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Editorial

IN this issue we publish two articles from opposite ends of the military spectrum which stimulate thought and, we hope, comment. "The Royal Engineer Commander" gives us Lieut Colonel R Macdonald's views on the command of engineers in operations based on his experiences in the Falklands. Of no less crucial importance to the peacetime Army is Major M S Norbury's "Management of Today's Sapper Officer" which warns us against complacency in the business of retaining our officers in peacetime.

Colonel Macdonald's article looks, *inter alia*, at the question of operating in an atmosphere of fear and stress, something which has not been discussed in the *Journal* recently despite the Corps' long experience of Northern Ireland Operations. It may prompt some thoughts on how training can prepare for such conditions and the role of adventurous training. Adventurous training may produce situations in which men can learn to face their fears (although by no means all the junkets masquerading under the title do so) but it is hard to argue that such training makes men brave. Lord Moran's analysis in *Anatomy of Courage* suggests that men have a finite well of courage on which to draw. Arguably, the more that men are exposed to fear (in adventurous training or anything else) the less will they have to draw upon when the real need arises. If adventurous training cannot give men courage, what can it give? Team spirit?—any sport would do the same. Endurance?—field exercises achieve this in a more relevant setting. Perhaps the clue lies in a quotation from some correspondence we conducted with Colonel Macdonald in the course of preparation of his article. "The planning stage on board HMS *Fearless* was particularly stressful and pressurised, but I took time each day to listen to some music on my "walkman"; occasionally watch a film and have a drink so that I could keep going for as long as the operation required. Had I not had previous operational experience (in Northern Ireland) I do not think I would have been so strict about regulating my own personal routine. There is no doubt in retrospect that this did work and was of great benefit. I consider that the 'well of courage' is restored by rest and relaxation".

Some of our older readers might have valuable comment to offer on the subject of training for stress and we hope they will give us the benefit of their experience. Major Norbury's article, on the other hand calls for more up-to-date comment. He reminds us that a professional army's success when the call comes (and hence its credibility in deterrence) will depend on its ability to field its full strength of experienced and properly motivated officers and soldiers. We ignore officer management at our peril. Old hands may be tempted to hark back to their own carefree young days and wonder what the problem is; an officer's career has always had an element of the survival of the fittest in it and, at least family disruption on the scale of the sudden and long unaccompanied tours of the post-war years are a thing of the past. But the point is that things have changed. In the "good old days" there was always the excitement and the call of duty to compensate for the exigencies. Prospects were seen not only in promotion terms but also in terms of opportunities for the stimulation and extra responsibility offered by overseas service. If the old soldiers dwelling on the past can not see how things have changed over the years at least their sons and daughters opting for careers in civilian life, where understanding officer management is a commercial imperative, can. There may be a need to return some of the fun element to peacetime soldiering. If that costs money at the expense of equipment, what price the tank with no one to command it?

1986 Corps Annual General Meeting

ADDRESS BY ENGINEER-IN-CHIEF

AT the Annual General Meeting of the Corps, held on 22 October 1986, the Engineer-in-Chief, Major General C J Rougier CB, spoke on Corps Affairs.

INTRODUCTION

"Looking back over the most recent years, certain single 'themes' seem to stand out in the affairs of the Corps, sometimes to the extent of dominating the action. The combat phase of the Falklands: the subsequent military works area: the interlocking and overlapping 'studies', some of them openly threatening the shape and function of the Corps. All these events, activities and problems provided considerable challenge to my predecessors and demanded both rapid reactions and imaginative forward planning. These were not lacking. This year there has been, perhaps, more opportunity for the EinC(A) to select his own priorities when looking forward to the future of the Corps. This increased opportunity provides its own challenge, but it is not one that can be discussed in any but the broadest terms at an AGM. Suffice it to say that we are making progress on a number of fronts with the aim of ensuring that the Corps is organised, equipped and trained to meet its role in the future.

"I propose to divide my talk into sections, which will overlap a bit as follows: World Wide Activities, Training Matters, Manning, Corps and Regimental Affairs, Sport and Sappers at Large.

WORLD WIDE ACTIVITIES

"The last twelve months have been typically active, with members of the Corps working or training in forty-two different countries; but it is perhaps in Northern Ireland that the work of the Corps has been in the forefront of political attention.

"*Northern Ireland.* The increased capacity of the PIRA to mount damaging mortar attacks and terrorist intimidation of contractors has resulted in a radical change in both the nature and quantity of construction tasks for the Sappers. To counter this situation a sequence of field squadrons has deployed on emergency roulement tours, starting with 20 Field Squadron from Maidstone last November followed by 42 Field Squadron from Hameln: 30 Field Squadron from Iserlohn are still there. The main tasks have been of two kinds:

First, assistance to PSA building blast walls on security force bases. We have done this at a number of locations.

Secondly, assistance to the RUC, started in January 1986, for example at Ballygawley, where 20 Field Squadron constructed a protective shell over a Portakabin and cover from view fencing around the perimeter of the site.

"Work was also completed at RUC Stations at Toomebridge Coalisland and Enniskillen, and work is now being completed at Clady. 33 Independent Field Squadron were involved at Carrickmore, as well as completing innumerable other challenging and demanding tasks. All the squadrons who have served in Northern Ireland in the last year have done a truly remarkable job, and deserve the greatest credit. However, none of this would have been possible were it not for the contribution of three other elements of the Corps family. 325 Engineer Park have the major responsibility of providing the resources required as well as a formidable amount of workshop support and without them, nothing would have have been possible. Secondly, the DCRE Works, manned by our PQEs, GEs and Clerks of Works, who with the Military Works Force in UK have played a central role in the design and supervision of all the tasks and have displayed in full measure the value of their professional

Photo 1. Projectile walls constructed by 20 Field Squadron. 150mm precast reinforced concrete on strip foundations.

training and expertise. Thirdly, the CRE and his staff have commanded, controlled and coordinated all the Sapper effort in an exemplary way.

"Lest you think I have gone overboard in my praise of the work done by the Corps in Northern Ireland in the last year. Let me just quote a paragraph from a letter written this month from Secretary of State, Northern Ireland to our own Secretary of State, copied to the PM and senior members of the Cabinet.

'I must take this opportunity to put on record for you and the colleagues to whom I am copying this letter my profound gratitude for the efforts that the Sappers have so far made and are still making in support of the Police. There can be no doubt that their flexibility, capacity for hard work and ingenuity in procuring materials in the face of the Provisional IRA threats is an inspiration and a very significant boost to the morale of every policeman in the province.'

"In sum, it has been a good year for the Corps in Northern Ireland—indeed almost too good, because our significant contribution naturally leads to requests for more of the same. The work undoubtedly provides challenging and rewarding construction engineering experience for our squadrons but at the price of other important commitments not being met and this will face us with some difficult decisions in the future.

"*South Atlantic*. Another major deployment from Germany takes place this month, 25 Engineer Regiment from Osnabruck, with a company of Royal Pioneer Corps (RPC), are deploying to the South Atlantic. The major tasks involve recovering military equipment from the Falkland Islands, principally the AM2 aluminium airstrip laid at Stanley immediately after the conflict, together with the RUBB shelters and other ancillary equipment. The other is rebuilding the King Edward Point jetty in South Georgia.

"There are still numerous Argentinian minefields in the Falklands. We have not yet been able to find a cost effective way of clearing the mines to the safety standards required in peacetime. So for the time being they must remain within the fences that clearly mark their location. However EOD battle area clearance continues, concentrating on Goose Green and Wireless Ridge. In the last six months alone 250 hectares have been cleared and 15,000 items of ammunition in various states removed. The site of the recently discovered crashed Pucara aircraft, which led to the much discussed funeral of the Argentinian pilot and the presence of his father, was cleared of unexploded rockets and cannon shells by the detachment of 33 Engineer Regiment (EOD).

Photo 2. A search operation in progress on Stonecutters Island in Hong Kong harbour.

"*The Far East*. The Queen's Gurkha Engineers, have as usual played a prominent part in the military activities of the Far East: in operational patrols, projects, collective training, individual and trade training. (*At this stage the EinC showed a number of slides to illustrate these points*).

"*Annual Construction Tasks*. There are certain parts of the world where we carry out a combination of training and construction every year. Belize, Kenya and Canada for example. The first because our squadron forms part of the garrison. The other two, particularly Kenya, involve all arms deployment for major exercises in terrain which would otherwise not be available. It is the Sapper construction contribution, which is of lasting benefit to the host nation which makes the all arms training more acceptable.

Photo 3. Construction in progress in Belize.

1986 Corps Annual General Meeting 2 & 3

Photo 4. Preparation of a culvert in Kenya.

"Canada. At the Canadian Forces Base Camp Petersfield, Gagetown, 9 Parachute Squadron constructed a boundary road and accommodation buildings.

"Disaster Relief. Disaster relief has called for, and achieved very rapid Sapper response recently. Last year you heard about 32 Field Squadron's achievement in Mexico. This year officers and soldiers of the Corps received seven awards for their work there after the earthquake: including the MBE for Major Webb, the Squadron Commander, and a BEM for Lance Corporal White—just rewards for determined and difficult work.

"In June this year a team of one officer and three other ranks from the QGE in Hong Kong deployed to the Solomon Islands in the aftermath of cyclone Namu. They undertook bridge reconnaissance and provided engineer advice, as part of the ODA relief effort.

"At this moment in El Salvador we have a team of seven Sappers at work in the aftermath of the earthquake.

"*BAOR Sappers.* I sometimes feel that the BAOR Sappers get rather less than their fair share of reporting because they spend much, though not all, of their time on routine training for their war role in the central front. This year, as I have mentioned, they have made a major contribution to the work in Northern Ireland and the Falklands. (*Here the EinC showed a number of slides illustrating work in BAOR*).

"*Military Assistance.* We have, as usual, carried out a variety of tasks known as Military Assistance to Civil Ministries (MAC-M) and to the Civil Community (MAC-C). The only one I will mention is on the Sandringham estate where we are undertaking a charitable project to celebrate RE 200 for the Leonard Cheshire Foundation at Park House making a black top drive and car park. In another exercise in April, at two days notice and at a weekend, 69 Gurkha Independent Squadron laid 1500 feet of Class 30 trackway at Windsor Castle to help Her Majesty the Queen welcome the King of Spain. The trackway was of course for cars, not coaches.

"Survey and Postal. We have always been delighted at AGMs to report on the exotic places where Survey and Postal conduct their activities. This year we have illustrations of these two branches of the Corps occupied with military duties other than their primary roles.

"Corps Commitments. In the short time available I have only been able to skim the surface of the work of the Corps in the last year. I apologise to the vast majority

Photo 5. Accommodation block built by 9 Parachute Squadron in Gagetown.

whose efforts I have not recorded either through lack of time, or because of security considerations. The Corps has been very heavily committed and we must watch carefully that we get the balance right between challenging and rewarding tasks overseas and the demands of family life. It is a delicate balance and I have my eye very carefully on it.

"In my first year in office I have visited the greater part of the Corps both Regular and TA in Great Britain and Northern Ireland, in the Falklands, in BAOR, in the low countries, in Gibraltar and I'm off to Cyprus in two weeks time and to Germany for the fourth time this year in December. I can assure you, from what I have seen, that the work of the Corps continues to be carried out in the same determined and cheerful way and to the same high standards that you would expect of us.

"*Engineer Support to 1 (BR) Corps.* The new Northag concept of operations which has been implemented already has major implications for us as Sappers, in that it involves a more mobile and aggressive form of defence. Up to now in 1(BR) Corps we tended to plan, organise and equip ourselves to meet as a first priority our counter-mobility role. There is no doubt, (and the Army Battle Doctrine Committee recognised this point in a meeting two weeks ago) that much greater priority must now be given to mobility support by the Royal Engineers. At the same time we are seeing an important increase in the battlefield mobility of the combat arms. We have to be in a position to provide proper and prompt support to armoured brigades.

"Probably the major factor which has spurred both us as Sappers and 1(BR) Corps into action on this subject is the opportunity that opened up with the availability of large numbers of Chieftain hulls following from the introduction of Challenger. 32 Armoured Engineer Regiment produced a prototype Chieftain AVRE. This carries three fascines and is a great advance in terms of mobility support compared with the Centurion AVRE. We are in fact converting thirteen Chieftain hulls now at Willich as a short term measure and should get forty-eight proper Chieftain AVREs by 1990.

"1(BR) Corps see the Brigade Engineer Squadron in the early 90s as being much more equipment intensive with armoured engineer equipment an integral part of the squadron and a somewhat reduced field engineer element. However this is not just a question of armoured engineer equipments. In that timeframe we shall start getting into service other equipments such as the MGB replacement, future demolition equipment and perhaps a short range scatterable mine system which will help us to

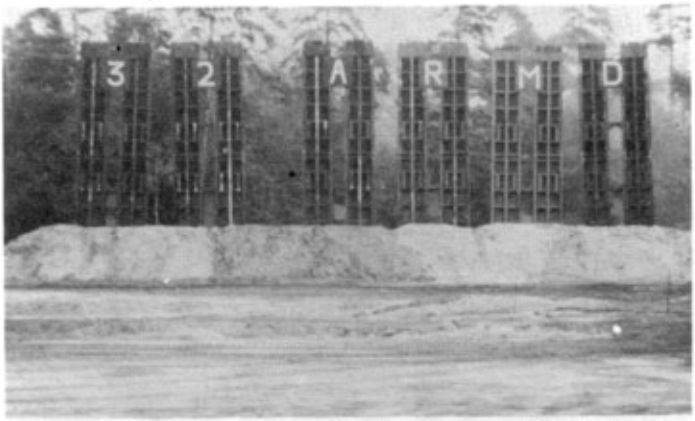


Photo 6. An unusual general salute performed by 32 Armoured Engineer Regiment.

provide the support required at brigade level. Most armoured engineer equipments, and there may well be considerably more than there are now, will be held forward with the armoured division brigades.

"The conversion of thirteen AVREs at Willich gives 1(BR) Corps the opportunity to try out this new concept and the Corps Commander has given his blessing to a trial based on 23 Engineer Regiment in Osnabruck starting in April 1987.

"There will still be a requirement for divisional or general support engineers and probably these squadrons will be organisationally not very different from current mechanised field squadrons.

"We are a long way from final decisions on all this, although we shall have to address many of the problems in detail in 1987 in order to get money into the LTC. In particular for any additional armoured engineer equipment required. There are many major problems to be resolved in implementing this fundamental change of balance in 1(BR) Corps—accomodation and training areas being amongst the most intractable—but I believe that commanders and their staffs are beginning to understand that the change is essential if the new Northag concept is to be applied properly and successfully. After all the best tanks and APCs in the world are of little value if they cannot move.

"*The Professional Arm.* The professional arm of the Corps—our PQEs, GEs and Clerks of Works are of central importance to us in war and without them we could not have faced the construction engineering challenges of post Falklands or Northern Ireland. But we are still having diffiulty in persuading sufficient high quality officers and NCOs into this stream. It is not a new problem but it is vital. We have recently reviewed the whole area and have made a number of improvements. The key challenge, however,is that after their demanding and high quality training we must provide work which both stretches them professionally and also gives them a sense of achievement. In many cases that is so at present, but not in all and it is an area where I intend to make further progress next year.

"*The Territorial Army.* Next the TA, and I should start by saying that I have seen a good deal of the TA this year and have been immensely impressed by their dedication and enthusiasm. Their importance cannot be overstated and I have been heartened to see the progressive and imaginative training that they have carried out this year.

"The Heseltine initiatives to increase the size of the TA have also served us well.

In the last year we have seen the continental TA pilot scheme expand to include a plant troop for 43 Plant Squadron and it is also encouraging to note that the TA Troop in Berlin is well recruited. 33 Engineer Regiment (EOD) has now expanded into a regiment of two regular squadrons and four TA squadrons and I am now looking to splitting the regiment to form two separate regiments. HQ 29 Engineer Brigade has moved from Newcastle to York to colocate with HQ 2 Infantry Division which makes more sense. All eight field squadrons (ADR) have now formed up with five of them actually on station. The remaining three will be on station by 1988. Recruiting is going well and it is my intention to declare the remaining six sponsored squadrons independent by April 1988.

"The RE Home Defence Organisation is now in being with the regular elements coming from the individual training organisation. HQ UKLF are now pressing ahead with the provision of vehicles and plant on dormant hire contract agreements organised by Districts. This gives us a force of sixteen squadrons with associated STRE's and engineer parks.

TRAINING

"ROTE. Forgive me if I first mention the Review of Officer Training and Education (ROTE) study which I led last year. The Army Board have approved fifty of the fifty-one recommendations that we made and these are now being implemented. The main changes include an extension by 50% of the non degree course at Sandhurst, the introduction of a coherent junior training package at captain level, a small reduction in the length of all parts of the Army Staff Course and the introduction of a higher command staff course for senior officers at colonel level. Most of the proposals are modest in isolation, but taken as a whole they will, I hope, lead to a substantial improvement to the way in which we train our officers in the future.

"Dover/Chepstow Amalgamation. Following the Groom study the Army Board endorsed the recommendation that Junior Leader training and Apprentice training should be colocated. The current plan is that our Junior Leaders Regiment moves to Chepstow in late 1990, once works services have been completed. PSA are just finishing their feasibility study which, we understand, will indicate a very substantial cost and a completion date of 1993. Once all the balls have stopped moving we will be re-examining the pros and cons of such a move, in financial and manpower terms

Photo 7. 507 STRE constructing a length of permanent way at Bracht during their annual camp.

Photo 8. A scene from Exercise *PYRENEAN POST*, a mountaineering exercise mounted by the Postal and Courier Depot in 1986.

amongst others, because I for one have some doubts as to whether it is in the best interest of the Corps or the Army.

"*YO Training.* A quick word about Young Officer Training. As a result of a full external validation we had identified a need to increase our YO Course to some thirty-six weeks from its existing twenty-nine weeks. I could not accept this for two main reasons: first, I was under remit from ROTE to reduce the existing course by a week; and secondly, the need to improve officer manning in units, and in particular to get value for money from our SSC officers, some of whom only serve for three years after leaving Sandhurst. Clearly, to spend the better part of a year in training them (when leave is included) is not cost effective.

"The new course, which will start in 1988, will therefore be twenty-nine weeks as now. However by ceasing unit attachments, except where the gaps between Sandhurst and the start of the YO Course allow, and better programming of the other associated Young Officer Training (AFV Management, EOD, etc) we will save at least six weeks in the overall training time: and in many cases a great deal more. We will in future be able to get properly trained officers to units in a substantially shorter time than is taken at present.

"*Diving.* You will be aware that the Royal Engineers Diving Establishment moved out of Marchwood and is now colocated with the naval diver training fraternity at *Vernon.* This has been a thoroughly good move as far as we are concerned. REDE is firmly established as an entity in its own right yet has access to an improved range of training facilities denied them in their old location. I visited them last week and was delighted to see advantages that have stemmed from this move.

Manning

"*Officer Training.* Officer manning is a subject which has become a more familiar topic of conversation in the Corps over the last year as the effects of our shortages have taken their toll.

"Once again there has been a good number of promotions to colonel and lieutenant colonel and this trend will probably continue since it is difficult, if not impossible, to gap posts in these ranks. The effect of this however is to draw on the rank of major at a time when the inflow to the rank is smaller than we need and when we are still

Photo 9. Major General C N Thompson, Director of Military Survey, during his visit to China in April 1986.

losing more officers on PVR than we can afford. The high PVR rate is not restricted to majors, there is now a worrying indication of increasing PVR at lieutenant colonel level and, in keeping with an Army wide problem, amongst senior captains. We have now reached the deficit of sixty officers in the rank of major that my predecessor forecast last year and there is every indication that the problem will get worse before it gets better.

'The term 'black hole' which has been used to describe the officer shortage over the past ten years or so now has a quite different meaning to that which it carried initially. It is no longer a marked deficit of officers over a span of some four or five years of birth but a much more general one covering some twelve years or more; an indication that our officer recruiting targets have perhaps been set too low for too long. We are now shifting the target upwards and looking to encourage a higher proportion to take regular commissions rather than SSC at the outset.

"Overall the situation is a difficult one but we have done much to alleviate the problems for example through increased commissioning of late entry officers and more use of acting rank for young Captains. The actions that we are taking now should lead to a considerable improvement in the future, but in the short term we are still faced with a difficult few years.

"To return one moment specifically to recruiting. Officer recruiting has been going extremely well for the past three years and we are now well able to reach our annual targets, although, as I have said, in retrospect these targets have not been high enough. As at 1 October this year we had achieved 94 RCB passes and appear to be well set to exceed the record of 105 passes achieved in 1984. Another mark of this success is the record number of undergraduate cadets and bursars we have at universities and polytechnics and the very high number of Sapper candidates entering Sandhurst and arriving on YO Courses at Chatham.

"Generally I am very pleased with the quality of the potential officers that we have recruited. One measure of this, or at least of their physical quality, has been shown this summer when five of our undergraduates passed P Company and another the Royal Marines Commando Course, out of seven starters.

"We have been attracting more engineering graduates, especially mechanical engineers, than in the recent past, although electrical engineers of the required calibre

are still too few. However, the increased numbers overall should ensure that officer manning difficulties are reduced in the future and that we are able to be more selective in choosing those for the long professional engineering training and survey courses. We owe a debt of gratitude to ERLO and his staff for this sterling work.

"*Soldier Manning.* For soldiers, we have no real problem with adults or Junior Leaders. Many trades are now full and we cannot always give recruits the employment of their choice. Because of this some have to be directed towards the less popular trades, but we are fairly confident that we will be able to recruit high quality Sappers to meet our requirement in the near future. However for a variety of reasons our field regiments will experience a degree of under manning next year.

Corps Affairs

"This last year has seen much progress not only on construction work for the Museum, but also on raising money for its future development. Fund raising for the Museum is a Corps responsibility. We have tackled this by establishing a Royal Engineers Museum Foundation, with a full time director. This is supported by a Fund Raising Committee and a number of fund raising groups covering various sectors of commerce and industry.

"This organisation consists of powerful and influential people in civil life, many of whom are wartime or national service Sappers. Their enthusiasm and goodwill towards the Corps is tremendous and I have no doubt that we will achieve our target. We are warmly grateful for this support, which gives great credence to the saying that "Once a Sapper always a Sapper". You will hear more about the Museum from the President of the Institution. Suffice if for me to say that the Corps Museum is well worth a visit.

"On the organisation of the Corps' affairs, the Chief Royal Engineeer's Committee agreed a number of steps to rationalise the way in which we conduct Corps business. Basically we are in the process of placing the responsibility for accounting for Corps monies, in the broadest sense, with the Corps Treasurer, whilst leaving the responsibility for the policy of the money with the Boards concerned. We have also formed a Corps Secretariat which controls the publicly paid clerical staff in the HQ. A recent IE Inspection has confirmed the changes we made and, unusually, for this day and age, has recommended significant staff increases particularly on the benevolent side of the REA, although this does not necessarily mean that we are going to get them.

"My predecessor mentioned last year that the new Corps Band had got off to an outstanding start, indeed they were awarded an 'Outstanding' grading by Kneller Hall, which is a rare honour. This last year has been an exceptionally busy one for them and I suspect we have overstretched them. I shall look closely at next year's programme to ensure that whilst they remain busy, they have sufficient time for both musical and military training. Nevertheless, this year they have done us proud, judging by the flow of excellent reports which have followed them wherever they have gone. I would argue that at present we have the best band in the Army.

"Finally on Corps Affairs, I would like to say how much I look forward to RE 200 next year. Much hard work has already gone into preparations for the events and I would commend to you particularly the family show in the Albert Hall on 14 February, the service in St Paul's on 18 March and the Royal Tournament at which we have the lead spot for the Army. I am very much encouraged to see how headquarters and units are entering into the spirit of the year and are 'doing their own thing'.

Sport

"The Corps' achievements this year have been as remarkable as ever and fully justified the increased investment we have made in them. In the interests of brevity I cannot mention them all here—indeed they cover twelve pages of foolscap but results will appear in the *Supplement*. Suffice it to say that we have had individual or major or minor unit champions at Army level in the following sports:

Badminton	— Individual
Basketball	— Major Unit
Canoeing	— Devizes to Westminster Team
Cricket	— Minor Unit
Judo	— Individual Inter Service Under 65kg
Parachuting	— Army Team Champions
Rugby	— Minor Unit
Shooting	— Both Individual and Unit Army Target Rifle
Volleyball	— Major Unit

"There were also notable performances by our oarsmen and sailors both offshore and dinghy. Our Corps Football Team completed the season without losing a match and we beat the Gunners convincingly at rugby 20-3.

"Our Juniors have won at Army level in fencing (of the fifteen under 20s to represent the Army at the Royal Tournament, fourteen were Sappers), skiing, squash, rugby, triathlon and tug-of-war, Inter Service Champions for the latter.

Sappers at Large

"Finally, how are Sappers faring in the hierarchy of the Army? Not long ago we only had three major generals in the Corps, and two of those were in tied Sapper appointments. The competition for promotion is undeniably more acute than ever before. But we now have seven major generals in sight; there are more to come. The quality of our senior officers in the rank of colonel and above is second to none. Brigadier Hyde is about to command an armoured brigade in BAOR, we hold the post of DMO and are destined to fill the post of DASD—the first time in living memory that these two influential one star posts have both been held by Sappers, and Sapper officers are liberally sprinkled through the key colonel appointments in the Army.

Summary

"To conclude, there are, inevitably, clouds on the horizon—indeed, it would be surprising if there weren't. My greatest parochial concern is the continuing drain of high class officers at the captain and major level. On a wider front the ever increasing financial and manpower constraints, which seem to grow inexorably year by year, with no sign of a real reduction in commitments are inevitably going to lead to some painful decisions ahead. But overshadowing all that is the fact that the Corps, as always, are second to none, and I think I can say with confidence that its reputation is as high as it has ever been in peacetime. And long may it last!

The Royal Engineer Commander

LIEUT COLONEL R MACDONALD MBE B Sc

Lieut Colonel Macdonald was commissioned into the Corps in 1968. He has served with 9 Independent Parachute Squadron, 26 Armoured Engineer Squadron, 28 Amphibious Engineer Regiment, 2 Armoured Division Engineer Regiment and commanded 59 Independent Commando Squadron. He has served as an SO2 G1 at PB7, SO2 G3 with the AMF(L) and as a DS at JDSC. He is currently a DS at Staff College and selected to command 36 Engineer Regiment in 1988. He has served two operational tours in Northern Ireland in the infantry role during 1973 and 1977 and commanded his squadron in action during the Falklands Campaign.

THE question of the role of the commander in battle is, understandably, a recurring theme among Staff College students. Though he experiences most of the usual problems of command, the Royal Engineer commander, because of the specialist nature of his task, finds himself in a unique situation. Therefore, the way he organises his staff and directs units to exercise effective command and control and his approach to dealing with stress are likely to be subjects of some interest to young officers. The following thoughts represent a personal view of the broad principles of command which are relevant to Royal Engineers at any level, the method by which these can be applied in battle, the pressures likely to be experienced and how to overcome them. In the process, I shall draw on examples from the Falklands Campaign to illustrate my thesis. I make no apology for this, since it remains the most recent experience in the annals of our Corps.

The first problem that any engineer commander faces is that of carrying out two jobs simultaneously ie, commander and arms adviser. Broad parallels may be drawn with the role of the artillery commander but this is superficial for a number of reasons. The artillery commander is usually only one or two ranks junior to the commander he is advising, he is dealing minute by minute with the contact battle and because of the lack of ambiguity of his role he will usually have had sufficient time to integrate with the headquarters of the formation he is supporting. The engineer commander on the other hand is, more often than not, at least one rank junior to his artillery counterpart. He will tend to be less experienced in all arms matters than his rank indicates and because of the nature of his job and the equipment at his disposal he may have a much harder job, in peace time, appraising the Commander of his unit's capabilities and limitations.

Group identity and pride in being a member of a fighting team is a vital prerequisite for success in war; it underpins morale and ensures cohesive and directed effort in the all arms battle. It is also a factor in reducing stress on engineer commanders at all levels. The regimental system, so extolled by the British Army, is an important element in creating this spirit at unit level. Unfortunately for the regimental system, infantry battalions and armoured regiments cannot operate effectively in isolation on the modern battlefield. The engineer commander should use this situation to integrate both himself and his unit into the regimental family. Although there are many well

Lieut Colonel R MacDonald MBE
The RE Commander

integrated brigades and battlegroups in BAOR I have found this task tends to be easier in commando or parachute formations where everyone wears the same coloured beret. Accordingly, integration with other arms is probably the most important function of an engineer commander in peace second only to ensuring his unit is fit for role.

In order to achieve this integration he needs to visit his higher headquarters regularly, to get to know all the staff personally and to ensure that his own staff have established cordial relations with the relevant staff branches. He should emphasise that it is the job of his staff to get on with the formations and units they are supporting, not the other way round. He must encourage professional and social links between lower level engineer commanders and battalions and regiments whilst at the same time emphasising this may not be an automatic grouping in war. Most of all, he must actively contribute to the headquarters as an adviser. To do this, he must understand and have a thorough grasp of the all arms battle as well as the impact of logistics on planning; and he must go out into the field as often as possible with the formation he supports. His competence as an adviser is arguably more important than knowing how to carry out a detailed design of a double storey MGB.

Fostering the relationship between the engineer and artillery commander is particularly important and can be mutually beneficial. Each can act as a sounding board for the other, discussing exercise plans before deployment, operational concepts before recces, and new ideas before they are presented to the commander. The artillery commander is also a useful link for the engineer commander to keep up to date with the overall tactical situation after periods of absence from the headquarters as the artillery commander does not need to be on the ground commanding his troops to the same extent as the engineer.

In order to carry out the job of both commander and adviser, the engineer must be totally aware of his all arms commander's intentions and have a good grasp of higher level plans. For example, the engineer commander at brigade level must be totally aware of the brigade plan and his commander's intention, have a thorough grasp of the divisional concept of operations and an idea of the corps plan. In this way he can think ahead, regroup his own assets, order up stores and equipment before they are

Photo 1: Be in a position to make constructive suggestions as part of the planning group.

asked for and be in a position to make constructive suggestions as part of the "R" Group.

In seeking to achieve this the engineer commander will spend a lot of time away from his own command with the "R" Group. This tends to apply even more in peace than in war. To ensure that this absence does not jeopardize the operation of his unit the engineer commander should command by directive and not immerse himself in unnecessary detail. Subordinate commanders and engineer staff officers must be given clear tasks and responsibilities, and be encouraged to use initiative to the full. This system of command must be developed and tested in imaginative peacetime exercises, which should assist in developing trust between all levels of engineer command.

Once committed to battle the strains of war are as hard on Sappers as on any other arm. It will appear at times that everything is conspiring to prevent plans from working. It requires great drive and willpower on the part of the commander on the ground to influence events directly and make things happen. This is not interference, it is applying direction and effort at the critical point (ie the place where things are going wrong).

An example of this was the construction of the emergency fuel handling equipment (EFHE) at Port San Carlos in 1982. It was perfectly clear that Commander 3 Commando Brigade's intention to break out of the bridgehead at San Carlos was dependent upon the construction of EFHE to enable the vital support helicopters to be refuelled ashore, as there were insufficient refuelling points on the ships left in the Sound. Consequently there was great pressure on the troop responsible for the EFHE construction. After most of the stores had been moved ashore (in itself a significant task), I visited the site. The troop commander responsible for the EFHE contruction had been advised that the task was not possible as we had the wrong pipe couplings. Of course, this was technically correct, but the duty of the enginer is the same as any other soldier in war and that is to achieve his mission. Therefore, I tasked the troop commander to redesign the system from scratch using the stores available, and pump the fuel up the hill into the flexible tanks beside the Harrier strip, then being constructed by 11 Field Squadron. This was done, and when I returned some hours later fuel was flowing.

A further illustration concerning the place of the engineer commander on operations was the construction of the Murrel Bridge. The plan was conceived by the overall engineer commander. He coordinated a two squadron operation by 9 Parachute Squadron and 59 Independent Commando Squadron which resulted in a pre-constructed airportable bridge being flown into location by Chinook helicopter. In fact, the emplacement was fairly complex because the bridge was too short but I was confident that the troop commander had the job well in hand, and therefore I did not visit the task. It was not critical because it was going well, therefore I did not have to be there.

Knowing where to be and where not to be is a matter of feel, but in general terms, my priority was to go first to the sub-unit with the most difficult or dangerous task. Once an operation was completed I visited the sub-units which had suffered the most casualties first. Merely by being there, even if not for long, during those times will be of great value to your officers and sappers and gives you a first hand impression of what is actually happening on the battlefield and the state of morale. The engineer commander must not tie himself to formation HQ as permanently as he might in peacetime. Under battle conditions the engineer commander will have to arrange times to join the "R" Group during the day or at night when planning for the next phase is in progress. In fact the overall battle picture obtained by visiting sappers in every location will be valuable in discussing future operations.

Although it is important to go to critical points, to visit tasks and sub-units, there is clearly some danger involved. If at all possible travel with someone who can assess the risks on your behalf. Whenever space permitted I moved about the Falklands Battlefield with my escort Warrant Officer. Luckily for me, he already had a great deal of combat experience and an even greater amount of common-sense and was able

Photo 2: Visit the sub-units which have suffered the most casualties first.

to advise on the dangers involved. I found that with my head full of plans and ideas and the natural desire to see with my own eyes and to communicate with my own men face to face, it was important to have someone to look after the safety aspects for me.

It is not always appreciated in peacetime that, in war, all ranks are going to have to think and operate at a higher level than they do in peace. Commanders and staff officers at all levels may be killed and others more junior then have to take over. The

Photo 3: A visit will give you a first hand impression of the state of morale.

headquarters staff may have to be replaced by NCOs and junior NCOs or sappers may end up commanding troop tasks. During the final attack on Stanley my squadron command net was eventually controlled, without assistance, by my driver.

As was stated at the beginning of the article, the engineer commander is under similar pressure and demands in battle as his infantry and armoured counterpart. He must therefore be both physically and mentally agile to cope with a fast moving and constantly changing situation. There is a great responsibility on all commanders to ensure that they are thinking as clearly as possible, particularly when decisions or the lack of them may be a matter of life and death. Commanders must learn to accept that they will be stressed and learn to recognise it in others. They must learn to pace themselves, to regulate their lives in such a way so that they feel they can go on for ever. During Operation *CORPORATE* I made sure that I did get sleep and used to take a little time out each day to cook a meal with my driver, talk and write up my diary. Incidentally it follows that the commander's driver should not only be intelligent, independent, capable and a competent signaller but also someone with whom he can coexist amicably.

A commander must watch subordinates for signs of stress and avoid working "willing horses" too hard or they will eventually crack. Despite these observations I failed to recognise how over-strained my whole squadron was when we reached Stanley. It was only when we started to sustain serious accidents while clearing mines that I recognised the problem and obtained authority to stop the clearance. Moreover, commanders and staff in the Commando Brigade failed to recognise that they were all in a highly stressed state. It took most people about six months to readjust to normal patterns of living. Recovery could have been quicker had we or our higher commanders in UK anticipated the problem by sending us directly on leave, for a short period, when we returned to UK before subjecting us to the necessary but stringent after battle debriefing sessions.

Stress within a unit is reduced by sensible discipline. It is a framework of normality that everyone needs in a far from normal situation. Commanders and junior leaders must not over identify with their men or become too familiar because discipline will then disintegrate and it becomes more difficult to issue orders which could result in the death or injury to soldiers. Officers and soldiers should be told not to worry about being frightened as this is something to be expected. In this respect the regular visits paid by commanders to all units or sub-units are of vital importance. If junior commanders cannot retain basic standards of discipline in their sub-units such as regular weapon cleaning, shaving and vehicle maintenance they must first be warned then removed from command.

In summary, the engineer commander in war experiences similar stresses to his contemporary in other arms plus others that are unique to his position. The efforts he makes in peace to integrate his unit or sub-unit into an all arms grouping will pay great dividends in war. To do this and be able to understand the commander's problems and plan ahead, he must have a thorough grasp of all arms tactics and a full understanding of the importance of logistics. In order for him to be in the right place at the right time on the battlefield he needs to command by directive. Engineer commanders can train for this in peace by encouraging the maximum delegation of reponsibility and use of initiative set against a background of clear intent and unambiguous tasks. This will assist commanders at all levels to think clearly and all ranks to cope with greater responsibility in war. It follows that there must be a considerable degree of trust and understanding between all levels of engineer command and their staff which can be developed in peace through testing and stimulating exercises.

Operation JOLE
42 Field Squadron in Northern Ireland

MAJOR A S CRAIG B Sc (ENG) RE

The author was commissioned into the Royal Engineers in 1971. He took a degree in Civil Engineering at RMCS Shrivenham. After service with BAOR and UK Engineer Regiments and as ADC to the Governor of Gibraltar, he attended Staff College. He then spent two very interesting years as SO2 G1/G4 HQ DSAS & SAS Group. He took command of 42 Field Squadron on 24 January 1986. The Squadron deployed to Northern Ireland on 26 February 1986.

INTRODUCTION

WHAT is the construction role of a BAOR Field Squadron? Answers on a postcard to Engr 1. Is it to be prepared to rebuild RUC Police Stations?! 42 Field Squadron put this role to the test at the beginning of last year. During the latter part of 1985 the IRA mounted a concerted campaign of attacks against RUC stations. The majority of attacks were by mortars and the campaign quickly achieved a high degree of success and numerous stations were damaged or destroyed. Designs for new stations were hurriedly completed by the Police Authority Northern Ireland (PANI) and the work was contracted to civilian firms. Before major work could begin the IRA began to intimidate and threaten civilian firms causing them to withdraw. The situation became critical and the Army were called in. 20 Field Squadron from Maidstone were already in the Province constructing blast walls around security force accommodation and Ops rooms and were tasked with the first police rebuild—RUC Ballygawley. At the same time 42 Field Squadron were warned to follow 20 Field Squadron and work almost exclusively on RUC stations.

CRITICAL FACTORS

THE warning was short—seven weeks—but quite sufficient. There was no time for frills just stick to essential training; survival first, brush up on infantry tactics, and construction skills second. The first was relatively easy as our Sappers are versatile and quick to learn although it did come as a surprise that three quarters of the Squadron had never served in Northern Ireland. A NITAT package, tailored to our needs, was hastily arranged. Construction skills were more difficult. What was the scope and size of the tasks? The recce took place five weeks before deployment (as soon as the new OC had handed over his staff job in London!) and established that the tasks were substantial and very technical. Did a BAOR field squadron have the experience and skill to complete the tasks to the required high standards? Outline plans had already been prepared by DCRE NI and it quickly became clear that refresher artisan training at Chatham would be essential. The training was arranged immediately and each troop spent one week at Chatham—the first troop flying to

Major A S Craig
Operation Jole

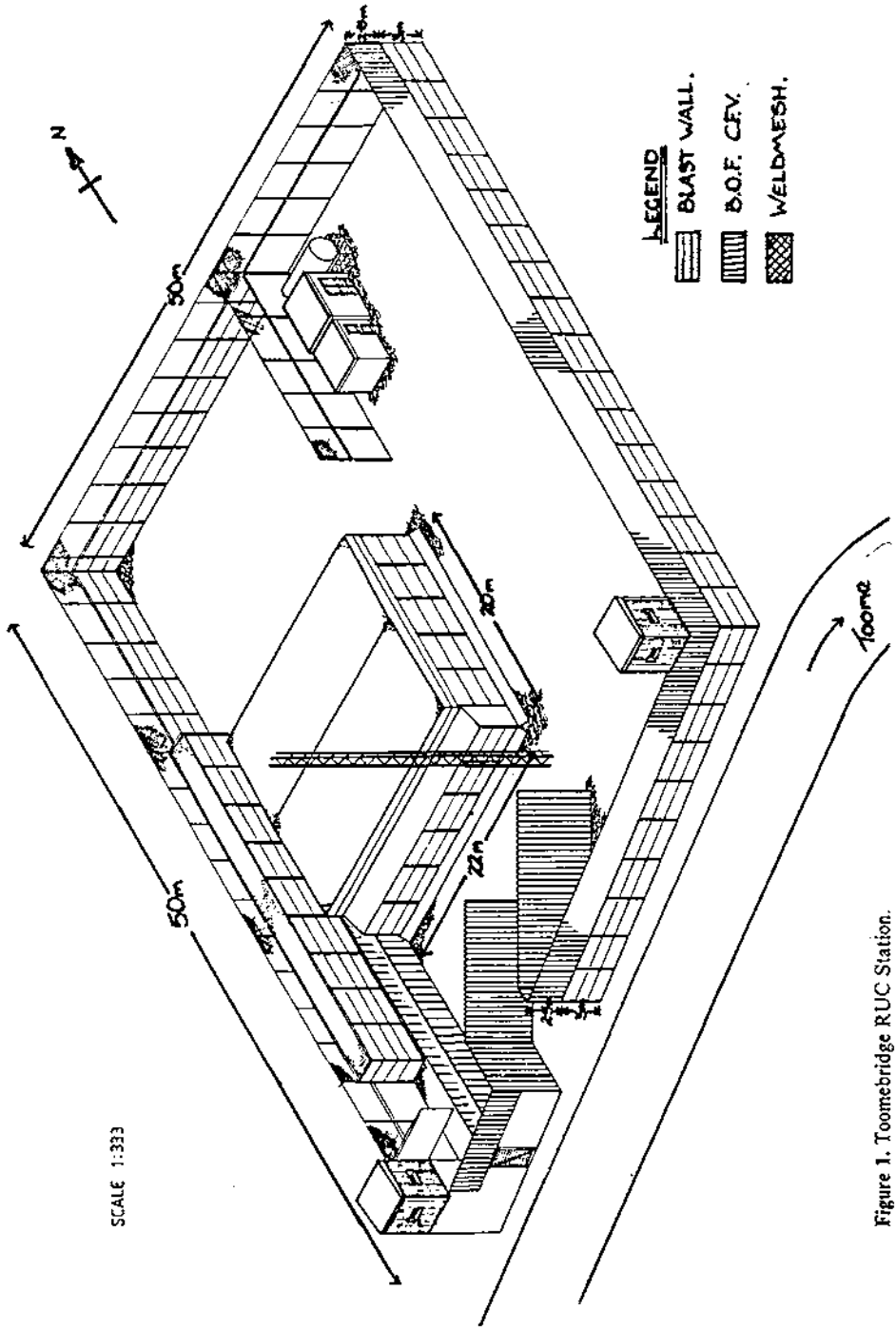


Figure 1. Toomebridge RUC Station.

England the day after finishing the NITAT package. The other critical factor was the ORBAT. The tasks were troop sized and spread across the Province—Toomebridge (fifteen miles west of Antrim), Enniskillen in Fermanagh and Bessbrook in Armagh. There had to be a Project Officer to coordinate and control the day to day running of the tasks and sort out design and resource problems. Many firms were refusing to supply the Army either directly or indirectly with materials. Therefore there had to be a strong central Resources Cell colocated with 325 Engineer Park at Antrim. This cell came under the command of the Project Officer. The Squadron Second-in-Command would control the operations and especially the interface with RUC, UDR and Regular Army units. Was the Project Officer technically trained? Did he need to be technically trained? Answer in both cases NO. YO training was quite sufficient but commonsense was vital!

Training

The infantry training was hard, concentrated, efficient and enjoyable. The climax was a five day NITAT package consisting of:

a. Presentations, films and demonstrations . . . . . 1 day
b. Ranges . . . . . 2 days
c. Tin City . . . . . 2 days

Training covered movement in civilian cars as well as conventional infantry tactics. The majority of movement on the tour was covert. The scenarios at Tin City were related to our future tasks and proved to be an excellent preparation for the field troops. The artisan refresher training was similarly tailored to our specific needs although each troop carried out some common training. The outline plans of the tasks gave CE Wing RSME a feel for the essential training that was required. Each troop had a weeks training on its own. The troop management were able to discuss problems with the Staff whilst the soldiers brushed up on the techniques they would use in Northern Ireland. Many mistakes, which could have been critical to the successful completion of the tasks, were made at RSME, and were therefore avoided later on in the tour. This vital period of training gave the troops the confidence to tackle the tasks and to make a quick and efficient start immediately on arrival in the Province.

Deployment

The Squadron deployed to Northern Ireland over the period 21 to 28 February and moved into the following locations:

SHQ including Ops and Project Cell	Drumadd Barracks, Armagh
7 Troop	Masareene Barracks, Antrim
8 Troop	RUC Enniskillen, Co Fermanagh
9 Troop	Bessbrook Mill SF Base, South Armagh
Resources Cell	Masereene Barracks, Antrim (Colocated with 325 Engineer Park)

The wide spread of troops meant that they needed to be self supporting and they were given their own plant and REME assets, with a backup from the Squadron echelon if necessary. This system worked well and cut down travelling considerably. The Project Officer worked very closely with the DCRE, who provided two clerks of works based at Lisburn, on all design and technical advice and with 325 Engineer Park on the procurement of all resources whether of Army or civilian origin. There was also a close liaison with PANI, RUC Building Branch, on an almost daily basis. Face to face meetings were vital in sorting out the many problems which arose.

Tasks

Toomebridge

7 Troop's task was to build a new mortar-proof station at RUC Toomebridge and to demolish the existing, badly damaged station. Toome is a small Republican enclave at the northern end of Loch Neagh about fifteen miles west of Antrim. On 5 December 1985 a van containing a 500lb bomb was driven up to the eastern perimeter wall of

RUC Toomebridge. The station building was only 2m from this wall. A fifteen minute warning was given before the bomb detonated causing severe damage to the station and completely demolishing the garage opposite. Fortunately there were no casualties but the station building was damaged beyond repair. The new station was designed to withstand a direct hit from a Mk 10 mortar; it was an immense structure. In addition all the perimeter walls were replaced with blast walls and the area of the station compound was increased by some 25%. An artists impression is at *Figure 1*.

The inside of the new building was fitted out entirely by civilian contractors but the troop were responsible for feeding in all the services which proved to be a complex task on its own. The outer shell consisted of walls formed by placing reinforced concrete slabs into the channels of steel universal columns at 3m centres. The station wall nearest the road consisted of two blast walls, 1.5m apart, and filled with concrete to combat proxy or car bombs. The roof consisted of 12mm steel plate with 450mm of reinforced concrete on top. Around the foot of the station walls was a 1.4m high, heavily reinforced collar to protect the structure from ground burst mortar or one that had rolled off the roof. The blast wall design was also used for the perimeter and again was 3m high but topped with Button-on Fence (BOF), Cover-from-View (CFV) screen or weldmesh. The western perimeter wall, which was nearest to the new station, was a double blast wall filled with concrete. Once finished it was an impressive sight being 4m high, 1.5m thick and nearly 30m long. A CFV pedestrian access was constructed from the road to the station using BOF components to prevent civilians discovering the design of the new station. A new mild steel sanger was constructed at the south east corner of the perimeter and this gave an excellent field of fire into the village—the direction of the last car bomb attack. Finally the existing two storey police station was demolished.

The task was very large and technical for a troop. But beside the engineering problems, the troop had to contend with moving to and from the work site daily. The troop were accommodated in Antrim and moved to the site by road, helicopter and sometimes boat. The different timings each day required detailed planning to enable the engineering work to be kept on schedule. The station also came under machine gun attack, a blast bomb was thrown and there were constant stonings of vehicles. At one time or another all routes were closed because of suspected IEDs. Despite these constant threats and disruptions the troop still completed the task ahead of time. At one stage there were ten pieces of plant on site. The task devoured 200m^3 of crushed rock, 500m^3 of concrete, 200 pre-cast panels weighing a ton each and 1370m^2 of reinforcing mesh. The total cost of the task was approximately £300,000. At no time did the station go out of commission.

Enniskillen, Coalisland and Belcoo

8 Troop's initial task was to rebuild and renew all the perimeter fencing around the RUC Training Centre at Enniskillen. On 4 September 1985 the Centre came under mortar attack from an 18 tube mortar mounted on a lorry base plate 200m to the south of the Centre. Eleven rounds fell inside the perimeter causing substantial damage to the main building and destroying over forty cars and vans. Miraculously there were no casualties although a recruits muster parade was due to take place ten minutes later. The repair work to the main building was started by civilian contractors but they refused to work on the vulnerable perimeter fence. The first task for the troop was to erect their own mortar protection around their portakabin living accommodation. The Rapid Assembly Protection Wall (RAPW) was used—fortunately the IRA did not put it to the test! The existing perimeter fence was fifteen years old and generally in a very bad state of repair. It was of various designs, heights and materials and this caused a great deal of minor practical problems for the troop. Work began on the 600m perimeter and all chainlink was renewed, wooden panelling replaced, stanchions either replaced or reduced in height, stripped of rust using a sand blasting machine and finally painted and braced. There were three new fences to be constructed, two were chainlink and designed to enclose all the land belonging to the RUC and to achieve stand-off. The third new fence was 100m long, 8m high BOF

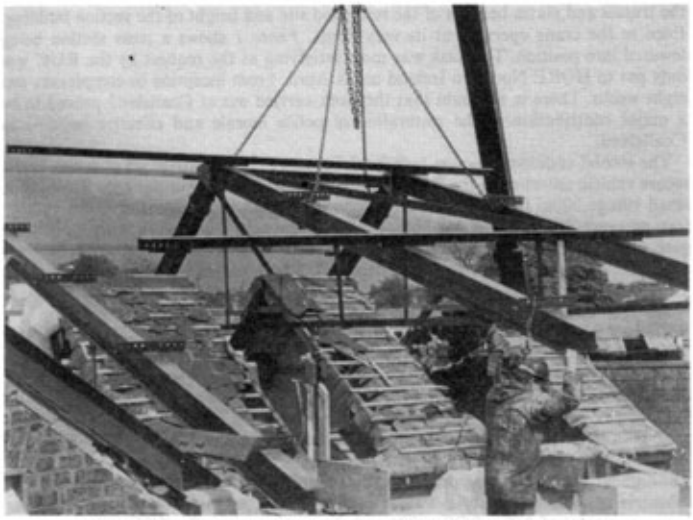


Photo 1. A truss section being lowered into position at RUC Coalisland.

CFV screen which denied line of sight to the main square from the high ground where the mortar attack had been initiated. Only the top 5m was clad, as existing buildings on the perimeter afforded the bottom 3m of cover and it also meant that cars could be parked between the stanchions. The foundations were 4m × 1m × 1.5m concrete pads placed below ground level. Excavation of the thirty bases proved tricky as the services plan was totally inaccurate!

By mid-tour it was clear that the Troop had worked well and were ahead of schedule. As a result for the last five weeks of the tour two sections were detached from Enniskillen to carry out two tasks for the RUC. The first was to provide a mortar-proof roof for the RUC at Coalisland. Coalisland is a small, very hard Republican town, six miles north east of Dungannon in County Tyrone. It has a long history of terrorism with a active cell, headed at one time by Peter Sherry, one of the Brighton bombers. On 31 January 1986 a 400lb bomb was driven up to the outer perimeter wall of the station and detonated causing extensive damage to the station building, luckily there were no casualties. A civilian contractor was found to do the repair work needed on the station itself and to construct the padstones that would take the new roof. On 7 May 1986, thirty minutes after the Troop Commander's confirmatory recce had been completed, the station was grenaded in an attempt to frighten off the civilian workers. It was partly successful as they refused to continue work on the roof. The section was covertly moved in that night, a week early, to complete the concrete padstones on the roof. The mortar-proof roof consisted of 15mm steel plate clad with two layers of 18mm plywood and finished off with profile sheeting. At the time, tests were still being carried out on this design and subsequently the thickness of steel was reduced to 12mm. This roof was the first of the Operation *WIDGEON* design although it was a one off, tailor made for RUC Coalisland. The roof plates measuring 4m by 3m, were fixed on steel trusses secured to the padstones placed on top of the station walls. The main roof was 'L' shaped and measured 20m long with a return section of 7m. To complicate matters the building was not square! The valley plate which joined the main roof to the return section could not be made until all of the other plates were in position. A 54 ton crane had to be used to place

the trusses and plates because of the restricted site and height of the section building. Even so the crane operated at its very limits. *Photo 1* shows a truss section being lowered into position. This task was most satisfying as the request by the RUC was only put to HQRE Northern Ireland on 18 April. From inception to completion was eight weeks. There is no doubt that the work carried out at Coalisland proved to be a major contribution to the restoration of police morale and effective policing in Coalisland.

The second additional section task for 8 Troop was the construction of a new more secure vehicle entrance to the RUC Station at Belcoo in Co Fermanagh. Belcoo is a small village 300m from the border. The task involved the construction of a vehicle trap entrance consisting of 4m high, double diaphragm block walls with ½/⅗ steel gate. Concrete bollards were also placed at the approach to the rear entrance. A small disused telephone exchange had to be demolished before work could start on the gate. The Section lived at the station for four weeks and successfully completed the task. No civilian contractor was willing to work so close to the border.

Bessbrook Mill

The final task undertaken by the Squadron was at the Security Force Base, Bessbrook Mill and was carried out by 9 Troop. Bessbrook is some five miles north of Newry and has been the home for the South Armagh Battalion for many years. 9 Troop had two main tasks. The first was to enlarge the size of the top two helipads as a first stage in the improvement of the helicopter facilities at Bessbrook. The 'heliport' is the busiest in Europe with an average of two hundred movements a day. Throughout the task it was operationally essential that helicopter movements were unrestricted. The second task was to renew all the perimeter fencing around the heliport, a total of 360m BOF, CFV and the construction of a CFV chicane at the northern entrance to the Mill complex. Enlarging the helipads was a very technical task and involved building a retaining wall and backfilling with crushed rock. It was a huge construction measuring 55m long, 0.48m thick at the base reducing to 0.35m at the top and, due to the slope of the ground, varying in height between 4.4m and 5.4m. The largest single pour was part of the foundation being 20m×5m×0.9m. The wall contained 450 tons of concrete, 14 tons of reinforcing bar and required 50,000 Acrow ties. Before work could begin there was a lot of site clearance and preparation. One of the main dangers to the Troop, terrorists aside, were the helicopters. It was agreed that all movement would stop on the two helipads and that a temporary helipad would be constructed in the area between the southern entrance and the existing helipads. The site was levelled and Tensar geofabric was placed on the ground with 300mm of 75mm crushed rock compacted on top. Some 160m³ tons of crushed rock was used. The temporary pad was designed for light helicopters but it proved to be so successful that Puma and Wessex also used it. The area of the retaining wall was extremely boggy and so before foundations could be excavated, extensive drainage had to be placed. This was not helped by continuous very heavy rain and in order for the plant to dig the foundations a temporary road had to be built. This was some 90m long with Tensar and crushed rock being used again. Preparatory work on the site had taken longer than expected and so the Section working on the wall fell behind schedule. But this was soon made up when the wall sections were poured as the Sappers became highly proficient at placing formwork, fixing reinforcing bar, pouring concrete and striking formwork. Even so 12 to 14 hours, seven days a week was required for a month. SGB formwork was used, and produced a high quality finish. The wall was backfilled with 2200m³ of crushed rock. *Photo 2* shows the retaining wall.

The other task involved replacing the existing CGI and chainlink fence with 360m of 5.5m BOF CFV fence. This involved excavating 1.5m×3m foundations to a depth of 1.5m, erecting 120×5.5m stanchions and fixing over 600 sheets of 3m×3m cladding. The foundations required 500m³ of concrete and there were frequent steps because the perimeter was not level. Despite all the problems the Troop managed to complete the tasks on schedule which was most satisfying as doubts had been expressed at

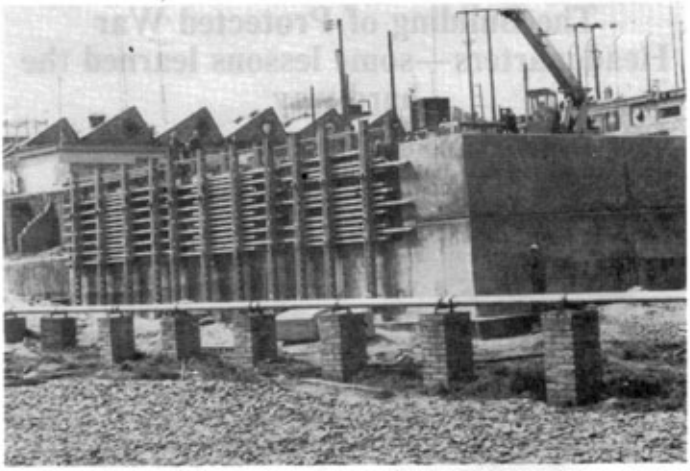


Photo 2. The retaining wall at Bessbrook Mill.

Chatham, on the pre-project training, as to whether a field troop would be able to cope with such an enormous task on its own. Careful planning ensured that vital helicopter operations in South Armagh continued unrestricted throughout the task.

Conclusions

Operation *JOLE* was a unique opportunity for a BAOR Field Squadron to prove that it could undertake a series of technical construction tasks and complete them ahead of schedule and to a very high standard. The experience and skills to carry out major construction tasks do exist in BAOR field squadrons but they do need brushing up with pre-project training. This training proved to be essential for Operation *JOLE*. The Troop Commanders were given a large independent task which fully tested them and their troops in an operational environment. Early warning of a tour of this nature is not vital. Indeed reduced training time focusses everyone's attention on the essentials. The sapper, as we already know, is a very versatile animal. All we need to do is to put him in the right place at the right time with the right resources and he will do the rest.

Finally the scale of the project was huge. Without going through a list of statistics, suffice it to say that there was over £1m of plant on charge to the Squadron and the total project cost was approximately £¼m.

Closing Thoughts

There has been much recent discussion in the Corps on construction engineering. Let me add a few thoughts. 42 Field Squadron proved that the construction engineering capability, both individual and unit, has not deteriorated. However I do believe that we do need to take every opportunity to practise our skills preferably on a squadron basis. Perhaps we should push to become more involved in disaster aid like the Mexican earthquake? The opportunities are there but of course the political will must exist. Not only would units be able to practise construction engineering but the kudos for the Corps would be enormous. Pre-project training is essential and must surely be one of the RSME's more important roles? Finally don't let us overestimate the difference between construction and field engineering. The vital factors for success are common to both: training, organisation and above all else leadership.

Operation Jole 2

The Building of Protected War Headquarters—some lessons learned the hard way

WING COMMANDER D F AKHURST RAF (RETD)

Wing Commander Dennis Akhurst joined the Royal Air Force as a National Service conscript in 1951, qualified as a navigator, and subsequently transferred to the regular Service. His flying career was mainly in the maritime role including periods in the UK flying in Lockheed Neptunes and as a navigation instructor on the Shackleton, and overseas with the Royal Canadian Air Force flying in the Canadair Argus, and as a flight commander on a RAF Shackleton squadron in Singapore. He is a graduate of the RAF Staff College and the US Air War College and from 1974 to 1976 served on exchange duty with the US Navy in San Diego, California. He has had several staff appointments including two years at Northwood on the NATO staff of CINCHAN/CINCEASTLANT. From June 1982 to December 1984 he was the Works Liaison Officer on the OPCON Project at Northwood, and from then until his retirement in November 1986 was a senior member of the Project Coordination Office at Headquarters Strike Command.

INTRODUCTION

THE writer of this article is not an engineer. He is a former Royal Air Force aircrew officer who, immediately prior to his recent retirement, was Project Officer for the building of two underground war headquarters in the UK. The first was the joint RN, RAF and NATO headquarters at Northwood, and that was followed by the new headquarters which is now under construction at High Wycombe for the AOCinC Strike Command/CinC United Kingdom Air Forces. In many ways these were very different undertakings. At Northwood a large extension was added to an existing bunker, parts of which had been built in the early days of the Second World War. It was located in the middle of a busy military establishment in the "Stockbroker Belt" of North London. Throughout the construction of the extension the original building was in use as the operational headquarters of CINCFLEET, Flag Officer Submarines and AOC No 18 Group, and of the co-located NATO staffs of CINCHAN, CINCEASTLANT, COMSUBEASTLANT, COMMAIRCHAN and COMMAIREASTLANT. To add to the interest Operation *CORPORATE*, the campaign to regain the Falkland Islands, was controlled from Northwood during the latter part of the construction programme. By contrast, the headquarters now being completed at High Wycombe is a totally new building, on a green-field site at a comfortable distance from existing operational facilities, and there is only one Service involved. The High Wycombe project, like that at Northwood, is managed by the Property Services Agency, but RAF works services procedures are different to those of the RN,

Wing Commander D F Akhurst RAF

Photo 1: The finished product—the main operations room in the Northwood War headquarters.

and there is a different contractor. Nevertheless, there were many similarities and common problems.

There will be many readers who are professional engineers or project managers, who have heard it all before and who may be disappointed because security considerations prevent the inclusion of some technical details. However, I hope that even they will find something of interest in this layman's account based on five years experience of "learning it the hard way".

The Nature of the Task

Most War Headquarters (WHQ) projects follow a common pattern. The function of a WHQ is to provide protected accommodation and facilities to support the Command and Control tasks of a commander or commanders in war and exercises, and probably to a lesser extent during normal times. A typical, large, modern WHQ will be a several-storey underground building with outer walls, base and roof of reinforced concrete some two to three metres thick. There may be a detonation slab, of similar construction, over the top and extending well beyond the building's lateral limits. It is likely that the WHQ will be sited close to a related, and unprotected peacetime headquarters, and it may also be near to an older, protected facility which it will complement or replace.

The WHQ will be required to provide an agreed level of protection against conventional, biological, chemical and nuclear attack, including the effects of Electro-Magnetic Pulse (EMP). Most WHQs are partly financed from NATO Infrastructure Funds and to qualify they must conform to the NATO criteria. In practice the criteria for WHQs throughout NATO are those issued by SHAPE. These criteria define how long the building is to be capable of independent operation when closed down against an NBC threat, and what facilities shall be provided for support of the occupants; in those circumstances the population of the WHQ may number several hundreds.

The internal layout will comprise an operational area of "role cells", probably grouped around some kind of central operations room, with other areas to house domestic services and support systems. The WHQ will be equipped with extensive communications and Command and Control Information Systems (CCIS), most likely including one new, major CCIS that will be under development whilst the WHQ is being constructed.

A project of this size and complexity will typically take about ten years to complete, from the writing of the Staff Requirement until the building becomes operational. This includes an allowance for programme slippage which, dare I say it, seems to be inevitable. It is this long timescale that presents the main challenges, and demands that special attention is given to management, continuity and control of change. The overriding aim, however, must be to meet the needs of the future users, and this requires an appreciation of the operational roles and tasks of the commander and staff for whom the WHQ is being provided. In meeting these challenges the project team must strive for a delicate balance between flexibility in the face of changing requirements and technology, and resistance to unjustified changes that will incur time and cost penalties.

Management, Planning and Co-ordination

It may seem obvious, but it needs to be said, that top management has an important part to play throughout the life of the project. A well-known and cynical view is aptly summarised in the "Six Stages of a Project" often seen displayed on the office walls of project managers:

1. Enthusiasm
2. Disillusionment
3. Panic
4. Search for the guilty
5. Punishment of the innocent
6. Praise and glory for non-participants

In my experience, as the occupier of the desk where the "buck might be expected to stop", there is only a little truth in that analysis. However, it is natural for there to be a great deal of high level interest at the start, and another surge towards the end of the programme when the product is recognisable as a shiny new war headquarters, when unforeseen last-minute problems threaten completion, and when the local staffs realise that occupation of the "new hole" may happen during their tour of duty. During the in-between phase, when the site resembles a First World War battlefield, it is equally important to keep the commander informed of progress and problems. At Northwood, where special arrangements were necessary due to the disparate nature of the various elements of the joint headquarters, a Steering Committee was formed. The Chairman was the Chief of Staff to CinC Fleet (vice-admiral) and the members were the Chief of the Allied Staff (Dutch rear-admiral) and the Chief of Staff of No 18 Group (air vice-marshal). This committee met at about six monthly intervals and gave much appreciated support and direction to the project team. At the Headquarters of AOCinC Strike Command/CINCUKAIR, which is basically single-service, and where the WHQ building programme has had little impact on the day-to-day work of the peacetime headquarters, normal staff procedures are used to advise top management how the project is progressing and to enlist help when needed.

Beneath this "top cover" the next level of management is usually the Project Team. It is part of the local commander's headquarters' staff and reports to one of his Principal Staff Officers, but is generally allowed a large measure of autonomy. Broadly speaking the tasks of the Project Team come under the headings of Planning and Co-ordination; however, what actually happens under those headings encompasses a wide range of activities. Planning can extend from the "strategic" level of drafting a plan for the move of the staff into the new facility whilst maintaining an uninterrupted

Command and Control capability, down to the "tactical" level of deciding where best to locate a visual display unit for Wg Cdr Ops so that he can actually see it, but without infringing the electrical regulations. Similarly, Co-ordination can be concerned with ensuring that the programmes of several Installation Design Authorities (IDAs) intermesh satisfactorily, or making certain there is not a JCB blocking the entrance to the site at the time of a VIP visit.

I mentioned earlier that a new WHQ will most likely contain a major new, computer-based Command and Control Information System, or CCIS, which will be under development at the same time that the WHQ is being constructed. This was true of the two projects with which I was closely associated and in both cases a combined WHQ and CCIS team was set up. There are many advantages in the two projects being controlled by the same organisation, under one principal staff officer, but it is desirable to dedicate different people to each task. The development of a CCIS can generate a very heavy workload including the writing of technical specifications and the evaluation of complex tenders. This should not be allowed to interfere with the WHQ programme and it is essential that adequate staff are available to deal with both aspects.

The Project Team should therefore be constituted in such a way as to contain a mix of operational experience, mechanical, electrical, ADP and communications engineering knowledge, and practical commonsense, and should also have an ingredient to ensure continuity over the life of the project.

It is my view that the Project Team leader need not necessarily be an engineer and that, in view of the overriding aim of meeting the needs of the future users, there is advantage in him being the prime source of operational knowledge and the main interface with the staff. If he is not an engineer it helps if he has an interest in how things work, and other desirable personal qualities are a high frustration threshold and an ability to get along with all kinds of people. Commander/lieutenant colonel/wing commander is the usual rank.

Equally important is the selection of the senior engineer, who will probably be of the same rank as the team leader. He will have a wide range of responsibilities but the emphasis is likely to be on electrical, communications, and ADP matters. Irrespective of who is the team leader, the senior "operator" or the senior engineer, they have to work closely together and present a common front even when their specialist viewpoints do not coincide. What happens within the privacy of the project office is another matter. One of my engineer colleagues summed up the relationship by referring to me—his "Ops" opposite number—as "the loyal opposition." In turn, and when bemused by the flow of incomprehensible technical jargon, I named him "the Stanley Unwin of the Project Office".

The remainder of the team should be multi-disciplined and provide a suitable mixture of operational, engineering and supply expertise. The inclusion of a supply officer/Q staff officer/quartermaster can be very helpful; consider the task of provisioning, at the right point in the programme, hundreds of tables, desks, benches, mattresses, and filing cabinets, plus fire extinguishers, Fullers Earth for the Contamination Control Area, wellington boots and foul weather clothing.

Finally, and recognising that the service members of the team may change several times during the life of the project, some thought should be given to continuity. No matter how efficient your filing system there is a lot to be said for the human memory bank—the long serving team member who can tell you *why* something was changed five years ago, and prevent you making the same mistake again. One solution is to include a retired officer in the team, probably a RO 2 with relevant Service experience. Continuity is also safeguarded if, as at HQSTC, the military project office is assisted by a civilian engineering team. At High Wycombe there is an organisation called the Systems Co-ordination Installation Design Authority (SCIDA), staffed by Cossor Electronics Ltd under a contract let by MOD(PE); like the war headquarters it is part-funded from NATO Infrastructure. The SCIDA supports the project team, which at HQSTC is known as the Project Co-ordination Office, or PCO. (To digress

again, some wag on the staff noticed when browsing through the Radio Times that the initials PCO also stood for the Polish Chamber Orchestra; he observed that this was most appropriate because we "spoke a foreign language, made a lot of noise, and were always on the fiddle").

The tasks that the SCIDA carries out for the PCO include: production of overall system and individual role cell diagrams, installation plans and cable management plans; co-ordination of the installation design proposals of the individual equipment and system IDAs; co-ordination of works services specifications; establishment of Configuration Control facilities; provision of technical advice on screening of electronic emissions (TEMPEST), Electro-Magnetic Compatibility (EMC), Electro-Magnetic Pulse Protection (EMPP), RADHAZ, shock resistance of the building and installed equipment, and safety standards—and the preparation of control plans for all of these; co-ordination of the testing of interoperable equipments and systems installed by different IDAs; liaison with all relevant agencies and authorities and general project co-ordination.

The SCIDA, which is housed in Portakabins and has a staff of about twenty, is equipped with two useful management aids. There is an Artemis computer for the storage of data, and with which multi-colour PERT network drawings can be produced and quickly revised when planning factors change. The SCIDA also has a computer-aided drawing system known as Auto-CAD on which multi-colour building layout drawings, at various levels of detail, can be rapidly generated and easily modified. The value of such an organisation to the PCO, and the project as a whole, is very great; having once experienced the benefits it is difficult to imagine tackling a WHQ project without some similar arrangement. Not least of the advantages to the project team is the warm feeling of knowing that one is always working from the latest issue of a particular drawing. The PCO, of course, needs to have all building layouts readily available. These were held in a special, secure container—secure because, although the basic building plans are generally unclassified, when some equipment details or the identity of certain role cells are added, they may become classified. Many drawings were also held by the PCO on microfiche, but there were moves to provide the PCO, which was not co-located with the SCIDA, with a remote terminal from the SCIDA computer system.

All design documents produced by the SCIDA, including drawings, are subject to formal control procedures. The layout of a role cell, showing the proposed positions of desks, VDUs, telephones etc., will first be produced as a sketch by the PCO after consultation with the future users. The SCIDA will probably also contribute some ideas, and ensure that TEMPEST and EMP Protection integrity is maintained, and the layout will be then issued as a "Chilled" design. Thereafter changes may be recommended by the PCO or SCIDA and these will be documented by means of Change Request Notes. After further investigation by the SCIDA, in consultation with the appropriate IDAs, a modified drawing is produced. This is put before one of the regular meetings of a Project Configuration Control Board (PCCB), at which stage it becomes a "Frozen" design. Frozen drawings are issued to all authorities who need them for detailed planning.

Before leaving the management and planning aspects of WHQ projects it is worth mentioning the use of physical models. It is tempting at the outset of a project to commission an elaborate model, to a very accurate scale and showing every cable run and air-conditioning duct. This is a job for a professional model maker and can be very expensive. On one project £50,000 was spent on such a model which in the event was not used enough to justify the cost. In fairness to those concerned this happened before the great strides in Computer Aided Design (CAD) which have occurred in recent years. Part of the problem with models is the arch enemy—change; an elaborately constructed model is difficult to modify. A simple model can, however, be useful. At Northwood we had one which had been made by a PSA drawing office from balsa wood and card, and at very little cost. It had a lot of use and we modified and repainted it ourselves. The scale was 1:100 and sections could be lifted out to

Photo 2: Diaphragm wall-building—the early stage of WHQ construction.

reveal the lower levels. It was particularly useful for briefings. At High Wycombe there is a different type of small model, professionally made, which shows the external appearance of the war headquarters as it will be when finished. This has been used to effect for PR purposes and it has been photographed from "ground level" to demonstrate how inconspicuous the site will be when construction and landscaping are complete. In summary, it is better to avoid sophisticated models and to use simple models and a CAD system.

Design, Change and Flexibility

The NATO criteria for WHQs require that the structure be designed "in accordance with common engineering practice for the host nation", and in the UK the basic design will be carried out by PSA or by consultants under contract to PSA. It is important to recognise, however, that the siting and construction methods, and the external and internal shape of the building, are likely to be influenced as much by local geology, and the need to meet the NATO protection criteria, as by the building's function. The agreed amount of floor space will be provided and the architects will do their best to design to a notional internal layout given to them by the operational sponsor. However, some compromise will be necessary when it comes to fitting the role cells into the concrete boxes that the designers provide. As the internal structural walls contribute significantly to the strength of the building, and probably consist of about 600mm of reinforced concrete, they constrain internal layout. Fortunately, the basic rooms are usually quite large, perhaps 10m × 15m, and smaller rooms can be created within them, in a variety of shapes and sizes, using demountable, fireproof

partitions. This simplifies changes to the layout in later years. Unfortunately, it also encourages the attitude, before building completion, that "we can easily change that, it's just a case of knocking down a stud wall". Up to a certain stage of the programme, and with the agreement of PSA, that might be possible. However, a point is reached when it will be both quicker and cheaper to finish the building as originally designed and make the change afterwards.

During the long time span of the project many things can happen that will suggest that design changes are needed. There may be a major event, like Operation *CORPORATE*, as a result of which new requirements are recognised. That happens to be a good example. My early days on the Northwood WHQ project coincided with the tragic losses of RN ships in the Falklands war and quickly concentrated our minds on the need to eliminate PVC-coated cables and other materials that produce toxic fumes when subjected to heat. It is now standard practice to specify low toxicity cabling in WHQs. *CORPORATE* also showed the need for additional role cells in the WHQ. Other factors may cause changes to the original design. Technology advances and some better piece of equipment becomes available. The threat changes or the Command's role or organisation is modified. Health and Safety legislation introduces new, statutory requirements. Finally, there is the human factor. The staff changes, and newcomers bring new ideas which have to be carefully considered; remember the overriding aim of meeting the needs of the future users. However, the possible impact on the overall programme must also be considered. The fact is that in many cases the true worth of proposed changes will not be known until the WHQ has been tested in a couple of major exercises, and it may turn out that there was not much wrong with the original design. Alternatively, a real problem is identified but the proposed solution is not the right one. So each case must be considered on its merits and above all the Project Team must try to preserve good relations with the staff, who in the final analysis they serve, and with the long-suffering PSA Project Manager who must consider the programme, contractural and cost implications of any change.

The effects of changes are lessened if the inevitability of change is recognised at all stages of planning and design. For instance, there must be ample reserves of electrical power, air conditioning and water supply. If the project officer is not allowed to have as many diesel generators as he would like, he should at least try to have space for an extra unit, and make sure that it is accessible. If it may be necessary to extend the building laterally at some future time it is feasible to "cast-in" additional openings in the outer walls during construction. The selection of some equipment is best left until late in the project; something better and possibly *smaller* may become available. Internal fixtures and fittings should not be too permanent; but here, it must be admitted, there is a conflict of requirements. These days practically all desks carry a VDU, at least two telephones and possibly an intercom. Cable management is a subject in itself, and one I will return to later. It is sufficient at this point to mention that desks, when wired for equipment, become semi-permanent fixtures, and their positions are influenced by underfloor cable ducting arrangements. Nevertheless, some flexibility is possible by avoiding long runs of benching, and using instead individual desks, or a modular system. Similarly, elaborate consoles with built-in terminals are difficult to change and should be avoided except in the case of some special systems.

There should be a constant seeking after flexibility, in matters both large and small. At the smaller end of the spectrum there are "things to be fixed to internal walls". These include fire extinguishers, security key boxes, first aid boxes, emergency lights, notices, communications trunking, domestic power sockets, map boards and coat hooks. Some of these, like emergency lights and power sockets, are normally installed at a relatively early stage of the programme. Some of the other items that have to be fitted to walls, like sliding map and tote boards—which, interestingly, are still very popular in this age of the alphanumeric and graphics VDU, and large screen displays—cannot be left to the last minute to be installed. However, most of the others, such as coat hooks, can and should be positioned very late in the programme. In practice, room layouts have to be designed in minute detail to avoid conflicts in the

positioning of equipment, as regards space, electrical compatibility and TEMPEST considerations. Consequently, the eventual occupants are liable to find themselves working in a room which they had little hand in designing, and which they cannot easily change if they do not like it.

Wiggly Amps and Other Mysterious Matters

I HAVE already mentioned TEMPEST, which is the business of ensuring that electro-magnetic emanations carrying classified data cannot be intercepted by hostile intelligence services. The fact that the WHQ itself consists of thousands of tons of concrete and reinforcing steel provides a measure of screening against spatial emanation. Specially sensitive parts of the building may have to be enclosed in additional TEMPEST screens, and equipments such as VDUs are usually required to meet government TEMPEST standards. In addition all power and signal cables have to be filtered where they penetrate the building, and within the building there has to be separation between certain equipments and cables. That is all that can be said about TEMPEST in this article, and about all that needs to be known by the budding WHQ project manager; there will be a specialist to worry about the details.

Another threat that demands shielding and filtering is Electro-Magnetic Pulse (EMP). The electrical and magnetic fields from a ground, near surface or high air burst nuclear weapon can damage cables and electronic equipment over a large geographical area. An exoatmospheric detonation produces a pulse which can be felt, with little attenuation, over the whole of the area of line-of-sight coverage from the point of explosion. From an altitude of 150km this area is equivaleht to most of Western Europe. Since survivable communications and electronics are essential to the functioning of a WHQ the provision of Electro-Magnetic Pulse Protection (EMPP) has a high priority. Shielding can take various forms but a common method is to enclose the whole building, or selected sensitive areas, in a box of welded steel. Special attention must be paid to the quality of the welding and to electrical continuity. If possible, it is preferable to shield the whole building; this allows maximum flexibility in the future use of the WHQ. EMPP has to be applied to everything that penetrates the shield, such as power and signal cables, sewage and water pipes, air intakes, diesel exhausts and personnel entrances. It is usual to route all cables through EMPP "vaults" and the adoption of an overall building shield minimises the space required for this purpose. An EMPP shield will assist in reducing TEMPEST emanations but where building penetrations are concerned separate filtering arrangements are necessary for EMPP and TEMPEST because different frequencies are involved.

Whilst still on the subject of matters electrical I will mention cable managment. A majority of the rooms in the WHQ will contain, in addition to domestic lighting and power supplies, a large number of visual displays and communications systems. TEMPEST considerations and electrical safety regulations impose constraints on how and where the various cables are installed. In those areas where there are many systems to be accommodated it is usual to have some form of suspended floor beneath which most of the cables are run. The suspension mechanism for the floor may be quite massive in order to meet the shock resistance criteria (equipments can also be individually shock-mounted) and thus the underfloor space available for cables is likely to be restricted. The situation may be eased somewhat if those cables that do not have to be routed below the floor, or those which have to be separated from others at low level, are taken through high level, wall-mounted ducts. Regarding the actual cables, the trend these days is to use fibre optic cables which save space and also contribute to security.

Other matters requiring careful planning are the means of bringing cables up from the underfloor space and terminating them on the desks. It is necessary to select furniture that is available from government sources and modify it to receive cabling. The lead time for supply of such items in the quantities that are required for a WHQ is about two years. Consequently, it is prudent to obtain specimen desks well in advance of installation and decide what modifications are needed. Desks and laboratory

benches from The Crown Suppliers are suitable for WHQ use but ducting and termination devices have to be selected from what is commercially available. There are several types of metal trunking that can be attached either on the desk top or below it, and which allow the various power and signal sockets to be positioned where they are needed, with blanking plates in between; the trunking itself has to be earthed.

Finally, a word on cleanliness. Modern electronics are particularly susceptible to dirt and dust and before the final installation of equipment the more sensitive areas, such as main computer rooms, have to be given a "super clean". This is usually carried out by specialist contractors and includes the underfloor spaces, roof voids, and air-conditioning trunking. Obviously the process is assisted if cleaning is carried out throughout the construction programme and with increasing emphasis as the time for electronic installation approaches.

Internal Lighting—A Subject in Itself

If you speak to people who have worked for long periods in an underground office environment you will hear much criticism of the lighting. It will be claimed by some that long exposure to artificial light, and especially fluorescent lights, has ruined their eyesight. However, my amateur investigations have not shown that there is any scientific support for this claim. In an ideal world internal lighting for a WHQ would be planned in detail at a very early stage in the programme. Each work space would be provided with background lighting and local "task" lighting. The task lighting would be related to the positions of desks and items of equipment, thus ensuring that reflections were eliminated and operators were not working in their own shadows. Unfortunately the basic lighting plan has to be produced by PSA long before room layouts are known. The building specification calls for "350 Lux at desk level" and this is provided by means of symmetrical rows of ceiling-mounted fluorescent tubes. Later efforts to improve the lighting plan are thwarted by considerations of cost, cable management, electrical safety, and availability of power. I cannot offer a solution except to suggest that a study should be undertaken to find ways of allowing some flexibility (that word again) in lighting installations.

The project managers can help in ways which are not directly concerned with the lighting itself. Glare is a source of eyestrain and therefore reflective surfaces should be eliminated as far as possible. All finishes should be matt, including small items like locks on doors, which should be in "satin" finish rather than bright metal. The colours of wall finishes and doors should be restful and have a degree of variety; PSA and the Services have environmental experts who are only too willing to advise. Lastly, there should be an absolute ban on the common practice of covering desk tops with perspex; where perspex or glass has to be used, for example on wall tote boards, it should be non-reflective—and shatterproof. The glare from fluorescent lights can be reduced by selection of suitable diffusers. A doctor once gave me a convincing explanation of what happens if fluorescent tubes are not fitted with diffusers, or if they are fitted with unsuitable devices. Imagine a large office, with no windows and about forty ceiling-mounted fluorescent tubes, with no shielding on the sides of the tubes. As the desk-bound occupant goes about his work he is continually looking up from his work surface and then returning his attention to papers on his desk. Each time he looks up the iris of his eye partially closes as a reaction to the overhead lights; when he looks down the reverse occurs. This continuous process causes eye strain. The solution is to install diffusers which direct the light downwards so that the eye is never looking directly at the light source. This may require additional lights in order to maintain an adequate level of illumination at desk level, however, the better types of "honeycomb" diffusers employ internal parabolic reflectors which help to overcome this problem. Some of the tidiest installations consist of parabolic diffusers that are flush-mounted in the ceiling.

My final suggestion is that many of the complaints about lighting in underground buildings stem as much from psychological as from technical factors. I believe that

people who have to work for long periods in underground offices, either during exercises or because it is their peacetime place of work, and who are subject to an unimaginative lighting arrangement, feel like battery hens. They have little or no control over the lighting and their individual preferences cannot be satisfied. However, there are some technical options available that can improve their lot. For instance, if there have to be forty fluorescent tubes in a large room they can be controlled by four switches so that the occupants can choose to extinguish some of them when it suits them to do so. Dimmers can be installed, although it must be admitted that there appear to be technical difficulties with the dimming of fluorescent lighting. Finally, and although I was not very successful in this area, I am convinced that individual desk lights could be provided if the requirement was recognised at an early stage of the design. Having said that, I recall a frustrating attempt to have desk lights retrospectively installed. There were two problems. First, how to get the cables to the desks, and in this particular case we were not assisted by the floor design which was solid concrete with cast ducts. Overfloor cables from wall sockets were not acceptable, and vertical cables from the ceiling void would have been an unsightly nuisance. Second, there were questions of electrical safety and compatibility. The desks each had a 15A socket to power the VDUs and these were fed from the WHQ's Uninterrupted Power Supply (UPS). Had we been prepared to feed desk lights from the wall-mounted domestic power sockets we would have been bringing together at the desk two different sources of 240V power; although this would not have contravened IEE regulations it would have introduced a possible safety hazard. If we could have fed the desk lights from the UPS we would have been in danger of creating "transients" on the computer supply whenever lights were switched on or off. At about this point in the discussion I gave up, but not before suggesting a low voltage lighting system which I had seen at an exhibition of office equipment; for various reasons, not unconnected with cost, that also was a non-starter. Lest this sorry tale appears to be a veiled criticism of my many friends in PSA I hasten to add that it is unfair to attempt to make such changes at a late stage of a project and the right time to address these matters is at the beginning. In conclusion, however, I feel that lighting, which like all environmental factors has an impact on operational efficiency, is an area which has been neglected.

Safety, Survival, Security and Comfort

WHQ project managers and designers have a great responsibility for the safety of the future users. A fire in an underground building is bad enough in peacetime, in wartime when there may be no external help available it could be an operational disaster. As an obvious first step there must be an insistence on the use of fire resistant and low toxicity materials; cable sheathing has been emphasised but the requirement extends to many other items. For instance, a population of several hundred and the application of the two-watch, hot-bed principle equals many mattresses. As a result of experience in HM Prisons, where some inmates discovered it was a good stunt to set fire to their beds, the Crown Suppliers did excellent work and produced fire resistant matresses. Linen stores should be avoided and privately-owned bedding should be banned; fire resistant sleeping bags are available from Service sources. Similarly, all furniture should be fire resistant, with particular attention to the padding in chairs. The use of large amounts of wood seems to be unavoidable in WHQs; softwood can be fire-retardant treated but hardwood has a degree of fire resistance and should be preferred. Fire resistant paints are available and these should be used wherever appropriate. In my opinion everyone concerned in the design and equipping of WHQs should be ruthless about eliminating even small amounts of potentially dangerous material; many small quantities add up to a lot.

If a fire should occur I believe it is more likely to be in peacetime, and caused by carelessness, than in wartime as a result of enemy action. However, the only major fire in an underground military building in the UK in peacetime, that I am aware of,

was the result of arson and three civilian firemen died in the attempt to bring it under control. There are a number of lessons to be learned from that tragedy and the implications of any fire in a WHQ. The design of the building and its services make a major contribution. Individual rooms must be fireproof compartments so that a fire can be contained, and the air handling system must be capable of reversal, by zones, to extract smoke and fumes. The whole building should be equipped with a fire detection and fire alarm system. Sprinkler systems are not usually employed in WHQs, water and electronics not being compatible. For the same reason hose reels, if installed, have to be used with caution; the unnecessary flooding of an underfloor space full of cables could be a spectacular own goal. Consequently there must be an ample provision of the right types of First Aid Fire Appliances and some special areas such as computer rooms may be fitted with automatic halon gas fire suppression systems—complete with warning devices to alert the occupants to the imminent danger of asphyxiation. A key man in any building emergency is the PSA shift engineer who will be required to operate various systems, shed electrical loads and take other emergency actions. It is therefore important that the PSA staff be provided with the necessary facilities. At the minimum I suggest that these should include a single control room from which all building services can be monitored and controlled, an adjoining office with storage for building drawings, a spares store, and a rest room with sleeping arrangements, toilet, washing facilities and somewhere to brew up. The shift engineers should also be provided with communications to whoever on the military staff is responsible for building management/damage control.

Evacuation procedures must be carefully thought out and practised, and escape routes marked. It is not practicable to provide "fireman-standard" breathing apparatus for all occupants; apart from storage considerations extensive training is necessary. However, it is possible to provide short-life breathing sets, at least for essential personnel, which last for about ten minutes and give an increased chance of survival to those key personnel who may have to stay behind to secure classified material, or who are required to work in remote parts of the building.

In the event of a peacetime fire local military resources may need assistance and it is therefore Standard Operating Procedure to call the local Brigade to any reported fire. Clearly, the Fire Brigade are at a grave disadvantage if they are not familiar with the building, so regular visits should be arranged, starting during the construction phase. It has also been found useful to obtain from PSA suitably mounted building plans which can be handed to the firemen when they arrive at the site, on which the positions of fixed firefighting equipment, water supplies etc are shown and on which the location of the fire can be marked with a grease pencil.

Various aspects of survival in wartime have already been discussed and little more needs to be said except to mention a design feature which may be overlooked. This is concerned with access to the diesel generators. In a NBC situation the diesel generator house (DGH) is usually a "dirty" area, outside the NBC-filtered part of the building. The diesels either start automatically when mains power fails—a battery system providing essential power during the transition—or they can be started by remote control. Fair enough, you say, there is no need to be able to gain access to the diesels when closed-down against NBC. The cynics among us, however, ask "what happens if the diesels do not start as advertised?" The discussion then follows the lines of, "No problem; old Alf (the PSA shift engineer) puts on a Noddy Suit, exits the building via the Contamination Control Area and walks round to the outside door of the Diesel Generator House". Apart from the fact that old Alf may not be excited at the prospect of braving shot and shell, this solution also overlooks the fact that on arrival at the outside of the DGH he would be confronted by a great armoured door designed to allow big diesels to go in and to keep the Spetsnaz out. The solution is obvious; design the building so that the Contamination Control Area is connected both to the personnel entrance and to the DGH.

Regarding normal security arrangements, project managers must not underestimate the task of advising PSA on the requirements for security devices. The local security

officer will recommend the locks that should be used for various rooms, and these come in many different types. There will probably also be a requirement for some rooms to be fitted with special doors, intruder detection devices, bells, and door viewers. PSA cannot read our minds and they have to be told, in the case of interconnecting doors, which side the key hole should be, and in which direction the viewer will be used. External security will involve special fences and lighting, and probably Closed Circuit Television; again, specialist advice is readily available. The usefulness of CCTV security systems is significantly enhanced by the inclusion of a Motion Detection System.

Someone, I believe an Army officer, once said "Any fool can campaign in discomfort." It is going to be no fun being incarcerated in an underground war headquarters for an extended period, probably with less than adequate washing facilities, whilst all hell is going on outside, and having to snatch sleep in a bunk recently vacated by some great hairy monster who is also overdue for a shower. Similarly, it is not much fun working in an underground, windowless environment in peacetime. So I make no apologies for suggesting that some thought be given to creature comfort. The NATO criteria require that, in general, WHQs are constructed to "austere" standards, presumably on the principle that it is better than being in a trench. However, the small print allows some relaxation for those areas where personnel work on a semi-permanent basis, for example peacetime staffs for whom the WHQ is their normal place of work. What is achieved under that clause is largely up to project managers, and their effrontery, charm and deviousness. Sadly, one area that may be neglected is the means of providing a constant supply of coffee or tea, where it is needed—at the place of work. This requirement, which is almost a Principle of War to soldiers, sailors and airmen, is not necessarily seen in the same light by architects and designers. I will not belabour this point but merely suggest that it should not be beyond the wit of project staffs to achieve a satisfactory solution, including arrangements for washing the cups, and which will not be an eyesore.

The Stages of a WHQ Project Programme

In simple terms there are two phases to the construction of a WHQ. During the first phase the site is in the hands of PSA, represented on site by a Senior Resident Engineer (SRE) and staff. The SRE's staff sometimes includes Royal Engineer personnel and the Corps is to be congratulated on the high quality of the succession of SNCOs who have served with PSA at High Wycombe as Clerks of Works (Mechanical) and (Electrical). The prime contractor also has a staff on site, headed by a Site Agent. This phase culminates at the "Beneficial Occupancy Date" (BOD) with a handover of the building to the military authorities. At this point the basic building is complete and all systems have been tested and commissioned. At BOD the local PSA District Works Officer (DWO) becomes responsible for the operation of building services, through his shift engineers, and the local military organisation becomes responsible for security, fire prevention, cleaning, routine building maintenance and Health and Safety. After BOD there is the second phase, during which operational systems, such as telephones, computers and displays are installed, under the control of the project office working through various Installation Design Authorities (IDAs). That is the theory. In practice it may be necessary to allow some overlap of these two phases, usually because there has been some slippage of Phase 1, and there is pressure to meet the final deadline, Initial Operational Capability (IOC). An overlap can cause organisational, administrative and technical difficulties and should be avoided if possible. BOD is a very critical point in the programme and careful planning is essential to achieve a smooth transition. In particular the DWO and his staff should be gradually introduced to the project before BOD so that they are not suddenly expected to start operating large, complex and potentially dangerous systems. Ideally, the DWO's engineers should be recruited, or posted-in, well before systems testing and BOD so that they can become familiar with their future tasks.

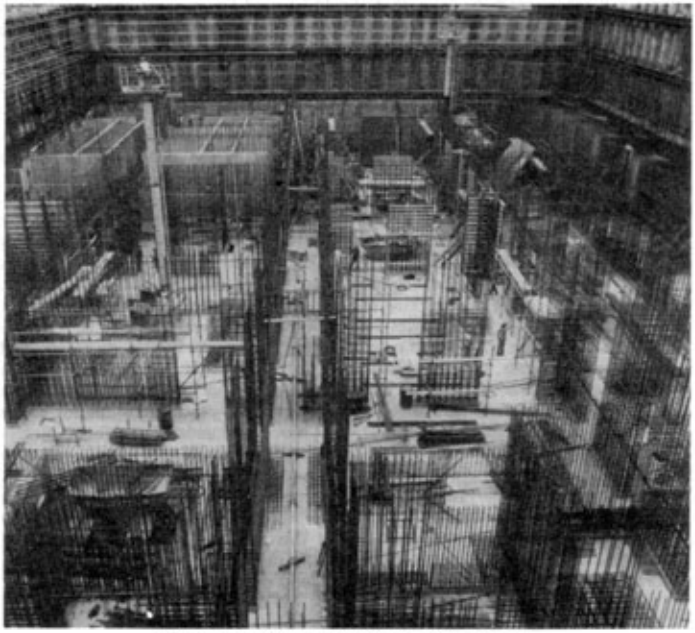


Photo 3: 'Y' thousand tons of steel reinforcing bars.

VIPs and other Visitors

Statement of fact: WHQs attract visitors like flies to a honeypot. Most of them have quite legitimate reasons for seeing the WHQ—although the SRE might take some convincing—and it must never be forgotten that up to BOD the contractor "owns" the site and etiquette demands that the SRE is always asked to obtain approval for a visit; I have never known a refusal. The first notification of a possible VIP visit usually comes as a telephone call to the Project Office from a Flag Lieutenant or ADC. After the preliminaries, about the date and time of the visit, the next question from the Project Office is "What size boots does he wear?" (We are now getting down to the real nitty-gritty of WHQ project management.) You get no thanks for plastering VIPs in mud and cement dust, so protective clothing is essential, and hard hats are mandatory. VIP visitors may include senior military officers, senior civilians from government departments, or members of the House of Lords or Commons. However, the occasional ambassador is welcome because this allows jokes about "Gumboot Diplomacy." Almost without exception these visitors are charming and genuinely interested, and *late*—except for one admiral who arrived long before the scheduled time and had a wander around on his own. It is a good idea to have various statistics available—"How deep is it?"', "How much will it cost?", and "Who is paying for it?" are the most popular questions. Despite careful preparation the escorting officer will sometimes be caught out. A British general once asked "How much does it weigh?" For future visits we were able to recite that the project had consumed " 'x' thousand tons of concrete and 'y' thousand tons of steel reinforcing bars which if laid out end-to-end would stretch 'z' thousand miles". For on-site briefings a handy-sized folder of diagrams and photographs is useful.

Conclusion

Every Service expects its officers to be able to turn their hands to almost anything and in the Royal Air Force this is given some formal recognition in that its aircrew officers comprise the General Duties Branch. During my thirty-five years in the RAF this principle was thoroughly tested and I was fortunate in having many varied and interesting postings. None of these was more challenging or satisfying than the two periods I spent as the project officer for war headquarters. This article is an informal, and not too serious account of my experiences and some lessons learned. I hope it may also assist anyone who is embarking on a WHQ project. I conclude by offering my list of:

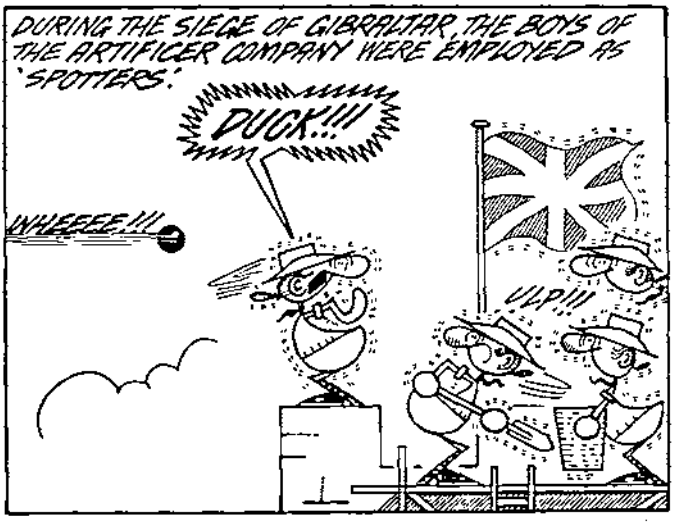
THE LAWS OF WHQ PROJECT MANAGEMENT

1. When faced with a design decision, and unable to decide on any other basis, adopt the solution that allows maximum future flexibility.
2. Somewhere there is an expert who knows the answer to your problem. However, specialists do not always suggest the most obvious or simple solution. Do not be afraid to apply Layman's Lateral Thinking
3. Computers get smaller but their numbers increase to fill the space provided.
4. When someone tells you that he wishes to introduce a small, stand-alone desk-top computer, no bigger than a typewriter, producing very little heat, and requiring only a domestic power socket—treat him with great suspicion.
5. a. Always give careful consideration to the views of the future users; they will have many valuable ideas.

or b. Do not recognise the existence of the future users; they are self-opinionated, ignorant troublemakers.

6. If the tops of your gumboots are 420mm above ground level the mud-filled hole into which you step will be at least 430mm deep, which just proves that:
7. YOU CAN'T WIN—at least not all the time—but its fun trying.

KNOW YOUR HISTORY



In at the Deep End

PAE

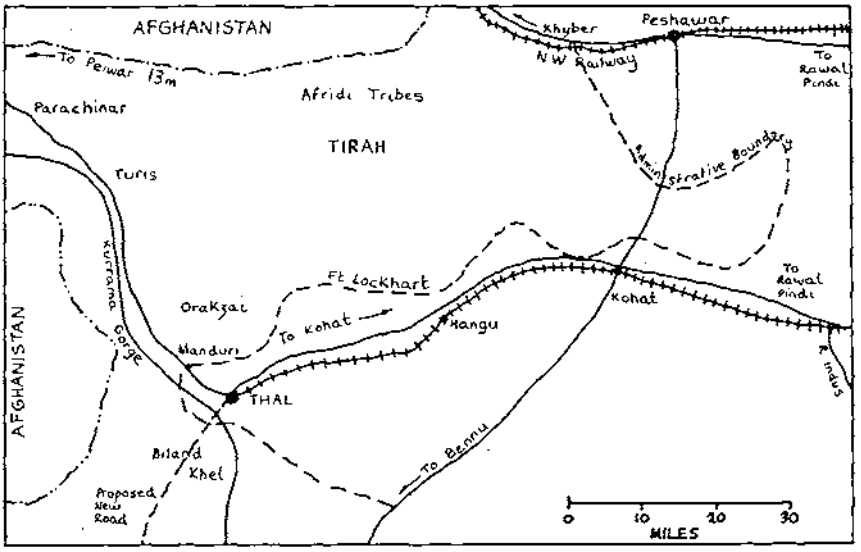


Figure 1. Map of part of the new North West Frontier province.

THE barrier between the Indian sub-continent and Afghanistan lies in the great mass of mountainous country that extends from the Karakorams to the Persian Gulf. Here live the Pathan tribes, each fiercely jealous of its boundaries and ruled to some degree by its tribal council, the *Jirgah*. Murder, pillage and blood feuds were not unknown: bloody raids on the slightly more prosperous villages on the edge of their mountain fastness up to the Indus were almost the order of the day.

Until the beginning of the present century the Punjab Government endeavoured to give some protection to these isolated habitations by the posting of small piquets and by the sending of punitive expeditions from the Frontier Force and Guides cavalry but with little effect. But at the beginning of this century the new Viceroy, Lord Curzon, managed to reach some accommodation with tribal chiefs. A new North West Frontier Province would be established with its capital at Peshawar. Corps of frontier Militia would be organised from reliable tribes, existing military posts would be abolished and in their stead cantonments would be organised at a few strategic points, such as Peshawar, Kohat and Bannu. Certain roads would be constructed which would be British even if passing through tribal territory and allowances would be paid to tribes for good behaviour. At Peshawar there would be a chief commissioner, answerable direct to the Central Government and some Political Agents would be appointed for liaison with tribes.

When I arrived in Kohat at the beginning of the hot weather in 1925, the Waziristan Campaign was ended and along the North West Frontier there was a general atmosphere of calm except for two appalling outrages in Kohat itself. A British girl had been abducted by a gang of Afridi outlaws—Afridi territory extended to within a mile or two of Kohat: in the cantonment itself a British doctor and his wife had been brutally butchered one night. Fortunately the girl was rescued by a gallant missionary some weeks later.

Communications in this part of India (now Pakistan) were few and far between. From time immemorial the road to Kabul from Peshawar passed through the Khyber

Pass. South from Peshawar and forty miles distant lay the cantonment of Kohat, the road passing through Afridi territory, and further South the road continued to Bannu and beyond. But, less well known, is the road, leading from Kohat to the Peiwar Kotal (pass) 130 miles to the West, the Kotal forming the border with Afghanistan, over which Lord Roberts led his force in 1897. Twenty five miles along this road from Kohat lies the very open and small cantonment of Hangu. Here were the offices of the Assistant Political Agent and of the Police Officer, controlling the Frontier Constabulary as well as a battalion of Gurkhas, which also formed a garrison for Fort Lockhart, two miles to the North and a couple of thousand feet higher and which overlooked the Southern parts of the Afridi territory in the Tirah. For the next thirty-six miles the road passed through undulating hilly and stony country at the end of which stood the fort of Thal, perched on a bluff, some two hundred feet or more above the small township from which it took its name. Originally a four-square fort, it now had a hornwork to enable accommodation for a battalion and two 4.5 inch howitzers. Half a mile away to the South ran the Kurram river, over which a bridge had been constructed in the previous year. It had emerged from a deep gorge at the village of Manduri, some fourteen miles distant. A couple of miles to the North was the border of the bellicose Orakzai tribe. Close to the fort lay the fortified railway station of the metre gauge railway between Thal and Kohat.

From Kohat the road passes through non-tribal territory, administered by the British, but beyond Manduri lay Turi country, that tribe having invited the British to enter to afford protection from neighbouring Sunni tribes whereas the Turis were Shias. The road terminated at the pleasant small but cool (approximately 6,000ft) open cantonment of Parachinar with its garrison of Militia, enrolled from the Turi tribe and camping ground for troops from Thal and Kohat in the hot weather. A 'fair weather' track led to the village of Teri Mangal, thirteen miles distant, lying below the Peiwar Kotal itself.

My CRE, realising that his new officer would have no experience of Works had laid on a short course of instruction: part of my time in the office and part with one of his sub-divisional officers, after which I would be attached to a garrison engineer. He explained that on the North West Frontier there was no Public Works Department and that the Military Engineer Services did both jobs. This, of course, opened up a much larger horizon including such interesting subjects as roads and bridges. Indeed, a little later I was responsible not only for the maintenance of a gaol but also for the gallows which it housed. But, first, I had to get used to the local climate. I had arrived just as the hot weather was getting into its stride and it was disconcerting to find the sweat running down one's arm to the pen nib. Out on the road everything was very, very dry and the glare intense.

This easy period was suddenly interrupted. I had been in Kohat for just about a fortnight when one morning a very worried CRE entered the office. The GE at Thal had suddenly and unexpectedly been shipped home and very shortly the GE at Parachinar was being posted away. "I am afraid that you will have to take over." I would need a car and a driver as to drive a car and to inspect a road was not possible. "I will find both for you." He did; a Chevrolet car and an Afghan driver. I would be stationed in Thal and my first priority would be the construction of the road on the far side of the Kurram, starting from the bridge which had been completed in the previous year. But before any work could start agreement with the Biland Khel tribe would be necessary as the road would pass through their territory. This would mean the assistance of the APA from Hangu. I was soon to learn that the Biland Khel would not be amicably disposed as their village had been razed to the ground a couple of years previously due to some 'badness'. My predecessor had made a preliminary survey of the first few miles and a small survey party, making notes of more details, had been kidnapped by a gang of Wazirs, whose territory was not far distant.

My new station was certainly no health resort. Although the country was described in an early route book as being 'fairly cultivated' there was little sign of cultivation at this time of year and would be more closely described as semi-desert and both the

walls and the thick barbed wire fence fairly effectively prevented any breeze from entering the fort. Fortunately on the East side of the fort there was sufficient space between the fort walls and the wire to permit a small tennis court but woe betide the man who hit his ball into the middle of the fence.

A visit to the APA at Hangu was soon arranged and with it I combined a visit to Fort Lockhart on the fringe of Afridi territory and to one of its forward posts, from which I could descend from the ridge on which it was located by a mule track to a Levy post at the bottom where I could be met by my car. But escorts were necessary. A Gurkha party escorted me from Hangu to the fort, a second party to the forward post whence a small posse of local levies would be my protection down to the Levy post. All went well until the second dog-leg of the mule track when my band of wild-looking and well armed scallywags suddenly halted. Pointing to a group of similar looking individuals moving along a nearby valley they uttered the word 'baddies' in their local tongue, followed by the word 'come'. Irrespective of the heat, boulders, large and small, gravel, shale and stunted bushes we plunged down the twelve to fifteen hundred feet of the *khud* side at an incredible speed and I was indeed grateful for the cup of very sweet tea that was given to me by the caretaker of the Levy post at the bottom. Emerging from this post quite by chance I spotted a low brick wall. It was the boundary wall to a small cemetery for men who had fallen in the Tirah campaign of 1897.

A fortnight after this minor escapade the APA arrived from Hangu to hold a meeting with *maliks* (head men) of the Biland Khel to obtain their agreement to the road passing through their territory and together we proceeded to the far end of the bridge, spanning the Kurram, where the meeting was to be held. However, to his surprise not only were the seven or eight *maliks* at the redezvous but about forty to fifty villagers. All were armed with what would appear to be service rifles, either stolen, bought from the rifle factory in the Kohat Pass or bought in Kabul. Their cross belts carried rounds of ammunition in loops and each carried a knife, about twelve inches long in its scabbard, stuck in his waist belt. There was also a sizeable posse of Frontier Constabulary Police under the command of the head constable. They were also armed. But, first, the *maliks* invited us to tea in their village about a mile and a half away. To refuse would have been a mortal insult. Anticipating our agreement two ponies were produced and in one mass we moved to the village—the Frontier Constabulary keeping very close to us.

A table and two chairs had been placed at one end of a single room house on the outskirts of the village; rather grubby boiled eggs and mugs of tea were produced while our hosts squatted on the ground in front of us. But looking up from my tea there was a rather curious sight. Greatly doubting the honesty of purpose of the Biland Khel the head constable had taken precautions. Through each window aperture pointed a rifle from the outside, aimed at the back of our hosts, who were squatting in front of us. Luckily no one pulled a trigger and in an hour's time we were back at the bridge to 'argue the case'. Two chairs had been brought and the *maliks* squatted in front of us while the rest of the 'company' about fifty strong, supported their head men from the rear.

The APA stated the reason for the road. He stressed that every endeavour had been made in its siting to avoid any interruption to their fields, very slight signs of which could just be seen, and that we would do our best to fall in with any reasonable suggestions on their part. He then invited the *maliks* to give their ideas. Clearly they did not like this proposal at all and as each *malik* said his say, more and more of their supporters joined in. Then they produced their "ace". They were about to dig an irrigation channel along the side of the river and our road would be in the way. "No difficulty at all", said the APA, "we will build a culvert". Instead of pacifying the atmosphere this had the reverse effect. We had trumped their ace and the noise of dissent grew louder, many of them, by way of emphasis, withdrawing their *peshkos* (knives) half way out of its sheath and ramming it back with a most disconcerting click. At last the APA turned to me "I have had enough of this" and stopped the

Photo 1. Desert waste south of Thal.

proceedings, adjourning the meeting until later in the day when it would be held in the police station on the other side of the river and only *maliks* would attend. Then an obstacle. Up came the head constable. "Malik Sanobar Khan is engaged in a blood feud. He recently 'got his man' but unfortunately inside the administered boundary. Therefore when he crosses the bridge I shall have to arrest him on a charge of murder." However the APA had served long in these parts. Summoning Sanobar he tore strips off him. Not for committing murder; that was part of their code but for being so utterly careless as to commit the act outside tribal territory. However he would give him twenty-four hours grace to enable him to come to the meeting and afford sufficient time to make a clear escape. A few hours later the APA entered my office. At last the *maliks* had agreed and we could start work. These were not days of earth moving plant but in about a week sufficient coolies had been mustered.

At last a short lull and a little light relief. One morning a sweating coolie arrived with a dirty piece of paper. At irregular intervals a couple of very light reconnaissance cars would come up from Kohat with cash for the garrison of Thal and for those troops in Parachinar. One had gone too near the outer edge of the road and one wheel was in space. Could I help? Fortunately nearby I had a steam roller at work on the road so out I went to see what could be done, hoping that the weight of the car would not be too great for my roller. Soon we had hitched the rear of the roller to the rear of the car and I gave the order to my driver to pull. It was a small matter and soon a triumphant Muslim driver was chugging away along the road towing the car and announcing his triumph to all and sundry by keeping his hand on the whistle cord.

I had earlier been warned that GE Parachinar was leaving and that I would have to take over. Shortly after this episode he arrived in my office with the words "Here is my imprest", passing me a sand bag with some money inside. "My SDO, who is British is outside and I am off". And that was our handing-over. A few days later I visited my new parish around which I was conducted by the SDO. Other than a camping ground for troops, the headquarters of the militia and a few civil buildings, including the bungalow of the PA Kurram, some offices and the gaol with its gallows

I could not see how a GE with a SDO could keep themselves occupied. Even a fifteen mile track to the Afghan border was hardly a continuing engineering problem.

Clearly this was the quiet before the storm as only a few days later my SDO arrived with a harried expression. "There are no coolies on the work as the Biland Khel have ordered them off". Obviously I had to go to find out the reason. Arrived on the site, there were five or six of our 'friends' making digging gestures where the proposed water channel was to come. But on seeing us, down went their spades and up came their rifles which were lying nearby. No love was ever lost between a Sikh and a Pathan and on my SDO's shouted query, they raised their rifles to the aiming position and told him clearly that we were to go away and at once. He took the hint and was soon speeding towards Thal, leaving me without an interpreter. Here was a true dilemma. I was unable to talk to them, knowing no Pushtu and their gestures became more menacing. I doubted if they would really fire but there is always a first time and there might be a 'twitching' forefinger. But I was not going to rush off in the manner of my subordinate, but there was no alternative. Slowly lighting a cigarette I wandered at a slow pace back to my car, very angry. That little episode cost the tribe half a year's tribal allowance, a sentence that was later passed in my presence.

While in Kohat I had been given the job of designing a frontier tower as one was to be built on the edge of the Orakzai territory on the hills to the North behind Manduri. Four square and about twenty-five feet high, this was no architectural problem but for the fact that the bottom eight feet had to be of solid masonry to prevent a potential arsonist from doing his worst; the door being so many feet above ground and entrance being by a ladder. The site had already been determined and now approval for the work arrived. Now we had to discover a suitable outcrop of rock to be our quarry and to make a track, capable of use by camels.

Returning from inspecting the work one morning I was accosted by one of the dirtiest and most villainous looking Pathans that it had ever been my lot to meet. He was the head man of Manduri village and he had a demand. His son should be one of the mates on the work, ie draw the pay and do no work. The son was even more evil-looking than father and I turned down this request at once. Away he went, muttering. Two or three days later my SDO arrived with the news that shots were being fired at the workers from the Orakzai side of the border. Rightly, my SDO—not the Sikh—also gave a warning and came to report. A few days later there was a repetition and I went to see what was happening and why, but arrived too late. But this time I had an ace of trumps. Warning both father and son that, if there was another case, real trouble would begin but from me; my threats were met with a leer. Again there was a shooting but by then I had had the time to contact the OC of the Kurram Militia. Two days later at "shooting time" in trotted a troop of Mounted Infantry of that Frontier Corps.

I hoped that now all would be well and that "normal jobs" would prevail. But first a minor ripple. One morning my head clerk entered with the information that in December I was to be transferred to the Bombay Sappers in Kirkee. Seeing the look of incredulity on my face he continued "I have a cousin in Delhi. He knows all these things". Later I was told that "these cousins" frequently made quite a "bit on the side" by passing similar information to interested parties.

Now the storm really broke. A cutting about six feet deep and about 100 yards in length had to be dug on "my road". Any diversion was impossible as it might pass on to co-called agricultural land. About three feet deep some skeletons had been revealed. Not only would the coolies not touch them but gleeful and avaricious Biland Khel immediately claimed them as their own. Now they really "had me over a barrel" as they could see much revenue coming to them in the removal of these remains and all that appertained to such a job;—winding sheets, actual removal, discovery of a new graveyard and so on. All a well known Frontier custom. By the depth of these graves it was most unlikely that they had ever been part of the Biland Khel and, further, my SDO declared that by their positions they were not even Muslim graves. The argument dragged on for weeks and progress of course stopped. Eventually an agreement was

Photo 2. Peiwar Kotal (Pass). Tea with Afghan Captain.

reached between them and myself with the reservation that it would have to have the authorisation of someone far senior to me. But nothing ever happened during my sojourn in the job and the road was not completed for another seven or eight years.

Some years earlier an excellent MES manual had been published regarding Roads and in it was a chapter on road signs. Prior to my arrival on the scene my predecessor and the CRE had selected a number of locations in the thirty mile length of the Kurram Valley Gorge where the signs should be erected and on one of his rare visits the CRE gave me details. My suggestion that the road was only used by an average of four or five vehicles a day, all of whose drivers were well acquainted with the hazards of this difficult piece of road, was not well received and I was instructed to start preliminaries immediately. The signs would arrive shortly from Kohat. But we had forgotten the time of year. Many nomadic tribes had started to wend their way with all their goods and cattle from the high grounds in Afghanistan, where snow would shortly be arriving, to the warmer area of the right bank of the Indus. Here the men would hand in their rifles and go and seek work in the more southern climes while their families remained in their tents near the river. In due course the road signs were erected but unfortunately on the day before the CRE was due to arrive to inspect his show piece a tribe of nomads moved down the valley. But what had the kind Government of India given them? A number of beautiful red and white aiming marks. And when we arrived to view this show piece every sign had at least half a dozen bullet holes. We were not amused and I was quickly instructed to remove the lot.

One morning a Gunner officer arrived with the news that he was going to fire the two ancient "Hows" that were part of the Thals armament. All seemed to go off satisfactorily except for one shell that failed to explode. I then learned that it was customary for Sapper officers to deal with this. Fortunately having watched the display I did not have too much difficulty in finding the miscreant. Having forgotten what I was supposed to have learned at the Shop about fuzes I approached the culprit and handled it fairly gingerly. Having attached guncotton, primer, detonator and safety fuze according to book I lit the fuze and awaited results. A sharp crack, the shell

leaped about twenty feet into the air while the disintegrated guncotton slab descended from heaven in a sort of snow. Luckily the shell fell into a neighbouring deep nullah and all was well at the second go.

Arriving back in the fort, OC Thal had two important pieces of news. In the first instance it had been reported that a large raiding party of Orakzais was making its way to encircle the fort so that it would be most inadvisable to leave the safety of the fort for a day or two: the second was to give me the date when the rest of the battalion would be returning from Parachinar and that it would be accompanied by a field company which would bivouac on the camping ground adjacent to the fort. The day arrived and in the morning I checked that all standpipes were working and having instructed the overseer regarding the ETA of the unit I went "about my chores". Shortly after the arrival of the column a note arrived in my office. "Please can we have some water". Apparently as soon as my back was turned earlier all stop cocks had been removed for safety's sake and the water turned off.

The date of my departure was drawing near and I hoped for a short period when I could prepare notes regarding the "oddities" of this job, but without any luck. A signal arrived ordering me to start at once to construct a mule track from Teri Mangal at the bottom of the Peiwar Kotal (Pass) to the border at the request of the Afghan Government. Funds were available. It was a fairly steep slope of several hundred feet of rock, shale and boulders with a little scrub vegetation but did not appear to be too difficult a task. Coolies were soon collected and work proceeded well. Then another signal. The Afghan Government objected to any British being seen on this job. Could no job be reasonably straightforward in this part of the world?

Two and a half years later I was again in Parachinar but then as a subaltern in a field company. On one occasion I was invited to dinner by the Political Agent (Kurram). Among the guests was the Deputy Commissioner from Kohat who had the additional role of being PA of the area in which was the Biland Khel territory. After dinner the two PA's were chatting and I could not miss hearing the following. Our host enquired of his fellow PA something about a road and the Biland Khel. "Ah", replied his guest. "There was quite a good arrangement made with the tribe. But we could not possibly agree to it as it was made by a very junior Sapper subaltern." So, protocol was more important than defence. I made no sound. I wanted to remain in the army.

* * * * *

The Bailey Story—Part 2

COLONEL J H JOINER B Sc(Eng), C Eng, MICE, FI Struct E

The Evolution of Bailey

As we have seen, towards the end of 1941 the Sappers had coming into service an excellent dry support bridge, capable of use at a very wide range of spans and at load classes up to Class 70. Over the next few years this basic design of bridge proved to be versatile perhaps beyond the wildest dreams of the designers. Its main development was undoubtedly for use in the floating role, as the Bailey Pontoon Bridge, but it was also successfully adapted as a railway bridge, a canal lock bridge, a retractable bridge, as a multi-span bridge, for dual-carriageway use, and in the assault bridge role. Perhaps its most spectacular use, however, was as a suspension bridge. In 1942 the

Far Eastern Theatre had a requirement for a bridge to carry a laden 3-ton lorry, that is Class 9, over a 400 foot gap. The EBE considered that this requirement could best be met by a suspension bridge using Bailey panels for the stiffening girders, for the towers, and even for the anchorages. Bailey parts were to be used for the decking thus keeping the need for special parts to a minimum, the main new requirement being for cables and hangers. After trials in late 1942 and early 1943 the design was finalised. Bailey Suspension Bridge No 1 could carry unrestricted Class 12 traffic, that is up to five vehicles on the bridge at one time, not closer than 80 foot nose to tail, at a clear span not exceding 400 foot. The 55½ foot high towers were of Double/Single construction, and supported six 2⅜ inch circumference high tensile steel cables on each side of bridge; each cable was 750 foot long. Subsequent trials showed that the 400 foot bridge would take a single Class 40 tank, provided that the top and botton chords of the stiffening girders were strengthened by bolting on standard chord reinforcements.

With no projections below the bottom chord of the Bailey panel, it was soon realised that the girders, complete with their decking, could easily be positioned on suitable pontoons to fulfil a much needed requirement for a new floating bridge. Design work was therefore put in hand for a Bailey Pontoon Bridge. An important design aspect to be resolved was the degree of rigidity that would be acceptable in the bridge girders; some rigidity was obviously necessary to enable a load to be spread across a number of floating bays of bridge, but complete rigidity would have resulted in excessive bending moments, even from the action of waves and swell alone. After using relaxation methods of analysis, the system that was finally adopted was one of limited articulation; thus floating bays were joined together by using special connecting posts, with a universal joint at bottom chord level and a butting joint at the top. The connecting posts could thus transfer the shear forces between bays, and could resist sagging bending moments, but not hogging moments due to swell; contraflexure of the girder was also avoided.

The standard form of construction finally adopted for the Class 40 bridge linked together the requisite number of floating bays, each comprising 32 foot of Single/Single Bailey supported on two pontoon piers; each bay was handled in the water as a separate unit, prior to being coupled into bridge. The bridge was completed by a landing bay at each end, which spanned from the bank down on to a special four-pier landing bay raft. As with dry span Bailey, construction could be varied at will, according to the site encountered or the load class required. For example a Class 70 version could be built using Double/Single construction and three pontoon piers for each floating bay, together with six-pier landing bay rafts.

The major new component needed for the bridge was of course the pontoon pier. Luckily the Mark V pontoon was available, but since this would not provide the necessary buoyancy on its own, a design for a new centre pontoon was produced. This pontoon was coupled between two Mark V bow pontoons to form the 60 foot long Bailey Pontoon. The first full scale trial of the BPB took place at Wallingford, on the River Thames, in early 1942, and thus another variant of the Bailey was made available to the Allied Forces.

Wartime Use of Bailey

No account of Bailey would be complete without mention of at least some of the bridges built "in anger", but selection of examples must be an arbitrary matter bearing in mind that almost 2500 Baileys were built during the Italian Campaign, from 1943 to 1945, and over 1500 during the advance into NW Europe from May 1944 onward. The bridge was also extensively used during the Far Eastern Campaign.

The first Bailey Bridge actually built in contact with the enemy was a 100 foot span Class 40 Triple/Single bridge, built at Medjez el Bab across the River Medjerba in Tunisia. The bridge was built on 26 November 1942 by 237 Field Company but only after the original bridging convoy had been set on fire by enemy action. The first Bailey Pontoon Bridge built in action was used to cross the River Volturno, at Capua

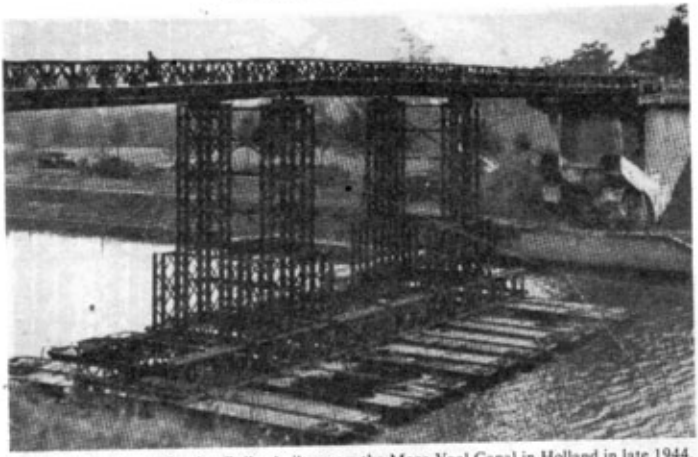


Photo 6. A high level floating Bailey built across the Maas-Vaal Canal in Holland in late 1944. Note the extensive use of Bailey for piers and substructure.

In NW Europe the 1509 bridges built during the advance into Germany comprised 29 miles of normal Bailey and 3 miles of floating Bailey. For sheer size the Class 40 Bailey Pontoon Bridge built in February 1945 over the River Maas, at Gennap, Holland, is a good example; with east and west approach viaducts of some 960 and 2230 feet respectively, and a main span of over 800 feet, the total length was 4008 feet, the bridge weighing 1,126 tons. Anbther impressive bridge built in Holland (*Photo 6*) was Tower Bridge, built across the Maas-Vaal Canal at Hatert. However, the pontoon bridges crossing the Rhine were probably more spectacular, some exceeding 2000 feet in length (*Photo* 7). As the war progressed, and even just after the war, a number of semi-permanent bridges were built across the Rhine, in order to cater for the ever increasing flow of military and civilian traffic. These bridges were, in the main, high level bridges making use of piled piers or floating piers constructed from Bailey components and large sectional pontoons. The first such

Photo 7. Digger Bridge, built across the Rhine at Xanten, Germany, was nearly 1200 foot long and was built by 7 Army Troops Engineers on 24 and 25 March 1945.

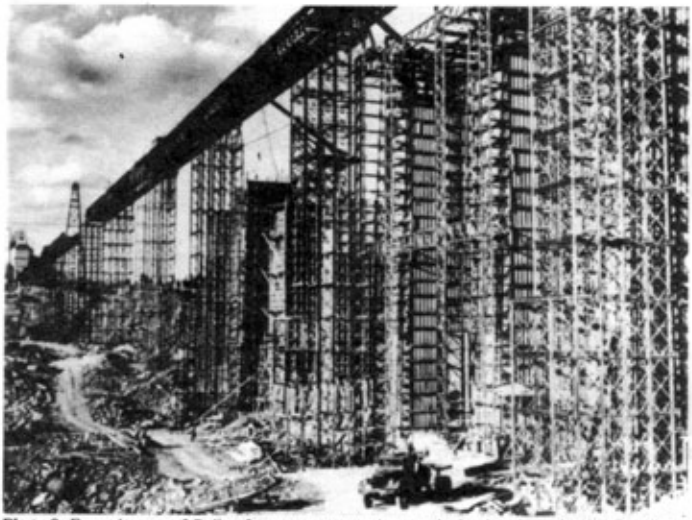


Photo 8. Extensive use of Bailey for temporary works on a hydroelectric project in Canada in the late 1940s.

crossing was the twin Tyne and Tees Bridges (Class 70 and Class 40 respectively), crossing the Rhine at Rees. The bridges were built in April and May 1945 and were about 5000 foot long, reputably the longest military bridges in the world. A recent article in the Sunday Telegraph quotes Chancellor Erhart as saying that without these "semi-permanent" bridges across the Rhine, the "economic miracle" of Germany's post-war recovery would have been long delayed. The Montgomery Bridge, built across the Rhine at Wesel where Montgomery crossed the Rhine, was not replaced until the late 1950s, and the Patton Bridge, which crossed the Rhine at Cologne, was still in use in the 1960s.

After the War

In 1946 Bailey was knighted for his valuable contribution to the Allied victory. EBE was reorganised as the Military Engineering Experimental Establishment, or MEXE,* and Sir Donald became the Assistant Director, becoming the first civilian Director in January 1957. Also in 1946 he was awarded the Honorary Degree of Doctor of Engineering by the University of Sheffield, his old university, an honour he much valued.

Meanwhile the potential for the use of Bailey for temporary and permanent civilian bridging has been exploited world-wide by the civil engineer, as has its versatility for other purposes, such as gantries, towers, support structures and formwork (*Photo* 8). Two firms at the forefront of its current supply and manufacture are Thomas Storey (Engineers) Ltd and Mabey & Johnson Ltd. The Bailey Bridge at present manufactured by Storey's uses a higher grade steel (ie, Grade 55C, with a yield of 29 tons per

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* *Footnote*. After a further reorganisation and name change in 1970, the establishment finally reorganised as the Royal Armament Research and Development Establishment (Christchurch), or RARDE(C), in 1984.

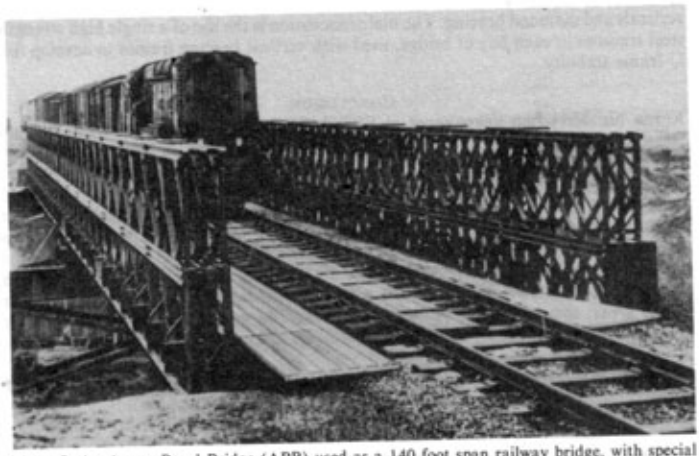

Photo 9. An Acrow Panel Bridge (APB) used as a 140 foot span railway bridge, with special transoms, stringers and swaybrace for the heavy rail loading.

square inch), and rectangular hollow sections for the panel verticals and diagonals; this greatly increases the strength and life of the panels. Steel deck panels are available for permanent bridges. Their Acrow Panel Bridge (*Photo* 9) is based on the Bailey design but has moved the transom position into the panel diamond instead of fixing it beside the verticals; this means that two transoms per bay are used for all loadings. The panels use the high grade steel and hollow sections as used in the Storey Bailey Bridge. The Mabey Super Bailey is totally interchangeable with original Bailey but has been significantly improved in detail and in strength. It has been largely superseded by the Mabey Compact Bailey (*Photo* 10); this equipment makes full use of modern welding techniques to realise the full potential of the Grade 55C steel used. The basic size and configuration of the Bailey panel is retained but channels are used for the

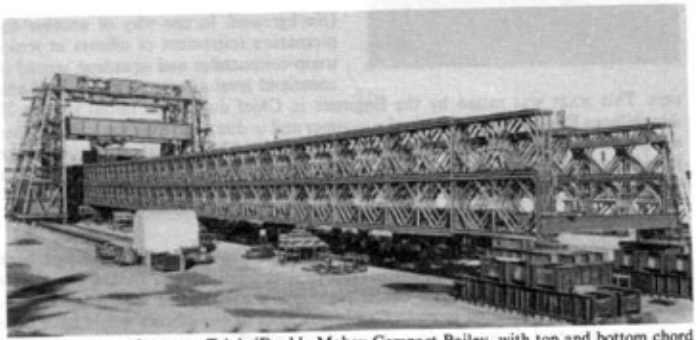

Photo 10. A 200 foot span Triple/Double Mabey Compact Bailey, with top and bottom chord reinforcement, under test load at Christchurch. The 500 ton test rig may be compared with that used to test the original Bailey in 1941 and shown in *Photo* 3 (Part 1).

The Bailey Story Part 2 (9, 10)

verticals and diamond bracing. The main innovation is the use of a single high strength steel transom in each bay of bridge, used with vertical bracing frames to develop full U-frame stability.

Conclusion

After his thirty-four years spent at EBE/MEXE, Sir Donald went on to become Dean of the Royal Military College of Science, Shrivenham, in September 1962, a post that he held until he retired back to Christchurch in 1966. He was a modest considerate and courteous man and an engineer with a real flair for design who could look back in pride on his full career—his many years valuable contributions to the development of engineer equipment for the Royal Engineers—his knighthood—his honorary doctorate—community service as a magistrate—Council membership of the Institution of Civil Engineers—and above all the design of the bridge that bore his name, a bridge that is still in service with the British Army today, for use in rear battle areas, some forty-five years after it went into production. Sir Donald Bailey died on 4 May 1985, sadly mourned by members of his family and his many friends.

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Management of Today's Sapper Officer

MAJOR M S NORBURY RE

Following commissioning in 1970 and tours in Hameln and Dover, he became ADC to the present Chief Royal Engineer when he was at HQ UKLF. In 1977 he moved to Waterbeach as Adjutant and then on to the RSME as AI Bridging, before going to Minley as OC 28 Training Squadron. After attending the Army Staff Course at Camberley he completed a tour as SO2 G2 HQ 1 Armoured Division, before assuming his current appointment as OC 23 Amphibious Engineer Squadron.

(*Background.* In one way or another the premature retirement of officers at senior troop commander and squadron second in command level affects all regimental officers. This point was raised by the Engineer in Chief during his initial visit to 28 Amphibious Engineer Regiment in the summer and in due course the author produced a paper on this somewhat sensitive and emotive subject. Three specific areas of concern have been studied and it is emphasised that the views expressed are those of the author and do not necessarily reflect official opinion.)

Introduction

Most Sapper officers who were commissioned in the 1960s or early 1970s look back on their early careers and remember enjoying themselves and having an almost supreme indifference about their career planning. If asked what PQS 2 involved or how an officer was selected to go to Camberley most of our officers would have been unable to answer. Life was lived for the moment and officers left their career planning to their Commanding Officer and to AG 7.

Today, things have changed. Our young officers have a different concept of life and

Major M S Norbury

their careers and it is this, I believe, that is causing so many of our officers in their middle to late twenties to leave the Army. Unless we acknowledge the changing world and bring ourselves up to date there is a very real danger that the current PVR situation will only get worse.

The reasons why officers choose to leave the Army are multifarious but in my view most feel disenchanted in some or all of the following areas—their aspirations, their leaders or the status of their wives.

Aspirations

Today's young school leaver who decides to join the Army attends RMAS for whichever commissioning course is appropriate. This course is an intensive and high pressure one. Gone are the days when life at Sandhurst, in its broadest sense, could be really enjoyed. Young officers then join their Regiments or Corps believing that the pace of life on SMC or SGC will continue in the unit, and of course it usually does not. This put together with the fact that today's school leaver has firm and positive ideas about how he wishes his future to pan out means that our young officers arrive in their new units keen as mustard, expecting to work hard and with clear ideas on the way ahead in their chosen careers.

Although formal career guidance at this stage is of little value, these officers do need briefing in general terms including details of their age, educational qualifications and the jobs they will have to do in due course. Up till the early 1970s most captains wanted good confidential reports but more for reasons of pride than its effect on their careers. Today's young officer realises the importance of his reports and will strive to do his best at all times considering an occasional lapse to be disastrous. He finds it difficult to believe his squadron commander when he says he is not concerned about any mistakes so long as the young officer learns the lesson and doesn't make the same mistake again.

As I have already said these officers expect some form of counselling. They want to know about PQS 2 and PQE training. Not telling them increases their sense of lack of control over their career. I would go so far as to suggest that most officers find the absence of security and stability in their careers profoundly disturbing. The first time they can see some sort of certainty is when PQS 2 is behind them. The spectre of PQS 2 has always been divisive but its importance is now perceived far earlier, thus the almost historical questioning of one's future done by those preparing for PQS 2 and then either going to Camberley or up the Staff Qualified (SQ) ladder is seen by our young officers and it concerns them.

In my view the Corps must take an aggressive stance on the management of our officers. It must be done in conjunction with the points I will make later but it is vital if we are to stem the outflow of talented officers. I propose that we instigate a formal two yearly career counselling letter which will include such details as:

Personal Details: Type of Commission
Age
Educational qualifications

Career to date: Jobs done
CR gradings
Standing with one's peers

Way Ahead: Jobs that need to be done
Time and space
Requirements of the Corps

It might well appear to some older officers that either our young officers don't need something as formal as this, or indeed that it usurps the role of the Commanding Officer. I would only say that I believe our officers are far more career conscious than

we realise. We will ignore this fact at our peril and we need to introduce some sort of common standard across the Corps. There are naturally differences in man-management and leadership in the Corps which in many ways is a strength but it is also a weakness. I have covered the former in some detail and would now like to look at leadership.

Leadership

The system for selecting officers to command squadrons or regiments in the Corps has changed little over the years. One thing that has changed is the situation whereby PB 7 are experiencing increasing difficulty filling squadron commander slots with high calibre officers. They are therefore likely to have the same sort of problems filling commanding officer slots in the years to come. This will in turn aggravate the position whereby commanding officers are often perceived to be using their appointments as a spring board to their future career rather than accepting it as their last proper command job and concentrating on that. Unfortunately it is a truism that Sapper commanding officers are always expected to look both upwards and downwards. An Infantry commanding officer is told how to defend a piece of ground—the Sapper gives advice and is then told what is required of him. The danger is that commanding officers, who are of course as equally career conscious as their subordinates, are perceived to be placing greater importance on their dealings outside the regiment rather than on the officers and men within it.

Our young officers are bright and perceptive and only too well aware of weaknesses in the chain of command. Unfortunately the impact a bad commander has on his command today is greater than it would have been a few years ago. Today's officers are far more outspoken in their views thus any discontent is more apparent and is discussed more freely. A view I have increasingly found over the last five or six years is that commanders at all levels are out to make their names regardless of the effect on their subordinates. I consider that this view, although not a new one, is aired because our officers feel that they are ignored as people, they are treated as nobodies and they are not led properly. In essence, therefore, I would suggest that we are getting bad at communicating with and leading our officers.

Officers today need two things. Their career needs to be managed properly and they need job satisfaction. More so than used to be the case ten to fifteen years ago an officer expects to have a job that keeps him busy, exercises his mind and thus gives him job satisfaction. It is sad that today's young officer often finds himself with too few men to look after his increasingly complicated kit properly, too much paperwork and the ever increasing restrictions on the Defence Vote. The first point is not a new one but the latter two are and they are getting worse. Our officers, therefore, often feel that they are set impossible goals and standards that they can rarely meet, however hard they try. Superimposed on top of this is a chain of command that is all too often overbearing, cramps initiative and discourages the making of mistakes, even in training. I do not believe that many of the points I have made here can be easily solved but there are certain things that we can do to ease the problem. For example I would like to see the Corps take a far greater interest in all our officers. In an infantry battalion a major event in an officer's career is marked by a letter of commiseration or congratulation from Regimental Headquarters. We do nothing and it is this overt apparent lack of interest that I have been alluding to all along that so concerns me. As a Corps, from the top to the bottom of the chain of command, we must all take a far greater interest in our officers' work, their lives, their future, their aspirations and their hopes.

Wives

Today's young wife is similarly different to those whose husbands were troop commanders or squadron seconds in command ten to fifteen years ago. A far greater proportion are trained in one field or another and wish to have a career of their own. They expect to give up work for some years to bring up a family but otherwise want

to use their minds rather than letting them vegetate in a somewhat parochial and stifling Army garrison, especially if they are abroad.

Most wives are quite simply not prepared to put their own aspirations behind those of their husbands. They view the Army with suspicion and not a little dread and realise that if their husband does not PVR then they can expect to lose some of their individuality and have to adopt a lifestyle alien to their wishes. They do not want to be subjugated, they want a high standard house, their own furniture and they don't want the hassle of moving every two years with its associated aggravation and penny pinching. It has been identified that moving is the single most stressful experience in marriage and yet the Army appears to take great delight in making it more difficult.

Somebody who has recently completed a detailed study of this one aspect of army life is Colonel Gaffney. In his report he is honest enough to say in paragraph 3.5 ... "We were unwilling at first to accept many of the things we were told at face value and mentally tuned them out as exaggerations, misconceptions or misunderstandings. However, to our dismay we found that most complaints could either be verified or that there was enough to support a misconception. We know, from talking to other officers of my own seniority that many share my own original scepticism and ignorance. Some find much of what we have to report uncomfortable, preferring, as I did at first, to believe their own, more palatable perceptions."

With the recent publication of this study I would not be so presumptious as to say I know all the problems and all the answers. I would only say that our wives have different expectations today. If they perceive that life in the civilian world has less hassle, more stability and the chance for a full career it is a strong wife who will not pressure her husband into at least thinking about leaving the Army.

Summary

HISTORICALLY we have always spent a lot of time managing our other ranks and their careers properly. Unfortunately we have not done the same for our officers and are now paying the price. I have concentrated here on what I consider to be the three major problem areas but I do feel that two things are likely to prevent a thorough overhaul of our officer man-management. The first is money, or rather the lack of it, and the second is the fact that to solve some of the problems would require a major review Army wide of some of our more accepted practices.

In my view the most dangerous attitude for us to adopt is one of complacency. Today's young officers perceive things differently from most officers in the Corps over the age of thirty-five. It is therefore logical to assume that our more senior officers do not fully understand the concern of these young officers. This fact is borne out by what Colonel Gaffney has to say in his study.

I have deliberately made few suggestions as to how our officer management and leadership might be improved. The reason for this is not that I do not have ideas, but rather that I am concerned that any recommendations I make might be considered too costly or impractical and thus the whole problem ignored without further thought.

Having said that, I would dearly love to see the Corps strive to improve the quality of regimental life within the Corps. One way in which this could be done is for us to make use of our pool of Colonels Commandant. Why not invite each of them to father a group of officers. With their wealth of experience and knowledge they could provide a degree of continuity, stability and counselling over the years that is lacking at present.

RAF Saxa Vord

LIEUTENANT A BOTTING B Sc(Econ) RE

The author was commissioned into the Army in September 1983, joining SGC 4 after reading Economics and International Politics at Aberystwyth University. Prior to attending 83 YO course at the RSME he spent a couple of months as a climbing instructor at JSMTC Scotland. He joined 38 Engineer Regiment as a troop commander in March 1985 and has commanded both a support and field troop. His service with the squadron has taken him on exercises to Germany and Kenya.

RAF Saxa Vord on Unst, the northern most island in the Shetlands, is in a rather desolate and isolated part of the British Isles: the only albatross in the northern hemisphere has chosen to make its home on the other side of the hill, and a tree does well to grow as large as a rose.

A new aircraft navigation beacon was needed before the end of September 1986. The site selected was on Vallafield and the second highest hill on the island at 600ft, overlooking both the Atlantic and the North Sea, was chosen. There was no access road and none due to be completed until late 1987. Furthermore, PSA contracts could not be tendered or completed in time thus 11 Field Squadron was tasked with about two weeks in which to prepare. The Squadron was required to construct the concrete base onto which the RAF would bolt a radome. The dome was to house a Tactical Air Navigation (TACAN) beacon, an American equipment normally free standing in a field, but housed in a tent by the RAF in Belize. A tent, however, was hardly robust enough for the North Atlantic.

The nature of the problem then, was chiefly logistic. The construction of a 6m diameter circular concrete pad with no reinforcement (as it interferes with the beacon) would be relatively simple, for example, at Ascot race course, but construction three miles uphill, across a peat moor from the nearest Landrover track, and three ferries away from the Scottish mainland, presented a whole host of new problems.

The first of these was the acquisition and transport of stores to site. Long Marston received a copy of the stores list and containerised them for shipment to Unst. They also prefabricated the formwork required. Secondly, the RCT at Bulford was contacted to obtain two BV 206 Hagglunds as used in Norway to enable the workforce to reach the site every day. These proved invaluable, as the only wheeled vehicles that could reach the site were three wheeled Honda motorcycles. RAF Helicopter support provided a Chinook at various stages throughout the project to airlift stores and concrete to site.

Having thus far got the project underway, a recce was undertaken by OC 11 Field Squadron, the Troop Commander and Recce Sergeant of 2 Troop; DR and PR in hand, three days were spent arranging accommodation, plant hire, landing sites for the Chinook and a multitude of other requirements. On our confident return to Ripon the majority of our solutions became out-dated as the ground rules changed daily.

After a further frantic week we were almost ready, indeed ready enough to leave at 0001 hours July 1986. We eventually caught a ferry from Aberdeen, having narrowly escaped with our lives from Arbroath after reckless comments had been

Lieut A Botting
RAF Saxa Word

Photo 1. Pouring concrete.

made to Marines by one of the drivers. However, before leaving Aberdeen there was a telephone call from OIL (Shetland) Ltd, purveyors to the oil industry, asking why the containers had not arrived for their crane to off-load. An interesting hour then passed as the civilian buck-passing machine got into full swing, the carriers concerned finally nominating the P & O representative at Lerwick the guilty party.

On arrival the next day at Lerwick the said guilty party was tracked down and explained that he hadn't sent the containers on as "he didn't know we had a crane". "Ask and ye shall be told" was the essence of the somewhat blunt reply.

After a further two ferries, little bigger than a shoe box, we arrived at Saxa Vord to find the containers and crane had finally met up and were being off-loaded to the sound of ringing alarm bells. The BV 206s were off-loaded and we all settled down at Saxa Vord, crammed into PSA accommodation, four men to a one man room, and ten in a room prominently labelled "Sitting Room": perhaps it should have read "Sitting Room Only".

The following day was a site recce for all concerned: both BV 206s took the Clerk of Works, Surveyor and rest up the hill, meandering around the peat groughs to find the best route for the daily "Journey of Death" as it became known, taking an hour each way from Saxa Vord to site.

Work then started on what can only be described as an uncommonly exposed site. The land dropped steeply to the sea to the west, sloped gently to the east and was devoid of any shelter from the wind whatsoever. The first task was to dig down to bedrock by hand which proved not too tiresome. Construction then began and progressed as follows.

Initially the very rough bedrock was evened off by the laying of a rubble wall to provide a relatively level base on which a block wall could then be laid. This wall was circular and 6m in diameter, built to a tolerance of ± 2mm. Once this was complete circular formwork was bolted to the top to achieve a smooth regular surface. Concrete was then poured into the hole thus formed and was subsequently scraped away at the circumference to create a chamfered edge for water run-off. In the centre of the circle a central plinth was cast to enable a finish to be applied and a ramp was cast up to

the edge of the circle, to which the wall was butted. Power cables were laid in a 300m long hand dug trench and the electrics completed. Finally an aggregate hard standing was put down for a standby generator.

Initially the blockwork was started using materials carried up piecemeal by the BV 206s until the first Chinook arrived. This carried two out of the three containers up the hill, followed by a Bristol compressor, a 200 litre mixer, a hired water bowser, a builders skip containing aggregate, and blocks and sand in a net. Only the mixer was placed exactly where it was wanted, third time lucky. Work then proceeded on schedule, interrupted at regular intervals by farmers complaining either about the peat, (the ridge suddenly becoming prime peat-cutting land when the islanders heard about the road), their fences or their sheep. All of these were thorns in our side for the duration of the project.

Once the wall and formwork were completed, the ramp and plinth having been cast from concrete mixed on site, it was time to pour the bulk of the concrete. The logistics of mixing twenty-seven tonnes of concrete on site were too appalling to contemplate, and this was therefore pre-mixed by a contractor at Balta Sound airstrip, two minutes flying time away and in line of sight. The DR & PR specified $1m^3$ skips to be used by the Chinook to airlift concrete to site, but those supplied were substantially smaller than this, and hopelessly inadequate. Three excellent $1m^3$ skips were subsequently purchased and arrived with hours to spare having "got lost" in Scotland for five days. Unfortunately the pre-mix lorry then missed the ferry and it was 1100 hours on 9 August before the first load flew up the hill.

The day progressed fitfully, collapsing in chaos as the Chinook broke down and was repaired, the pre-mix truck ran out of aggregate, air traffic clearance to collect more from Lerwick was denied, and finally when the Chinook broke down once more. Formwork cut from anything that did not move fast enough suddenly appeared in the hole, and the proposed continuous pour had a vertical joint, ending up looking like a pie with a segment missing. Long faces were the order of the day as the bricklayers worked into the night completing the finish.

The ensuing day, the pre-mix lorry had a fresh batch and the Chinook was healthy again. But this day brought a new problem: the day before, the concrete had to be shovelled into the skips but flowed out, this time it flowed into the skips and stoically refused to come out unless attacked for about fifteen minutes with vibrating pokers, sledge hammers and shovels. The only cause of this that we could identify was that the cement was different on each day, the first being Febmix and the second Febcrete. The general consensus of opinion was that the structural strength of the base was not affected significantly in the light of the stresses to be imposed on it, and the joint was not visible after the surface had been ground down.

For the entire duration of the project a small group of sappers had been digging the trench for the power cable. This trench flooded regularly every night and a cunning arrangement of dams had to be used so that work could progress. Much time was needed to break the boulders that lay in the way by hand. The normal procedure is to lay sand at the foot of such a trench, but the logistics were too great. The solution was to use plastic agricultural drainage pipes that fitted over the cable like a sleeve. Had sand been used the project would have been delayed for many weeks as the night before the cable was laid the torrential rain that fell would have washed all the sand to the downhill end of the trench.

The project as a whole was interesting for its many aspects: it produced many problems in equipment, man and crisis management and was full of those minor calamities that somwhow never make their way into the site diary, and those larger catastrophes that have to be recorded. It was rewarding to take a troop of 11 Field Squadron to literally the northernmost point of the British Isles and to work on the most inaccessible part of that island. The problems encountered were not just those of a military or constructional nature with any urgently needed supplies having to come from Lerwick seventy miles and two heavily booked ferries away, but also those of a diplomatic nature as much discussion was needed with landowners.

Photo 2. Finishing off the concrete pad.

The project was finally completed on time and once the concrete had cured the RAF managed to erect the dome on the second attempt. The TACAN should be operational shortly.

* * * * *

The Museum of Army Transport, Beverley

In view of the Corps' historic connection with military transport we publish this invitation from the Museum of Army Transport.

Photo 1. A "between the Wars" Morris 15cwt truck, a Dingo and Monty's Rolls-Royce lined up at the Museum entrance.

On 15 July 1965, as a result of a report written by General McLeod, there was a big shake up in the supporting Services of the Army and the Sappers gave birth (yet again) to more Corps Babies. This time it was the operating and workshop sides of the Transportation Service RE and the Movement Control Service RE. Railway and Port Workshops were absorbed by REME while Railway and Port Operating and Movement Control was combined with the transport functions of the RASC to form the Royal Corps of Transport. The Royal Engineers still remain responsible for railway and port construction and maintenance.

Railways were based at Longmoor and for a variety of reasons it was decided that the old Transportation Museum should be amalgamated with relevant parts of the various Longmoor model rooms to form the Royal Corps of Transport Railway Model Room and Museum. Later this moved from Longmoor and after a short stay at Leconfield, where it joined up with the RCT collection of Army vehicles and other vehicles on loan, it was moved to Beverley. Here, in an ex-tannery building, the collection had a chance to be displayed to better advantage.

The Museum has two acres of exhibition hall, together with one and a half acres of open-air displays; in this latter is being re-assembled the first production model Blackburn Beverley Transport Aircraft ever to fly—and the first one ever to be moved by road for that matter—around which in due course a narrow gauge railway is being developed. Other facilities include plenty of parking, a shop, WCs, a cookhouse and a mid-day licensed bar. There is also an audio-visual and conference centre which is self-contained and can seat some 200 people.

Passing through the Reception Area which houses "Monty's" Rolls-Royce and a WD Fire Engine and the locomotive *Gazelle*—*Gazelle* is the smallest standard gauge steam locomotive ever to have been made—one reaches a small area given over to the Crimean War when the first military railway was built and operated. Then comes the Railway Section. This houses locomotives *Woolmer, Waggoner, Rorke's Drift* and *AD110*. There is also a re-build of a World War I armoured train gun truck on its original wagon. *Woolmer* is said to be the only loco ever to have been completely

The Museum Of Army Transport Beverley 1.

Photo 2. A White half-track in the Desert Scene.

derailed in the middle of a drill square while *Rorke's Drift* was built in 1934 to see if this thing called diesel was going to be any use on a railway. To these are being added a variety of tank carrying wagons owned by the British Army . . . but "What's this? A huge hook mounted on a railway wagon!" This is a German device. Lower the hook under a sleeper, attach two big engines and off we go. Result . . . a mess for the Sappers to repair! It was captured in Italy. Moving on, to the specially built Railway Gallery housing some thousand photos and artefacts, we pass some World War I narrow gauge railway wagons; one of these is an Ambulance wagon—one of only two that remain—now under restoration. Moving on we pass a signal box incorporating the old lever frame from Oakhanger Blockpost, Longmoor Military Railway (LMR) . . . and so to the Railway Gallery where are displayed Film Stills from pictures made with the assistance of the LMR: *Top Secret, Young Winston, The Great St Trinians Train Robbery, Inn of the Sixth Happiness* and others. Straight ahead is the Railway Workshops and Re-railing Room displaying relevant photos and artefacts while to our right we find the Permanent Way and Railway Bridging Room. Here, amongst other things you will find a manual, fish-plate hole drilling machine—twenty minutes hard labour per hole and eight holes required for each joint! Our predecessors were mighty men! Thence to the General History Room holding items of 8th and 10th Railway Companies RE. One wonders what these Field Company men must have felt on being told that they were now Railwaymen and would be trained as such on the London, Chatham and Dover Railway before going out to Egypt and the Sudan. This room also houses a small Movement Control Section which contains, amongst other things, what must be the Queen's last ticket. Journey: From London to Nairobi. Passenger: HRH The Princess Elizabeth. Date of issue: 28 January 1952. Crossing the passage we are in the Railway Signalling and Traffic Room with its block instruments and miniature locking frame used by thousands of students. Next to this is the Locomotive Room with details of many Longmoor locomotives and interesting workable models of steam valve gear. The final room commemorates the Longmoor Military Railway itself; its contents cover items from the railway and photographs from its earliest days.

The Museum Of Army Transport Beverley 2

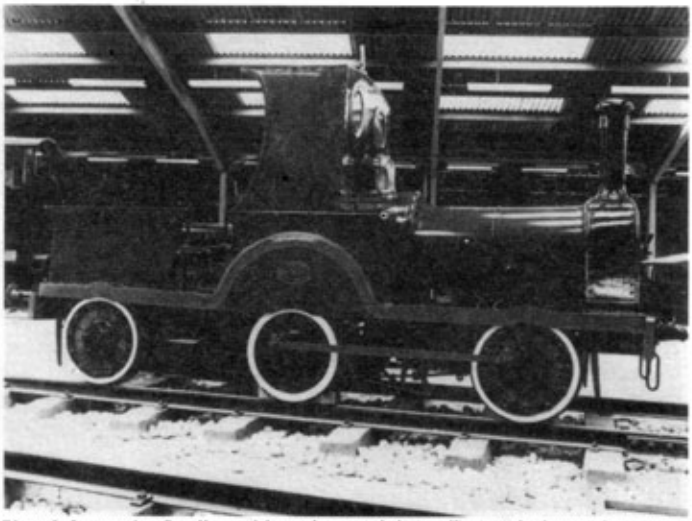

Photo 3. Locomotive *Gazelle*—a rich man's toy and the smallest standard gauge loco ever to have been built.

From the Railway Gallery we pass through the gloomy, muddy scene of a World War I narrow gauge railhead where road transport is being loaded from narrow gauge railway wagons. Included in this display is an ambulance to carry horses—this is thought to be the only one of its type in existence. There is also a Chinese wheelbarrow commemorating the assistance that the Chinese Labour Battalions gave. Our way now takes us through the period between the wars. Here we see a three wheel motor cycle with the wheels in line and an early attempt to modify an off-the-peg vehicle to improve its cross-country performance by giving it a second powered rear axle . . . and so on to a World War II scene. Picture, if you will, an RASC MT unit workshop in a French orchard under cam nets, in the background the usual workshop noises . . . and you're there. As we emerge we come up against a Comet tank on a transporter—just one of the loads that must be carried as indeed are the well simulated casualties in an Austin ambulance. And so into a German barn taken over as an HQ with the usual office and communications vehicles.

Now to the realms of fantasy as we pass through the Experimental Section—a battery powered car; a Harrier motor vehicle which folds up into its own travelling crate; the Rhino (the only one of its breed, built to see whether a heavy wheeled vehicle could be skid-steered like a tank and playing its part in the design of the Stalwart).

To bring us back to earth again we have a beach scene with DUKW, Bushmaster LVT III, Weasel and other vehicles. Ahead of us are vehicles used in Limited War. These are a hit with children as they have the word "Explore" on them—as do a number of items we passed earlier—and this means just that. When the kids have been dragged off we pass a Beaver aircraft shortly to be joined by a Scout helicopter and so through a park of Staff Cars including those used by royalty. Tucked away in *a corner is a Mobile Field Bakery. The oven was recalled to active duty in the* Falklands and then returned. Our final scene depicts recovery in the Western Desert.

We reckon you can fill the whole day with little difficulty. No problem over parking. How about a visit? . . . as an individual, as a family or as a regimental or other group.

The Museum Of Army Transport Beverley 3

Memoirs

BRIGADIER K H STEVENS MBE BA

Born 3 April 1914, died 20 September 1986 aged 72

KENNETH HERBERT STEVENS was born and brought up in Vancouver and joined the Royal Engineers in 1936 after a brilliant career at the RMC, Kingston. After the usual courses at Chatham and Cambridge, where he got a Blue for Lacrosse, he was posted in July 1939 to 55 Field Squadron.

In 1940 he went to France with 12 Division Engineers, together with his precious golf clubs. He was severely wounded in a train which was bombed by the Germans and was taken to a hospital in Niort where he remained during the Dunkirk evacuation. After the armistice with Germany he managed to reach Bordeaux with six other wounded officers. They were lucky enough to be picked up by HMS *Galatea* which was sent over to evacuate the British Ambassador. On arrival at Plymouth he was met by his batman, still carrying the golf clubs which he had brought away from Dunkirk. Ken spent the next six months in a convalescent hospital where his future wife was serving as a VAD.

In January 1941 he became adjutant of 9 Armoured Division Engineers and then took over 10 Field Squadron and later 146 Field Park Squadron. He got married and was posted to Chief Engineer Northern Command as SORE 2 Ops. In 1942 he went to the Staff College and from there to Chief Engineer 5 Corps. He went right through the Italian campaign for which he was awarded the MBE.

In 1944 he was posted to the SME India as Chief Instructor in Bridging, but after VJ Day he returned to E3 in the War Office. In 1948 he did a two-year exchange with Canada, becoming Chief Instructor at the Canadian SME. In 1951 he was recalled to be an instructor at Camberley and from there went to 23 Engineer Regiment in BAOR, first as 2IC and then for three years as CO, where he was greatly respected by all Arms and Services. In 1958 he became GSO 1 Ops in the Joint Planning Team in Singapore, where he became the driving force.

In December 1960 he returned to the UK to command 12 Engineer Group, part of the UK-based Strategic Command, and also dealing direct with the EinC over Christmas Island affairs. In November 1961 he was ordered at twenty-four hours notice to take command of a mixed force sent to Belize for rescue and rehabilitation work and internal security following Hurricane Hattie. He quickly got all problems under control and restored morale among civilian officials. In June 1962 a small-scale invasion took place from Guatemala. Ken directed an extremely tidy and efficient operation which resulted in the rounding up of the leader and half his followers, the remainder being chased back across the border.

In August 1963 he became Col AQ East Anglian Div/Dist and in March 1964 returned to Singapore as CE FARELF. RLC writes: "He was CE FARELF throughout the heat of the Borneo campaign in which the Sappers completed a massive

Brigadier K H Stevens MBE BA

programme of road and airfield development in one of the least developed mountainous jungle terrains in the world, coupled with the fortification of isolated infantry posts in which twelve battalions held back vastly superior Indonesian forces along a 1000-mile frontier—an unsung triumph of Commonwealth arms."

In March 1966 he returned to the UK as CE Southern Command. He became Chairman of the Southern Command Golf Society and did a lot to improve the Tidworth Golf Club. He was made ADC to the Queen and retired in January 1970.

After his retirement he became RO 2 in the RCT publications section. Such was his character that he completely identified himself with his adoptive Corps, showing immense loyalty and enthusiasm for the work and making many friends. He retired from this appointment in 1978.

Ken was a passionately keen golfer and a very good one, representing the Corps and the Army over twenty-five years and being Captain and Vice Captain of the Army Golfing Society and Army Champion in 1958. PVH remembers: "I can vividly recall every shot of his last two birdies to tie. Even Jack Nicklaus would have been proud to have hit those shots under those circumstances." He also won many other tournaments. He was Captain, Vice Captain and President of the REGS and captain of Liphook Golf Club in all of which he took a full part. JGTP says: "It was not just his skill, but his generosity and consideration for others less gifted that made him such a charming golfing companion. He was a true sportsman—magnanimous in defeat and humble in victory."

Ken was a keen fly fisherman and an expert furniture restorer. Many people will remember him repairing their broken treasures.

He died at home on 20 September 1986 of cancer, leaving his wife, Angela, to whom we express our condolences. She supported him wonderfully throughout his Army and civilian careers and was his regular golfing companion. They had no children.

HRG, WGAL, RLC, PVH, JGTP

BRIGADIER R E HOLLOWAY CBE

COLONEL D C S David MC writes:

"Dear Sir, may I amplify one sentence in the obituary of Brigadier R E Holloway in the September 1986 *Journal*. Rex took over command of 4 Field Company King George V's Own Bengal Sappers and Miners in the Western Desert in October 1940. Six weeks later he led it in the first successful British offensive of the war, the left hook across the desert by 7 Armoured Division and 4 Indian Division which, taking the Italians completely by surprise, captured four defended camps to the south of Sidi Barrani and opened the way for the advance to Bardia and El Agheila. It was not an engineer's battle, but the company supported 5 Indian Infantry Brigade in the attack on Tummar West Camp and afterwards helped to collect and remove the mass of prisoners and captured equipment.

A month later 4 Field Company was taking part in the advance of 4 Indian Division from the Sudan into Eritrea. At Agordat this was held up by Italian forces in the wooded hills around the town. 11 Indian Infantry Brigade gained a hold on Mount Cochen, the key to the position, but the situation deteriorated and a section of 4 Field Company which had been making tracks up the rough hillside was ordered to re-occupy positions evacuated by the infantry. Rex himself was ordered to take charge and organize the defence of the summit, still held by our infantry but hard pressed; this he did with distinction. In the course of the battle a detachment of the company made a bayonet charge to capture a machine gun post, for which action Jemadar Kirat Singh was awarded an IOM. After the fall of Agordat the Divisional Commander in a special order of the day drew attention to the part played by 4 Field Company which, he said, "contributed to a large degree to the success of the operation on Mount Cochen". Next day Rex left to return to staff employment, after three eventful and distinguished months of command.—Yours faithfully, D C S David"

Correspondence

Are We Playing at Being a Technical Corps?

Lieut Colonel W H T Spaight
BSc(Eng), CEng, MICE, MIHT
64 CRE (Works), Chilwell Station
Nottingham

Sir,—It was refreshing to read an article like Major Campbell's concerning the technical competence of the Royal Engineers (*Journal* Dec 86). I would agree with him that many of our regimental officers, especially those who serve for long periods in BAOR are not engineers. They have not been given sufficient opportunity to become more than general managers who are responsible for getting the right equipment and men to the right place at the right time. They have had little construction site experience.

It is time that the Corps decided if we wish or need to be more than assault pioneers only. If there is a requirement for the Corps to have an engineering capability then we must raise the engineering knowledge and experience of all our officers, not just a very small minority. Ideally most Sapper officers would become Chartered Engineers as part of their normal career and they should still have time to be employed in regimental and staff appointments. Only the few "high flyers" will not have time to practise engineering on their way to senior rank.

Finally I should like to dispute one point in Major Campbell's article. I still favour in-service engineering degrees. The non graduate, but the potential degree officer will join the Army younger than a graduate. He will also have the opportunity to serve in a unit before starting his degree and therefore will have had practical experience of his future job and should know how he will use his degree when he leaves university.—Yours faithfully, W H T Spaight.

Major G C Kershaw, BSc, CEng, MICE
62 CRE (Works), Chilwell Station
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Sir,—I agree with some of the points made by Major Campbell, in his article *Are we playing at being a technical Corps?*. The Corps does lack engineering expertise and there is a need to raise the general level of engineering ability. However I disagree with his conclusion that the PQE system is an obstruction to achieving this improvement. The PQE should be encouraged, in order to pull the Corps' expertise upwards from the top.

To gain his knowledge and skill the Engineer must go through a period of training and gaining experience. He must spend time in the design office and on site to confirm and enhance his training. To achieve this the Corps needs to undertake project work. This generally involves money, often other people's money. The Corps carries out tasks for many agencies. These agencies like to deal with qualified, experienced engineers. They are not inclined to continue seeing their finances spent on "training tasks" which may end up as less than perfect. Thus the Corps is forced to ensure a high chance of success by using people with higher qualifications than would normally be expected for the design of straightforward tasks. This may appear to be an argument for abolishing the PQE system but it is the opposite.

It is in the designing of a project to match the client's requirement to the capabilities and limitations of a Sapper Squadron that the real skill lies. Officers following the regimental system do not have the time or opportunity to work on large engineering sites and engineering expertise cannot be gained only from the construction of "mud

huts". To do a job well there must be a degree of specialisation and this is achieved with the PQE system.

The answer to the low standard of engineering within the Corps is to improve the knowledge, experience and status of the PQE. Knowledge and experience can be enhanced through interesting and challenging projects. These in turn will enhance the status by attracting high quality officers into the PQE stream.—Yours sincerely, Guy Kershaw.

Lieut Colonel P M R Hill, CEng, MICE
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Sir,—Major Stuart Campbell is right in deploring the low standard of engineering expertise of the 'standard' Sapper officer. Unfortunately his solution of recruiting engineering graduates in place of officers taking in-service degrees would not work, as most graduates enter the Corps at such an age that they can only fit in one tour as a Troop Commander. An alternative might be not to send Sapper officers on the RMCS phase of Divisions I and II of the Army Staff Course and use the time saved to give them engineering training and experience. Most of the RMCS course has little relevance to the needs of SO2(W) posts filled by the Corps and it seems to have been accepted that PQE officers with a staff qualification are equally suitable for these positions.

One word of warning. Battlefield construction will rarely be based on calculation but on engineering 'feel'. The slogan is that if it looks right, it is right. This 'feel' for what looks right comes with practical experience on construction sites and not from text books.—Yours sincerely, P M R Hill.

Major M D Cooper,
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Sir,—I read Stuart Campbell's article *'Are we playing at being a Technical Corps'* (*Journal* December 1986) with double interest as I am both a PQE and, as one of the Corps' two in-post fuels engineers, command the single regular STRE (Bulk Petroleum). At long last someone has aired the problem of PQEs and the closely related technical future of the Corps.

My belief is that the problem is more basic than Stuart suggests. I feel that the Corps needs to make a decision as to whether it wants to remain a technical organisation, like the Royal Signals or REME, or whether it wants to opt out from the ranks of the 'technocrats' and concentrate on being a combat engineer organisation with all the implications that that involves. If it is the latter the Corps must admit to the ever-decreasing and increasingly disillusioned PQEs that they are really an embarrassment and are, as many have long suspected, no longer required. If the Corps does wish to retain a full technical capability in logistic and construction engineering then it must positively reassure PQEs that they do have an important and valued place in the scheme of things. It should then seek to reassert itself, as a Corps, where encroachment has occurred into our traditional responsibilities.

The case of fuels engineering, which is of particular professional interest to me, appears symptomatic of the problem. The divisions of responsibilities in fuels matters between Corps in the Army, and indeed the RAF, are clearly defined in *Administration in War*. Throughout the world, except in Germany and particularly in 1(BR) Corps, these demarcations are recognised and are largely obeyed. Within 1(BR) Corps, and to a lesser extent in the Rear Combat Zone except on the airfields, the Corps appears to have abrogated the fuels engineering role almost completely to the RAOC. This

Corps has now gained enough rudimentary expertise, albeit of dubious engineering quality, to carry out all its own design, construction, testing and commissioning. It is now a fact that, as Stuart states, many others see the RAOC as fuels engineers. It is a fact that the Corps has no-one stationed in Germany who can act in a consultant capacity and redress the balance by supervising the construction quality assurance of expedient fuel installations. It is a fact that there is no RE unit in Germany, with the possible exception of 10 Field Squadron, who can carry out the Corps role in fuel engineering until the arrival on mobilization of the RAF Support Regiments and 29 and 30 Engineer Brigades. Finally, it is also a fact that a unit of 14 men is probably insufficiently established to carry out all the tasks that would be required of it should the Corps reassert itself.

Why is this? I am told that it is all a question of assets, troops to task, manpower ceilings, compensating reductions and financial cover; all good and probably valid staff cries. However, I and the members of my STRE do not see it like this. We feel that where there is a will there must be a way, and if the Corps really did wish to reassert itself in fuels engineering surely this could be done? Personally, I doubt very much whether that will does exist in the case of fuel and I suspect that the same may be true for other types of non combat engineer type engineering.

To return to the latter part of Stuart's letter, it is my belief that the Corps has to solve the problem of how it sees itself in the engineering field before it can decide how to improve the standard of general engineering experience in its officers. I suspect that this may take longer than the time that many PQEs are planning to stay in the Army.—Yours sincerely, Michael Cooper

Further views on this discussion, particularly from "the other side of the house" would be most welcome. The Deputy Engineer-in-Chief, who was in hospital when this issue went to press, will be commenting in the next issue—Editor

Major D A L Seekings,
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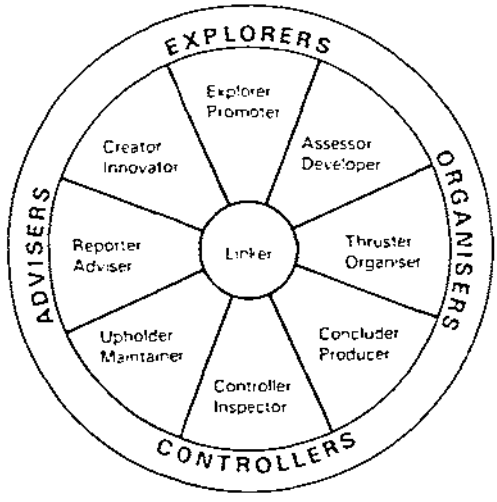
Judging Characters

Sir,—The extract from the letter from Brigadier Sir Mark Henniker (*Journal* December 1986) recording how General Bird, in the mid-1920s, was able to display an uncanny insight in judging characters. His method of casting his mind back to his own YO days and trying to see which of his contemporaries most nearly resembled the man he was currently reporting upon should not be dismissed lightly. General Bird had, no doubt unwittingly, used techniques which in some respects predate the contemporary work of Professor Margerison and Dr Dirk McCann by some fifty years.

Margerison and McCann have developed what they call the Team Management Index. Building on the earlier work of Carl Jung, Mintzberg, Myers-Briggs, Belbin and others, they have shown that managers (and, indeed by inference, army officers!) fit into a number of broad categories. Managers who fall in one particular category all display similar characteristics when working in a team or when acting as managers.

Broadly, managers fall into one of four categories—explorers, organisers, controllers and advisers. Within these categories, Margerison has identified a number of team roles which individuals tend to fulfil (see diagram). In many cases, the titles are almost self explanatory—we have all known Thruster Organisers, people who set up systems, allocate work and make sure time and output requirements are set, and who do not let obstacles stand in their way.



We have all also known Creator Innovators—people who tend to enjoy thinking up new ideas but who seem less interested in following them through.

Margerison and McCann developed simple tests which identify where individuals "fit" on the management wheel. In this way, it is possible to assemble balanced teams—for a team needs a balance of all type of managers if it is to be effective (a team made up only of, say, Thruster Organisers, will spend its time arguing about who is in charge rather than getting on with the task!).

It can readily be seen that, by observing the characteristics of different officers and fitting these characteristics to other officers who display similar traits, General Bird was almost certainly placing officers in their places on the "management wheel". Having done this, his pen pictures—like those produced by Margerison and McCann—would accurately describe the individual officers concerned. Yours faithfully, D A L Seekings.

Colonel W T Dennison, OBE
Regimental Headquarters
Royal Engineers

In Favour of Painted Warriors

Sir,—As Chairman of the Corps Paintings Committee may I say that the Committee welcomes the views of members of the Corps such as those given by Major Campbell in his article in the September *Journal*. However, in this case it is necessary to clarify the facts.

Firstly, the new Falklands picture was not designed to portray the war, but rather to commemorate the splendid work done by the Corps afterwards.

Secondly, much thought and effort by many people went into deciding how this might best be portrayed and wide consultation took place. The eventual content of the painting was agreed by the Corps Paintings Committee, the Engineer-in-Chief's Regimental Committee and the Chief Royal Engineer's Committee, which is the standard procedure before commissioning a new painting. The artist was given the exact requirement.

The Paintings Committee recognises that this was a one-off painting and it is their policy for future paintings to concentrate on "narrower", "more alive" subjects.—Yours sincerely, W T Dennison

Lieut Colonel A H Gye, MBE, MA
Coombe, Gracious Street,
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Officer Shortages

Sir,—Others, no doubt, share my sadness at seeing the advertisement in the *Supplement* (July 1986) calling for the re-engagement of retired officers. How far we have sunk from the days when the Corps was able to attract the pick of the RMA output.

I wonder if others share my reservations as to this recruiting ploy? Anyone attracted back is likely to be classified "Failed Civil Life", however unjustly, and likely to be resented by those officers loyally soldiering on who will see their opportunities for accelerated promotion to fill the gaps denied.

I can imagine no better way to accelerate the regrettable exodus of those now serving.—Yours sincerely, A H Gye

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The Development of the Tank

Sir,—The book *A New Excalibur—The Development of the Tank 1909–1939* by A J Smithers was well reviewed in the September *Journal* by "JEN", but he fails to discover the reason for the name "Tank" being adopted. Surely they were christened "Tanks" by Swinton "in the pretence that they were to be used for water supply, a deception which links them for ever with the Royal Engineers." This statement on page 75 of my ten years old book *The Royal Engineers* (Famous Regiments Series) has, to my knowledge, not yet been challenged.—Yours sincerely, Derek Boyd.

Book Reviews

FINDING WATER

RICK BRASSINGTON

(Published by Pelham Books—Price £7.95)

In an age when water supplies are taken for granted, it is refreshing to read a book that goes back to first principles. In doing so, the author has produced a simple and practical guide for finding, investigating and developing a water supply for those who cannot be connected to a mains supply. The book, written for a UK environment, examines where water comes from, how much water is available from a wide variety of sources and how to measure and obtain the correct amount from a source. It also includes useful chapters on the building of new sources including sources such as collection of rainwater, rivers, streams, springs, wells and boreholes, and on water quality and treatment.

The value of the book to a military engineer is, however, limited, because of his reliance on specialist equipment to produce water. Nevertheless, there are always opportunities when a young officer has to revert to first principles, especially in an under-developed country, and this book will be a very useful reference to him.

DIR

CHURCHILL'S PRIVATE ARMIES

ERIC MORRIS

(Published by Hutchinson—Price £12.95)

MUCH of Eric Morris' book consists of hitherto unpublished reminiscences of the costly operations of Independent Companies and Commandos early in World War II. Unfortunately it cannot be recommended as serious reading for student officers.

So far as the Corps is concerned, it mentions the existence of Sappers in some important new appointments—for instance that of Major John Rock as the first ever officer in charge of a Parachute Training School in the British Army—and other Sappers in numerous different operations. But their contributions are never studied in any depth. Moreover, throughout the book there are too many misleading "howlers", which should never have been allowed to appear in the final production of a researched book of this sort.

For example, on p30 there is the first mention of a well-known sapper officer, the late "Tiger" Urquhart, when he was Brigade Major to the Commander of the Independent Companies in Norway in 1940. In a note about him the author inexcusably mixes him up with Major General Roy Urquhart, originally HLI, the commander of 1 Airborne Division at Arnhem and who subsequently brought the rebuilt Division to take part in the liberation of Norway in 1945. Granted, "Tiger" Urquhart also became a well known Major General. But they were not even related!

An unfortunate error occurs on p205, where Morris refers to the loss of two glider loads of "Parachute Regiment" raiders in the costly and completely abortive first attempt to destroy the German Heavy Water Plant near Stavanger in Southern Norway. In fact, every one of these brave soldiers, all of whom lost their lives, some in brutal circumstances, were volunteer Sappers from 9 (Airborne) Field Company RE, a glider-borne unit.

It is irritating and confusing to any student of history that the name of Captain Maund RN—later commander of *Ark Royal* and, after she was lost, head of Combined Operations in the Middle East—should appear mis-spelt on p146 as "Mound", and in the Index as "Mount". Even the dustcover is not free from careless misprints. SOE appears as "FOE", once again to mystify the ignorant and stamp the book as a poor production.

The doubtful accuracy of some of the reminiscences of the author's raconteurs are, in your reviewer's opinion, more serious in character. For instance, the frequently mentioned commander of the Independent Companies in Norway in 1940, Brigadier (later Major General Sir) Colin Gubbins, subsequently became widely known as the forceful and intrepid military head of SOE, the Special Operations Executive. Yet, on p37 of his book, Morris refers disparagingly to a view of Gubbins' behaviour as showing "an unnecessary loss of nerve". At this time your reviewer was the other end of Europe, but he later served under Gubbins' command and he considers that in all likelihood this opinion of his behaviour is unjust.

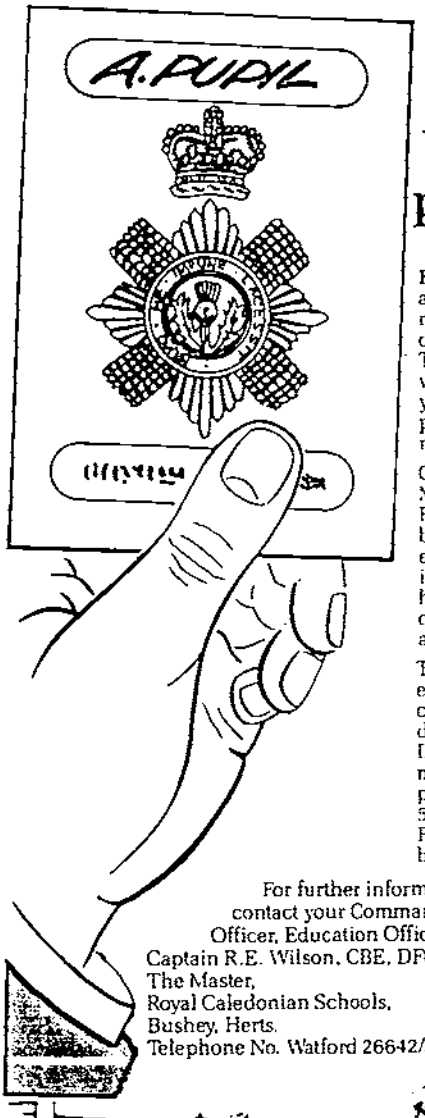
Yet again, on p128 of his book, the author gives the impression that SOE's primary work in the field was "intelligence gathering". In fact this was seldom more than an incidental task. SOE's primary role was encouraging and assisting in indigenous disruption and morale raising Resistance in enemy occupied countries. Deeply penetrating intelligence gathering usually remained the jealously guarded preserve of SIS, the Secret Intelligence Service.

Yet, in spite of being in so many ways a second class production, Eric Morris' researches have resulted in the publication of many hitherto untold stories of great heroism, all too often sadly, as is so much in warfare, wasteful. To this extent his book is deservedly readable.

ECWM

* * * * *

The Royal Caledonian Schools



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For further information
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Captain R.E. Wilson, CBE, DFC, RN,
The Master,
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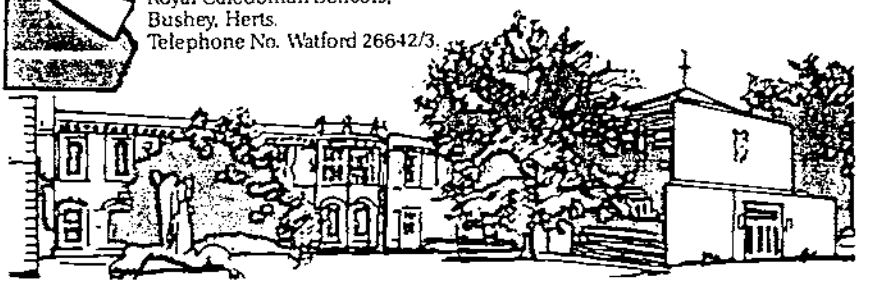

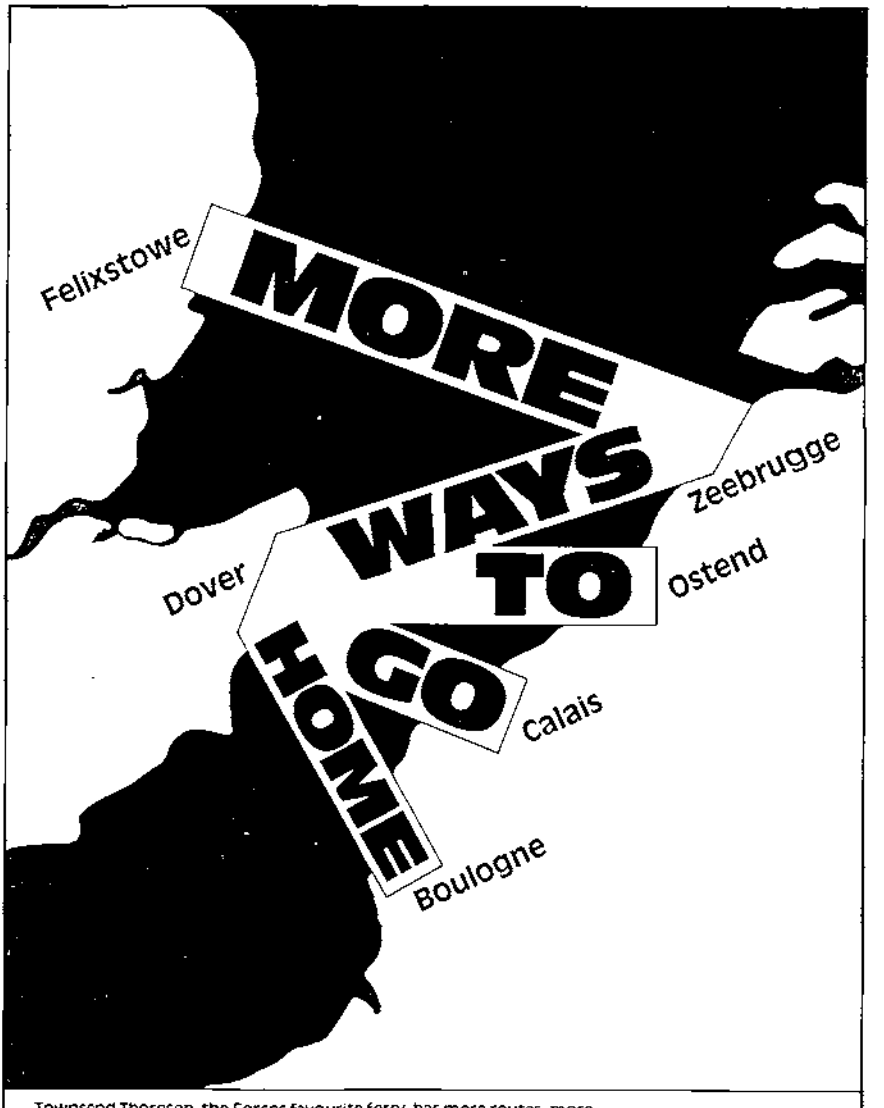

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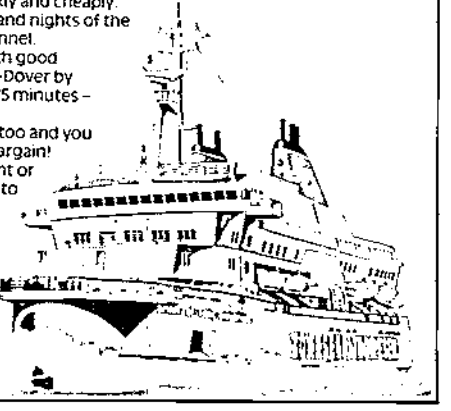

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