inclination of the hole and its direction with reference to Magnetic North. The data from the transducer is transmitted via an electric cable to a data processor in the control cabin. The processor in turn provides the operator with a continuous readout of the coordinates of the drill head and its direction of drilling. As drilling proceeds, a casing pipe of larger diameter is driven down behind the pilot string. It consists of a cutter head, followed by screwed drill pipe sections, and serves to reduce friction between the pilot string and the ground. It cuts its way by rotary action applied by the drill rig. This casing is also shown in *Figure 2*. Drilling proceeds until first the pilot string and then the casing emerge at the far end. In this way a pilot hole can be drilled following a predetermined path to a predetermined point of exit. The accuracy achievable is typically to within 3m after 600m of drilling.

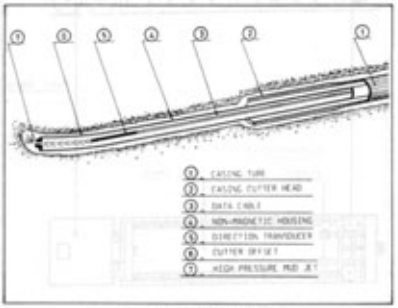


Figure 2. Pilot string

The Equipment

As already stated, the equipment is self contained and trailer mounted, and operates essentially in these units with a minimum of preassembly. A crane is necessary to set up the drill rig and to handle drill pipe sections. The working area required need not exceed 30m by 20m. The equipment has been successfully operated from barges as illustrated in *Figure 3*. *Figure 4* shows the drill rig in the road transport configuration. It comprises:

Figure 3. Equipment operated from a barge

- Main drill rig trailer (*Figure 5*), consisting primarily of a ramp on which is mounted a rolling carriage which in turn carries the hydraulic motors for driving and rotation of the drill pipe and casing.
- Hydraulic power unit trailer, rated at 650HP. Diesel engines are coupled to 200KW generators and to hydraulic pumps, providing power for the mud pumps and rig operation.
- Mud tank/mixing unit, capacity 38m³. (See *Figure 6*).
- Control cabin with hydraulic control of drill rig and remote control of the other systems.
- Trailer of 3'' drill pipes for pilot string.

Figure 4. Road transport configuration

- Trailer of 5'' drill pipes for the casing.
- Trailer for ancillaries including submersible pumps for supplying the mud tank from suitable water source, reamers, jet reamers, etc.

The Method of Operation

During the initial setting up and drilling of the pilot hole, the pipeline, or bunch of pipes or cables, is prepared at the far end. Preparation involves the preassembly of sufficient length of pipe etc, laid out and supported on rollers. Pipe sections are welded, joints are coated, and the complete length is pressure tested before installation. A pull head is finally attached to the end of the pipe or bundle, this being a dome shaped protective end piece with a towing lug at its apex.

Once the pilot string has emerged at the far end, the casing is run to the surface and the pilot string itself is withdrawn. The casing tube now becomes the work string and to its further end is attached the reamer assembly. The first part of this is a

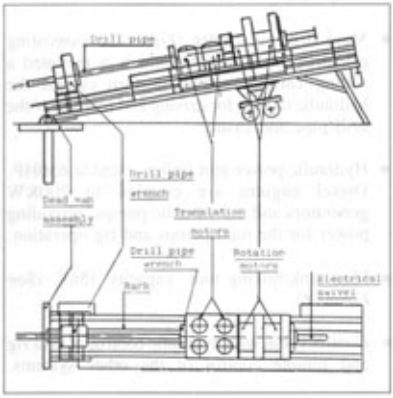


Figure 5. Drilling rig

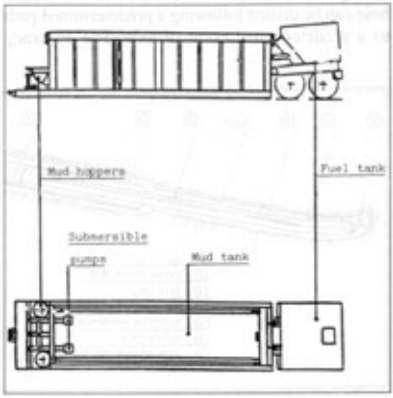


Figure 6. Mud mixing unit

reamer cutter which rotates as the casing tube is rotated by the drill rig. Behind the cutter is a universal joint and a jet reamer. The jet reamer is a cylinder with dome shaped ends in which are located rings of jets. This item serves to clean away debris left by the reamer cutter, to smooth out the inside of the hole, and to lubricate the passage of the pipe as this is drawn in behind it. The jet reamer is followed by a swivel, and this in turn is connected to the pull head. Thus as the drill rig simultaneously rotates and withdraws the casing/work string, the reamer assembly enlarges and cleans out the hole and pulls in the pipe. Where large diameter holes are required, reaming may be carried out in two stages. Details of the reaming/drawing-in process are shown in *Figures* 7 *and* 8, and a photograph of the jet reamer in action is given in *Figure* 9.

ADVANTAGES OF THE SYSTEM

IN addition to the obvious advantages inherent in not having to disturb surface and other buried installations by opening trenches across motorways, canals etc, there are additional benefits provided by horizontal drilling. In the case of waterway crossings, erosion of river beds, dredging, and ships anchors all pose a threat to buried facilities. The thicker the cover required over the crossing, the greater the cost of trenched crossings. Costs become even higher if it is necessary to cut through constructed waterway banks such as sheet piling, concrete walls or dykes.

In addition, where the river current is fast, trenched crossings are further complicated by the tendency of the trench to silt up during construction and laying, necessitating the use of expensive coffer dams etc. All of these problems are resolved by drilling which can pass below walls and dykes and at a safe depth below the river at no extra cost.

The process of drilling a crossing is fast. Typically, in good ground, a pilot hole can be driven at a rate of between 50 and 100m per hour. Since the hole can be produced concurrently with the prefabrication of the pipe to be installed, the complete installation can be completed in a few days, including the relatively short time needed to set up the equipment.

In normal trenched river crossings, because of the possibilities of damage to the coating, of the pipe floating out, and of exposure of the pipe by river bed erosion, special coatings are necessary, usually involving a concrete sheathing. With drilled crossings this is not necessary. Tests have shown that because the hole is reamed larger than the pipe, and because the pipe is floated in in a mucl slurry, virtually no scoring occurs to the normal types of coatings. This introduces substantial savings in coatings and transport.

The reduction in damage to, and disturbance of the environment is very significant. While trenched crossings recover in time, virtually no disturbance is created in a drilled crossing.

Finally there are substantial potential savings involved in the maintenance of drilled crossings due to their immunity from erosion. Trenched crossings require groins, riprap bank reinforcement etc, and the installation and maintenance of these can all be dispensed with.

LIMITAnONS

THE mam limitations to Directional Drilling techniques are geological conditions. Loose gravels and sands are particularly difficult as the

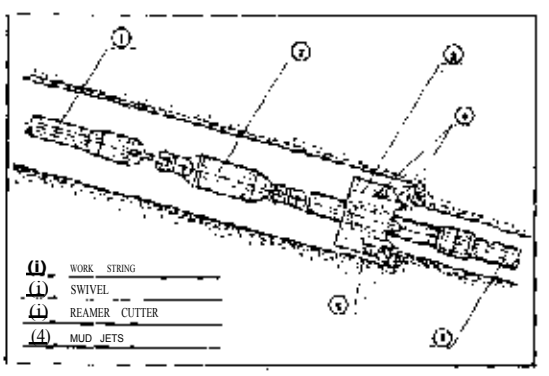


Figure 7. Reamer cutler assembly

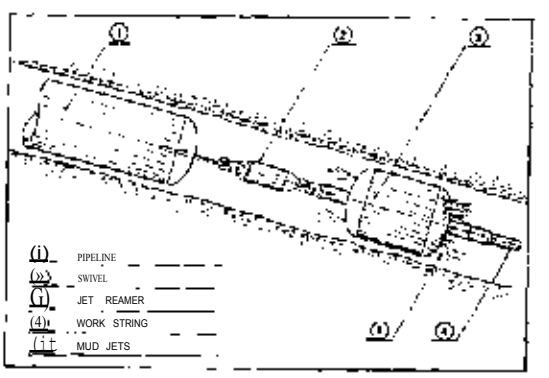


Figure 8. Jet reamer assembly

hole tends to collapse, and the mud escapes between the particles. Hard rocks also resist this type of drilling as it exists at present. Users of rotary cutters consider that this method is effectively restricted to compacted alluvial deposits. Users of the jetting method on the other hand claim that they can cut through soft limestones and shales.

The magnetic sensor-based guidance system requires both a detailed magnetic survey and refined calibration. For example, the distortions of the earth's magnetic field created by the close proximity of sheet piling, or even of high tension cables, can introduce navigational errors. Before drilling starts, a very detailed survey is required of the whole route, not only to establish the soils to be encountered *en route*, but also to identify magnetic anomalies. Where geological obstacles are detected, some deviation is possible to avoid isolated rock outcrops or erratics, but this is limited to very shallow curves.

Mobility of the equipment is limited effectively to roads and access tracks, since the various units are similar to commercial semi-trailers. This could be enhanced to some extent, by using 6x6 tractors for example, should the need arise.

As already stated, the maximum lengths of directionally drilled installations currently being achieved are up to 1.8km, and diameters range from a minimum of 3in up to a maximum of 42in. Practical minimum lengths are about 130m.

Applications

Directional Drilling is a specialist technique developed to meet a specific requirement, that is, the installation of pipes, cables, or bundles of either under obstacles such as rivers, canals and motorways, without creating any interruptions to surface users of these facilities. This must therefore be considered first and foremost as its prime application. It has now been demonstrated on many occasions that this method of installing facilities underground can be effected more cheaply than by conventional trenching techniques. Two specific examples are: a double crossing of the river Main in Germany with 12in pipes — saving of 800.000DM; and a single crossing of a major ship canal carrying ships of 30,000tons near Marseilles with a single 14in pipe — a tender for drilling was some FFr3.0 million less than one proposing trenching. One company quotes experience of 118 drilled crossings with a total length of some 50km.

Because it is a deliberate technique, requiring detailed initial survey and fairly heavy equipment, applications to the military scenario are not obvious. Were it to be decided, as a matter of policy, to install demolition chambers under

Figure 9. Jet reamer in action

NATO airfield runways in the same way that some bridges have been constructed, this method would apply, but this seems unlikely. Battlefield applications, or short response requirements arising out of enemy activity could not be met by this equipment either. However for the construction in peacetime of infrastructure support to NATO forces in the form of the CEPS pipeline network, this system is a winner.

The Short Service Limited Commission — One Set of Experiences

SECOND LIEUT P CZEKALOWSKI

Second Lieutenant Czekalowski spent ten months of his Short Service Limited Commission with 62 (Cyprus) Support Squadron in 1988. He is now reading Economics at Churchill College, Cambridge.

It all started in school — as these things so often do. I wanted to take a year out between school and university. I was very bored and wanted to do something different — travel across Australia? Hitchhike to Nepal?

I would need some more money so I flicked through a 'Jobs before University' pamphlet — one article caught my eye, by a previous SSLC who had spent his time with tanks in Germany. I had virtually no army connections in my family but had been thinking about the Forces for some time as a possible career.

I had only been thinking very vaguely however — I did not even know that the school had an Army Liaison Officer.

Suddenly here was a very concrete opportunity — to see the Army for myself and spend my year before university without committing myself afterwards.

It was April and applications should have been in by February but it said that late applications could be accepted until about July time. The small print said that Headmaster's approval was required and gave the relevant address at the MOD. I almost ran off to the Headmaster's office, got his rather surprised blessing and tore off a letter that afternoon. One step behind as usual, I was trying to make up lost distance.

'A' levels were looming large but I fitted in a visit to a retired colonel in Middlesex. He was rather surprised when I had absolutely no idea what to join and had not even really considered having the choice.

We eventually settled on either the Armoured Corps or the RCT — the latter he assured me could offer a wide range of postings. Rather disappointed to find that we do not maintain many Main Battle Tank regiments in Hong Kong I also asked about the Blues and Royals — those dashing types in big helmets and thigh length waders.

The colonel did his rapid best to change my mind. I wasn't really too bothered — the Army was the Army and I was off.

Next steps Stanmore and Buller Barracks where the relevant Corps selected me to go on the Royal Tank Regimental interviews and pre-RCB respectively. I was getting rather good at talking to colonels about my school, interests and team sports so there were no great hurdles.

RCB was coming up fast — I was working in London after 'A' levels — and I still could not really decide: RCT or RTR?

I mentioned what I hoped to do to one of the senior managers in my office. Aha, he told me, my brother did that. Royal Engineers — building a road in Belize or something — had a great time.

Second Lieut P Czekalowski
The Short Serivce Limited Commission

Engineers? I had thought of them emerging from under tanks, covered in grease and wielding nothing more than a spanner. No, he told me that was the REME *(sic* - sorry lads!)

RCB - four days ofIQ tests, talking to Colonels about school, and shouting your silly head off during frantic attempts to prove that it is difficult to cross 8' gaps with 4' planks when you are in a big hurry. Incidentally I did not complete my individual command task so my bluffing must have been more successful than I thought! .

Back to work for one week. Engineers, huh, I was pretty late but that was never something that had really worried me. Colonel, you know all that stuff about team sports - yes and school as well, well I think the ideal people for all that would be the Engineers. Yes, well I know it's a bit late - two weeks to Sandhurst? That should be enough shouldn't it? Blah blah ...

I had passed RCB at SSLC level anyway and the Sappers pulled out all the stops. I rolled up at Sandhurst on a blowy Sunday afternoon a bit unsure what was going on but somehow sure I would cope.

Intense course, huh? Well I can handle that - they must mean. lots of lessons - there must be quite a bit to learn.

Wrong - the 1i~tseemed quite short actually: drill, tidiness and sfu;lttingup. I have still not really got these sorted out so it is a good job that they weren't trying to failanyone.

The first few days Were unpleasant, shoulders aching from arm swingil\g marching, hand burnt with an incandescent spoov whilst burning down shoes, forehead raw from wearing a beret (which hung down to about the shoulder).

Then it got worse - exercises in the field; stag on and shut up. That means you as well, Czekalowski. I shan't forget our staff sergeant who, so happy to get back in the field, started singing 'Blinded by the Light' with a pair of Blue Brr ~rs shades on whilst I hacked away at my trer.",n. Bastard.

Hands exhausted from digging, lips and faces raw from the wind, we did our best to do what we were told. We turned out better than the TA lot operating alongside us so it can't have been that appalling. Can it?

Oh yes. Eating. I'd better mention it since it's down on my Sandhurst report. Blah, blah, average ... "noted for his incredible appetite for food". It was not me!

Well, yes it was going into my mouth etc etc but I have since discovered that when the pressure is on I go into my high stress diet - basically cramming myself until I grind to a halt. I don't think that it is an attempt to commit suicide in a Monty Python fashion but rather that I strongly connect food with relaxation, with life. Short of sleep, warmth and company, the Army will do its best to keep you supplied with food - and I suppose that it's some sort of substitute.

Finally, passing out. I wish we could have done, at least after the parade. Bl1t, no, the Sappers were so keen to get us that we were hurtled almost straight from parade to Chattenden and the Royal School of Military Engineering.

Here we were put onto the Young Officers' final exercise for two days. Brought back, fed and told about bridges and minefields, etc. Straight over my head but then I don't think they expected much to stick. It would just be pretty embarrassing if someone asked "what did they teach you about engineering?" and you replied, "nothing, actually" .

Then a month's leave - but that's for my memoirs.

January 8th I flew out to Cyprus.

All I can really remember when I got off the plane was "HELP!". It suddenly hit me that I knew absolutely nothing about where I was going or what was happening. Sandhurst had taught me a smattering on a range of topics but three weeks was not enough to give any depth, any experience, any confidence. I was completely out of my depth but did not know what to do or say about it.

The next weeks were a turmoil as I tried to adjust. There weren't any more colonels about with endless time for me, my school, etc. There were a lot of people running about trying to get jobs done and me getting in the way.

Getting out on site with field troop was just as bad - I hardly knew one end of a saw from the other. The Section was not in the least interested or impressed by my going off to university - they had a job to do and I was absolutely not helping them to get it done.

Looklpg back, the biggest break was the Unit's expedition to Turkey. We spent three weeks in total, about a week on site with the best part of a week travelling each way. Enduring, even enjoying the seemingly endless journeys, the food, the weather knit the whole expedition together . The mountain-walking was physically quite tough - as always the first days are toughest, you are carrying the heaviest loads and have not yet

Second Lieut Czekalowski (centre) with members of 62 (Cyprus) Support Squadron near the summit of Engin Tepe in Central Anatolia, Turkey, in May 1988

fully adapted. The sense of achievement at the end of the day, sore feet toasting in front of a fire was tangible, the scenery superb. On my return from Turkey I felt much more confident within the unit, that I had done something concrete for perhaps the first time during my stay.

I participated in a lot of adventure training during my time in Cyprus including skiing, water skiing, sailing, parachuting and sub aqua but nothing gave me such a feeling of achievement as the trip to Turkey.

Back to the Unit now. I spent more time on site, learning a little more about constructions but all the time now working slowly towards the Unit's Open Day which I was co-ordinating. For such a small event, the amount of organisation required was incredible. (Incidentally, on a back-of-the-envelope type calculation the Squadron put in over 2000 man-hours on the Open Day, producing total profits of about 50p (UK), 40c (Cyprus) per man-hour).

As the Unit spends so little time on exercise (four days in the field back in April) I have had very little opportunity actually to get to grips with command. Watching the Troop in action on site I picked up a few hints about man management which I would say is distinct from command although definitely related.

I had a fascinating week on exercise with the 17/21 (Death or Glory) Lancers zooming around the Cyprus valleys in their Ferrets and Saladins.

By chance however I became troop commander when I volunteered to go on exercise with 61 Field Support Squadron RE, out visiting the island for four weeks. Expecting just to be troop officer, I was assigned to 2 Troop which had neither Troop Commander nor Sergeant — the Troop Sergeant was acting Troop Commander. Lunchtime on the first day, after a beach landing and 5km trek he tore several groin ligaments and could not walk. Expecting only to lead a patrol during the whole exercise, I was suddenly thrust into command of all aspects of the troop; guards, feeding orders, marching, discipline. The stress was sudden and almost unbelievable — everyone was looking to me and I was frantically trying to remember all

The Short Serivce Limited Commission (1).

the way back to those distant lectures in Sandhurst during which I was half asleep.

Guards? Yes, that's two per section isn't it? Section Commanders? Well, they do what you tell them don't they? A heliborne move, an orders conference then the culmination ... a deliberate assault on a deserted village - the chaos of FIBUA in a dawn attack.

Those three days were undoubtedly the best experience that I have had on infantry work and also some of the scariest of my life.

What can I say? I learned a lot, about myself, about squaddies. I hope I contributed something to my unit - thanks for everything.

THIS sketch was made by John Skelton, the sculptor of the Korean War Memorial in the Brompton Garrison Church. It depicts a scene at the bridge table on *MV Celicia* en route to Burma in March 1945. The Sapper subaltern in the foreground is wearing a light to simplify being picked up had the ship been torpedoed. Identification would be welcome.

Five Into Six Equals Four

MAJOR I R IRELAND MC MA

The author was commissioned in 1941 and was immediately sent to India. After a few months in Roorkee he was posted to North Assam (Ledo Road project) and in late 1942 joined 23 Division Engineers at Tammu on the India-Burma border. In early 1943 he was posted to 17 Indian Light Division, where he served successively as Field Engineer, Platoon Commander, Second-in-Command and Company Commander until the end of the war. He remained with the Division in southern and central Burma until late 1947. After two years at Cambridge University, postings included SME, Pakistan followed by Command and Staff College, Quetta, and staff appointments at SHAPE and Allied Forces Northern Europe.

At the beginning of 1944 the divisions of 4 Corps were well forward of Imphal, the capital of Manipur State. Reacting to the big offensive planned by the Japanese against Imphal and Kohima, the Corps Commander ordered 17 Indian Light Division† to withdraw from the Tiddim area in the Chin Hills some 160-180 miles south of Imphal.

During the early part of the withdrawal 63 Brigade was holding a defensive position covering the Manipur River crossing which was vital for the withdrawal of the Division. 60 (QVO Madras) Light Field Company RIE, with the other divisional engineers, remained in Tiddim to destroy whatever might be of use to the enemy. Two days later, when the Company joined 63 Brigade, after a 40 mile march, among other useful things left behind by the previous occupants of the Manipur River Bridge area, who had clearly left in somewhat of a hurry, were found six anti-tank mines.

The OC 60 Company mentioned the mines to the Brigade Commander who said he did not think they would be of much use, or indeed needed at all, since there was little fear of enemy tanks approaching along the narrow mountain road leading from the Burma plains a hundred miles south. However, the Brigadier agreed we might consult the CO 1/10 Gurkha Rifles whose battalion was in a defensive position including a feature six miles

†The Division consisted of only two brigades, 48 and 63. Except for a few heavy vehicles to work on the line of communication, the Division was mainly on a jeep and pack basis. An unusual feature was the provision of two reconnaissance battalions, which each had two mounted infantry companies and two 'jeeped' companies.

Major I R Ireland
Five Into Six Equals Four

south of the river crossing, known as the Tuitum Saddle (height 4000 ft) over which the road passed before dropping to the river 2000 feet below.

The writer was detailed to sell the idea of laying our six anti-tank mines, which again was not received with any great enthusiasm by the Battalion Commander.

After several night attacks against the company holding the Saddle, it was eventually overrun but was recaptured the next day. The consequent strengthening of the position next day provided a suitable opportunity to offer our six mines once again. This was accepted and the mines were laid with wide and irregular spacing on the Tuitum Saddle, just north of a bend in the road and out of sight of an approaching enemy. The only hindrance to the actual laying of the mines was a rocket attack by RAF Hurricanes which luckily missed their target!

Before first light the next day the enemy again attacked the Saddle position, with the support, much to everyone's surprise, of five light tanks which were heard trundling up the road from the south. The leading tank struck the fifth (and penultimate!) mine, the second tank was trapped between the first and third tank which also struck a mine. The fourth tank was also damaged, only the last tank being able to stop in time and turn round never to be seen again.

The score may be calculated in two ways:

four tanks for six mines laid:
effectiveness 66 %

or four out of five tanks put out of action:
effectiveness 80%

The Sappers were delighted with their score of four out of five or six and the result was later celebrated with the Gurkhas, the RAF having conveniently just delivered a consignment of rum.

Are There Still British Military Railways In Germany and Belgium?

CAPTAIN F S COMPTON

Captain Frank Compton joined the Army as an apprentice in Chepstow in 1961. He served with 25 and 33 Field Squadrons as a combat engineer and at Cove as a training NCO. On completion of the Clerk of Works (Construction) course at Chatham in 1973 he gained site experience with PSA HQ Special Sites at Mildenhall and then with MAWA Salalah. Tours followed with 52 Construction Squadron on ADR trials, with the Queen's Gurkha Engineers in Hong Kong and the Permanent Way Troop in Germany. Following a full tour as SMI Construction at Chatham he was commissioned in May 1985. After travelling the world with MWF as Garrison Engineer and Resident Engineer (See Journal *June 1986, 'RE RE?') he returned to the railway organisation in his present post of OC PWT.*

Introduction

Contrary to common belief there are in fact many military rail depots in Germany (22) and Belgium (1). The track work, or to use the correct term, permanent way, within and leading to these 23 depots, for which British Forces (BF) are responsible, amounts to over 100km. The extent of depots is shown at *Figure 1*.

Historical Background

The development of the existing organisation started in 1945 as HQ Transportation Troops RE part of 21 Army Group BAOR. The unit had under its command such units as 250 GSO Port Operations Unit and 253 GSO Railway Construction Unit.

In May 1952 all the railway units were brought together under 79 Transportation Squadron RE at Herford. The squadron took on the training of both port and railway trades. In 1956 the unit was redesignated as Transportation Inspectorate RE and in 1957 moved to HQ BAOR in Rheindahlen. In 1963 the 'staff' joined AD (Mov and TN), while the executive personnel formed 79 Railway Squadron RE (BAOR).

During 1965 the RCT took over the rolling stock, locomotives, railway workshops, signalling responsibilities and control of BF sidings in Germany. MPBW, now PSA, took over the responsibilities for permanent way maintenance and new works. In Germany, 79 Railway Squadron RE became 79 Railway Squadron RCT as it is today.

The PSA responsibilities for the permanent way are carried out by the Railway Superintendent who, because of the strategic importance of the rail infrastructure, will always be a sapper officer appointed by Director Engineering Services as part of the MES organisation. By this appointment, not only is the continuity of the railway infrastructure assured but the Corps is also provided with the opportunity to retain the skill and expertise necessary to construct railways worldwide.

Rail Repair Organisation

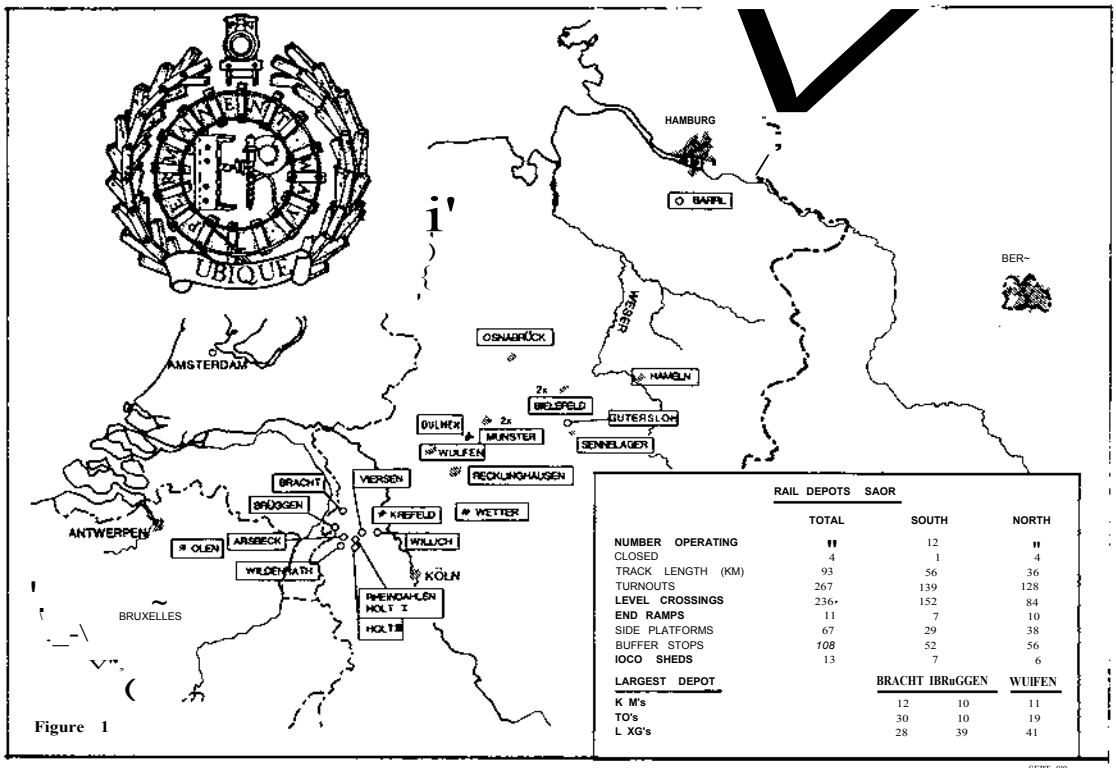
In Germany and Belgium the rail repair organisation is the Permanent Way Troop (PWT). The overall command structure is shown at *Figure 2*. The PWT is made up of two troops each with two SNCO's (MES) and twelve Mobile Civilian Group (MCG) local civilians.

PWT (North) based in Dortmund covers the area from Barrl in the north to Wulfen at the western edge of their area. PWT (South) based in Krefeld have a much smaller area from Olen in the west to Wetter in the east.

The structure of each troop is similar: a Superintendent of Works (Railways) who is a Clerk of Works, a Sergeant Fitter, an MCG Chargehand and an Inspector/Interpreter.

The southern team are based in Heynes Barracks Krefeld and administered by 232 MCAG. The

Captain F S Compton
British Military Railway In Germany And Belgium



RAIL DEPOTS SAOR	TOTAL	SOUTH	NORTH
NUMBER OPERATING	"	12	"
CLOSED	4	1	4
TRACK LENGTH (KM)	93	56	36
TURNOUTS	267	139	128
LEVEL CROSSINGS	236	152	84
END RAMPS	11	7	10
SIDE PLATFORMS	67	29	38
BUFFER STOPS	108	52	56
IOCO SHEDS	13	7	6
LARGEST DEPOT		BRACHT IBRuGGEN	WUIFEN
K M's		12 10	11
TO's		30 10	19
L XG's		28 39	41

Figure 1

SEPT 8'0

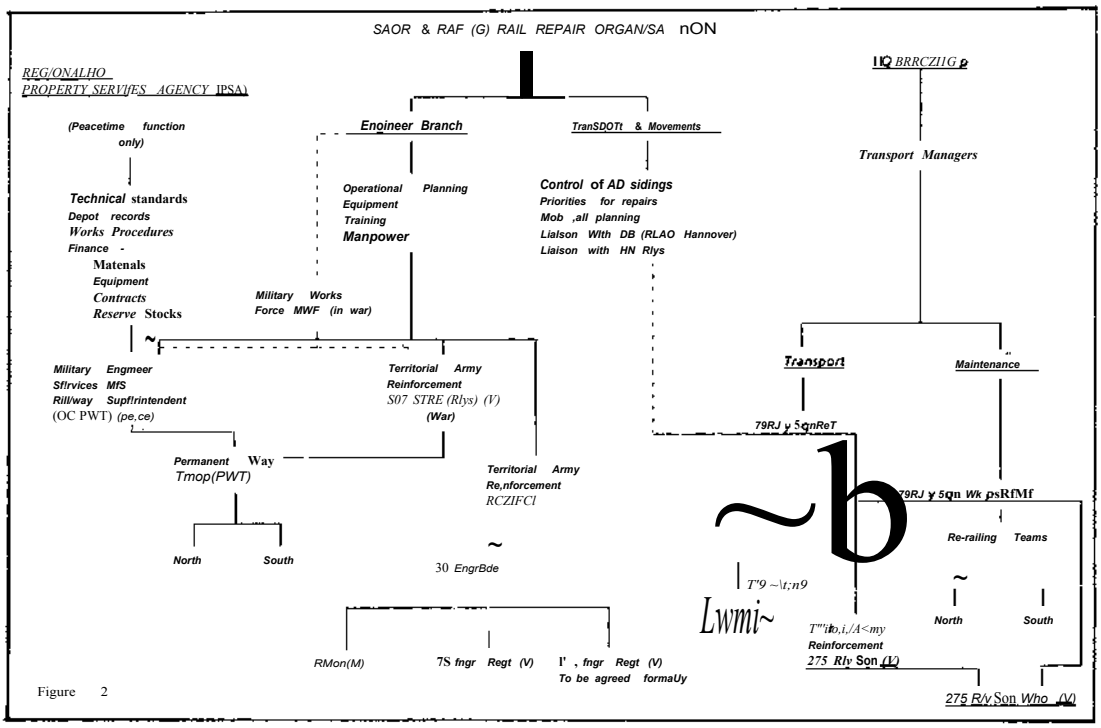


Figure 2

79 Railway Squadron RCT Mönchengladbach

A member of the PWT cutting out damaged rail

The completed repair

northern team has an office in Dortmund and are administered by 221 MCAG. Because of its large area of responsibility PWT(N) still operates from a maintenance train which moves between Bielefeld in the winter and Wulfen in the summer. The MCG personnel live on the train during the week.

The train has 23 coaches including living accommodation, dining car with kitchen, a bar coach, ablutions, toilets, offices, stores and a workshop. With an annual budget averaging DM1.5 million the Railway Superintendent, along with PWT(N) and PWT(S), provides the maintenance effort required to keep the 'rail estate' in safe working order. The routine maintenance work is carried out by the PWT on a planned maintenance programme.

Most renewal and new works are carried out each year by contracts prepared and supervised by the PWTs. Railway works are undertaken to meet the operational requirements of Command Transport and Movement and are carried out in accordance with German Federal Authority standards.

Training for War

During TTW and prior to reinforcements in the form of 507 STRE (Railways) (V) arriving, it is anticipated that the greatest threat to rail will be sabotage. At a time when depots are outloading this clearly would be a problem.

Throughout the year the PWT practice their ability to carry out emergency repairs to damaged track. Ex *PLASTIC PUNCH* was the name given to the series of exercises based on track demolition trials carried out by PWT in 1987.

Plain track and turnouts (switches) were demolished with various PE charges placed at critical points by combat engineers from 40 Army Engr Sp Gp at Willich. The damaged rail was recovered and is now used by the PWT to simulate sabotage damage. The PWT take it in turn to set an incident to which the other responds.

On the day of the exercise the Railway Superintendent (OC PWT) contacts the troop who will respond to the incident and gives the grid reference of the damage. The troop gather up the tools and deploy to the location where the SNCO and inspector carry out a recce. By the time the

Are There Still British Military Railway In Germany And Belgium 1

recce is complete the rest of the troop, travelling in slower vehicles, will have arrived and they are briefed on the task ahead. Rail cutters are used to remove damaged rail and any craters are backfilled.

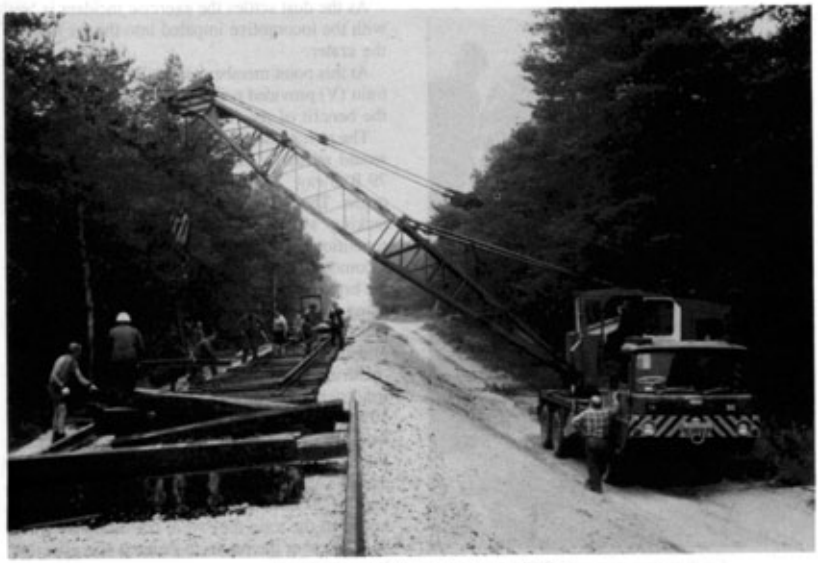
If more than three sleepers are destroyed then support is required under the rail. A section of new rail is cut to length and clamped into position to complete the repair which takes about 30 minutes to complete once the troop arrives on site. 507 STRE (Railways) (V) come out to Germany each year to exercise their reinforcement role. In war, 507 STRE and PWT combine to form 8 Military Works Group (8 MWG) Railways under command of Engineer Works Organisation (EWO). 507 STRE is made up as far as possible from BR personnel and has a strength of three officers and twenty ORs. Its role in war is to maintain the outloading capability in two key depots and provide recce and advisory teams over the whole area. To meet this role, 507 STRE undertake trade training in UK at the Rail Repair Training Facility (RRTF) at Chilwell and in Germany during EX *TURNOUT* on the permanent way and a training facility in Willich. At both locations German rail, fittings and hand tools are available so that realistic training may be achieved.

Another vital aspect of 507 STRE's training in BAOR is to familiarise themselves with the many depots and access to the sometimes long approach tracks forming the Military Rail Estate in Germany. This is essential to their advisory role particularly as response times for rail repair can be doubled if access to the damage and to reserve stores cannot be located.

Engineers In Support Of Rail Repair

Major track damage involving craters from say air strike cannot be repaired by 507 STRE without plant support.

30 Engineer Brigade (V) are now tasked to provide such support as well as undertake track repair outside of 507 STRE's area of responsibility. To meet this role elements of 30 Engineer Brigade are given familiarisation training in UK during training weekends at Chilwell and in BAOR during Ex *SCHWARZER ANKER* by 507 STRE and PWT.



507 STRE Railway (V), trade training on site

Are There Still British Military Railway In Germany And Belgium 2

Exercise *Schwarzer Anker* 1986

Exercise *Schwarzer Anker* 1988 — battle simulation

In alternate years, during Ex *SCHWARZER ANKER*, PWT lay on a major rail incident in BAOR to enable all elements of the rail repair organisation to practice their skills. During Ex *SCHWARZER ANKER* 1988, part of the film *SAPPERS IN SUPPORT* was shot. To provide dramatic footage for the film the rail incident was set realistically by using a sacrificial locomotive and coach, with the kind permission of 79 Railway Squadron RCT of course.

Familiarisation training in Willich

Members of 26 Engineer Regiment provided the battle simulation to great effect. Later, while the film crew were shooting from within the locomotive to get shots of a terrified driver approaching the detonations they found more realism than they bargained for. One of the battle simulation charges took out a window in the locomotive and put real terror on the face of the driver! To set the incident the locomotive and coach were propelled at about 20 kmph into the prepared craters.

As the dust settles the exercise incident is 'set' with the locomotive impaled into the far bank of the crater.

At this point members of the RAMC ambulance train (V) provided realistic simulated casualties for the benefit of the film.

The next phase of course is repair. The first task would normally be EOD clearance followed by 79 Railway Squadron RCT REME recovery teams. The REME have special remote hydraulic jacking systems to re-rail rolling stock. By repetitious jacking, packing and backfilling the locomotive is hauled out of the crater by inserting the broken rails sideways under its wheels and by using another locomotive sledging it up and out. Once clear the sappers backfill the crater and reinstate the track.

During the exercise an element of 111 Engineer Regiment (V) along with an advisor from 507 STRE demonstrated to many invited guests from HQ BAOR, HQ RCZ and the Deutsches Bundesbahn (DB) a tactical repair of sabotaged track. The guests were astounded by the repair time of 20 minutes and even more astounded to hear that the train they were travelling on would be taken over the repair to prove it was effective. It was.

Are There Still British Military Railway In Germany And Belgium 3

The locomotive drops into the crater

The impetus of the locomotive lifts the track in front of the crater

Future Developments

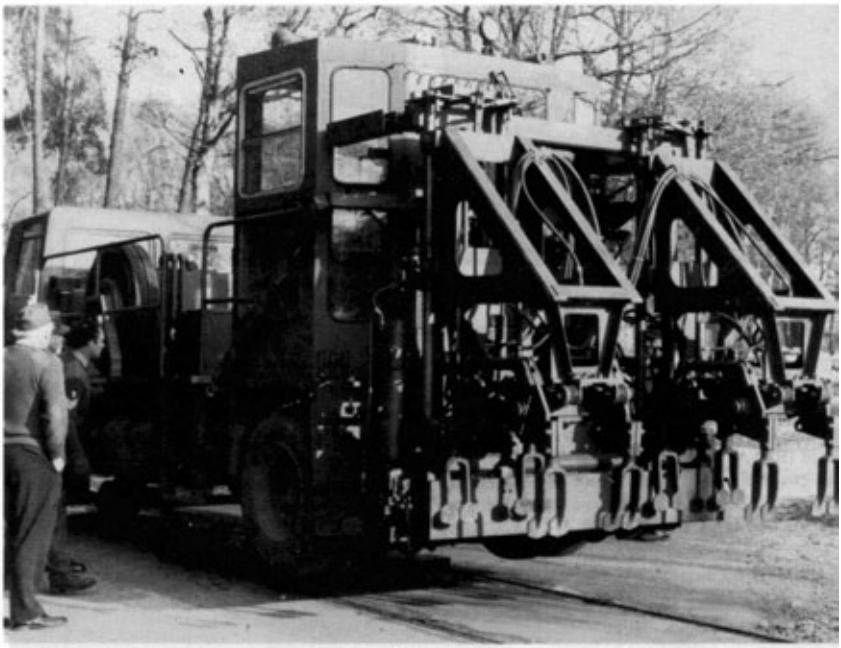
ME Vol VIII Ports and Railways, the railways element is at this time being drafted by Lt Col (Ret'd) Ian Page ex OC 507 STRE and member of the Royal Engineers Specialist Advisory Team (RESAT). It is proposed that this ME Vol will cover all aspects of railway engineering to help the Corps in the future with railway construction tasks worldwide.

The PWT is always aware of developments in the permanent way world. New road/rail tamping machines have been purchased to enable lift and pack operations to be carried out in the many depots without tying up low loaders to transport old tamping machines around the depots.

A hydraulic plate allows the tamper to be moved from its road to rail wheels with the minimum of effort.

The track is reinstated

Are There Still British Military Railway In Germany And Belgium 4



The new Road/Rail Tamper

Development of turnouts includes the use of solid block crossing sections to eliminate maintenance of bolted sections, damage from derailments and restrict access for the saboteur.

Trials later this year will be undertaken to determine just how many sleepers can be left out from the permanent way before derailment occurs.

Finally, track sections have been laid in a range area so that demolition trials may be undertaken on a particular type of rail fixing used extensively in BAOR to determine the effect of charges up t 45 kg.

In Conclusion

There is a military railway organisation in BAO and it is active all year round. With some 15,00 waggon movements per year and a heavy strategi role in war, more than 80% of 1 (BR) Corp ammunition is moved by rail, the PWT are full committed to providing a rail infrastructure tha can be maintained in peace and kept open in wa

Are There Still British Military Railway In Germany And Belgium 5

Royal Engineers Staff College Demonstration 1988

CAPTAIN M D P LEONARD RE

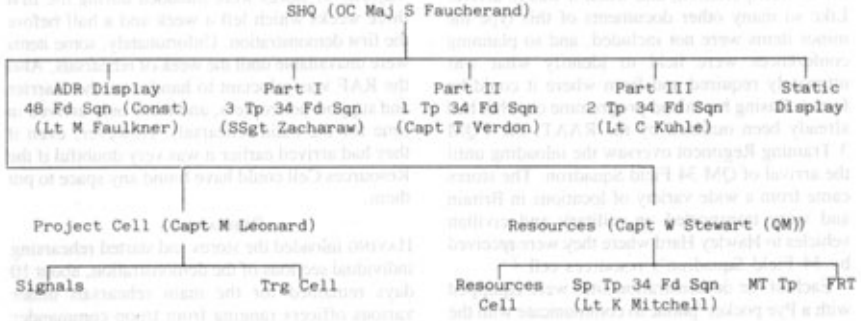
Captain Leonard was commissioned into the Corps in 1984, having attended Sandhurst and after reading Civil Engineering at RMCS Shrivenham. His first posting was as a troop commander in 51 Field Squadron based at Ripon, where he served in the Falklands as well as the UK. This was followed by a posting as a troop commander at 3 Training Regiment with 57 Training Squadron. During this tour he was attached to 34 Field Squadron for the 1988 RE Staff College Demonstration. He will shortly be starting No 8 JCSC, and will then be posted as 2IC 61 Support Squadron at Maidstone.

Introduction

The annual Royal Engineers Demonstration to the Army Staff College took place at Hawley on 19 May last year. This was the main demonstration given by the Corps and, apart from Army Staff College students, spectators included foreign military attaches, members from both Houses of Parliament, and representatives of local and national press.

A demonstration squadron, this year 34 Field Squadron, is earmarked for the period, but this does not fulfil necessary manpower requirements, therefore more specialized units send additional personnel for parts that reflect their own roles. The combined manpower reaches some 250 all ranks but added to this are the RAF contingents, that both man and support the Harrier aircraft and helicopters, and administration parties from 3 Training Regiment.

The demonstration period comprised four phases; inloading stores, rehearsals, demonstration days, and the backloading period for stores. The inloading had already been initiated by 3 Training Regiment when 34 Field Squadron arrived a month before the first of the demonstrations. The Squadron orbat was as follows:



Captain M D P Leonard RE
RE Staff College Demonstration 1988

Chinook with underslung No 9 tank bridge

Inload

The most onerous of tasks for the demonstration was the provision of stores. The area of Hawley Hard took on the image of an Engineer Park, and with the number of MGB bridge sets alone we could have bridged the Rhine! The inload of the stores was made in conjunction with the Regular Army Assistance Table, which had been compiled two years previously. This defined where the equipment was coming from, who was responsible for its transportation, and when it was to arrive. Like so many other documents of this type the minor items were not included, and so planning conferences were held to identify what was ultimately required and from where it could be found. Basing his inload programme on what had already been outlined by the RAAT, the TQM 3 Training Regiment oversaw the inloading until the arrival of QM 34 Field Squadron. The stores came from a wide variety of locations in Britain and were transported on military and civilian vehicles to Hawley Hard where they were received by 34 Field Squadron's resources cell.

Each of the demonstration sites were equipped with a Pye pocket 'phone to communicate with the Project Cell. Besides the obvious need for a safety net, this provided a valuable link back to the Squadron. This was further complemented by a field telephone link from Project to Resources Cell, enabling a troop to request stores via the Project Cell, who in turn monitored progress. The field telephone link meant that the Project Cell could contact the Resources Cell immediately without fear of interruption on a radio net, and obtain the necessary release of stores. The majority of stores were inloaded during the first three weeks which left a week and a half before the first demonstration. Unfortunately, some items were unavailable until the week of rehearsals. Also the RAF was reluctant to hand over the Harrier and support helicopters, and these only arrived in time for the main rehearsals. However, even if they had arrived earlier it was very doubtful if the Resources Cell could have found any space to put them.

Rehearsals

Having inloaded the stores and started rehearsing individual sections of the demonstration, about 10 days remained for the main rehearsals under various officers ranging from troop commander

to Commander 11 Engineer Group. The format of the display was as follows:

- Airfield Damage Repair, given by 48 Field Squadron (Const)
- Engineers in the Combat Zone
- The Reserved Demolition
- Water Crossing Capabilities
- Static Display including:
  - Engineer Ordnance Disposal
  - Survey
  - Postal and Courier
  - Military Works Force
  - Royal Engineers Diving Establishment
  - Workshops
  - Movement Light

Airfield Damage Repair (ADR)

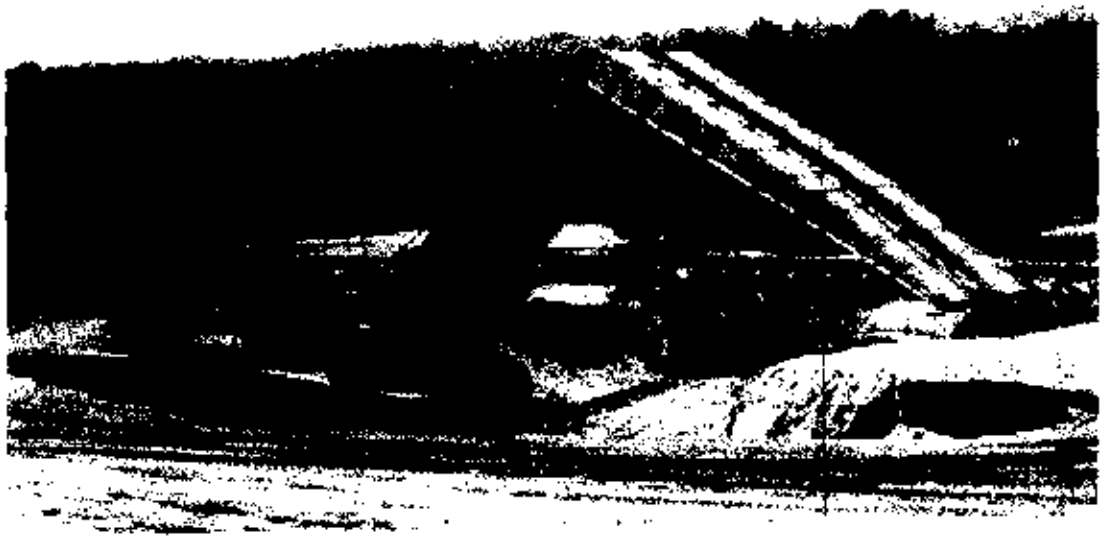
To say that miracles are not impossible, and that they just take a little longer to do, is fair comment for Royal Engineers. Unfortunately, time was not on the side of the Demonstration Squadron, and any attempts to convert the airfield on Hawley Hill to look like RAF Gütersloh would have sadly overrun the time allocated for preparation. As a result this first part of the demonstration was set around a static display. The spectators were introduced to ADR by OC 48 Field Squadron (Const) whose squadron is committed in its wartime role to the support of RAF Gütersloh. After the introduction the spectators were divided into three groups and guided around the display. The areas of interest were: the use of plant in the 'clean bowl' method of crater repair, dynamic compaction, and the maintenance of essential services.

Engineers in the Combat Zone

After the VIPs had refreshed themselves with coffee, and the lesser mortals had viewed a 6-bay DS MGB build, the spectators moved on to the next part of the display; 'Engineers in the Combat Zone'. This year attention was drawn to the emergence of Close Support and General Support squadrons in BAOR. However, because of the limitation in both the size of the arena, and the availability of equipment, the display focused more on the means and equipment that combat engineers could provide for future formation commanders. This effectively encompassed all types of earth moving equipment at squadron level, both wire and mine obstacles, the various types of gap crossing equipment from mini fascine to armoured

Centurion AVRE(165) demonstrated laying of maxi-pipe fascine

RE Staff College Demonstration 1988 (2)



Combination Bridging - AVLB laying No 8 Tank Bridge from No 8 Tank Bridge with Trestle

combination bridges, and finally general support to the RAF which centred on the Harrier. This display was delivered with the customary penchant for battle simulations, so at the end, the more weak hearted of the audience were grateful to step forward and view the equipment.

THE RESERVED DEMOLITION

AFTER moving by coach to Hawley Hard, and a further cup of coffee, the spectators walked to the stands for the next part of the Demonstration. Sitting on a 3-span DS MGB the audience watched the reserved demolition of a mock steel girder bridge. Amidst yet more battle simulations, and several comical interludes, the importance of the AFB 9811 was suitably pressed home. The ordinary spectator might have found this a little bit strenuous as the local BBC News certainly reported this part as, "~..a spectacle that involved a few bangs and a lot of form filling!" However, with the successful 'demolition' of the bridge, the audience then moved on to view the final part of the Demonstration.

WATER CROSSING CAPABILITIES

UNLIKE in previous years where a speed build on a 5-bay SS MGB was carried out, this year saw a small APB build which was designed to complement the demonstration of the APB raft. This part of the display involved the use of divers, for checking the river. profile, and they were shown operating from both assault boats and helicopters. Once the 'rficce' of the river had been completed the audience were then shown the various types of crafts and equipment that could be used in support of river crossings.

This incorporated the use of a variety of craft: from a two man inflatable recce boat to the Combat Support Boat. The highlight of this part was the entry of a CET into Hawley Lake at speed. The CET then swam across the lake and recovered itself using its RPG.

STATIC DISPLAY

WITH the end of the display on the water, the audience were invited to tour the static display. This covered the many other facets of the Corps that had not been included in the Demonstration. There was a large EOD display that included equipment and machinery that this rapidly expanding side of the Corps now uses. REDE's display consisted of a water tank in which divers showed the skills that they must learn besides being employed on river recces. A workshop stand

Divers dropped by RAF Puma

...Air Portable Raft

RE Staff College Demonstration 1988 (4)

gave an insight into what tradesmen from a field support squadron could produce in the field. The Military Works Force showed all aspects of engineering: civil, mechanical, electrical that involve tradesmen and clerks of works. Both Survey and Postal and Courier displayed their level of commitment to the Army in the field. Finally 873 Movement Light Squadron (V) showed how the Corps can turn darkness into daylight on the battlefield. This proved to be the culmination of the day and brought to an end the RE Staff College Demonstration. The display had lasted just under four hours and apart from amphibious engineering, every facet of the Corps had been incorporated in some shape or form.

Backload

Once the euphoria of the demonstration was over, the process of returning the stores, vehicles, and equipment took place. Because of their forthcoming tour in Belize, 34 Field Squadron had a week to strip out and return the stores that had been used. An additional complication was that some items had to be sent to the British Army Equipment Exhibition at Aldershot and not to their original engineer parks or stores. The backloading plan was formulated by 34 Field Squadron in conjunction with the TQM of 3 Training Regiment. This plan decided the order in which the stores were recovered and prepared for handover.

The same agencies that had been used for the inload were in turn used on the backload where possible. Once again the Resources Cell proved to be the key to this operation. Although the troops were able to strip out and clean most of the stores on their respective sites, this still left the job of checking the stores by CES and sorting out any last minute problems prior to their return. It was found that, in addition to the manning of the Resources Cell, a section was required for moving items around and assisting with the loading of vehicles. As the backload progressed and manpower could be released from the field troops this problem was rectified but in the earlier stages a composite section had to be formed. It was due to the pre-planned format of

CET takes to the water

RE Staff College Demonstration 1988 (5)

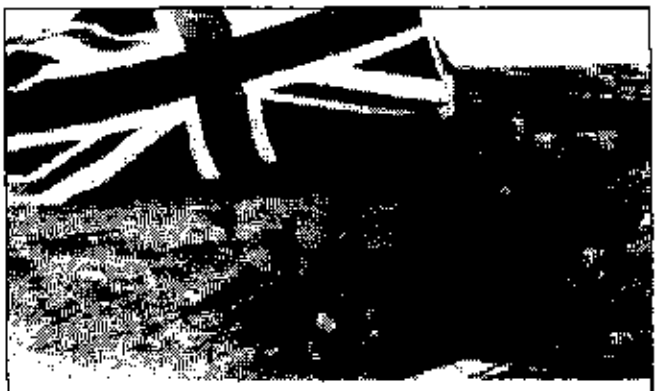
Terex places 'Staff Car' into 10 ton self-loading dump truck

the strip, and the efforts of all thé sub units, that the stores were returned within the week.

Summary

THE feedback from both the Staff College and the other members of the audience was favourable, and this year's demonstration was deemed a success. Apart from the three main demonstration days, there was an intense period of inloading, construction, rehearsals, as well as the backloading period. It was to the credit of all those concerned, especially this year's demonstration squadron, that the demonstration days were not only a success, but that the periods prior to, and after, the demonstration ran so well.

RE Staff College Demonstration 1988 (6)



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POLICE MUTINY

QUOTING from *While Memory Serves* by Lieut General Sir Francis Tuker (GOC-in-C Eastern Command at that time): "In the evening of 24 March 1947, the GOC learnt from the Deputy Inspector of Police at Patna in Bihar, that the (Indian) police had attacked their (British) officers at the Police lines and had taken charge of their barracks and armoury. There was urgent need for military aid. A mutinous police in charge of their own armoury, with, to them unlimited ammunition, was not to be tolerated for a moment in case the habit spread and the Army found itself let in for a stand up fight with small bore weapons" .

By 26 March the mutiny had spread to other lines. At about 6pm on that evening the magistrate at Mongyr (Mr J S Elliott ICS) asked me to get troops ready as he had heard there was trouble at Jamalpur (a nearby town) and he was sending a police party under the Superintendent of Police to investigate and report to him. By 9pm, the Superintendent was back with the information that the Jamalpur police had seized their armoury at about 6pm, assaulted their British sergeant and taken the keys.

The Civil Commissioner of Bhagalpur Division (Elliot's boss) happened to be in Mongyr that evening and summoned a conference of civil and military officers, as it seemed certain t"at the Mongyr police would also go over that night. We discussed plans to pre-empt the police and capture the Mongyr armoury ourselves. I was handed a formal request for troops to be sent in "Aid of the Civil Power". It was my first experience of such a task and a bit different from our traditional training exercise of dispersing an unarmed riotous crowd of civilians banging drums and throwing stones.

But while the conference was discussing, the police had been acting, and had already seized the Mongyr armoury.

I returned to our company lines, stood to the remainder of the company, since one platoon was on 15 minutes standby from earlier in the evening, and held an a Group. It was not difficult to cordon off the police lines. They were roughly square. Two sides were formed by the banks of the River Ganges and one side backed onto the Mongyr Railway Station Terminus. The fourth side, which contained the main entrance, faced onto the city walls. Mongyr was an ancient city surrounded by high walls, similar to York. The plan was to dispatch one platoon under Richard Holmes to cordon the flank by the railway station, whilst I, with the remainder of the Company, cordoned off the main entrance from the City Walls which dominated the entrance to the Police Lines. The River Ganges hemmed in the other two sides.

By lam we were in position. Having deployed covering troops on the City Walls, I drove towards the entrance of the Police Lines accompanied by Subedar Ambika Prasad, the Magistrate Elliot and British Police Officer, Harle. On approaching to within 30 yards we saw a man put his rifle across the top of the gate and take aim. We stopped the vehicle and went forward together. There were two or three fires burning on the *maidan* (parade ground) and we could see police in the light of the fire moving about carrying arms. Their attitude was threatening as they were shouting "andar mat ao!" (no entry!) and "hat jao turn log!" (go away!) The British Police Officer attempted to command their attention by raising his hands above his head and shouting "suno!" (listen!) They responded "hukm na manega!" (we're not taking orders!) I ordered a withdrawal to the City Walls where the two platoons were deployed.

Here, at the Magistrate's request, the Police Officer called out three times in Urdu for the mutineers to surrender, with no result.

The Magistrate then required me to "disperse the unlawful assembly". I detailed six sappers to fire a round apiece from where they stood on the City Walls into the darkness towards the Police Lines. The Police immediately fired in reply, so I called up a bren gun and ordered the No I to open fire. Harle then called again for ten men to come forward and surrender their arms. He guaranteed that they would not be fired upon. The mutineers' tone by now had quietened considerably but there were still shouts of "hukm na manega!" and "hat jao!" I ordered another burst of bren gun fire. This silenced them completely but none came forward to surrender. Finally I called Area HQ on the telephone, reported the lack of progress, and requested that they send me a troop of armoured cars in the morning. I did not wish to put my sappers into an attack over open ground unprotected. And so we watched and waited.

At about 4am the Magistrate and I left for Jamalpur, where the trouble had been reported earlier, escorted by a detachment from the Garrison Company in Mongyr which was commanded by a YCO. We arrived after about an

Some of the British and Viceroy Commissioned officers having *Khana* (a meal) together. Ambika Prasad is in the left foreground.

hour's drive to find the Police Lines deserted, the armoury wide open, and empty! In town however, we found the Police Station still manned. I left the VCO of the garrison company and a section of his men with these police to bolster their loyalty, and returned to Mongyr.

I went first to Richard Holmes' platoon which had been deployed where the railway terminus backed onto the Police Lines. He had been there since lam and now had a bren gun on the station roof covering the Police Lines. He told me that whilst I had been at Jamalpur, the early morning coolie train from Jamalpur had arrived. As it drew in about thirty armed Indian police jumped out and rushed towards the Police Lines led by a tall man in a dhoti. These were the Jamalpur mutineers and their ring leader Indar Deo Singh. But as they careered towards the Police Lines in the darkness before the dawn, their fellow mutineers, fearing it was an attack by us, fired on them!

At about 9am a Senior Police Officer arrived from Patna with a man in a black beret; another ringleader who had previously surrendered. He advised the mutineers to give up as armoured cars were on the way. From that moment onwards a trickle of men started to come out, carrying their arms. First out were their wounded, who received immediate attention. During the morning the Sappers made a barbed wire cage in their lines into which the Indian police mutineers were put. By noon, the mutiny was over, and a hundred and twenty five Indian Police had surrendered with their arms. The Sappers had suffered no casualties.

Next morning, after the excitements of the past twenty-four hours, 74 Field Company was back to its Bailey bridging.

Post Script

I RETURNED to India on business in 1979, visiting Delhi and Cawnpore. Whilst out there I was fortunate enough to meet Subedar Ambika Prasad. Throughout the past thirty years we had maintained contact by correspondence. He had by then retired, as an honorary lieutenant, his last appointment having been Subedar Major of the Boy's Battalion at Roorkee. He was a tremendous character, and a great support to a young (aged 22) and inexperienced Company Commander in 1947, as I grappled with the task of our unexpected initiation into aiding the Civil Power, with a newly formed company of Hindus who were obliged to fire on fellow Hindus.

After retiring Subedar Ambika Prasad had returned to his village near Cawnpore where he was headman. He was particularly proud of two projects begun in retirement. He had started a voluntary school for his District, and recruited three hundred and fifty children and teachers, without any Government finance. He organised it all and found the money locally. Secondly the crop output on his land had increased sevenfold in ten years, through use of fertilisers, irrigation wells provided by the government, and improved seed provided by the FAO. "The miracle of India," he said, "is that we need no longer fear the threat of famine. In fact we have become an exporter of food". The prophetic truth of his words was proved after the drought of 1987.

India is a wonderful country, and the Indians have great regard for Sapper officers. We are always welcomed with great hospitality. Alas, *tempus fugit* — Ambika Prasad died in 1987.

Bridging Camp At Mongyr 1947 2.

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Bridging Camp at Mongyr 1947

MAJOR J H G PARFECT MBE

The author travelled out to India as a young subaltern, aged 20, in January 1945. He was posted to the Bengal Sappers and Miners at Roorkee. After a year in the Training Battalion he joined 5 Indian Division Sappers at Ranchi where he remained until a couple of months after Independence. He returned home for a few months and went back to the Far East to become a founder member of 67 Gurkha Field Squadron in Autumn 1948.

Background

5 Indian Division returned to India in 1946 from Burma, and then Indonesia, to occupy tented camps around Ranchi in Bihar province.

I joined the Divisional Sappers soon after their return. After a short time with 2 Field Company, I was appointed OC 74 Field Company. The Divisional Sappers were employed on their traditional tasks of helping units make themselves comfortable in new surroundings. In the early months the priorities were a piped water supply in each camp, overhead electricity lines to produce light in each tent, and converting each tent into a "Wana Hut" — (a pre-war term from the North West Frontier Campaigns).

EPIP tents were given concrete floors and brick walls to make them drier in monsoon weather and warmer in cold weather. Some buildings were improved — like messes, canteens and secure stores. Another minor task was constructing fire places in the messes which did not belch smoke back into the room. We wanted log fires for Christmas 1946. Trivial tasks for a peace time trained army, but difficult for a field company skilled in war time combat engineering and short of skill and experience in tradesmen.

Internal Reorganisation

During 1946, in anticipation of Partition all divisional Sappers and Miners were converted to one caste field companies by a complicated nationwide switch of platoons. Historically in the Bengal Group, each field company comprised three platoons of Hindus, Punjabi Musselmans and Sikhs respectively. After reorganisation 74 Field Company became all Hindu.

Subedar Ambika Prasad the senior Viceroy Commissioned Officer was posted to the company and he became a major influence in helping the company reorganise. He had been a VCO in 10 Indian Division Sappers in the Italian Campaign, and came to us full of experience and wisdom.

Internal Security in Bihar

Almost from the time of the return of the Division to Ranchi in 1946, whilst the Sappers were making the camps more comfortable, the infantry battalions were active in maintaining law and order in Bihar, Calcutta and Bengal. The massacres, which later spread to the Punjab in 1947 started in the Eastern Provinces in 1946.

Bridging Camp at Mongyr

Once the divisional camps were made more comfortable, Sapper training was resumed. A valuable piece of company training, helping to absorb newly received Hindu platoons, occurred when 74 Field Company was sent to the Command Bridging Camp at Mongyr in March 1947. Mongyr was in North Bihar on the South Bank of the River Ganges. One of its attractions was its remoteness from Ranchi where HQ RE was located — a day's journey by jeep. We planned a month of bridging and field engineering training.

Major J H G Parfect MBE
Bridging Camp At Mongyr 1947

Hindustani Words In The English Language

MAJOR NEVIL S MILLER TD FICE FRTPI

The author, who now lives in South Africa, was born in Wolverhampton in 1906 and qualified as a municipal engineer. He was commissioned into the Territorial Army (4th Battalion the Border Regiment) in 1929 and transferred to the Royal Engineers (315 Anti-Aircraft Searchlight Company, Croydon) in 1931. During World War II he spent six years in the regular Army and this article is the result of a number of years spent in India.

CAN you speak Hindustani? You may not think so, but do you know how many Hindustani words you use in everyday speech, and how many others you understand? I did not until I found myself in (what was then) India during the 1939-1945 War. Though British Service, I was attached to the Indian Army and became subject to a rule which laid down that all British officers in the Indian Army must pass an examination in elementary Urdu before promotion could be gained. Urdu is the military version of Hindustani and is a mixture of Arabic, Persian and Hindi.

I passed my examination at Peshawar up on the famous North-West Frontier (now in Pakistan), and while learning Urdu and later speaking it, I was surprised to observe the number of words which I used or understood in English. Though it has taken me many years to get round to it I think it may be of interest to put this on record for the benefit of English-speaking people who do not realize just how many Hindustani words there are in the English language. These words must have been brought back to Great Britain by traders and soldiers from about 1760 onwards and later by civil servants and others, and have now become a part of the language.

I am not a university graduate or grammarian, so what I set down will be my own observation, plain and devoid of derivational details. Firstly, it is necessary to explain that to avoid variations in military Urdu the spelling in Roman letters was standardized. Where necessary I shall give the Roman Urdu spelling in brackets after the Anglicized form and it should be noted that a final 'i' is pronounced 'y' as in pretty, (as in sari). The double 'oo' much used in names takes the form of 'u' so that Mr Naidoo becomes Mr Naidu and Hoosain Ameen becomes Husain Amin, Rajoo Reggie Singh becomes Raju Regi Singh, and so forth. My past training constantly makes me feel that some Indians don't know how to spell their own names!

To my mind the 55-odd words I am about to list fall into three broad groups:

- Those incorporated into the English language as legitimate words in everyday use.
- As above, but not in common use, though generally understood.
- Slang words, some of which have become semi-legitimate.

GROUP 1

LET us start off with two pure Hindustani *words* with slightly changed pronunciation, bungalow (*bangla*), and verandah (*beramda*), followed by barrack and bazaar (*bazar*, market or shopping area); then there is the bund to a road or stream (*band*, closed, ie a verge or embankment), and jungle (*jangal*). Two pure importations in the criminal field are *amuck* (ie he ran amok) and loot

Hindustani Words In The English Language Major Nevil S Miller TD

(fut), while the legal expression, the case will be heard 'in camera', may come from *kamra* (a room) meaning 'in private'.

Now to clothing: What we call a camel coat is perhaps associated with *kammal* (blanket). All old soldiers will know what *khaki puttees* are (both Urdu words), and understand the expression 'going out in muftey', which comes from *mufti* (free), that is 'free' clothing as distinct from uniform; while a topee *(topi,* a sun helmet) is still worn by polo players, as are *jodhpurs* (combined breeches and gaiters) - a garment that takes its name from the State in central India where it originated *Polo* itself was exported from India along with the word chukker *(chakar),* which is an interval of play, and syce *(sa* is, a horse-minder) .

Pyjamas is not a word one would associate with Urdu but its origin is in the Mohammedan east. It is really a singular word and refers to the Prophet's trousers. These full-cut garments have a narrow cuff and voluminous legs and are said to owe their origin to a belief expressed in the Holy Koran that one day the Prophet would be born again of a man. (Perhaps when he was not expecting it!)

No doubt the early Europeans in India discovered that its generous folds of cool cotton made it a desirable sleeping garment. The later addition of a jacket caused the word to assume its present plural form of "pyjamas".

The once-popular material for ladies' dresses known as cashmere originated in the State of Kashmir but I did not realize until recently that calico, dungaree, gingham, chintz, shawl, and sandals are all Urdu words, as are chutney, curry, pepper, cheroot, caddy, and shampoo.

GROUP 2

THOUGH not much used currently this group of words can still be heard in Great Britain especially amongst retired soldiers and civil servants from India. Perhaps the most common is chitty meaning a note *(chitthi,* a letter) followed by *tiffin* (lunch), and at the bar when asking for a whisky - 'a burra peg or a chota peg' *(bara* is large, *chota* is small and *paeg* is a measure); hence also the expression Burra Sahib meaning 'big master' and Chota Sahib, the son.

Retired army and civil officers may also refer to their wives sometimes as 'my memsahib'. A favourite word is 'pukka' *(paka,* good, first-class or proper); thus a pukka-sahib is a good chap or a gentleman, though in Hindustani it has a much wider meaning, eg a 'paka bangia' is a brick-built bungalow as distinct from a mud dwelling, and a 'paka alu' is a cooked, not a raw, potato. Parney *(pani* - water) has largely dropped out now (but years ago was much used in the military areas of England), so has dobey for washing clothes *(dhobi* - a washerman), and the holding of a Durbar is now a piece of history *(Darba* - a court).

GROUP 3

MOST of the words in this group have been taken back by the Armed Forces to the UK over the years and two that are frequently heard are 'give him my salaams' *(salaam* - a salutation) and 'buckshee', meaning free - this comes from *bakhshish* (a gift or reward); then there is the expression 'in a cushy job' *(khushi* - happy) and 'jolly him up' *(jaldi* - quick), also in the game Bingo 'ajaldy three' (a quick three numbers); then follows 'let's have a dekko' *(dekho* - to look), and 'a cup of char' *(chae* - tea).

WaUah is an interesting word. It has no direct translation but, as used by the troops, took the form of a 'fronty-wallah', for example, one who has served on the North-West Frontier, and a 'paisa-wallah' meaning one who looked at his money *(paisa* - cents), also a 'loose-wallah', a tricky or treacherous type who may have been in choky *(choki* - a police cell). Randy is another example *(randi* - a prostitute). Evening exchange in the cantonment.. "Where going to-night, Jack?" "I'm off to the bazaar for a bit of randi" .

Blighty is a corruption of *Wilayati* which is the Hindustani for Europe. Conversely their word for matches is *dersalai* - this comes from soldiers saying in rough speech 'gi' us a light'. Matches were unknown in India prior to the British occupation and so this expression came to be adopted as the official word for them.

It can be seen, then, from this selection of Urdu terms in the English language, that something of the life of the old British army in India and of the Indian Civil Service is resurrected whenever we use these borrowed words.

No doubt our readers can provide many more linguistic delights - any offerings? - Editor.

Monkton Farleigh Mine

Members may not be aware of the Sapper connection with the Monkton Farleigh mine illustrated below. The following notes by Brigadier W McM Keane CBE explain his involvement.

THE Corsham Underground Ammunition Project consisted of:

The Box Tunnel mine the largest of the lot
The Monkton Farleigh mine
The Ridge Gastard mine

Brigadier A Minnis was in charge of all these and he gave me the Monkton Farleigh project to manage, (from 1936 to the outbreak of War) and I could not have had a more fascinating job.

They were not mines, but underground quarries from which Bath Stone had been cut for years and were no longer much used. They were on average 100 feet deep, and covered with rock and limestone and considered to be fairly well bomb proof and suitable for conversion to the storage of bombs and ammunition of all kinds.

The clearance of these underground quarries was done by several thousand miners (so many being unemployed in 1935-1940) working on a three shift system. Most of them were put up in Bath and it was said at the time that the beds were never empty.

In addition to the direct labour of miners and tradesmen of all kinds a great deal of work was put out to contract - for instance the tunnel from the floor of the Monkton Farleigh mine to Bathford Station in the valley nearly a mile away, also many inclined and vertical shafts.

After many months we were ready for the first instalment of ammunition. To the horror of the RAGC, who looked after the ammunition, the boxes started to grow hair and mould and it then became necessary to put in air conditioning. To air condition over 100 acres of underground storage was quite a problem but it had to be done and it was.

In due course the mines were filled chock-a-block with bombs and ammunition with twelve million tons in Monkton Farleigh alone.

Now that the ammunition is no longer there it is of great interest to me to hear that Monkton Farleigh is a show place open to the public where they can see a great work done by the Royal Engineers between the Wars.

The curatorial staff at Monkton Farleigh would be very grateful to hear from anyone who was involved in the early planning of the depot in order to establish the original concept which probably differed considerably from the final result. Their own enquiries through the Public Record Office and elsewhere have so far drawn a blank.

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Memoirs

COLONEL H R D HART BSc(Eng)

Born 14 May 1921, died 11 June 1988 aged 67

HAROLD REGINALD DOWELL HART, known universally as Hank, was educated at Bradfield and commissioned into the Corps in 1940 after six months at OCTU. After two years with 267 Field Company (61 Division Engineers) he went to India and remained in that theatre until the end of the War. He was a Bengal Sapper and took command of 80 Independent Field Company late in 1943. GLD who had formed up the company from scratch and became Hank's second-in-command, relates that the company was no easy command, it was one of the last to be formed up and the officers were young and inexperienced. It was employed on airfield construction but "we had no mechanical equipment so everything had to be done by hand. When the American Air Force arrived relationships were a bit funny and we had several silly rows but Hank, in his calm and resolute manner, eventually won the day."

He returned to UK in 1947 for his supplementary course and degree course at Shrivenham, immediately followed by Staff College at Camberley. Thus equipped he was posted to GHQ FARELF where he spent a year in the Military Intelligence Staff and a year in command of 15 Field Park Squadron. MGS writes: "It was while Hank was serving as a Military Intelligence Officer in Johore, in 1953, that there was a dire shortage of officers' quarters. Hank and I (a DCRE doing a stint in Works Services) decided to share private accommodation; Hank quickly secured the lease of a spacious modern bungalow in Johore Bahru, to which we duly 'called forward' our wives from England. It was during that year that I gained the life-long friendship of Hank and came to know him as one of the gentlest, kindest and most impeccably-mannered persons I have ever met."

He returned to England in 1956 and after a year in BAOR was appointed SO2 at AG7 where he remained until the end of 1959.

After attending the Joint Services Staff College at Latimer he went to BAOR as 2IC 4 Divisional Engineers.

AJIP writes "It was great having Hank as 2IC. In the short time we were together, as well as being a tower of strength as 2IC, he became a staunch companion, and valued friend and counsellor.

"Quiet, relaxed, good humoured and extremely capable he was always the same whether dealing with senior officers, working with the other Arms and Services or handling junior officers and soldiers. He was what one would call a proper regimental officer in the true sense, and he gained the respect and affection of all who served with him. He was also a very understanding person, with plenty of plain commonsense, and particularly interested in people so it was not surprising that in 1961 he went on to one of the most important commands, which provides the Corps with its Junior Leaders".

He remained at Dover until August 1964 and tours then followed in Southern Command (Q Movements) and on the British Army Staff in Washington as a full Colonel AQMG (Movements) until he returned to England to command 1 Engineer Stores Depot at Long Marston.

In 1970 he returned to Stanmore as AAG AG7 remaining there until his retirement in May 1973. MGS continues: "As Deputy EinC (1970-72) I

Colonel H R D Hart BSc Eng

continued the close association with Hank formed in Malaya, as we were both concerned with the careers and postings of officers. I think that all who looked to Hank for advice, and those who changed jobs during his tenure of AG7 (now PB7), will have greatly valued his fairness, his judgment and his human understanding.''

After retirement he spent over ten years as a careers adviser with the London University Careers Advisory Service working mostly at Chelsea and Queen Mary Colleges. He was very popular with students and staff alike and had an excellent relationship with employers. He was much missed when he chose to retire early, for personal reasons, in June 1983.

He leaves a wife, Jane whom he married in 1950, and two daughters, Ynis and Alison.

MGS, GLD, AJIP, BES

COLONEL B P TYRWHITT-DRAKE MBE BA FRSA

Born 25 August 1915
died 13 July 1988, aged 72

PETER TYRWHITT-DRAKE was educated at Haileybury and the RMA, Woolwich, before being commissioned as a member of 34 YO Batch in July 1935. He then went up to Pembroke College, Cambridge, and after obtaining his degree and completing his YO course, joined the Burma Sappers and Miners in Burma in 1938. During the Japanese invasion he was wounded, but managed to get back to India on foot with the remnants of his company. He was then attached to the Royal Bombay Sappers and Miners and fought in the Arakan, before joining the staff of HQ 14th Army as SO2 RE 4 Corps in the same appointment. He attended the Quetta Staff College in 1945 before returning to England initially to York and later as DAQMG (Plans) in Southern Command, when he was charged with raising 27 Field Engineer Regiment as Second-in-Command. He was awarded the MBE in 1950.

He then attended a JSSC course and was appointed AQMG (Plans) (Lt Col) in HQ AFCE in Fontainebleau. This was in the early days of NATO and his work in getting the various nationalities working together was much appreciated. This included the off-duty activity of running an international amateur dramatic society. He then served as CRE, Kent, until he went to Hong Kong in 1956 to take command of 24 Field Engineer Regiment. In 1958 he returned to Europe and a staff appointment with HQ AFNORTH as GSO1 (Training) followed. Here his work with the Danish Troops was particularly successful and earned him the thanks of the King of Denmark; and he was believed to be the first army officer to run a NATO naval exercise.

A difficult assignment as Colonel followed, that of commanding 22 Engineer Group (TA) from 1960 to 1963, with the task of turning four former gunner regiments into Sappers, which he achieved successfully. After this he returned again to Fontainebleau as head of the NATO International Secretariat. After a final appointment in Quartering as Colonel Q2, he retired in 1969 to his home in Effingham, where he began to take an active part in local affairs.

He was a member of the Parish Council as well as the Rural District Council, becoming a member of Guildford Borough Council, when the District merged with the town. He was elected Mayor of the Borough for 1978/79 and was appointed an Honorary Alderman in 1984. He served as Chairman of the Building & Works Committee and on the County Highways Committee, and his exertions on behalf of the Yvonne Arnaud Theatre were much appreciated.

He was also a governor of two of the local

Colonel B P Tyrwhitt Drake MBE BA FRSA

schools and President of the 1st Effingham Scouts.

In later years he suffered a stroke, but refused to give up and carried on with his local activities in spite of ill-health.

He was an active sailor, a member of the RORC and REYC of which he was Hon Secretary from 1966 to 1967. Amongst his many other interests were model railways and bell-ringing.

Peter was a forthright character with the ability to get people working together and he had a great sense of humour. He had a strong sense of public service and was always ready to help in community activities.

He married in 1944 Diana Massy, who also took an active part in Corps and local affairs. Amongst her other contributions she served on the REA Benevolent Sub-Committee from 1971 to 1983. She and their three children survive him.

JCW

LIEUTENANT COLONEL R T L ROGERS, FRICS

Born 4 April 1909, Died 23 July 1988 aged 79

ROBERT THOMAS LEONARD ROGERS was born in Cobalt, Ontario, and went to Ridley College and the Royal Military College, Kingston. From RMC he decided to join the small but select band of Canadians who, between the wars, applied for commissions in the Royal Engineers. He was commissioned in May 1931, joining 26 YO Batch with his friend Rodney Greenwood, also from RMC. At Cambridge Bob threw himself whole-heartedly into the social and sporting life, representing the University at lacrosse and as captain of the ice hockey team, and being elected to the Hawks Club.

His first posting on leaving Chatham was to the 1st Anti-Aircraft Searchlight Battalion at Blackdown, a tour which included an eleven month detachment to the Mobile Naval Base Defence Organisation in Alexandria during the "Abyssinian Crisis" in 1935-36, and a secondment to the Sherwood Foresters in Nottingham as Training Adjutant. In 1938 he sailed for India and joined the Survey of India at Dehra Dun, specialising in air survey. His war service took him with field survey companies to Egypt, Persia and Iraq and Burma, all poorly mapped countries where there was an urgent need for definitive maps for military purposes. After the war he returned to the Survey of India, becoming Director in 1949.

In 1953 he retired from the Army and joined Fairey Surveys Ltd as their managing director in India, but later returned to England to become chief executive of the Company at their head office. From there he travelled widely to supervise their major contracts, including survey and mapping of Northern Iraq, a hydro-electric scheme in Thailand and many projects in the Arabian Peninsula. In the course of his work in the Gulf States he established cordial relations with many of the Rulers, and on retiring from active employment with Fairey in 1975 he was invited to become a consultant to the governments of Saudi Arabia and Abu Dhabi. He was also retained by Fairey as a consultant director. Bob Rogers was a well known figure in the survey world, and held many important appointments. These included Secretary-General of the International Society of Photogrammetry, Vice-President of the International Federation of Surveyors, and member of the General Council and Chairman of the Land Surveyors Committee of the Royal Institution of Chartered Surveyors.

Bob was an extrovert and cheerful character who made friends wherever he went. He had a remarkable ear for music and an instinctive feel

Lieut Colonel R TL Rogers FRICS

for harmony. He never learnt music formally, but had the great gift of being able to sit down at a piano and play any tune from memory. As a guest night pianist he was in a class by himself. On returning to England he took up golf, and became an enthusiastic and popular member of Sunningdale and Rye Golf Clubs. In 1980 he finally retired, and he and his wife Olive moved to Vernon in British Columbia to be near their son and daughter, both of whom are living in Canada. At about this time he developed Alzheimer's disease, and although for a time the symptoms were hardly noticeable the illness certainly hastened his death. The world always seemed a better place when one was in Bob's company, and he will be sadly missed by his many friends.

HRG GWD

BRIGADIER H W KITSON CBE MA

Born: 19 January 1910, died 28 July 1988 aged 78

HAROLD WILLIAM KITSON was educated at Haileybury, the Shop and Pembroke College, Cambridge. He was commissioned into the Royal Engineers in January, 1930.

After his training as a young officer he was posted to India and served with the Royal Bombay Sappers and Miners from 1933 to 1937. During that time he served in Quetta and took part in the immediate reconstruction work after the 1935 earthquake. JRGF writes: "I first joined up with Harold when I went to Quetta in 1934, posted to 17 Field Company, Royal Bombay Sappers and Miners. At that time the usual complement of officers in a field company was three. Pat Easton was in command and Harold the other subaltern. So began a close association that lasted, in spells, for the whole of our service. He was a delightful companion, whose light approach to the problems of life always did me a lot of good, whether it was exploring the Quetta mountains for skiing slopes or, the hill forts and villages of the Mahratta country inland from Bombay or, dealing with the aftermath of the Quetta earthquake."

In 1938 he was appointed Adjutant 52 Lowland Divisional Engineers and trained and mobilised them with the newly formed 15 Scottish Divisional Engineers. He went to France with the 52 Division; it was evacuated on the day France surrendered.

In 1941 he was again sent out to India for service with the Royal Bombay Sappers and Miners. He commanded a field company in Persia and Iraq and later became CRE 6 Indian Division. From that appointment he was flown over to North Africa to command 4 Field Company in the Bengal Sappers and Miners in 4 Indian Division; the CRE of that division, the OC 4 Field Company and three other officers having been killed by the same shell during the battle of Wadi Akrit.

On the conclusion of the North African campaign he was ordered back to India to command a training battalion.

In 1945 he returned to the UK and became SORE 1 (Ops) at HQ Eastern Command and in 1946 attended the Staff College.

He returned to India for the third time in 1947, as DAAG and then AA & QMG of the 1 Indian Armoured Division. He also filled GSO 1 appointments in Northern Command India and Pakistan. RCAE, who had known Harold Kitson since YO days and in the mid-thirties writes: "We did not meet again until 1946 in Rawalpindi. By then we had both married and life was rather less carefree than it had been before, particularly beset as we were by the difficulties and anxieties which arose from the independence of India and its partition into two mutually hostile states. Harold had become G1 to the Chief Engineer of Northern Command, shortly to become Engineer-in-Chief, Pakistan Army and found himself deeply involved in the various military and political operations that

Brigadier H W Kitson CBE MA

After raising a third training battalion he spent two years on the staff, first as SORE I Ceylon Army Command and then as SORE I to Chief Engineer 14 Army before being appointed CRE 4 Corps Troops Engineers in September 1944. This was the period of the rapid advance from Imphal to Rangoon. His units after hill road construction provided ferries over two major rivers, the Chindwin and Irrawaddy and then constructed a number of major bridges down the axis of Burma concluding with a Bailey Suspension bridge at Pegu. He left Burma a year later and was twice mentioned in dispatches for his war time services.

He returned to the UK and retired in September 1948 for family reasons. His retirement was spent mainly in Edinburgh where he held a managerial appointment in the agricultural industry. He and his wife Laurina shared a love of painting at which they both were singularly skilled. Harry at heart was a romantic Highlander but was capable of hard headed realism when necessary. More than one of the contributors to this memoir can remember the warmth of kindness given to them by Harry and his family together with sound practical advice as required.

His wife Laurina predeceased him and our sympathy goes to his two children and their families.

MBA, MCP-P, DCSD, RMP, WAS, RDH

MAJOR E C ODELL

Born 28 March 1897,
died 29 August 1988, aged 91

ERNEST CHARLES ODELL was born at Cuffnells near Lyndhurst where his father was head groom to the Hargreaves Family. Mrs Hargreaves, whose maiden name was Alice Liddell, was the original Alice of the Lewis Carroll stories. Perhaps this fact later inspired him as a story teller but 'Ernie', as he was always known, certainly was a link between one of the most well known characters of the last century and the present day. He became one of the best known warrant officers of the Corps though he later rose to commissioned rank as a major.

He enlisted in the Corps in March 1915 and, though he was unable to be sent to France until he was 19 in 1916, then remained on active service in France and Russia until he was posted to India in 1920. He joined the Bengal Sappers and Miners at Roorkee and after a short time there again saw active service first in 57 Field Company, under Captain (later Major General) J S Lethbridge, and then in 3 Field Company, under Major (later General Lord) Robertson, which was based at Peshawar. He returned to Roorkee later with the company now commanded by Lieut Colonel (later Lieut General Sir Philip) Neame.

His later service was as an instructor in the workshops until he became the senior warrant officer in the Bengal Sappers just before the start of World War II.

Major E C Odell

He was now due for pension but instead was commissioned and spent a major part of the war years at the Engineer Training Centre at Meerut when he finally left India to return to this country. During his long service in India he became noted as a *shikari* and an above average photographer many of his photographs remaining in the official records of that period.

But it was in later life that his fine qualities as a man showed out. He was the guiding light behind