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No 3

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1984 Corps Annual General Meeting

ADDRESS BY ENGINEER-IN-CHIEF

At the Annual General Meeting of the Corps, held on 22 June 1984, the Engineerin-Chief, Major General M Matthews CB, spoke on Corps Affairs.

INTRODUCTION

"Each year has its own emphases, priorities and salient points. 1982 was the year of the Falklands and events there were predominant in our affairs. Last year the Corp's contribution in the South Atlantic reached its peak in terms of numbers and established the vital role that only the Royal Engineers can play in the consolidation of a base, in reclaiming an area from devastation, and maintaining a garrison in an inhospitable and distant land. However, already last June we were fully aware that the life of the Corps went on in other parts of the world, and that the tide of reorganisation, as well as bringing in some prizes (like the Airfield Damage Repair Squadrons) could be eroding the cohesion of our command structure.

"I know well that perspectives change with distance and that points of overriding concern at one period may seem less significant when reviewed later.

"However this year, for the first time since its creation, the post of Engineer-in-Chief is at risk. Not his location, he has been rusticated before, not the size of his headquarters, that is a continuing saga; but the existence of his appointment is under scrutiny. In my present position, you will understand that I feel this is a matter of some consequence!

"In the Falklands one more chapter has been completed with the ending of the Military Works Area. As in the fighting stage our Sappers acquitted themselves with distinction. Our work there continues.

"There is, as always, a great deal going on in the rest of the world which involves the Corps, sometimes alone, more often in support of others.

"Our Corps Affairs, regimental activities, sporting achievements and domestic concerns are always important and I am sure of interest.

"I would like to talk on all these subjects this afternoon; to give you some facts and to explain my own views where appropriate, and within certain limits of discretion.

REORGANISATION

"Before I come to the Army wide studies and the Secretary of State's initiative to recast the Ministry of Defence, I would like to mention the more evolutionary changes that have taken place or are underway. Last year I explained that the Chief Engineer UK had in practice been rusticated. Now the appointment of Commander Engineers BAOR is no longer held by a Major General but by a Brigadier. To compensate this loss the Army Board has agreed that the post of Chief JSLO should be 'tied RE' as long as we can produce a suitable officer.

"On the brighter side I can say that the expansion of our Airfield Damage Repair capability is proceeding on course.

"For Bomb Disposal we have a second Regular Army squadron formed and trained. You will remember that there are four TA squadrons. Plans are proceeding to increase the number of sections in each squadron. All this adds up to more EOD trained men than we have had since the Second World War.

"I come now to the more radical proposals and studies. I will give them in the order that they broke on us.

"First there was the Study into the Individual Training Organisation. I was particularly concerned about three aspects of this: Apprentice and Junior Leader Training, Signal Training and Driver Training. At one time we were in danger of losing Chepstow, and having the Apprentice course reduced to one year. It has been agreed that the Army Apprentice College will stay where it is, and the Apprentices course will remain two years. Instead the Junior Leaders will move from Dover to Chepstow when suitable accommodation is available. This will not be before 1986/87 and possibly not until 1988. Signal Training for the arms was to have been concentrated at Bovington and we would have lost the Signal Wing at the RSME. Fortunately, this is now unlikely to happen. There will undoubtedly be a considerable amount of driver training done under civilian contract but this will be under the auspices of 11 Engineer Group who will retain their advanced driver training capability.

"Not a result of this study, but still in the training world, it has been decided that the Royal Engineer Diving Establishment will move from Marchwood to train beside naval divers on the *Vernon* site next year.

"Second there was *LEAN LOOK*. Twenty-eight studies to find 4000 men to man new equipment coming into service in the near future. The requirement was to reduce the military manpower in the support and training organisations and redistribute them to front line combat units by the end of this decade: this as a single service, Army, study. The effects on the Corps are unlikely to be drastic. The process assumes a sort of progression from military manpower, to MOD employed civilians (civilianisation), to civilian contractors, performing the task. Looked at in costing terms this looks attractive, and where it does not show savings it does not happen. But may there not be a degradation in the response to emergencies by the individuals and their performance?

"The loyalty of soldiers is unquestioned. MOD civilians are part of the system and are to a great extent acclimatised to Military situations as experience during the Falkland crisis showed. Not so certain is the commitment of the employees of the contractor who happens to have submitted the lowest tender.

"LEAN LOOK was followed, and indeed over-shadowed by SHARP SWORD, another Army Single Service study."

At this point the E-in-C described the aim and guiding principles of the study. He then went on to say:

"After this it will come as no surprise that Arms Directors were to be subjected to special scrutiny. The study was directed to:

-Examine the existing *functions* of Arms Directors in accordance with the principles given and recommend how they might be most effectively carried out, in particular

-Provision of a focus for Regimental Corps and technical matters and the *requirement*, or otherwise, for an individual head of Arm.

-Coordination of special to arm matters between and within theatres.

-Provision of technical and special to arm advice to MOD and Commands.

-Professional Interface (not my words)! with civil authorities."

The E-in-C then explained that while SHARP SWORD was in progress, the Secretary of State announced his own study into the reorganisation of the higher levels in the Ministry of Defence. He gave an outline of the proposals and the discussions which had taken place at that time. He then continued:

"The Corps is a Combat Support Arm, and must organise itself according to the support required. This is as true of the command and staff functions as it is of men and material in the field. My conclusion is that the fundamental structure of the Defence Staffs should be decided, and indeed tried out, before the future of the Arms Directors is resolved. I now have reason to think that I am not alone in this view.

"The realisation is now gaining acceptance that the Director of each Arm is different from the others and that the E-in-C is more different than most.

"I am sure everyone here will understand that I am not putting up a defence for the Corps, far less for myself, but for our "Customers" in Army and the other Services. I am sure *they* need a two-star E-in-C."

FALKLANDS

"At the last AGM I spoke at considerable length about our activities in the South Atlantic. We have achieved much since then, but to a great extent it has been in completing projects already underway last year and which I described then. I say South Atlantic rather than the Falklands as we still have a detachment in South Georgia and tradesmen on Ascension Island.

"Since last June the third *Coastel Persuivant*, has arrived and been brought into use as troop accommodation. You may remember that these useful vessels are wholly self contained and provide recreational facilities, swimming pool, gymnasium, squash courts as well as the essentials for sleeping and eating for around 800 people on each. They generate their own electricity, desalinate and purify the water they need, and treat and dispose of the sewage.

"The Sappers were involved to a great extent in the installation, and mooring of the Coastels, including dredging in the case of the third as its draught exceeded the specifications.

"Many more buildings have been erected. The Falkland Islands Logistic Battalion and 37 Engineer Regiment have been rehoused and a modern Bakery installed in a Romney Hut. Accommodation intended for the Military Police unit was completed in time to be used for temporary hospital facilities after the fire in the Memorial Hospital.

"One of the most successful projects completed this year by the Corps has been the construction of RADAR sites. Two major sites were required on remote and inhospitable mountain tops. This undertaking was unique in several respects: each project had its own large container ship with added Chinook helipad, moored for the duration of the project in the nearest deep water anchorage; the only (practicable) access to site was by helicopter (the three dedicated Chinooks were required to fly a total of 1000 hours), 300 ISO containers had to be lifted into each site. Of course the whole construction programme had to be kept to a very tight schedule not only so that the work was completed before the end of the Falklands summer but also to tie in with radars and civilian radar technicians arriving from UK. There were also ship and tug release dates to be met. Many of the stores were prepared at Long Marston. The tasks were undertaken by 3 Fd Sqn and the command element and 1 Tp from 73 Fd Sqn. They laboured on site for nearly five months frequently in the most appalling of weather conditions whilst living in the stores containers as they became empty. They earned the highest praise from the experts for their standard of workmanship. The projects were completed on time and both sites became fully operational in the Spring.

"As Port Stanley has always been a very inadequate port, a remarkable installation known as *FIPASS*, has been constructed (the Falklands Intermediate Port and Storage System.) This comprises barges as a floating platform with storage sheds mounted on them, and a causeway to the shore. The Corps contributed not only to the construction work to the shore approaches but also in the acceptance inspection on the E and M side.

"Many improvements have been made to the Airfield at Stanley which you will remember we extended and resurfaced and has now been equipped with quite extensive support facilities, bulk fuel installations, workshops, weapon stores, liquid oxygen plant and so on. Two years ago it was a damaged basic black top strip with no infrastructure. In the meantime construction of the new airfield at Mount Pleasant is progressing very well. In 1985 one runway will be ready and by mid 1986 the airfield will be complete. At that time the centre of gravity of the British Forces will be shifted there; the garrison will leave the Stanley area and the airstrip will revert to a black top strip. This is easy to say but there will be much work in decommissioning the Military Area, lifting the airfield surface matting and removing the Expeditionary equipment.

"As I said in my introduction, the Military Works Area ended on I April. This does not mean that we are no longer carrying out works, but that technical respon-

sibility passed to the Property Services Agency, and that expenditure is now borne on their Army Quartering vote instead of Vote 1. In fact although the PSA took over the operation of the Quarry in January and the Power stations in May and June, the General Maintenance Team Contractor will not be in a position until August. In the meantime we are doing maintenance on PSA's behalf.

"At the time we handed over responsibility the Quarter Master General wrote to me to thank the Corps for its contribution. I would like to read you some extracts from that letter:

"With the ending, on 1 April 1984, of the Royal Engineers run Military Works area in the South Atlantic, the responsibility for 'works' in the Falkland Islands passed to the Property Services Agency. That date marks the end of not only a very significant chapter in the recent history of the Sappers but also the highly successful conclusion of the first real occasion on which a Military Works Area has been established. It is a credit to all, in particular in some of the early planning based upon the minimal experience we had from Aden days, that the concept of a Military Works Area should have been so successful. The conclusion of this Military Works Area should not go unremarked and I would like to record formally the enormous appreciation of the whole Army for all that has been done by the Sappers in the Falkland Islands. I know also that the Royal Navy, the Royal Air Force and indeed the Falkland Islands Government have very much appreciated all your efforts in the South Atlantic during the last two years". The letter goes on:

"It has been a most magnificent achievement. A major military airfield; a logistics base in Stanley; six other camps throughout the Islands; three mountain top radar stations; plus countless other jobs have been completed, all provided with a full range of utilities, all built in extremely difficult conditions, and all relying entirely on imported materials. The whole episode has been a timely reminder to all of us in the Ministry of Defence—and I suspect to those in other Government Departments as well—of just how dependent the Armed Forces are on their military engineers who, once their part in actual combat is finished, can, with equal ability, get straight on with the job of rehabilitation and construction. Especially, it has made us all more aware of the importance of the Royal Engineers' capability as constructions experts—The Chartered Engineers and the Clerks of Works—and of the need for the Royal Engineers own resources organization. We owe a particular debt of gratitude to those two elements of your Corps." What a nice letter!

"There remains in the Falkands one RE task that is NOT completed and certainly not an activity we can pass over to any other agency. Explosive Ordnance Disposal; Minefields and Battle Area Clearance. If I may, I will remind you of what happened, as some of the earlier reports of indescriminate mining were not fully accurate. The Argentinians laid extensive minefields around Stanley in a deliberate manner. They were well laid, recorded, and fenced. However later, when we attacked from the West and the Argentinians were suffering from "surprise" they moved out towards the hills and laid many mines in what one might charitably describe as a hasty manner. They were not all recorded or even accounted for; some were not armed, some even left in their crates.

"However the main reason why we have not cleared the main minefields is not due to the method of laying them, but the nature of some of the mines themselves. Some of the small anti-personnel mines have so little metal that we have no reliable means of detecting them. Nor has anyone else. Without a very high assurance of safe detection we are not prepared to risk soldiers lives or limbs except where there is a military requirement to clear mines. Many individual mines have in fact been cleared, and large areas opened to the public on the grounds that after investigation and search, no evidence has been found that they ever contained mines. Minefields have been marked and fenced, and the devices on their perimeters cleared.

"Research to find suitable detector equipment, a magic gadget as I called it last year, continues and at least one idea shows promise, but at best could not be developed for eighteen months. You will forgive me if I do not go into technical details.

"The task we call Battle Area Clearance in the Falklands is different from the problem of the minefields. In the areas where there was fighting masses of debris remained. We are particularly concerned with Unexploded Explosive Ordnance, but there were other unpleasant things as in the early stages, dead bodies particularly, in enemy prepared positions. The unexploded ordnance included booby traps of various sorts and abandoned ammunition. Some of it in dangerous condition and missiles and shells which had been fired but failed to explode through some malfunction. This late category being extremely hazardous because a device which has not worked as intended cannot be relied upon to function in any predictable way. So far 16.000 hectares of land have been searched, 252,000 items of unexploded ordnance dealt with, and 2.4 millions items of Small Arms Ammunition removed.

"To sum up on the Falklands: we are still active there but the operation is clearly running down. At the peak we had six field squadrons, a field support squadron, a CRE (Works) with specialist personnel and the Bomb Disposal detachment, under the command of a full Colonel. The last Colonel has now returned and command of all Sappers has been assumed by the CO of 37 Engineer Regiment. There are now two field squadrons, one support squadron, a specialist team (works), a specialist team (maintenance) which will be withdrawn when the PSA Contractor takes over in August and the EOD detachment. During next year we will reduce to one composite squadron containing its own support and Airfield Damage Repair elements.

"I would like to end this section of my talk with another short quotation, an extract from a letter from the Chief of Defence Staff, dated 10 May, to the CGS: "I would be most grateful if you would pass on to the Engineer-in-Chief, and all ranks of the Royal Engineers, my admiration and gratitude for what the Sappers have achieved on behalf of all three Services and the Falklands Islands Government over the last two years. Following their crucial combat support during the conflict, their subsequent construction efforts have contributed most significantly to our operational effectiveness as well as making life in the Falklands bearable for all who are down there, and I know also that the standard of workmanship has been, as one would expect, always of the highest. I hear, for example, that the radome manufacturers commented that the bases on the radar sites were the most accurate they had ever encountered.

"Altogether the Falklands Islands campaign and follow up has been a unique episode and one in which the Royal Engineers have written another proud chapter to their history."

SAPPERS ROUND THE WORLD

"We have considered the Falklands at some length, but we must never forget that Northern Ireland is still an operational zone.

"Our resident squadron is 33 Indep Fd Sqn which remains in support of 8 and 39 Inf Bdes. There is also a roulement troop, presently of 4 Fd Sqn from BAOR dedicated to search in support of the brigades. They have been particularly busy recently and successful major finds included a large culvert bomb near Rosslea, 375kg of ANFO (an explosive made of Ammonium Nitrate and Fuel Oil) near Castle Wellan, another 1200kg of the stuff near Six-Mile-Cross. Our divers have been very busy checking sewers, clearing fouled propellers on HM Ships, and many other tasks.

"In Hong Kong the Queens Gurkha Engineers have started a major project involving the construction of a five span fifty metre reinforced concrete bridge and a fifteen hundred metre surfaced road to the new training camp on Lantau island. Lantau is the largest of the out-lying islands in the colony, some 10km west of Hong Kong island. 67 Gurkha Field Squadron deployed in February to construct the camp for 100 men, which is now nearly complete. 68 Squadron deployed in April have started clearance work, setting out the bridge, and cutting the initial haulroad. The task is expected to take between nine and twelve months to complete. 67 Sqn Boat Troop continue to patrol the waters off the Chinese/Hong Kong border to pick up illegal immigrants. A 10 man detachment of 33 Engr Regt (EOD) have finished the clearance of Lye Mun magazine. In six months they dealt with 18,000 items of unexploded ordnance and one and a half tonnes of ammunition.

"62 (Cyprus) Support Squadron had a detachment with the British Force in the Lebanon until February this year. A Sapper Lieut Colonel and another officer visited the US Marines in Beirut after the terrorist attacks on the US and French positions, to advise on protection from suicide lorry attacks and rockets. The size of the detachment was also increased at that time.

"A Garrison Engineer is still running the camp maintenance for the Multinational Observer Force in the Sinai. Many units carried out training in Norway and Denmark. In Nepal MES Works were engaged in camp rebuilds at Kathmandu and Pokhara.

"59 Indep Sqn deployed to Canada for the annual exercise called *Waterleap* which combines projects and training: tasks included development of a 4.6km road, construction of an accn block and observation tower. There was also some electrical work.

"9 Para Sqn and Tp 69 Gurkha Indep Fd Sqn exercised in Kenya—tasks included acen and road construction at School of Infantry at Isiolo. Forty men from 15 Fd Sp Sqn carried out minor construction and maintenance tasks in Gibraltar. 20 and 8 Fd Sqns have taken part in exercises and adventure training in Cyprus. A detachment of 15 Fd Sp Sqn carried out repairs of the United Nations patrol track. A troop of 9 Para Sqn deployed to build a replacement HGB to the Akrotiri Mole. 9 Para Sqn, 69 Gurkha Indep Fd Sqn and 51 Fd Sqn have all been in Belize. In addition to combat support for the Garrison, they have carried out construction tasks including range renovation and accommodation blocks.

"I do not forget our specialist branches. Survey have been as active and far flung as ever. 42 Survey Engineer Regiment mounted a reconnaissance in force to Kenya in preparation for a major exercise next year. They are now in Norway supporting the Norwegian Artillery. 512 Specialist Team have been in the United States.

"The Postal and Courier Service have supported exercises in many countries where they do not permanently support garrisons. These included: Canada, USA, Norway, Denmark, Fiji, Kenya, Sudan, Turkey, Portugal, Malaya, Singapore, Papua New Guinea and Lebanon. Postal and Courier TA units are now almost fully recruited. A boost resulted from TA units taking over Hong Kong postal duties as part of their annual training. The change over from OHMS labels to the new system of costing each item of mail achieved a saving of $f8\frac{1}{2}$ million world wide last year. Although this section of my talk is called 'Round the World' I would like to mention some unusual and therefore well publicised events in England.

"34 Sqn and many tradesmen from other units and sqns were deployed to Greenham Common in support of law and order. They constructed nine miles of inner perimeter fence and erected, then repaired watch towers.

"33 Regt were dramatically portrayed by the *Daily Telegraph* and other papers taking part in the entry to the Libyan People's Bureau after the evacuation by its staff. They were acting in the search role.

"In the field of Corps Affairs perhaps the highlight has been the granting of the Freedom of the Borough of Weymouth and Portland to the Corps in May. We have had a long connection with the Borough and many of us think of Weymouth with affection. In this connection too I would mention the excellent Freedom Parades and celebrations held each year by a number of units in UK and in BAOR, which do much for the good name of the Corps and for good relations with many areas of the country.

"I would like to mention the establishment of a close connection we have made with the Worshipful Company of Engineers, [the 94th Livery Company of the City of London) since their formation last year. We are in the process of finalising a more formal link between us, which I believe to be very important. "In the past year we have commissioned a Cunco Northern Ireland painting and a Falkland Islands silver centrepiece. We now plan a Falkland Islands painting and Northern Ireland silver centrepiece, together with a portrait of General Sir Frank Simpson.

"I should also like to remind you that by the end of the year our Corps Bands will amalgamate and we shall have only one Band. Both Bands are playing splendidly this year.

"28 Amphibious Engineer Regiment have kept their regimental band active in Germany despite difficulty in recruiting for their orchestral section.

"A word about Recruiting. For the time being we are doing well for officers. Inquiries have increased since the Falklands Campaign and these have been converted by the splendid efforts of the Recruiting Staff into sufficient young men joining the Corps to fill our quota. We are getting our share of high quality despite the competition. However from next year, the so-called Demographic Factors, the decreasing number of 18-year olds in the national pool will make recruiting difficult again. We certainly cannot relax our efforts. For soldiers we are having few problems with adults or Junior Leaders. However we are really very short of Apprentices. I would ask anyone who knows of likely young men to do all they can to point them in our direction as Apprentices.

"Sport has had another good year despite our participation in many events being hampered by the heavy demand on Sappers for the Falklands. 25 Engr Regt are Army and Inter-Service Fencing Champions. 28 Amph Engr were runners-up in the BAOR Soccer Final. 35 Engr Regt won the Army Basket Ball, were runners-up in Army Hockey and also have an Army Judo Champion amongst their ranks. 26 Engr Regt were also runners-up in both Army Boxing and Squash. In the sailing world 21 Engr Regt were the BAOR Dinghy champions. The Corps were also team champions for the second year running in the Devizes/Westminster Canoe Race as too were the Rowing Club when they retained the Open Coxless Fours Trophy in the Joint Services Regatta. 3 PC Regt won the Army Cross Country and 65 Corps Sp Sqn were the runners-up. 14 Topo Sqn were also successful in winning the Army Rugby Minor Units championships. Our Junior Soldiers have also done well, particularly on the Rugby field where the Junior Leaders won the Army Juniors Cup and Chepstow won the Army Youth Cup. We had four members in the British Olympic Pentathlon Team at Sarajevo and Captain Mike Mumford will be in Los Angeles with the Pentathlon Team. Our 'Freefallers' continue to represent the Corps well and our Hang-gliding experts are still amongst the leaders in their field. Some of our climbers are members of the Army Team going to the Himalayas, Henry Day is off to Tibet and John Blashford-Snell continues to mastermind Operation Raleigh. I can also report that in our annual tussle with the Gunners we have so far won at Rugby, Squash, Hockey and Soccer and are looking to the Cricketers and the Sailors to continue the trend."

CONCLUSION

"I have now been at the helm for just over a year. I have had the chance to visit many parts of the world where Sappers are stationed and where they exercise. I have seen them working on a great variety of tasks in contrasting conditions.

"I can report, without fear of contradiction that the standing of the Corps with the Army, and the other two Services is, deservedly, very high indeed."

* * * * *

DON'T FORGET THE RE MUSEUM APPEAL

"What Made You Join the Posties?"

CAPTAIN R S SMALL RE



The Atahor was commissioned into the Corps from RMAS in Aug 1979, He spent 5 months at the PCS Depot at Mill Hill completing, the first of two officer training phases, The second phase was completed at RHQ 2 PC Regr RE, South Cerney in 1980, He was then posted to 21 PC Sqn RE based at Bulford as 21C and OIC AMF (L) PCS Det. In June 1981 he was posted to 11 PC Sqn RE as 21C. He is now 21C 21 PC Sqn RE.

A QUESTION for a title is sometimes frowned upon as it allows an easy answer in the form of several points listed in order. This particular question has been put to me many times during my short time in the Army, particularly by people who have just found out what Service I am in. This question arises from either ignorance of the Postal and Courier Service and its organisation, or through some mixed up sympathy for someone who couldn't get into any other Regiment. The latter reason always brings a smile to my face. I would like to explain my impression of the Service gained at Sandhurst as a cadet trying to decide on which Arm of Service to ioin.

Thad in fact gained entry to Sandhurst through the sponsorship of the RCT, participating in their excellent Potential Officer Cadet scheme. To all intents and purposes I had decided to join this Corps and thought nothing of the remainder of the Army. Influenced by what I had seen on presentations and visits, and the effects of platoon commander training. I decided the RCT was not for me. I felt that I required more scope in the areas of responsibility, variation and access to military training and use of initiative. During this indecisive period a small piece about the Postal and Courier Service during an RE presentation caught my imagination. I was curious as to why such a Service was not better advertised. A visit to their Depot was arranged which gave me an insight, albeit short, into the world of the "Posties".

What I found was a small, tightly knit organisation. It numbered some one thousand soldiers and some fifty officers, who had the large responsibility of ensuring that a postal and courier service was provided for the Army, Navy and Air Force worldwide. The Service consisted of a Directorate based in London with a Brigadier in command. The Depot, also in London, acted as the main office for all outgoing overseas forces mails, as well as the main training centre for Postal and Courier Operators. With four Regular Regiments located at Hannover BAOR, South Cerney UK, Dusseldorf BAOR and Brüssels SHAPE numbered one to four respectively. 2 PC Regiment RE as South Cerney had squadrons, one at RHO and one at Bulford. This wide flung organisation obviously provided the chance of travel.

The fact that these small sub-units spread around the Forces globe were responsible to their respective formation commanders, more often than not Generals, impressed upon me the responsibility held by their officers and men. This independence and close liaison with every type of Arm and Service within the Forces indicated that a career with the "Posties" would not only be varied and interesting, but also challenging.

Forces administration in peacetime is very dependant upon the Postal and

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Captain R S Small RE

Courier Service and in wartime both morale and operational effectiveness, especially during electronic silences is heavily reliant on the Rapid Response and courier service provided. Having had this illustrated with references to a world plan at the Depot, I decided that joining the Service would provide an interesting and varied career.

Having spent just over four and a half years with the Service I feel that the appreciation I made at Sandhurst was the right one. My first year was spent in the UK attending military courses and learning the technical procedures within three environments, the Depot, RHQ of 2 PC Regt RE and 21 PC Sqn RE. Travel to Norway and Turkey with the AMF broadened that experience. Then followed a three year tour, that I am finishing shortly, as 2IC 11 PC Sqn RE in support of 1 Armd Div in BAOR. This Sqn provides postal and courier support in peacetime through nine FPOs in the major stations in the Divisional area. On exercise it supports the major formations from Brigade to Divisional level.

1 Armd Div provides a very busy calendar for all its Units and 11 PC Sqn RE is no exception. Not only Divisional commitments but our own Regimental military and adventure training has kept the Unit constantly active. This appointment has provided me with excellent practical experience and technical training.

In conclusion, not once have I felt my decision to join the Service was wrong, in fact it has been strengthened as each year has passed. I have realised that the Service becomes more interesting as you work towards making it more efficient. My answer to the question "What made you join the Posties?" is not the inability to join some other Arm or Service, but that the Postal and Courier Service offered me early responsibility, travel and the chance to work within a wide and therefore varied military structure.

The Requirement for New Armoured Engineer Vehicles

LIEUT COLONEL J H MCKEOWN RE, M Phil

Lieut Colonel McKeown joined the Regular Army in 1966 after a short spell as a TA Officer with 116 (Devon and Cornwall) Engr Regt. His first short tour with the Jnr Ldrs' Regt RE was followed by three BAOR tours, successively with armoured, field and amphibious engineers, including two tours in the infantry role in Northern Ireland. After Camberley, he was GSO2 (Intelligence) of the Sultan's Armed Forces and then commanded 34 Fd Sqn in the UK, Belize, Gibraltar, France and BAOR. On promotion to Lieut Colonel in 1979 he was appointed Army DS at the RAF Staff College, and in 1980/81 was one of the first Service officers to take the Master of Philosophy degree in International Relations at Cambridge University. He has commanded 32 Armd Engr Regt since March 1982.

The armoured engineers are currently in the third stage of a four-phase expansion which will double the number of Engineer tanks working in support of 1 (BR) Corps.

The original reason for the expansion was mainly concerned with the increase in the threat from scatterable mines and the decision that ploughs mounted on tanks manned by the Corps would form a major part of our counter-measures. AVRE's, due for phasing-out, were therefore reprieved. Conversion of more tanks was ordered. Decisions to form additional MBT (Main Battle Tank) regiments followed, with an appropriate extra scale of armoured engineer vehicles authorised.

Recent changes in tactical thinking in BAOR place a greater stress on more mobile tactics and the necessity for fast-moving, hard-striking counter-move forces. These thoughts re-emphasise the need for armoured engineers, and the requirements for at least the present expansion is now accepted as an urgent operational necessity.

The present outline organisation of 32 Armoured Engineer Regiment is shown in Figure 1. It will be seen that half of the Engineer tanks are AVRE's which, unlike the AVLB, are based on Centurion chassis. These are old, with a performance which no longer matches the current MBT, and serviceability which requires additional specialised work to maintain and which is likely to decline over the years as the base vehicles age and spares availability drops. There is already a significant difference in serviceability of the AVLB and the AVRE, and a higher workload for equivalent repair work on the latter.

This is a serious problem, as the AVRE is the workhorse of the armoured engineers. Although the AVLB is the vehicle most commonly used in peacetime because it is relatively simple, and carries out a single function which is necessary and apparent to all—the AVRE is the vehicle which will be of greatest utility in war; it can demolish small targets, parts of large targets, strongpoints and barricades with its gun and blade; can doze; clear mines with its plough and Giant Viper; lay 50 per cent more class 60 trackway than a CET in one drop; and with a fascine can "bridge" over 80 per cent of gaps in the 1 (BR) Corps area. It is a very useful vehicle in urban fighting, which will be one of the features of developing tactical thought in BAOR in the next decade.

The combination of assessed need and the declining asset which we now hold makes the provision of a new AVRE a high priority. As many will be aware, work is already proceeding on this, though it is iconoclastically being termed the AEMV (Armoured Engineer Mobility Vehicle). As a contribution to the thought being devoted to the next generation of engineer tanks, I tasked my squadron commanders in the Regimental Training Director for 1983 to undertake studies whose main aim was "to provide information from experienced armoured engineer officers which will be relevant to the development of the next generation of engineer tanks."

I specifically did not say the new AVRE (or AEMV) because I do not consider that we should be tied to a concept of replacing like with like: a Centurion AVRE with a present generation AVRE, followed later by the replacement of the Chieftain AVLB by a new AVLB. For example, there would be a better balance if the AVLB had extra capabilities so that it could do some tasks at present done by the AVRE—perhaps the AVRE could then be a simpler vehicle. Perhaps, on the other hand, a single base vehicle which could undertake the whole range of necessary tasks would be more flexible in use and more casily manned and maintained: perhaps best of all if some of the attachments on such a vehicle could be mounted on trucks or light armoured chassis for similar tasks under less enemy threat.

The topics given to the Squadron Commanders were as follows:

(1) OC 26 Armoured Engineer Squadron. The battlefield requirement for armoured engineering; a conceptual paper on what combat engineer tasks need to be done speedily from vehicles with full armour protection.

(2) OC 31 Armoured Engineer Squadron. What armoured engineer equipment other nations have or developing. This should include WP tanks and those of our major NATO allies, but I would prefer the paper to be unclassified or restricted with a classified annex if necessary.

(3) OC 77 Armoured Engineer Squadron. The use of an AVRE or a similar tank in urban warfare.

My thoughts behind these topics were that the two more experienced squadron commanders should approach the question of new engineer tanks from opposite ends of a scale; one working from pure concept on the need and the other on the present state of the art to meet the need. The third squadron commander studied the AVRE in urban warfare as a specific point which I believe will be of increasing importance, and which I found fascinating during a short study on FIBUA in which I was involved in RARDE in late 1981.



NOTES:

Approximately half the AVREs will be converted 105mm MBT which will not have the 165 demolition gun.
Incl 3 × CET, 4 × Crusaders with spare bridges, 1 × ARV, 2 × 434 and 2 × 432.
Incl 6 × CET, 4 × Crusaders with spare bridges, 1 × ARV, 2 × 434 and 2 × 432.
Tps indicated with dotted lines are anticipated Phase 4 increase.

The squadron commanders' papers follow this brief introduction. No attempt has been made to produce a synthesis of them, though of course we are making a contribution to wolk on the new AVRE through the usual chain of command. I hope that the following papers will be a useful contribution to the process of defining and developing new armoured engineer vehicles, both in the Corps generally and to the small number of officers with the responsibility for the crucial new asset we will need to support 1 (BR) Corps in the near future.

Combat Engineering from the Protection of Armour

MAJOR D M ROY RE, MA



Tom Roy was commissioned in 1963 and, after a YO course, spent his one and only tour as a field engineer at Maidstone. After Cambridge, he served as a troop commander with armoured engineers in Hohne and Iserlohn before transferring his loyalties to amphibious engineers. A tour as Training Adjutant at Chatham preceded Camberley. Since then, he has filled a weapons post at RARDE wargaming and computer modelling, commanded 26 Armoured Engineer Squadron, and latterly, until his retirement in October 1983, served on the staff of Headquarters 1st Armoured Division.

REOUIREMENT

What is the battlefield requirement for armoured engineering? What combat engineer tasks need to be done speedily from vehicles with full armour protection? PREAMELE

INTRODUCTION

The South Atlantic War is but the latest example of the many campaigns in which the need for combat engineers to work in the open, unprotected and exposed to both manmade and natural elements, has been demonstrated. There are many combat engineer tasks which cannot be completed in any other way, and often these tasks must be undertaken without the aid of machines. Such is the lot of the Sapper!

At the same time, the intensity of any future war in North West Europe will mean that the protection of all resources will be vital for success. The withdrawal of the BEF in 1940 is an example where high Sapper losses were incurred through a lack of protection: the advance into Normandy in 1944, spearheaded by specialist assault engineer vehicles, is in contrast.

The Sapper, as an individual and as a unit, in the order of battle in 1st British Corps is well trained and prepared to work unprotected, but the Field Squadron is ill-equipped to undertake any task that requires a degree of protection. AIM

The aim of this paper is to undertake a conceptual analysis of the nature and scope of those combat engineer tasks which need to be executed from vehicles with armour protection.

LIMITATIONS AND ASSUMPTIONS

Discussion will be limited to those tasks likely to be encountered in a general,

Major D M Roy RE MA

and probably nuclear, war in NW Europe.

References in this paper to "armoured engineering" will imply those tasks which require a considerable level of protection for the troops undertaking the task, rather than to traditional and existing concepts of the description.

THE BATTLEFIELD

THE THREAT

The aim of any Warsaw Pact (WP) offensive will be to break through main defences and launch attacks into our rear areas in order to destroy our defensive capability, and particularly our means of waging nuclear warfare. They will seek to achieve this aim by a rapid advance with a superiority of tanks, infantry and artillery, and achieve success by a combination of comprehensive reconnaissance, the use of surprise, rapid manoeuvre and intense firepower.

If unhindered, WP forces possess the ability to sustain a rapid advance. Where possible, this advance will be along defined routes, although major road networks will not necessarily be chosen for these routes. Where advance knowledge of our obstacles is available, bypassing will be their normal tactic. Where bypassing is impossible, breaching from the line of march will be attempted. Deliberate crossings will only be undertaken when opportunity "bounce" crossings have failed.

Despite other assessments, it is considered that WP forces will seek to make maximum use of routes through urban areas. These areas are difficult to defend or deny, and there is considerable propaganda value to be achieved by the "liberation" of a major German city.

Such tactics will limit their capability to create obstacles to hinder our own mobility, and their counter-mobility effort is likely to be limited to rapidly laid minefields, often remotely delivered; attrition on critical targets by direct and indirect fire; and the opportunity seizure of our own obstacles when such an action is to their advantage.

WP forces possess considerable ability to bring attrition on our own forces, often in advance of the arrival of their own ground forces. Intense indirect fire can be brought to bear on critical locations; for example, over 80% of the area forward of our FEBA lies within the range of WP artillery positioned the other side of the IGB. In addition, they possess an impressive capability for aggressive air action, notably the use of HIND at considerable stand-off distances.

Surveillance during peacetime will have provided the WP with sound intelligence of our dispositions and intentions. The resolution of this information is difficult to define although it may be at combat team level or better. The intelligence picture available to the enemy will be further enhanced by the advent of battlefield surveillance in the far infra-red region: at such wavelengths, traditional methods of camouflage and deception will be defeated, and the only sure counter-measure will be to dig-in!

THE 1st BRITISH CORPS CONCEPT

The battle within the Corps area will divide into two main phases; the delaying battle and the main defence.

The tasks of the delaying force will be to identify aggression, impose delay, identify major thrusts and inflict casualties. Essential to this delay will be the use of obstacles although, as mentioned before, bypassing will be the normal enemy tactic. Of equal importance will be the maintenance of our own mobility, not only to allow this delaying force to achieve its aims, but also to allow its subsequent withdrawal.

Immediately behind the delaying force will be the main defensive framework, structured in depth to absorb the enemy's momentum. Positional defence on its own is unlikely to be decisive and, to win the battle, the enemy must be engaged and destroyed by mobile reserves strong in tanks and artillery. To allow quick concentration for counter-moves, these reserves must have minimum restriction of manoeuvreability. All units in the Main Defensive Area (MDA) will require mobil-

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ity and protection to allow them to fulfil their mission.

THE ENGINEER BATTLE

Much of the ground to be defended is not of our choosing as it favours the mobile attacker in preference to the defender. In addition, our numerical inferiority requires a plan which causes maximum interference to the aims of the enemy and, at the same time, forces him into postures which provide the best profile for attack by our direct fire weapons.

A comprehensive obstacle plan is therefore highly desirable, and a major emphasis is currently based on the need to complete as much of this obstacle plan as possible. However there are indications which suggest the fulfilment of this intention may be thwarted:

(a) Political restraints are likely to curtail the implementation of a complete and comprehensive obstacle plan before battle is joined.

(b) The shortage of engineer resources will limit the proportion of the requirement that can be achieved, particularly in a "short-warning" scenario.

Based on the threat, of equal importance to the preparation of the obstacle plan will be the provision of maximum protection of our own forces. There are unlikely to be sufficient time or resources available for this task once battle is joined and therefore this task must be completed during the preparatory stages.

The conclusion must therefore be that, in these preparatory stages, the priority of engineer work must put sufficient emphasis on the need to construct protective positions, as well as the creation of the obstacle plan. Otherwise for what worth will the latter effort be if our direct fire weapons have been destroyed before they can make advantage of what it offers?

A second conclusion is that, while speed is of the essence at this stage, protection of engineer working parties is unlikely to be a critical factor in success.

In the covering force battle, success will largely depend on the ability of commanders to maintain the mobility of their forces, since insufficient preparation time, likely enemy intelligence of our dispositions and the overall availability of our forces mitigate against a more positional defensive plan. Sappers must have the ability to open routes and breach obstacles, many of which will be of an opportunity and unpredetermined nature.

The opportunity for widespread counter-mobility tasks will be limited but, again, there will be a chance for opportunity tasks. These may include the closing of defiles when an enemy intention to select that route has been detected.

These likely tasks in the covering force area, together with the enemy's likely ability for surveillance, will require not only speed in execution of combat engineer tasks but also a high degree of protection for the Sappers involved.

In the MDA, the initial requirement, that is during the covering force action, is to complete the protective measures for the positional defence and the obstacles plan, as far as circumstances allow. Such tasks are unlikely to have to be undertaken under more than sporadic, and unaimed, fire, although it may possibly be in a chemical environment and also in areas in which saboteurs are operating.

The conclusion is therefore that priorities in the MDA during this stage must concentrate on the completion of these engineer tasks, and that, although there will be a requirement for speed, protection of the tasks is not likely to be a critical factor.

However, once enemy forces are absorbed into this positional defence and counter-stroke forces are launched, there will be a high level of mobility required, and much of the engineer work required to achieve this will need protection. *SUMMARY*

The factics and capabilities of the enemy require our forces to achieve a high level of protection, and considerable engineer effort must be devoted to this task. If, however, this protection is to be fully effective, it must largely be completed before battle is joined.

A comprehensive obstacle plan is essential and, as far as possible, the bulk of this

effort should have been completed before the start of battle. But in any case there will be a need to continue and enhance this plan during battle. Such continuation may include areas in which preliminary reconnaissance has not been possible, as a result of a rapid or unexpected thrust. It will certainly require rapid execution under a high level of protection in such circumstances.

By far the most important category will be the enhancement of the mobility of our own forces, in both phases of battle, and usually at choke points in the battle. Since the enemy can be expected to pay particular attention to these moves and redeployments, speed in execution will also be crucial to provide protection.

Overall, the requirement and priorities in outline for armoured engineering is for mobility foremost, but also for the enhancement of incompleted counter-mobility plans.

THE REQUIREMENT

LIKELY TASKS

Within the scope of the outline tasks discussed above, it is difficult to define exactly the scope of those tasks which should fall within the realms of the armoured engineer. However, for the purposes of this paper, it is taken to mean those tasks which must be capable of completion either before surprise is lost or, failing that, before enemy direct fire weapons can be brought to bear effectively on the task equipments. Local circumstances will cause wide variations but it is assumed that any such task in the latter category which takes more than perhaps twenty minutes is likely to fail.

The maintenance of the mobility of our own forces hinges on their ability to cross obstacles; both man-made, whether by the enemy or ourselves, and natural. However, since they will have been taken into account when our own mobility is planned, those obstacles constructed by us should not require undue emphasis.

The tactics of the enemy will prevent them from creating more than rapidly planned and laid obstacles: these may include the emplacement of nuisance minefields, often remotely delivered, the seizure of our own obstacles which they can turn to their advantage and attrition that they can bring to bear by direct and indirect fire weapons.

Natural obstacles are a more complex problem and probably present the greatest difficulty. They will have been taken into account in the pre-planning but, at the same time, obstacles which may inhibit such moves range from the simple ditch up to the canal, and they may have been unforeseen.

The need for counter-mobility effort will concentrate on the creation of rapid, but localised and manmade, obstacles and the enhancement of natural obstacles on an opportunity basis.

There will certainly be a requirement for the rapid emplacement of obstacles to close defiles on known or suspected enemy routes. There will also be a requirement to enhance and expand the obstacle plan created in the preparatory stages. There will be a need to emplace obstacles on known enemy choke points, such as river crossings.

There will be a need to complete the demolition plan, especially on critical routes and at reserve demolitions; this will be critical at those areas where completion of the plan by other means has become untenable through enemy action. There is likely to be a particular requirement for rapid counter-mobility effort under pressure in urban areas where political restraints and local sabotage may have prevented earlier completion of the plans.

THE EFFORT

Any definition of likely tasks should be qualified by factors which are likely to bear on their successful completion. Some of these factors have been discussed already: speed of operation as defined by enemy response times; protection, as defined by the level of attrition for acceptable working conditions. But there are other factors. The dichotomy of current engineer organizations has already been mentioned. In an ideal world, interoperability of manpower and equipments for pre-battle and support engineering tasks on the one hand, and armoured engineering on the other, would be desirable, but the realism of attaining this goal is questionable.

It is unrealistic to expect single equipments, faced with the contrasting requirements of conservation of resources in procurement and the probable attrition inflicted upon them in war, to be adequate. An alternative solution is the mass approach; three equipments, tasked together to provide at least one success and each with an overall reliability, used in its widest sense, of 33%, would produce a statistical overall probability of success of 70%.

Armoured engineering, in current terminology, tends to imply combat engineer equipments based on the chassis of the in-service main battle tank. In fact, the requirement is that such equipments should be capable of operation in similar conditions to the tank, but should also be able to expect comprehensive all-arms protection during exposure. The cost effectiveness of providing a lesser degree of protection, possibly involving the procurement of a specialist chassis, must be compared with the expense of providing the full protection of the main battle tank. *THE TARGET*

Based on the foregoing discussion, a possible statement of the future requirement for equipments to undertake armoured engineering on the battlefield is attached at Annex A.

Obviously specifically quoted figures in Annex A are based on individual experience and, before a target such as this could be translated into a requirement, they would deserve more objective examination.

SUMMARY

The likely enemy threat and the resulting 1st British Corps concept of operations will require a considerable amount of armoured engineering. The major priority of effort should be given to those tasks in support of the mobility of our forces in close battle circumstances: however there will also be a requirement to enhance counter mobility plans, either because it has not been possible to complete them before battle, or because of an unexpected threat.

The scope of the required mobility effort will be the ability to breach natural and man-made obstacles for which preplanned contingencies do not exist or which have failed. The scope of the required counter mobility effort will be the ability rapidly, and often from a stand-off distance, to enhance existing obstacles or create localized new ones.

Such atmoured engineer tasks must be undertaken at speed, preferably before surprise is lost, but certainly before the enemy can bring effective direct fire to bear on the task vehicles.

ANNEX A

GENERAL STAFF TARGET (PROPOSAL) COMBAT ENGINEERING FROM THE PROTECTION OF ARMOUR

OPERATIONAL CONCEPT

1. In any future war in NW Europe, combat engineers will be required to undertake a variety of tasks in forward areas, including East of the FEBA.

2. Many of these tasks will be undertaken under conditions of intense enemy attrition from both air and land based weapons. This attrition will invariably include indirect fire and will often include aimed direct fire as well. These tasks will also have to be undertaken in chemical and nuclear environments.

THE NEED

3. The major tasks which are likely to be undertaken in these conditions are as follows:

(a) The ability to provide crossings over all gaps which constitute obstacles to movement by armoured fighting vehicles. The essential upper span is 25 metres, although 40 metres is a desirable capability.

(b) The ability to breach all types of minefield likely to be encountered on the battlefield to an essential depth of 400 metres, and a desirable depth of 1000 metres.

(c) The ability to breach improvised or natural obstacles, such as tree blow-down or rubble in urban areas. The scope of this ability is subject to further study.

(d) The ability to emplace localized obstacles rapidly in all types of condition and climate likely to be found on the battlefield. This ability must include the capability to emplace the obstacle from stand-off distances of up to 1000 metres with an accuracy of 5 metres. The obstacle must be sufficient to cause delay to all enemy vehicles for at least 30 minutes, and desirably 60 minutes.

(c) The ability to undertake demolitions. It is essential that this capability includes being able to take over and fire previously prepared demolitions, including acting as firing party at reserve demolitions. It is highly desirable that it includes the ability to undertake rapid demolitions of structures when other more deliberate means have failed.

4. The equipment will be required to operate in the hostile conditions described above and therefore no tasks should take more than 20 minutes to complete. The equipment and crew should be afforded a high chance of survival.

5. It is desirable that the equipment be compatible with other in-service equipments as regards maintenance and repair. It is desirable that, if more than one type of equipment is required, they should all be based on a common chassis.

6. It is highly desirable that the operation of the equipment should require no more than the current crew training load. It is desirable that the equipment should be capable of operation by any trained combat engineer, although it is possible that this might require revisions to the current syllabus.

FAILINGS OF THE PRESENT EQUIPMENT

7. Some of these tasks can already be undertaken by the current in-service Armoured Vehicle Royal Engineers (AVRE) and the Armoured Vehicle Launcher Bridge (AVLB).

8. The current holdings of these equipments is, however, small and is limited to one specialised engineer regiment. No other engineer regiment has the capability to undertake any of the tasks. Given the likely requirement for these equipments in war, current holdings would produce critical shortages.

9. AVLB is based on the Chieftain chassis and is therefore likely to have a useful life as long as the Chieftain battle tank remains in service. AVRE is based on the obsolete Centurion chassis and there are no other similar vehicles in service.

RELATED GSTS AND GSRs

10. There are no known related GSTs or GSRs.

OTHER SERVICE INTERESTS

11. There is unlikely to be any direct interest in this equipment by other Services. 12. There is likely to be considerable interest in the equipment by other ABCA and NATO armies.

Armoured Engineer Equipment of Other Nations

MAJOR A F M DOUGLAS RE, MA

Maj A F M Douglas was commissioned in 1967 and subsequently read Engineering at Cambridge. He served in 21 Engr Regt as Troop Commander and 10 before a tour

as Adjutant of 36 Engr Regt. Division 1 of the Staff Course was followed by a MOD job in Army Training. During 1982/83, he commanded 31 Armd Engr Sqn, and now has one of the OR desks in HQ UKLF. He made his troop commanders write the bulk of this paper, and most of the load was taken by Capt M W Whitechurch.

SI Units ("metric") are used throughout this article. For those somewhat unfamiliar with the symbols, those used are listed below:

g	gramme	min	minute
ĥ	hour	mm	millimetre
k	kilo	\$	second
kg	kilogramme	t	tonne or 10 ³ kg
m	metre		

BRITISH armoured engineer equipment consists of the Armoured Vehicle Launched Bridge (AVLB) mounted on a Chieftain chassis, and capable of launching two types of bridge; the AVRE, based on the ageing Centurion, which can carry out a variety of general engineering tasks; and the CET, which is not a specialist vehicle, but complements the other two. These three are the only equipment that allow Sappers to operate in battle with some protection. The purpose of this article is to describe what other nations have or are developing for the same purpose. I hope it will provide background for discussion of any future mix of armoured engineer vehicles in the Corps.

All modern armies have a bridgelayer, and several have other vehicles, or equipment that can be "bolted on" or towed by a tank. To give a framework to the article, current equipment is described before new developments, with each part sub-divided into bridgelayers, general engineering vehicles and minefield breaching. Data is compared in the Annexes for those who want a more detailed view.

CURRENT EQUIPMENT

BRIDGELAYER TANKS

The West German BIBER (Photo 1) uses the same hull as the Leopard 1 main battle tank, weighs 45t and has a crew of two men. It is also used by Australia, Norway, Canada and the Netherlands. Its bridge, built in aluminium alloy, weighs 9.8t, and spans a 20m gap. It is carried above the tank hull in two halves to reduce its length to 11.65m. The lower section is slid out first, then connected to the upper section and the entire unit slid horizontally into position. It carries vehicles up to 50t. Gaps up to 40m wide and 5m deep can be crossed using the techniques of combination bridging.

The American M48 AVLB (Armoured Vehicle Launcher Bridge) is fitted with a "scissors bridge". From 1963 the chassis of the M60 MBT (Main Battle Tank) was used and both tanks are still in service. Other users include West Germany, Spain, and Belgium. Italy and the Netherlands have modified M48 AVLB for their own needs.

The M60 AVLB weighs 56t and has a crew of two. The bridge is aluminium alloy, weighs 14.061t and when folded measures 9.6m long. It can take a 60t load across a 17m gap, and a 70t load across a 13m gap. For larger gaps combination bridging is used.

The "scissors" systems is used by the French Char Poseur de Pont AMX-13 (Photo 2), also in service with Argentina and Indonesia. It weighs 19.2t complete. The bridge is aluminium and weighs 4.1t, being only 7.15m long when folded. An unusual feature is that the bridge is launched from the rear of the tank by the bridge operator, not the driver as is normal. It can take loads of up to 25t across gaps of 12.2m. If two bridges are laid side by side a vehicle up to 50t weight can use the crossing. Combination bridging is not practised in the French Army.

The larger AMX-30 (Photo 3) bridgelayer weighs 42.5t and has a crew of three.



Photo I. West Germans BIBER launching the second bridge of a combination crossing

Its bridge is made of light alloy, and can span gaps up to 21m. It takes 10min, which is relatively slow, to be taid in a similar fashion to the AMX-30. Loads up to 50t can cross and the road can be widened from 3.1m to 3.95m.

Holland uses the British Centurion Mk 5 chassis. The original bridge was the



Photo 2. French AMX 13 launching a fascine

Armoured Engineer Equipment of other Nations (1 & 2)

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ARMOURED ENGINEER EQUIPMENT OF OTHER NATIONS



Photo 3, French AMX 30

British No 6 Tank Bridge. Made of light alloy it was 16.3m long, weighed 7t and carried loads up to 80t across 11.7m gaps. It was carried upside down on the chassis, and took 2min to lay and 4min to recover. Combination bridging is possible for larger gaps. In 1969 the Dutch replaced the No 6 Bridge with that of the M48 described above (Photo 4).

The Italians have deployed various bridgelayers on the M48 and M60 hulls, but more often on the older M47 and Centurion. Crewed by two, these tanks are called the A-20 (Photo 5), A-22 and A-26. The bridge on all three tanks is the same. It is a mixture of steel and aluminium alloy, is 22m long, 4m wide, and able to carry a load of 54t. Usually it can be recovered without dismounting from the tank. Another feature is that by locking the end ramp in the vertical position it can be used as a pier to lay a second bridge, obtaining a crossing of 36-38m.

The Swiss have an AVLB called the *Bruckenlaegepanzer* 68 (Photo 6), based on the hull of the *Panzer* 68 main battle tank. The alloy bridge is 18.23m long and does not fold, which must make it an awkward load to move around. The maximum capacity is 60t, normally limited to 50t. To launch, a beam is slid across onto the far



Photo 4. Dutch Bridgelayer (Centurion chassis/American bridge)

Armoured Engineer Equipment of other Nations (3 & 4)



Photo 5. Italian A20 using dropped ramps as piers



Photo 6. Swiss Brucken large panzer 68 with its span of 18.23 metres



Photo 7, Swedish BROBV 941

Armoured Engineer Equipment of other Nations (5, 6 & 7)

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Photo 8, East German BLG 60, of Polish Army, launching bridge

bank. The bridge is supported across the beam until it reaches the far bank and the beam is then withdrawn. The operation takes 2 to 3min. Combination bridging can be used.

The Japanese type 67 AVLB is a Type 61 MBT with a scissors bridge. It is in service with Japan only. The bridge is similar to the 18m M48 bridge, but at 12m is much shorter. It will span a gap of 10m. The maximum load is 40t.

much shorter. It will span a gap of 10m. The maximum load is 40t. Apart from bridgelayers built on the hulls of main battle tanks others are built on the chassis of light tanks, recovery vehicles, or even armoured personnel carriers. The AMX-13 bridgelayer, already described, could be considered in the light tank category.

The Swedish bridgelayer, the BROBV 941 (Photo 7), is a modified version of their armoured recovery vehicle, the BOGBV 82. The bridge weighs 7t, is made of



Photo 9. American M728 Combat Engineer Vehicle

Armoured Engineer Equipment of other Nations (8 & 9)

light alloy, and is 17m long. It is laid and picked up by a horizontally deployed telescopic beam. It is the only known bridgelayer which can swim. The bridge floats independently and is unloaded and towed behind the bridgelayer.

The American M113 APC has been adapted to carry a lightweight scissors bridge weighing 1.22t, which can span a 10m gap, and takes loads up to 25t. It is used by America only.

At the moment no bridgelaying variants of the Soviet T62 are in service. There are at least three variants using the T55 MBT chassis in service with the Warsaw Pact countries.

It is thought that the T54 MTU bridge is made of an aluminium alloy and has a length of 12.3m. The bridge is launched horizontally. A chain drive mechanism moves the bridge forward over a cantilever launching girder until the far bank is reached. The girder then lowers the span onto the near bank. It can carry loads up to 50t and combination bridging is possible.

The MTU-20 is based on the T55 chassis. It is distinguished from the MTU 55 by the folded ramps at each end, but has a similar launching method after they have been unfolded. It has a maximum clear span of 18m and can carry a load of 50t.

The MT-55 is a Czechoslovak development. It is in service with the Soviet Army (to an unknown extent) and Yugoslavia. Built on the T55A tank chassis, the tank approaches the gap and raises the bridge slightly from the transport position. The launching post is lowered to the ground and the span raised to the vertical position. The bridge then unfolds and is lowered across the gap.

The BLG 60 Bridgelayer (Photo 8) is a joint East German-Polish venture, used by both armies. The tank is based on the MT-55 MBT and the bridge has a span of 18m and can carry a load of 50t. The operation is the classic scissors method. ENGINEER TANKS OR DEDICATED ENGINEER VEHICLES

Armoured vehicles dedicated to engineer tasks can be modified main battle tanks, or recovery vehicles. Some equipment is "bolt on" and a few are unrelated to any family and have their own chassis.

The Americans have a modified gun tank, called the Combat Engineer Vehicle (CEV) or M728 (Photo 9). Its 165mm demolition gun gives it a stand-off demolition capability (the same gun is used on the British AVRE). An "A" frame is mounted on the front of the hull with a lifting capacity of 11,340kg. A two-speed winch at the rear of the tank has 61m of 17mm diameter rope. A hydraulic dozer blade is mounted at the front.

The German *Pioneer Panzer*, is also used by Belgium, Italy and the Netherlands. It is a variant of the German recovery vehicle, the *Bergepanzer*, built on the Leopard 1 chassis. The dozer blade at the front has a capacity of 200m³/h, and the winch has a pull of 70t. The crane can lift 20t and carry an earth auger for holes to a depth of 2m with a 70mm diameter. For demolition work a total of 17kg of explosives is carried but there is no remote or stand-off method of placing charges.

The current French engineer vehicle, Vehicle Combat Du Genie (VCG), is a variation of the AMX-13 APC. A remarkable feature is that it can carry ten troops. Its dozer blade is capable of moving 45m of earth an hour. An "A" frame has a maximum lift of 4.5t with a two-speed winch, and it can tow a trailer which can be detached remotely.

The Americans' dedicated engineer vehicle is based on the M113 APC. It has a dozer blade that can move 50m³/h. Other users are Canada and Switzerland.

The Japanese armoured engineer vehicle is based on the Type 67 MBT chassis. It has been designed to clear obstacles and is provided with a dozer blade and a crane. A second Japanese vehicle is the Type 78 bulldozer. Based on the D6, it is fully armoured with much improved mobility, a dozer blade and a winch. It can exert an 18t pull. The armour plates can be removed when working out of contact if required.

The Warsaw Pact have two dedicated armour engineer vehicles. The Soviet combat engineer vehicle, IMR (Photo 10), meaning engineer vehicle for the removal of



Photo 10, Soviet Combat Engineer Vehicle IMR

obstacles (Inzhenernaia Mushina Razgrazhdeniaa) is based on the T55. Crewed by two, it has a 360° hydraulically operated crane. The jib is telescopic and when travelling rests on a cradle. It has a pair of pincer grabs which are used to remove trees and other obstacles. The grab can be replaced by a bucket which is carried on the tank at the rear. At the front of the tank is a hydraulically operated dozer blade which can be used in a straight or V configuration, but cannot angledoze.

A variation of the IMR is the Polish M1878 Armoured Engineer Tractor, also used by the Czechs, and with a crew of three. It carries the M1867 Rocket Projected Mine clearing device mounted in "coffins" on the rear. Each coffin contains an explosive hose which can blast a safe lane of 105m × 5m in a minefield. The remaining equipment is the same as IMR, but with reduced performance.

The GMZ gives the Soviets the ability to lay mines quickly under the full protection of armour. The chassis used is identical to the SA 4 GANEF. The minelaying equipment is attached to the rear and is normally secured in the raised position. When laying, the equipment ploughs a ditch into which the mines are placed via a chute. The interval between the mines is adjustable. GMZ operates at a speed of 5km/h and can therefore lay its 200 mines in 20min or so in a row of 1000m. OTHER ARMOURED ENGINEER EQUIPMENTS

Several engineer equipments can be attached to a vehicle which has a different primary role, either "bolted on" or towed. They vary from dozer blades mounted on the front of a main battle tank, to devices which are used for mine clearing. Annex C lists the different types and designs of tank dozer blades with their respective capabilities and limitations. Tasks are enhancement of fire positions and obstacle removal.

There are three categories of armoured engineer rapid minefield breaching equipments. These are the explosive hose, plough and the roller systems. The explosive hose concept is employed by America. West Germany and the Warsaw Pact. The hose is usually projected across the minefield by a rocket and then detonated. Some hoses are pushed or dragged across the minefield.

The current American explosive hose, the M157 Projected Charge Demolition Kit consists of sixty-two sections of rigid hollow hose, each 1.6m in length. The sections are bolted together and towed to the breach site, then pushed across the minefield. The 1.6t of explosives is detonated and a path 4m × 80m is cleared of 90% of mines.

Armoured Engineer Equipment of other Nations (10)

The West Germans do not have much breaching equipment at present. Their mine clearing hose, known as the *Minenraumung-Sshnure*, is designed to clear a pathway $70m \times 0.60m$, which is not wide enough for tanks. The hose is an 80m length of detonating cord with 100g packages of explosive attached at 1m intervals, projected by a small rocket.

The Warsaw Pact uses a variety of explosive mine clearing devices which are launched from armoured vehicles. One example is the Soviet BDT which is assembled, towed by a tank to the edge of the minefield and then pushed into the minefield. The BDT consists of three separate linear charges formed into a "triplex" charge, a nose section, and a detonator box. If required, single or daplex charges may be used, but maximum length may not exceed 500m. The forward section is fitted with a roller to aid emplacement, and a metal shield is mounted above the roller to provide protection from premature detonation. The BDT can be detonated by one of two methods. Firstly, by an electrical detonator connected by a cable to the electrical system of the tank. The second method is by firing the machine guns of the tank at the detonation box which contains a number of percussion detonators connected by a booster charge to the line charge hose. A triplex, or three line charge BDT will clear a path 6m wide and 500m long.

Other devices are the ITB-2, SPZ-2 and SPZ-4. The ITB-2 is a rocket launched anchor and cable which is propelled across the minefield. Once in position the cable is understood to be pulled into position, by winch or tank, and then detonated. It is assessed to clear a 200m \times 6m path in a minefield. The SPZ-2 is similar but can clear mines to a depth of 300 to 500m depending on the type of charge. With the SPZ-4 the tank either pushes the charge into the minefield or, equipped with a mine plough or roller, tows charges to a maximum length of between 300 to 500m.

The mechanical roller systems work by simulation of target signature. They have a reasonable speed of operation, and the advantage that preparation time is short. They can, however, be easily defeated with sophisticated fuses and careful siting of the mines. However, with the advent of scatterable mines this device has regained importance.

The Warsaw Pact PT-55 is the standard roller system used today. A useful feature is a lane marker which cuts a furrow 80mm deep and 100mm wide. The PT-55 has a speed of 8–10km/h when operating and can be fitted to any the current Soviet or satellite main battle tanks.

The plough system such as the KMT-4 used by the Warsaw Pact has the advantages over the roller system of lightness and ability to defeat sophisticated fuses. It consists of a 600m wide cutting device, fitted with teeth, mounted at an angle in front of the track. It has the disadvantage of a low operating speed of some 4km/h.

The KMT-5 system is a combination of three rollers and a plough mounted in front of each track, a sweep chain for tilt rods, a lane marking plough, and the PK5 set which marks the cleared lane at night by means of luminescent material. It can operate at 5km/h with plough, and 15km/h using rollers only.

TANK BRIDGING

EQUIPMENT BEING DEVELOPED

America has developed a scissor bridge with a span of 27.4m able to take loads of up to Class 60. Although fully developed and ready for production, the American Army apparently does not intend to use it.

The American M60 AVLB system is due to be replaced by the early ninetics. It is planned to develop the next AVLB on the MBT chassis, the M2. A prototype is expected for 1984.

The new American Rapid Deployment Force requires an air portable assault bridge. The Light Assault Bridge is being developed to span gaps of up to 20m. It will be able to take loads of up to 25t. Carried on a trailer behind an armoured vehicle it will be launched from the trailer by remote means. It could be in service for 1990. West Germany is developing a Rapid Bridge system which can be deployed on site in several ways including the AVLB method. The advantage is that logistically there is only one bridge system in service. Their bridge will be able to carry up to 60t loads.

The Germans have recently abandoned development of a tank bridge with an integral pier. It was a complex equipment and it was found impossible to carry out multiple launches from under armour. There were also serious stability problems, particularly when the pier was fully extended.

The Germans are particularly conscious of the short gap problem and are planning to develop a new short bridge. They are watching the British fascine development with interest.

DEDICATED ENGINEER VEHICLES

The American M-9 is an amphibious earth mover for obstacle removal and route maintenance. The chassis is of aluminium alloy is specially made for its role. It has a bilge pump and winch with a pull of 11.34t. The M-9 can also draw trailers of up to 16.73t. The earth moving capacity is thought to be about 250m³/h over a 100m distance. The vehicle is fully developed and awaiting production. It is planned to be issued to the American Army in time for their major reorganisation in 1986.

The American Counter Obstacle Vehicle (COV) is a dedicated armoured engineer vehicle in the concept phase. It will be a general purpose vehicle and be able to clear paths through minefields by plough, roller and explosive hose. It will also have the ability to emplace obstacles, although details are not known. Equipment on the vehicle will include a demolition gun, a mine plough and full width roller, and an articulating arm for digging. It will also be able to pull trailers. A feasibility study is in progress. The American M88, M60 and M1 chassis are all being considered. It is expected that the first issue of prototypes for trial will be in 1984 and if successful issued for 1990.

The Germans are planning to replace *Pionier Panzer* 1. The new vehicle will be based on the Leopard 1 chassis. It will feature a hydraulic tilting dozer blade with ripper teeth, and a telescopic excavator arm with a variety of attachments in place of the crane. It will be waterproofed, have a 20t winch and will carry welding and cutting equipment.

The French AMX-30 Engin Blinde du Genie (EBG) is intended to replace the AMX-13 Engineer Combat Vehicle in the mid 80s. It has completed trials and is awaiting production. The crew is three men. Mounted at the front of the hull is a hydraulic operated dozer blade. At the back of the lower part of the dozer blade are six scarifying teeth for ripping up the surface of roads. A hydraulic winch with a capacity for 15 to 20t and 80m of cable can be used during amphibious operations. Pivoted at the front of the hull on the right hand side is a hydraulic arm similar to IMR with a maximum lifting capacity of 15t. The two part arm can be extended 7.5m and traversed through 360°. This arm can also be fitted with an earth auger which can drill 220m diameter to a depth of 3m. A 220mm cutting saw and a 50kW hydraulic PTO (Power Take Off) are also provided. On the vehicle, over the commander's cupola, is a launching tube for demolition charges and either side of this are two mine launching tubes, each of which have five mines in a container. The 142mm calibre demolition device takes a charge which contains 10kg of explosive. The charge is fin stabilised and fitted with a nose mounted point detonating fuse and has a range of between 30 and 300m. The mines contain 0.7kg of explosive and are thrown to a distance of 60 to 250m. They are claimed to be able to penetrate a tank floor equivalent to 50mm of armour at a stand-off of 500mm and 60° incidence. The mine will apparently break a tank track. The mines have a pre-set self destruct timer.

MINECLEARING

Mineclearing is a growth industry at present!

The American Army is developing a plough and roller very similar in design to the KMT-5, to be used with the M1 main battle tank. It includes track width mine

						SUM.	MARY OF BR	DGUANNG	TANKS	i						ANNEX A
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Mount Time	90 mins	100 mins	N/A	N/A
Dismount Time	60 mins	65 mins	NIA	N/A

rollers, a track width plough and a full width dozer blade. Like Soviet practice it will be a function of tank troops, as well as Engineers, to use the equipment. In addition the equipment will also have a device called Vehicle Magnetic Signature Duplicator (VEMASID) intended to defeat magnetic fused mines. The equipment has been developed, trialled, accepted and is being issued to American troops in Europe.

The Americans are also examining an improved explosive hose device. The Cleared Lane Explosive Widening and Proofing (CLEWP) is intended to be a device which will prove and widen a breach made by their new plough roller device. The hose is contained in a box on the back of the breaching vehicle. An anchor on the end of the hose is dropped onto the edge of the minefield as the tank ploughs/ rollers across the minefield. When the breach is complete the hose is fired. The device is in the study stage and is hoped to enter service in 1986.

America is also looking at remote controlled breaching devices. The operator controls a tank, fitted with breaching equipment already described, through a computer with a remote link. The current trials appear to be going well and the Americans are confident.

West Germany has revived the old principle of the flail, though the French have now left what was a joint venture. The device, mounted on an M48 chassis, is designed to clear a 4.5m lane 100m long in 10min. The Germans claim that the Flail Tank (*Landminenschnellraumittel* (LSM)) will clear all mines in its path to a depth of 800mm. The device should be ready for use in the late 1980s, though it seems to be running into difficulties.

The Soviets are thought to be producing a new armoured mine clearing vehicle. It is based on the chassis of the M1974 self propelled howitzers, with a turret-like structure that contains three rockets on launch ramps. These together with the upper part of the superstructure are hydraulically elevated for firing. Range of the rockets is thought to be 200 to 400m with each rocket connected, via a towing line, to hoses stowed in the uncovered base of the turret on the vchicle roof. The hose is connected by a cable to the vehicle which allows the crew to position it in the optimum breaching position once the launching has been carried out. The hose is then command detonated. It is thought to be entering service this year and may replace BTR 50PK.

CONCLUSION

What does all this information mean? I was asked to write this as a factual article, as one of a series contributed by 32 Armd Engr Regt. It was the intention that readers should draw their own conclusions. However, it seems to me from a brief study that:

(a) All modern armies need a dedicated AVLB, and it is unusual for this vehicle to have any other role.

(b) Level-launching bridges offer advantages in concealment during launching, but, for the longest spans, scissors bridges are generally chosen.

(c) General purpose engineer vehicles are gaining popularity. These usually have small crews, but many tools. Only a small number have a stand-off demolition device, the remaining preferring a crane or grab. Practically all have a winch.

(d) Apart from AVLBs, few countries are prepared to afford vehicles with only one specialised role, such as mine-laying. Perhaps we can learn lessons from others that will benefit ourselves.

The Use of the AVRE in Urban Warfare

MAJOR S K-E CLARKE RE



The Author was commissioned in 1972. On completion of his YO course he served as a Tp Comd in 28 Amph. Engr. Regt. this included an Infantry role tour in Belfast in 1973. From 1975 to 1977 he was a Tp Comd in 3 Trg. Regt. RE followed by a tour as 21C 50 Fd Sqn. Const (including a 7 month project in Kenya). After 6 months training as an Army Pilot he was posted as GSO3 Ops to HQ 8 Inf. Bde in Londonderry. This was followed by a year as Ops/Trg. Maj in 35 Engr. Regt and 6 months as Ops/Trg. Maj in 25 Armid Engr. Regt. He currently commands 77 Armd Engr. Sen.

INTRODUCTION

Ten percent of the 1 (BR) Corps area is urbanised and this figure increases continuously. Consequently, in the event of war in Europe, Fighting in Built-up Areas (FIBUA) will be virtually unavoidable. The implications of FIBUA are currently being studied in detail by the Royal Armoured Corps and the Infantry with the aim of establishing the tactics and training required to master this form of fighting.

It is time, therefore, to look again at the tasks and skills required of the Royal Engineers in FIBUA. The aim of this paper is to examine the use of the Armoured Vehicle Royal Engineers (AVRE) or a similar tank in this kind of warfare.

DEVELOPMENT OF THE AVRE

The AVRE was developed so that Combat Engineer tasks could be carried out from the protection and mobility provided by Armoured vehicles. The pre-D Day experience of the RE and the creation of Fortress Europe resulted in the introduction of specialised tanks to carry out engineer tasks quickly and in direct contact with the enemy. Once the coastal defences were breached the AVREs continued to be used to provide intimate engineer support and thus maintain the momentum of the advance.

It is worthy of note that despite the much smaller urban areas of Europe during the last war, forty percent of the battles were fought in built-up areas. In this context the Petard mortar proved a quick and effective demoliton system combining, as it does now in a new form, the size of an artillery shell with the accuracy, at urban ranges, of a direct fire tank gun. More recently at the height of the FIBUA in Northern Ireland AVREs were selected to spearhead *OP Motorman* and smash the barricades of Belfast and Londonderry.

THE THREAT

Soviet experience has taught them that FIBUA is a slow, manpower intensive operation in direct contradiction to their aim of fast mobile war. They acknowledge however, they may have FIBUA thrust upon them in order to gain the wital routes, bridges and logistic resources needed to achieve success. To this end FIBUA training is carried out by the Soviets, in particular by paratroops. In such an attack their doctrine calls for tanks leading the assault in order to seize a town quickly, the

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Major S K E Clarke RE

operations being preceeded by massive air and artillery bombardment. In the last war, up to forty percent of Soviet artillery was used in the direct fire role in urban operations in order to produce accurate heavy calibre fire. Assaulting troops would be reinforced with extra armour and chemical units equipped with hand-held flame throwers (a weapon to a large extent replaced by white phosphorus in the British Army).

The need to reverse normal Soviet doctrine in FIBUA is recognised and tactical responsibility is delegated to the lowest level because of the nature of the battle. This would appear to be one of the major problems for the Soviets of this form of warfare. However, their tenacious defence of Stalingrad and aggressive assault of Berlin show they can do it, and both battles produce a wealth of relevant, if somewhat dated, experience.

CHARACTERISTICS OF FIBUA

From an attacker's point of view FIBUA is a slow operation that soaks up manpower both in the assault and in the holding of captured buildings. It inhibits fast manoeuvre, long range engagements and the rapid deployment of reserves. It is also hard to achieve shock action with armour. However, it does concentrate enemy forces and the secondary effects of fire and falling debris can produce as many enemy casualties as the direct action of weapons.

In defence FIBUA provides the defenders with short ranges and good cover for small weapons. In particular hand-held anti-tank weapons (beware of back blast) making armour particularly vulnerable. The confined space inhibits armour to such an extent it may not be able to bring its armament to bear. The maximum elevation of $+20^{\circ}$ and minimum depression of -10° for most MBTs (Main Battle Tank) produces a blind spot above and below the tank ideal for the delivery of anti-tank fire from high buildings or cellars. The length of a modern tank gun barrel can also stop full traverse (Chieftain has a 47ft traverse radius) in narrow streets. Weapon effect on buildings is a contentious subject.

In the last war massive bombardment inflicted considerable damage on brick and masonry buildings. In more recent conflicts, such as in Lebanon, modern concrete buildings have withstood considerable bombardment by area weapons with relatively little structural damage. It is with this kind of modern building that European expansion is taking place. The problem of using conventional direct fire antitank weapons is that they tend to rely on the HEAT principle of a shaped charge or on kinetic energy. The effect of both of these is to produce a small neat hole and little structural damage. The Israelis in Lebanon copied the Soviet WW2 tactics of using heavy artillery guns in direct fire role. High explosive (HE) and possibly a phosphorus smoke round would appear to be the best answer and the more of it delivered accurately the better.

ENGINEER TASKS FROM THE PROTECTION OF ARMOUR

The need to maintain our own mobility and deny it to the enemy remains the priority task for Sappers in FIBUA. The AVRE dozer blade provides a route maintenance and route denial capability that can continue to operate in the sort of hostile environment that would defeat conventional plant. Obstacles to deny access or to expose belly armour can be quickly created by the AVRE. The output of the AVRE is similar to that of a medium tractor in ordinary ground but in the case of rubble and masonry the greater power and weight will produce a considerable margin in the favour of the AVREs.

The protection afforded by armour enhances the mobility of the combat engineers inside the tank and given compact equipment such as RCK and Off-Route Mines the crew can be delivered protected, to positions where these charges are required. Exploiting the narrow defiles in towns small teams with limited resources can achieve far more than the equivalent effort applied in open country.

For demolition tasks the 165mm gun provides a very accurately placed charge

(larger than 175mm artillery shell) up to a range of 1200 metres, far in excess of the range required for FIBUA. This charge can be delivered in and out of contact and to achieve either an engineer aim, or as an enemy killing device.

The need for mines in urban warfare is the same as for rural operations, but the confined space reduces the logistic problems and fewer mines and men are required than in a rural setting. The use of Off-Route Mines in defiles is again a low manpower job. The AVRE's crew, equipped with a relatively small number of mines and explosives can achieve a lot in a short time.

The laying of mines in spoil dozed onto roads from gardens provides an opportunity for both real and phony minefields, thus adding deception to the obstacle plan and producing withdrawal routes for our own forces not clearly apparent to the enemy. Booby trapping is another classic skill that can be employed by dismounted tank crews. The ranger system also lends itself to employment in gardens and parks and the smaller infantry ranger system recently trialled could be carried by tanks for specific tasks.

NON-ENGINEER TASKS FOR THE AVRE

Given the fact that every Sapper can become an infantryman under the right conditions, then the AVRE can also take on the role of an MBT, if the conditions are suitable. The narrower arcs of fire and shorter range in an urban area make the AVRE an effective enemy killing machine. It has two 0.30 Browning machine guns and the short barrel of the 165 gun gives a smaller traverse radius (20ft 5½in) than that of Chieftain. Its slow traverse rate is significant (full rotation rate 2 minutes) but given the narrower arcs of fire in a town it is not critical. The ammunition is not designed as a tank killer but the HESH round would undoubtedly stop a Soviet tank. The effect of a 165mm WP round would be well worth considering for both its real effect and its effect on the morale of a potential enemy. The protection afforded by the extra spaced armour of the dozer blade is also significant when considering its frontal protection compared with other MBTs.

CONSTRAINTS ON THE USE OF THE AVRE

The short ranges and good cover provides the infantry with ideal tank hunting conditions. Weapons as simple as Molotov Cocktails can prove lethal to tanks in an urban setting. The optics are also very vulnerable to the effects of artillery fire and secondary missiles, and even paint at short ranges can be effective. Movement in an urban setting is also limited by cellars, weak floors, sewers and craters. The large number of power lines in a town could also prove a constraint on vehicle movement.

The AVRE at night is blind, having no built-in night sight capability. Close infantry protection would, therefore, be essential. AVREs will shortly be issued PNGs, which will to some extent overcome this problem, but not remove it.

The key constraint which appears, is a dependency on close infantry support in an activity carried out by an AVRE. During the preparation for an urban battle, the AVRE could move about on its own, working on the obstacle plan. However, once contact was made the application of an AVRE to a task should be part of an infantry mounted operation with close protection afforded to the tank on its move to task, during the task and its recovery to a suitable hide on completion.

CONCLUSION

The economy of effort achieved by combining a heavy armoured bulldozer, a heavy calibre HESH gun, a combat engineer half section and two 0.30 calibre MGs produces a flexible combination of capabilities in a compact mobile unit.

All tanks, however, are vulnerable to small anti-tank weapons in the extremely close country conditions of a town or village. Consequently no operation could be achieved without close infantry protection. It is also worth remembering that in an "enemy killing" role, the AVRE has some advantages over the MBT in the FIBUA environment.

Sapper in the Sand

COLONEL H W B MACKINTOSH MBIM



Col Mackintosh was commissioned from Sandhurst in 1948 and thereafter served as a Tp Officer and Sqn 21C in various Fd Sqns in Hong Kong, Germany, the Canal Zone, England and Cyprus. After tours as an instructor at the BD School and TA Adit, he attended 15 TSO Course at RMCS. He was OC 54 Fd PK Sqn in Singapore during "Confrontation" and "Op Crown" and has held a variety of Weapons Staff posts at DOAE, MOD and MVEE. He retired from the Active List in 1981.

THEN

I should have known better. As we steamed northbound up the Saez Canal in daylight in the summer of 1950; I as a green young subaltern was vastly impressed by the suntanned troops lazing about under the palm trees of Egypt with their battered yellow trucks and ridiculous KD shorts—and desert as far as the eye could see. At intervals, groups of soldiers swimming in the Canal within hailing distance, called the customary British Army war cry "Getcha Neesbrown" (and other less printable epithets) to us. After a year in the rocky dampness of the Hong Kong New Territories, the whole place seemed irresistably attractive. "This", I said to myself, "muss be my next posting". Well, it wasn't, but perhaps I should have been more suspicious when at the end of my JO Course the officer from AG7 said: "The Canal Zone? Are you sure you want to go *there*?" I did—and so I went.

It was the end of 1952. We had a comparatively uneventful Mediterranean cruise aboard HMT Empire Fowey, unlike my previous trooping experience in the same direction aboard the Dunera, when we had had some light relief from a Lascar crewmember, perched precariously on a plank suspended over the side. Scraping away at the paint rather too energetically, he had fallen headlong into the sea and sipped rapidly behind our stern before the alarm could be raised. Even when it was, the momentum of a 17000-ton liner at full bore takes some halting, and on maximum left lock it seemed to take us several acres of the Mediterranean to turn round; thus it was no mean feat of navigation for the Capitan to bring us alongside the frantic bobbing figure. By now the rail was packed with a thousand or more fascinated onlookers, and the ship's RSM, in his crisp authoritarian manner, over the tannoy ordered "Right now, throw him down a life jacket—now!" To a man the troops obeyed, and what appeared to be the entire ship's complement of the things were hurled like confetti into the sea. The Lascar I am sure was saved, but I have my doubts about the life jackets.

Our ten day cruise this time passed without incident and we arrived (somewhat alcoholically in view of the date) on 29 Dec in Port Said. I had arrived at the station I wanted to serve in but since I last passed this way, two and a half years before, many things had happened.

In 1950 the garrison sunning themselves in the sand had consisted of a couple of brigades, an AGRA, and a scattering of minor units. But in October the following.

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Colonel H W B MacKintosh MBIM
SAPPER IN THE SAND

year Egypt abrogated the 1936 Treaty under which the UK kept troops stationed in the Zone, and rioting had broken out in Ismailia and Port Said. With an alacrity which would be hard to match even by Falklands standards, 6000 men were deployed into the Canal Zone in ten days: 2 Inf Bde and 16 Para Bde from Cyprus, 1 Guards Bde from Libya, 39 Inf Bde on two aircraft carriers from England and 19 Inf Bde airlifted straight from Exercise *Surprise Packet* on Salisbury Plain. In retaliation the Egyptians withdrew all civilian labour from the British camps, so 4000 Mauritian and 5000 technicians from other Middle East stations were promptly imported to replace them.

The serving soldier of today whose every move is fair game for a TV camera





Photo 1. ". . . wire, wire, and yet more wire (Falaise Camp, Tek)"

would be envious of the methods of operation available to his forebears in the "Fifties". In December 1951, following the killing of an RE Officer and some Sappers by snipers in the village of Kafr Abdu, eighty houses were systematically destroyed in *Op Flatten*, in order to prevent their possible re-use as firing points again, without as far as I know a cheep in the newspapers. from human rights supporters, or anyone else in UK. The following month a full-blown battalion attack was launched by 1 Coldstream Guards against the police, supported by aircraft and 26 Fd Regt RA firing 25-pdr HE. And in the same month two troops of Centurions from 4 RTR fired their 20-pdrs into the Bureau Sanitaire in Ismailia to quell determined police resistance.

By the time I arrived there were some 8000 troops deployed in a series of barbed wire encampments for the length of the Canal and westward as far as Tel-el-Kebir. As we travelled slowly by train from Port Said south, we passed through the 3 Division area, entering 1 Div as we reached Fayid. These two divisions were supported by a huge panoply of Corps Troops and base installations ranging from Workshops and Depots to Ice Plants, a Jerrican Factory and even a Tent-Slab-Manufacturing-Site. From time to time during the next few months, if tension rose, 16 Para Bde flew in from Cyprus and 1 Cdo Bde from Malta. All movement by roads outside the camps was rigidly controlled, often restricted to double vehicle running with armed escorts beside the drivers. The resulting drain on units manpower by having to provide escorts for NAAFI vehicles, and guards for their own perimeters, at times made training impossible. Constant vigilance against sniper attacks, ambushes and general harrassment was essential-even as late as April/May 1954, some fifty-two separate attacks were made against British Army personnel. The only unit I can recall which appeared to continue unscathed by all this was 27 Malaria Control Unit RAMC, who roamed even the most inhospitable Delta areas, their immunity assured by flying from their Land Rovers white flags-bearing a huge mosquito!

My first impression of Gordon Lines, Moascar, home of 25 Fd Regt (the 3rd Division Engineers) since March, was not reassuring. Just inside the main entrance past the guard tent was a huge DTL. (Deep Trench Latrine), a magnificent monument to. Sapper camp construction prowers with an overpowering capability of reminding us (particularly in the hot weather) of its presence. The remainder of the camp was largely tented apart from a few huts housing RHO, stores and Messes. There appeared to be a continuous roar from hydroburners in the cookhouse at the far end, accompanied by an all-pervading smell of baked beans. Everywhere was wire, wire and yet more wire (Photo 1), interspersed with upturned rusting oil drums as markers; and a never-ending stream of such camps, housing an incredible array of all Arms, Pioneers, a cemetery and open air cinema, lined both sides of the road running north to a T-junction of the Treaty Road where Spearhead (3 Div HQ) and Tobruk (Div Coln RASC) camps lay. Precisely at noon, every working day, a huge explosion reverberated from somewhere in the desert behind Moascar.

Sapper in the sand (1)

SAPPER IN THE SAND

In due course I learned it was Lieutenant Peter Wadsworth and his team systematically blowing up unstable munitions, much of it left over from the war.

Units had a strange assortment of dilapidated vehicles (Photo 2), some such as our GMC 1-ton vehicles clearly having seen active service in the war, and we still had thriteen Bren carriers in each field squadron. Motorcycles were withdrawn because of their riders' vulnerability to trip wires stretched across the road, and even Land Rovers, their windscreens folded flat to allow traverse for pintle mounted Brens, carried angle-iron deflectors at the high port in front to deflect the same threat.

Supper training was limited; there was nothing much to bridge, and with unlimited acres of navigable sand around not much opportunity for road making. Minelaying, breaching, and demolition practice, were generally confined to defiles and passes in the hills, and water supply was—well, there just wasn't any. With much of the terrain flat and uninteresting, exercises tended to use well worn areas like the Gebel Ataqa, south of Fayid, and the Mitla Pass in the Sinai. In the hills behind Ain Sukhna live firings could be carried out with gay abandon, while on the beach itself at Bir Odeib we set up weekend relaxation camps.

Frustrations, restrictions, and the generally inhibited existence most of us enjoyed produced their own crop of incidents. There was Corporal Smith, for example, who found it all too much for him. "Sir", said the SSM one morning, "Cpl Smith refuses to do Guard Commander tonight, so I put him on a charge. He says he only takes orders from God". Somewhat taken aback at this departure from the normal chain of command, I sent for the NCO. Perhaps surprisingly, since the summons must have appeared to him to come from a poor substitute for Higher Authority, he appeared before me, but nothing I could say would make him change his mind. After a short spell under arrest, he attended a psychiatrist in Fayid, and the next I knew was that he was airborne and heading for a discharge in UK.

Not so lucky was Sapper Brown. In an alcoholic stupor one evening he emptied a complete magazine from his Sten into the crowded NAAFI. Mercifully, he was a rotten shot, and apart from perforating the roof of the Nissen. he did no damage to anything. But for a few hectic moments there was frenzied activity by those on duty who were clearly under the impression that the locals had mounted a major assault on the camp.

In the Spring of 1953 a soldier went missing, believed abducted as a hostage by the Egyptians. As a reprisal, without much hope that it would do more than cause the maximum inconvenience to the locals, a massive stranglehold was immediately placed on all communications within the Zone by blocking road and rail transport. Troops from 50 Fd Sqn deployed into Nefeisha railway station, where Transportation personnel seized the signal box; all trains were then stopped and painstakingly



Photo 2. "Units had a strange assortment of dilapidated vehicles (50 Field Squadron MT Park)"

Sapper in the sand (2)

searched. The tactic worked as, after forty-cight hours or so, the soldier was returned.

At El Firdan just north of Ismailia a swing bridge carried the railway over the Suez Canal. On the first day of January 1954 we were called to assist at a very expensive accident—the leading tanker in a northbound convoy had tried to carry away a portion of the centre span. It was perhaps understandable that her navigation was not at its peak as the collision had occurred in the "wee sma' hours" at the start of another year.

The local Egyptians were adept at stealing and pilfering, despite all manner of deterrents, including minefields (round Tek), and constant patrolling and vigilance. Frank Griffiths, who commanded our Plant Troop, spent many hours with dozers and scrapers "cable mounding" between Ismailia and Fayid, trying to cover the buried copper telephone wires with sufficient sand to make their theft impractical during the limited hours of darkness.

These were the days when marriage under twenty-five was discouraged, and the troops were largely National Service. As a result, few were married. A few senior regimental appointments such as CO, Adjutant and RSM were allowed to have their families with them, and there was a scattering of wives accompanying squadron commanders, but in general it was only the Staff who were so fortunate. The Para Brigade, with typical ingenuity, somehow managed to bring many of their dependents out on a self-help basis by using 9 Son to build "Pegasus Village", an astonishing array of wooden huts under the palm trees on the shore of Lake Timsah. For the batchelors there was a chronic shortage of girls, who were limited mainly to the nursing staff in the BMHs or secretaries from sinister sounding Government agencies called POMEF, SIME and BMEO. The Officers' Club was therefore a largely all-male preserve, though we had an entrée to the French Club in Ismailia at times. On Sundays, Anglican worship was held in St George's Church, built in 1927 with much help from 42 Fd Coy RE. We were reminded at one such service in October 1954 that when the foundations were being dug, a buried steam roller was uncovered, presumably interred by troops unable to account for its possession. How little do the hazards of being a quartermaster change!

I was lucky on two occasions to leave the Zone, once to Cyprus for Exercise *Snowdrop* to umpire 9 Squadron, who descended from the skies near Morphou Bay and linked up with the Commandos for a "Falklands Yomp" across the island. The other escape was to Jordan for a brief attachment to the Arab Legion Engineers, partly to carry out some clandestine reconnaissance of the Allenby Bridge for some now forgotten contingency plan involving the armoured regiment at Ma'an. While I was at Zerka I was privileged to see the last Arab Legion parade to be taken by Glubb Pasha in April 1954.

That was the year that withdrawal, much rumoured over the years, was eventually agreed between UK and Egypt on 27 July, and to mark our departure an elaborate Regimental Farewell Cocktail Party was held at the US Club on 24 September. It was perhaps typical of the uphill battle which life seemed to have become that our Officers' Mess, which we had struggled literally for years to improve by building in stone to replace the crumbling marquee, was finally "housewarmed" on 13 Nov, exactly a fortnight before the advance party flew home to Maidstone!

AND NOW

Last year, out of curiosity, and just for a very few days, I went back to Egypt. Much has not changed, but then in a country which has possessed a highly civilised population for close on 6000 years, you would not expect much to happen in thirty. The pounds and piastres are as filthy as ever, and many locals seem to prefer to use the American dollar. The British Army has, however, left its indelible stamp on the geography, and there are still huge military camps in what used to be the Zone, now though filled with Egyptian troops. Ismailia, despite being bombed and shelled, is now once again remarkably attractive, particularly along the water-front shady with eucalyptus, casuarina and palm. The French colonial houses and even some of the Clubs have regained a little of their dignity, though I could not find the Officers' Club by Lake Timsah. Several of the bridges over the Sweet Water Canal remain blown, however, and Bailey expedients stand in their place. On the edge of the town the Nefeisha lift bridge and the railway station appear unchanged, as does the entrance to Moascar garrison. Inside the latter, now occupied in strength by the Egyptian Army, many of the pre-war buildings in the Mall remain though I did not see any sign of St George's Church. (As the stained glass windows were removed to Dhekelia about 1956 I suspect it may have been demolished.) The road out from Moascar to the north west still traverses a military area, in the midst of which the British Military cemetery stands, a beautiful, peaceful oasis (Photo 3), lovingly tended by Indian employees of the Commonwealth War Graves Commission, "permanently assured" as a plaque reminds us "as the free gift of the Egyptian people". A whole section is devoted to the graves of Servicemen and their dependents postwar, the most recent grave being dated 1958, Spearhead Camp is now "The 6th of October Rest House" and the desert road leading from it to Tek in the west or south to Nefeisha is part of a great dual carriageway bypass of Ismailia. A splendid highway runs as straight as a die diagonally across the desert from Ismailia to Cairo. making light of the sand where we used to crawl in great formations down to Gebel Iweibed and beyond. At one point there is even an enterprising irrigation schemethe Salha Project-in which mobile overhead sprinklers are used to bring green life to the desert; and at another there stands a T55 tank proudly on its plinth as a memorial to the 1973 War (Photo 4).

Further north at El Kantara where the ferry fusses its way across the Suez Canal are the fascinating remnants of part of the ambitious Egyptian assault crossings of October 1973. On the home bank what looks like a marshalling area still contains pontoons and bridging equipment; a BARV and more pontoons litter the banks on the other side. These eastern shores bear the scars where huge ramps were dozed through them to provide exits for the armour, and a few miles further into the desert the hulks of the tanks of both sides lie rusting where they were halted. We drove along the new coast road being built along the northern edge of the Sinai linking Egypt with El Arish and the Gaza Strip, and in places the twisted remains of the old railway which crossed the El Firdan bridge were still clearly visible. Further



Photo 3. "A beautiful peaceful oasis (British Military Cemetery, Moascar)"

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Photo 4. Desert Memorial on the new Ismailia-Cairo road

east, as we crossed the Jordan over a Bailey, I saw what I took to be the remains of the original Allenby Bridge I had painstakingly measured, now just a few girders, a hundred yards downstream, and observed how much irrigation has drained that great river to a shadow of its former self. Finally, the long winding Kings Highway from Aqaba in the south up through Ma'an and past Petra to Amman and beyond is now being pounded literally to pieces by convoys of huge Russian trucks—ferrying supplies for the Iraqi Army all the way up from the Gulf to Damascus. I was struck as we boarded our aircraft (guarded by a helmetted Egyptian soldier) by how little things have changed. Though the British Army, present at one time in such strength throughout the area, has now long since departed, other uniforms have taken their place. Everywhere the military tension remains.

Early Days

MLC

In 1884 the Royal Engineers Institute had occasion to change its Secretary, who was also Editor of the Journal. The outgoing Editor modestly congratulates himself, in the January 1884 Journal, on the achievements during the seven years of his stewardship. The latter included his attempts to open his columns impartially to all opinions (so long as there was no criticism of questions which had been "authoritatively settled") and, by informing individuals as to what their brothers officers were doing, to foster that "esprit de Corps which has always been a marked feature in the Royal Engineers."

In these "Early Days" notes, however, the question has often been asked as to why so much that was long and obscure was published in the Journals of 100 years ago, and what, in fact, did the readers of those days make of it all. A letter in the August 1884 number gives some indication. The writer is heavily critical. He states that the Journal had precisely not given news of the doings of "brother officers." Scientific and historical matter, let alone endless columns of extracts from foreign military periodicals, had almost entirely "usurped" the available space. Indeed, "few care to read it in detail" and most "merely scan it in the faint hope that they may find something of interest!" The new Editor does not see fit to comment.

Sapper in the sand (4)

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EARLY DAYS

except to state that he would be pleased to be sent more Station News! Anyway it seems that the modern reader is not alone in questioning the make up of the early Journals!

The retiring Editor in his article mentioned above goes on to remind his readers that "the Corps Papers had the object of circulating technical information of a nature valuable to the officers of the Corps. The object of the Journal was to enable officers, widely separated . . . to know what their brethren are doing and where they are quartered." The latter, incidentally, was mostly done by publishing what is now called the RE List and what was then called the Supplement, in its entirety month after month! In a way, and as judged by the modern reader, both the Journal and to a lesser extent the Professional Papers, seem to have failed as really worthwhile publications. The Journal, as indicated above, because it filled its pages over much with material of very narrow appeal. The Papers, because they tended to concentrate on Fortress Engineering. For example, on frequent accounts of trials on the effects of projectiles on various materials - masonry, earth and armour plate, etc, and on various methods of mouting guns in casemates. Since the Corps was very much concerned with the design of fortresses, for coaling stations if not for the home ports, this was fair enough, but the number of officers likely to be actually involved in such specialised work must have been relatively small. Again, to be fair to the Editor, articles on other military engineering subjects may just not have been forthcoming. The fact remains that both the Journal and the Papers may have had a disappointingly small readership. In short, the present system of having a quarterly all purpose Journal, an annual List and the monthly "Social" Supplement, seems to be a much better solution. But it is unfair to accuse people for not having got it right first time!

As far as military operations in 1884 were concerned, the position in the Sudan was the most critical. Early in the year the situation was so bad that the Egyptian Government (mostly in the person of Sir Evelyn Baring, later Lord Cromer) was of the opinion that evacuation was the only practical course. Since the insurrection under the Mahdi was religious, Baring, when offered the services of General Gordon, at first declined on the grounds that a Christian Governor and C-in-C was undesirable. However, no Egyptian officer of the right calibre could be found to take the job on, and Gordon was finally sent. The problem concerned not only the evacuation from Khartoum and the interior, but from the Red Sea littoral as well. Tokar, near Suakim, and its Egyptian garrison under British officers was being besieged and Suakim itself threatened. An expedition was thus mounted from Cairo, and from troops on their way to India, with the object of landing in Trinkitat Bay and clearing the tribesmen from the area. This relief force was under the command of Major General Sir Gerald Graham, VC, RE, who, readers may remember, had made his name as a Brigade Commander in the Tel el Kebir campaign. The expedition landed (barrel rafts and improvised piers played an important part) in February 1884, and then advanced on Tokar. The tribesmen were routed at Et Teb, where cool and disciplined fire from the time-honoured square overcame the massed attackers. In a later sweep to clear the countryside the tribesmen (one cannot avoid using the word "fanatical"!) were again defeated, this time at Tamar, using similar "Square" tactics.

It is perhaps significant that, when extracts from foreign military journals showed that tactical thought was very much directed at open order tactics and fire and movement, we were showing an intense interest—to be fair, both for and against in the continued use and handling of the "square formation." As mentioned above, General Graham had made good use of the square at El Teb and Tamar. Unusually, the square on both occasions had been used in an offensive role. The "mobile" square at El Teb, measuring about 100ft in depth by 250ft wide, was formed with a battalion on each flank (York and Lancaster and the Royal Irish Fusiliers), a battalion in rear (Black Watch), the Gordon Highlanders and 26 Field Company RE in the front and guns at the corners. The transport, 60th Rifles, Royal Marine detachment and Naval Brigade (dragging guns) marched in the centre. On the move the units advanced in fours, in company columns, ready at any moment to form line facing in the appropriate direction.

At El Teb this square formation was entirely successful, despite a hazardous move across the enemy's front under musketry fire. The whole square finally advanced to within 200 yards of the enemy works. After a further exchange of fire, the left face (York and Lancaster) were detached and carried the position. The whole action was a remarkable example of a "mobile square" being used to outflank and manoeuvre against the enemy positions—the tribesmen having thrown up a line of weapon pits. In the final stages of the fight the cohesion of the square was abandoned and the battalions pursued their own objectives, one of them always maintaining a firm base! It is clear from the description of the action by Captain A O Green, RE, which was published in the Journal, that the success of the operation was very largely due to the cool handling and control by General Graham.

At Tamar the tactics were broadly similar, except that at an early stage in the battle the forward edge was detached to advance independently on the enemy. Whereupon tribesmen were able to break into the square, now lacking its front face, and were only repulsed and the situation restored by Graham after some very critical moments during which the Naval guns were temporarily lost. All credit to General Graham!

The controversy on the use of the square which raged in the pages of the Journal (including extracts from letters to the National press) was inconclusive. Telling points were that if there were too many successful uses "our generals would be too prone to adopt it."! Also that, until a smokeless powder was in general use, a square could become so enveloped in smoke that no one could see what was happening!

As described in an article especially written for the Journal, RE work during the expedition primarily concerned elementary landing facilities (as mentioned above) water supplies and zaribas. As regards the latter the author comments that against "naked savages" the zariba was so effective that the troops were given a feeling of too much security. Indeed, an over reliance on prickly mimosa took the place of protection afforded by a "stout heart and a good rifle." The effect of this purple passage was somewhat spoiled by the message in the next sentence, which was that the G 1098 hatchets, bill hooks, etc were of "very inferior quality"!

General Gordon was murdered in Khartoum in early 1885, so doubtless the 1885 Journals will have much to say on this issue. In 1884 he also figured prominently. One learns that he was the only Christian for whom prayers were offered in Mecca, quite apart from the General being a Mandarin of the highest order. "Abroad he has been successful in ruling nations; at home he is only an officer of Engineers." In answer to a flowery letter sent to him by the DAAG, RE on behalf of the Corps when he set off for the Sudan, he wasted few words and replied in one line: "One of my greatest comforts is the kind interest our Corps has shown in me." Gordon also makes clear, in a memorandum to the Government and published in the Journal, that he wholeheartedly agreed with the policy of evacuation. "The Sudan is a useless possession, ever was and ever will be." Later, in Parliament, when the Opposition were bitterly resisting the dispatch of a force to relieve Khartoum, the Government were accused of sending an expedition to "rescue a man who did not need to be rescued and who had disregarded the instructions given to him" (to evacuate as soon as he could).

The Opposition also made much of the fact that Gladstone's Administration should never have got embroiled in Egypt in the first place. "Tel el Kebir should not have been fought. It put HMG too much in the saddle." Shades of the Falklands again!

At the time these debates were taking place the rescue force was slowly making its way up the Nile. The Sappers were fully occupied in opening communications (railway construction, surmounting or by-passing the cataracts, boat repairs, etc) and in establishing a water supply.

Despite the extensive coverage in the Journal of the operations in the Sudan, almost as frequent mention was made of the social occasions held in honour of General Graham! Dinners in London and Chatham, Swords of Honour in Newcastle, congratulatory telegrams . . . The Falklands in contrast seem scarcely to have been noticed! In an after dinner speech Graham reminded his audience that the Sappers were certainly Jacks of all trades, but the latter portion of the saying no longer applied. Good stuff indeed! General Graham may well have been thinking of the steadiness of 26 Field Company when they formed part of the squares at El Teb and Tamar. They had acquitted themselves as infantry to Graham's, and no doubt their own, satisfaction. Perhaps this reflected the importance set on the standard of unit musketry. Inter Unit shooting matches were frequently reported. In the March Journal there was an article on the newly-introduced Morris Tube. This, as readers will know, allows a full bore service rifle to be scaled down for use on a miniature range. This introduction, so the article tells us, would not only vastly increase the opportunity for live firing but "if their use is properly encouraged the Morris Tubes are calculated to have the effect of rendering rifle practice an amusement, and this is what is needed."

Perhaps, also, the Sappers were improving as steady soldiers through the efforts of the Brompton Barracks Temperance Society. In March 1884 there was a "great meeting" in the gymnasium presided over by the Chatham Garrison Commander, with the Lord Bishop of Rochester, the Commandant SME, the Commander of the Marines and many other notables in attendance. The object was "to do battle with one of the greatest enemies England had and one of the greatest enemies to home and individual life." At the time of the meeting there were 371 members. This Society dearly wished to send out from Chatham sufficient numbers who, in due time, would form a nucleus of abstainers in every unit, so that a member of the Society, fresh from Brompton, would always find an element of sympathy and support in his new unit.

Clearly the potential evils of barrack life did not effect the view of Baron Göltz, of the German Army, whose "Das Volk in Waffen" was reviewed in the April Journal. "War", remarks the Baron, "is said to be one of the greatest civilising agencies, in so much as that the calm preparation for it in time of peace tends to educate the masses and instruct them in their duty of obedience to the laws of the State, and a respect for constituted authority. Besides, it also helps the material progress of the country by the development of industrial arts and by the construction of roads and railways." The Baron was clearly not worried by any vision of the Military Industrial Complex being launched on to a sea of drink!

It would seem that it was in 1884 that the Corps started to send individuals on "Civil Attachments" for the education and training of PQ-or should one say professionally qualified-officers. "Now that machinery and steam or other motive power enter so largely into arrangements for defensive purposes . . . officers of the Corps will now be enabled to have better acquaintance with mechanical engineering than they are at present able to obtain."-so runs the official notice of the scheme in the Journal. Up to a total of six officers, who had completed their Chatham course and shewed a liking for this branch of engineering, were to be attached to engineering firms for "a year or two." The famous armament manufacturer, Sir William Armstrong of Newcastle-upon-Tyne, agreed to accept the first batch. Each officer was given a fairly comprehensive outline programme, which set out the broad division of the time, eg three months in the drawing office, and the sort of routine expected, eg that he should work from 9-12.45 and 2-4.45 each day. He could return to ordinary duty at any time at his own wish. Indeed, Armstrong's could also request the withdrawal of an officer at any time without giving a reason. At the completion of twelve months in the works, Armstrongs were asked, if practicable, to employ officers on site where machinery was being installed. It seems that the basic instruction given at Chatham in the other branches of engineering was judged to be satisfactory.

At this period there was clearly a policy to boost the interest in, and standing of, the Engineer Volunteers. The Annual Inspections of various units, including the laudatory addresses of the Inspecting Officer and descriptions of the actual parades and displays, were reported at some length. Leeds, Newcastle, Gloucester, Cheshire, Middlesex, the Tower Hamlets, Flintshire and Lancashire appeared in this way. These accounts contrasted with an article on the Punjab Frontier Force (the Piffers) which was originally raised from the Corps of Guides in 1846. Personal devotion to their Commandant was the hall mark of this force. When Lumsden (later Major General Harry Lumsden) was in command, the Inspecting Officer one year was the redoubtable Sir John Lawrence, Governor of the Punjab. It appears that Lawrence, in his questionings and searchings, seemed to have unduly harrassed "their adored chief." Indeed, an Afridi orderly sidled up to Lumsden and suggested that if Lumsden had been "pained or interfered with" it was only right that they should see to it that the Inspecting Officer, who was starting for Peshawer on the morrow, would never reach his destination! Perhaps there are many Commanding Officers who have harboured similar wishful sentiments!

But life was not all a matter which required "stout hearts". In an article on "Hints to Officers going to Natal", those concerned are warned that living conditions, sport, etc, were reasonable enough, but that "work is mostly an incidental item." However, all was not lost, since there was the hope that "there will probably be more to do shortly"!

The RE Widows Society came in for their usual mention at the Corps AGM. In 1884, the Trustees decided to "continue to widows the usual bonus of £25 in addition to the pension of $\pounds 30$." Princely sums indeed when measured against today's payments!

Developing a New Pontoon

LIEUT COLONEL J P FITZGERALD-SMITH B Eng, C Eng, MICE

THE PLACE OF PONTOONS IN MILITARY HISTORY

Pontoons have always played a major part in the Military Engineers' gapcrossing capability from Xerxes' floating bridge across the Helespont, and Caesar's Bridge of Boats across the Rhine—to the massive Bailey Bridges across the lower Rhine in the Second World War. The usefulness of a pontoon bridge, unlike any other form of bridge, is due to the fact that it has no span limits.

I find it a most extraordinary situation that, for the first time in the history of the Corps, we have no in-service pontoon. It is true we have an amphibious bridge in the M2; but as will become apparent in this article there are some limitations with any amphibious bridge.

Before a new pontoon is developed it is important to have the answer to one question which is certain to be asked by those who control the purse strings. What is wrong with the last lot of pontoons that were purchased? In the case of British Army—the Heavy Floating Bridge (HFB)—a tripartite pier pontoon which if it was to be built today I estimate would cost in excess of £100,000, without its transport. The principle of Archimedes does not alter with time. If a load of say 80 tons has to be carried, it will require so much buoyancy; so why cannot the HFB pontoons be used, instead of being sold at scrap prices to end their days as floating jetties in Marinas and Yacht Clubs? It is a valid question, and in the answer lies the clue to what is required from a new pontoon.

A UNIVERSAL PONTOON

It is a matter of history that when Folding Boat Equipment (FBE) became obsolete the FBE pontoon also became obsolete; when Bailey Bridges became obsolete. the Bailey pontoons also became obsolete; and the same happened with Light Floating Bridge (LFB) and HFB. It was not just because load classes increased, but also because each pontoon was so dedicated to the bridge for which it was developed it could not readily be used with the next generation of bridge. After all, HFB was built to take "Conqueror" on its transporter, ie (Military Load Classification (MLC) 80 T/100W—which means it could take present-day loads. Where it fell down was that it was too specific.

The first thing to avoid in developing a new pontoon is to be too specific to any particular equipment. This is the reason why I have advocated that the new pontoon should not be called "The Medium Girder Bridge (MGB) Pontoon", as it might then follow the way of its illustrious predecessors and vanish into obscurity, when the MGB eventually becomes obsolete. I am pleased to say that the new pontoon is now to be called a "Universal Pontoon" and there is no reason why it should not form the floating support for future generations of bridges, as well as for those bridges such as "Bailey" and "HGB" which no longer have a surviving pontoon. HOW CAN CHANGES IN LOAD CLASS BE MET?

Floating bridge designers have at present reached a water-shed. Should bridges be made stronger to take even heavier tanks? The Challenger is heavier than Chieftain! Or will tanks get significantly lighter? The big gun advocates have been wrong before, as the history of battleship development has shown; and also if the tragic lesson of the loss of Singapore is remembered. It is my personal opinion that weights will go dramatically down. The recent lesson of wars in Israel and the Falklands indicate that the next war will be a guided weapons war, where the tank could well be an armed missile control vehicle, picking up missiles launched from another vehicle. This is the crux of the question for the designer—should the bridge be designed as MLC 70T or MLC 18? The designer cannot afford to make the wrong choice. Fortunately, if the right pontoon is developed, both eventualities can be met.

Incidentally, this is one of the limitations inherent in an amphibious bridge such as M2 or Ribbon Bridge. They can only carry extra loads by sacrificing the beautiful simplicity of the original concept; and if used with lower-class vehicles then they are wasteful in logistic efforts. Two equations govern the design of floating bridges.

One gives the deflection in the water; the other gives the bending moment that the bridge will be subjected to under the load. In both these equations, a single parameter occurs which gives the answer to the question. This—in Winkler's nomenclature—is the elasticity of the foundation. More directly for Sappers, it is the load required to deflect the bridge one foot if the buoyancy were to be spread evenly under the bridge (as is the case in a Ribbon Bridge). It is important to understand this concept, so I make no apology for further explaining the statement by giving an example.

If it takes sixteen tons to force a single pier one foot down into the water, and the pontoons are at thirty-two feet spacing, this will give an elasticity co-efficient of 0.5 tons/ft/ft. Therefore, if a lighter load is to be carried while still utilising the same super-structure and maintaining the same freeboard, then the spacing can be increased until the elasticity co-efficient gives the desired result. If, however, the load increases, then the spacing can be decreased so that the strength of the bridge is not exceeded—and the freeboard is still adequate.

The second requirement is, therefore, that the pontoon spacing must be variable and the connections such that they can be attached to a wide variety of bridges. The dead weight of most modern bridges is such that the uplift at any point in the floating bridge seldom exceeds the dead weight. All that is essential is a simple strap to locate the pontoon in position during construction, and also, should a pontoon become holed, to ensure that it is not lost by sinking out of contact with the bridge. The new Universal Pontoon can be economically used with loads from MLC 5 to MLC 110. It can be used with "MGB", "Christchurch Bridge", "HGB" and "Bailey Bridge"; so it is truly a "Universal Pontoon".



Photo 1. Four Universal Pontoons can be carried nested within one another. In this photograph only three are being carried because of the carriage of the raft saddle in the top pontoon

COULD HFB NOT BE ADAPTED TO ANY BRIDGE?

The answer is "yes", but there are several severe disadvantages with the HFB tripartite pier.

Cost

To manufacture HFB today would cost over £100,000; and yet it has nearly the same buoyancy as a Universal Bipartite Pontoon Pier. Transport

To transport an HFB pier would take one 10T truck and a ST purpose-made trailer--at a present-day estimated cost of £40,000. That is to say, 40% of the pier cost.

Four Universal Pontoons give twice the equivalent flotation, and can be carried on a single vehicle at an estimated cost of, say, £35.000—ie £17.000 per pier. I cannot say what the new pontoon will cost as this is confidential information, but as cost is roughly proportional to weight, some idea of the cost can be formed by comparison of weights. (The pontoon pier weighs two tons compared with the HFB ten tons). (*Photo 1*).

Manpower

It took a team of ten men to launch an HFB pier, while time for launching was approximately ten minutes—ie after outer pontoons have been added to the centre portion of the pier and including the time to out-rig panels. ie 100 man-minutes to launch a pier. The equivalent flotation formed by the Universal Pontoon (*Photo 2*), thanks to my patent method of launching, can be launched in one minute and formed into a pier in another minute. Which means that the equivalent flotation can be produced in eight man-minutes. This capability means that piers can be brought into bridge to match the high rates of building now possible with MACH builds. A 400 foot (120 metres) bridge can now be built in as long a time as it takes to construct the super-structure. A daylight build of one hour is not impossible. *Essential Use of Bridge Cranes*

In every harbour area where HFB piers were assembled, a bridge crane was essential. There was always a high risk in operations that this essential piece of equipment might have broken down, which could have then put the whole bridging operation in jeopardy. The Universal Pontoon is assembled in water using a simple guide and connecting system operated from the inside of the pontoon. Four men

Developing A New Pontoon (1)

can make these connections in under one minute.

HOW CAN THE TRANSPORT REQUIREMENTS BE REDUCED?

The question of reducing the amount of air being transported while not having to spend too much time preparing the pontoon for use has always been a military Engineers' nightmare. We will consider what has been done in the past, and then see how this can be reduced.

Folding Boat Equipment (FBE)

This equipment used a very economical transport system, and while each pier did not have much buoyancy, up to twelve boats were carried on an elevating rack. The main drawback was the manpower required to get each boat into the water. Heavy Floating Bridge (HFB)

This had much more buoyancy, but it took fifteen tons of transport capacity to move the pier—and about 100 man-minutes to get a pre-assembled pier into the water.

Light Floating Bridge (LFB)

This had less buoyancy than HFB: on the other hand, the bipartite pier could be carried on a single three ton vehicle.

US-Aluminium Pontoon (M2)

This pontoon was very economical in transport, as it transported up to twelve pontoons on a six ton vehicle; but to avoid it becoming a water tanker, the pontoons were nested upside down and required a large number of men to launch them.

Uniflote (Civil Construction Pontoon)

This has good displacement, but only one can be carried on a three ton vehicle. It also requires a crane and quite a large number of men to construct a two-part pier in the water.

Krupp-Mann Inflatable Pontoon

It has a good displacement and a large number of units can be carried on a truck, as the equipment weighs about half a ton. Where it loses out is the manpower to make it ready. It is understood that it usually takes fitteen minutes before it is inflated and it takes about twelve men to lift the unit from the vehicle into the water. Therefore, I have taken the manpower requirements as 180 man-minutes. Unlive Factor (U)

A rough and ready criterion that would grade pontoons relative to one another on some common yardstick is required. The following criterion is suggested. This is called the Utility Factor (U):

- If B = Buoyancy in tons of a complete pier with zero freeboard
 - M = The manpower in man-minutes that it takes to get the above amount of buoyancy into the water ready to take its load

T = The number of tons of transport capacity required to move the pier B Then U = $(B + (M \times T)) \times 100$



Photo 2. Pontoons being launched: four men can launch a pontoon in one minute: a bi-partite pier in eight man-minutes

Developing A New Pontoon (2)

Example:	
Universal Pontoon	$B = 2 \times 22$ tons = 44 tons
	$M = 4 \text{ men} \times 2 \text{ minutes} = 8 \text{ man-minutes}$
	T = 2 tons
	$U = (44 \div (8 \times 2)) \times 100 = 275$
HFB	B = 34 tons
	M = 100 man-minutes
	T = 15 tons
	$U = (34 \div (100 \times 15)) \times 100 = 2.26$
Krupp-Mann	B = 24 tons
	M = 180 man-minutes
	T = 0.5 tons
	$U = (24 \div (180 \times 0.5)) \times 100 = 26.67$
Uniflote	B = 40 tons
	M = 80 man-minutes
	T = 6.0 tons
	$U = (40 \div (80 \times 6)) \times 100 = 8.33$
	· · · //

This type of analysis highlights the reasons why previous generations of pontoons never survived the bridge they were designed for. Rubber inflatables give a very good figure so long as only the buoyancy of the pier per vehicle ton is considered. However, they lose out as soon as the manpower factor is taken into consideration. The Universal Pontoon could be slightly improved if more than four pontoons could be carried on a trailer, but there is a limit to the stacking height that can be permitted on a vehicle. The STANAG limits this at four metres. WHY CAN ONLY FOUR PONTOONS BE CARRIED ON A SINGLE

WHY CAN ONLY FOUR PONTOONS BE CARRIED ON A SINGLE VEHICLE?

The answer to this question brings us to an important point; that is the question of vulnerability. Most of the post-war pontoons achieve some measure of nonvulnerability by sub-dividing the pontoons into a number of separate water-tight compartments. This meant, theoretically, in the case of LFB that unless all thirteen compartments in each pontoon of the bi-partite pier were holed it would not sink. This was the same principle that was applied to the unsinkable "Titanic"-and such pontoons share the same weakness. An aircraft straffing a bridge could hole all compartments at the same time so causing the pontoon to sink. The Universal Pontoon adopts a different principle. (Photo 3). The buoyancy compartments are 161/2in deep. This depth has been carefully chosen so that there is sufficient buoyancy in the pier to support the dead weight of the bridge. This means that even if the hull is riddled with holes, the only buoyancy loss is the volume of the projectile path in the foam. The pier has been designed so that the water level outside is always below the false deck level. It can never sink. It will still take some light load if the holeing is not extensive, and the vehicle is not kept stationary on the bridge. This is because the hull is made self-bailing by the use of one-way valves. A story of the self-bailing valve may be interesting to the reader. In the early concept stage, it was evident there was a need for a self-bailing valve if we were to avoid the same mistake the Americans made with their M2 pontoons. To avoid a Stack of nesting pontoons becoming large water tanks, collecting rain water, the Americans turned the Stack upside down, which then made it very awkward to launch. The secret of the rapid launching capability of the Universal Pontoon is that they are able to be slid off one another, starting from the top of the stack. This method of launching ensured that they arrived in the water ready for use.

There were two drawbacks consequent to this design decision: One was that the pontoon had to be open at the top and therefore they could collect rain; and secondly they would certainly ship a lot of water during launching.

These disadvantages could all be overcome if the self-bailing valves, located above the false deck, were capable of emptying the water inside the pontoon

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quickly. The question that had to be answered was how long should that time be? In the absence of any previous experience, an educated guess had to be made. It was felt that the valve should bail a pontoon completely, that had been filled to the gunwale, in three minutes. This was the time it was estimated would be available to pull a launched pontoon back to the bank.

Further calculations showed that some 600 cubic feet of water had to be passed through four valves. These would need to have a discharge rate of 0.83 cubic feet per second. At that time, there was a Boat Show in London so, based on the excellent principle that no-one wants to re-invent the wheel, it was decided that enquiries would be made at the Show on which firms manufactured self-bailing valves. There were several such firms, all of which professed interest in the project. Until they asked what flow rates we were looking for. When this was given in cusees, they threw up their hands in horror and said "what you are looking for is a b..., sluice gate; not a self-bailing valve". The first prototypes were made as flap valves not unlike a sluice gate; but these gave problems in sealing and were replaced by a patent valve such as is used in the Life Boat Service. They have a very similar requirement to bale out the life boat should it capsize.

Incidentally, tests carried out on the prototypes achieved the desired flow rates, with only a differential head of three inches. How right we were in adopting this very stiff requirement was proved some twelve months later. A pontoon carrying a raft saddle was launched at a very steep angle (45°) and it shipped water almost to the gunwale; when the pontoon was given a very slight lateral pull to bring it back to the bank it was very close to capszing. However, the valves worked so well, if quickly drained and the calamity was avoided. It was perfectly drained by the time it came alongside the bank. However, this is a digression. Suffice to say that the pontoon has a false bottom 16/2in deep; the height of a stack of four pontoons is the hull height of 46in plus 3 × 16/2in. This comes to a total of 95/2in which means that the vehicle bed cannot be higher than 5ft 2in. if the STANAG 4m height is not to be exceeded. A launching vehicle with a lower bed height could carry more pontoons; it is, however, not easy to see how this could be achieved as there is also a STANAG limit to the width of vehicles which precludes increasing the spacing of the wheels beyond the width of the pontoon, and so lowering the bed height.

We are very nearly in a position to write the specifications for the new pontoon: (1) It should not be dedicated to any particular bridge, but should be capable of being used with past, present and future bridges



Photo 3. Method of stacking. Note arrangement of buoyancy compartment and self-bailing valves. This is one of the reasons why only four pontoons can be carried on a single vehicle

Developing A New Pontoon (3)

(2) The method of attaching the pontoons to the super-structure must be simple enough to allow it to be used with any bridge

(3) The elasticity co-efficient must be variable so that the resulting system is economical for the heaviest load class; or the lightest load class; so that it does not matter whether loads go up or down

(4) It must have a high specific capacity (U) defined as cubic capacity per vehicle ton per unit preparation rate. A figure of 200 should be the minimum requirement

(5) Stacking height must not exceed four metres

(6) It must be unsinkable under its own dead weight and the dead weight of the super-structure

(7) It must be possible to replace a seriously damaged pontoon without stripping the whole bridge

(8) It should be rugged enough to provide for a large number of serviceable pontoons without the need for a big spare holding to allow for damage

(9) It should be easily repaired within the capability of a Unit Repair Organisation without the need to backload it to a second line or base workshop

I have not included the very desirable feature of a low unit cost, because if all the above points are incorporated the army that adopts this system will have a pontoon that will virtually be ageless, and will have a comparatively low cost in the long run. Certainly as low a cost as any system that could displace it.

New materials and techniques may well reduce the cost of the pontoon, but the design should not change and two pontoons could exist alongside one another in the same bridge.

Jerusalem Report 1984

LIEUT COLONEL A A TAYLOR MI Plant E. MBIM

THE country is dry.

We walked in mid-January from Jerusalem to Jericho, through the line of the old roads, Roman, Turkish, Mandate, all following roughly the same alignment in the difficult country, and, in less difficult terrain choosing one of several water-supplied tracks, where choice is possible. Between Maale Adumin-the Red Fort of the Crusaders, dominating the main ascending pass and now a new-Crusader Israeli settlement sprawl of egg-box housing and very light industry-and the precarious chicken-hut settlement of Kefar Adumin, we passed nomad camps in wadis which would usually be grazing their flocks over the light scrub of the great spread of the hills, pastures enough to sustain several tribes in a normal winter. The herds are controlled, patrolled, thin, scrawny. They are fed water from improvised galvanised troughs. The water comes from municipal sources and ironically that means Lake Galilee through the Israeli National Carrier and, according to our vociferous nomads, the cost is exorbitant. I checked with the West Bank Military Governor and he says categorically the water to the nomads is free: I see no reason to doubt him but undoubtedly our pastoral friends are making another political point and also exaggerating the undoubtedly ruinous cost to subsistence grazing of hauling the water from distribution point to where the flocks graze. Everybody exaggerates! The truth is elusive except the all-pervasive fact of this arid winter season.

From the 3rd Century BC with the superb water engineering of the Nabatcan civilizations of the Negev to the near 21st Century AD where the Israelis are trying to recover the old lost secrets to make the Negev the life-support system it once was, the country has always desperately needed the ability and knowledge to exploit its water resources properly. The history of Palestine is a long tale of cycles of strong government encouraging effective water engineering and thus efficient agriculture and prosperity, contrasting with weak government, collapse of efficient water management leading to subsistence agriculture and substandard economic and social structures.



THE ROYAL ENGINEERS JOURNAL

And the interlopers have been so many. Romans taking over the key Nabatean cities when the nomadic pressures on their independence became too great: the Romans in their turn producing superb engineering of a different sort; we can now bypass the Roman technology but we seem unable to match the subtlety and desert symbiosis of the Nabateans. I don't often confess to reading Sci-fi but many of the scenes in Herbert's "Dune" series are-at the least-evocative. The start of serious deterioration of the country's water infrastructure came with the eclipse of Byzantine rule by the Persian invaders in AD 617 and this new chapter in the long and stormy history was confirmed in 635 by the Arab invasion. The two centuries of Crusader influence (1099-1296), embattled tactical defence of a strategically indefensible slice of country, only kept the few remaining structures in rough working order, and they finally lost what proved to be the decisive battle with Saleh-ed-Din at the Horns of Hattin in Galilee through failing to secure their water supply. Then for 250 years the Moslem Mameluks from Cairo and for the next 300 years, the Moslem Ottoman Empire were so firmly in control that trade routes changed, were diverted away from Palestine, central government disappeared and the area became a backwater in the affairs of the Middle East until Allenby's capture of Jerusalem in 1917 broke the pattern of thirteen centuries. Thereby hang many tales and a large number of them involve either the Corps itself or individual members of it, before, during and after this climacteric.

Last week I took a party of theologians to Herodion, an amazing piece of egoism on the very edge of the Judean wilderness. Herod is reported by Josephus to be buried here (1) in this, the most ambitious of his fantastic palaces, though there is no archaeological evidence to bear this out. But there is visual and textual (2) evidence of the lavish use of water for recreation, ritual bathing, air conditioning, lush gardening. To a lesser extent this is repeated in the Temple Mount in Jerusalem, though here the evidence is mainly documentary, as almost total destruction and extensive redevelopment have obliterated most physical evidence.

Let me then describe the water systems that used to supply Jerusalem (see sketch map), and more limitedly Herodion, through the country's turbulent history up to 1967, because yesterday we went to Solomon's Pools. I doubt if Solomon was ever around the place, though Josephus (3) retails the legend of kingly disport in the gardens, but certainly the Turks were, for the first intimation of structure is a ruinous Turkish fort (4). Open the heavy doors and large bearded faces loom through the darkness of the old buildings around an enormous courtyard. Goats, of course,



Photo I. Solomon's Pools

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coralled in the dark inside mud and stone wall structures out of harm's way, not (as a first near heart-stopping impression) local representations of Moloch or Baal. This place was built as a reservoir, the nearest above Jerusalem, to collect the three local (Etam) springs with a flow of no more than 4,000m³ per day (5) and deliver them to Jerusalem, Bethlehem and Herodion in aqueducts, the alignment and many actual remains of which are clearly in evidence.

There are three pools, all rectangular, each below the other in the upper part of the valley leading to Artas village, probably Herodian block masonry in construction, although Pierotti dates part of them to the Israelite Kings (6), with thick retaining earth and masonry walls. The first is half full and small children swim and fish in its green translucent slime below threatening notices saying "DANGER! No SWIMMING" and play tag among the pine trees. This pool is 12m deep and holds 10^{1/2} million gallons filled; it leads through two channels to the middle pool, averaging 790 metres above sea level (hereafter abbreviated 790 ASL). 14m deep and holding 10 million gallons; then to the lower pool 17m in depth and with a capacity of 40 million gallons. Each of the pools has a complex system of sedimentation basins for the incoming aqueducts and remnants of a similar system for the outgoing waters. In March, after this dry winter, the middle pool is quarter full and the third pool is all but empty (Photo 1).

Two incoming aqueducts supplemented the three local Etam springs as Jerusalem's need for water increased in the second Temple period with three annual pilgrimages proving too much for the Etam springs, for the Spring Gibon and rain water collection in Jerusalem itself. The first one probably built by Herod the Great 37-4 BC, and certainly showing some evidence of his engineering genius, comes 40km with a fall of only 1/2000, contour hunting through mountainous country (8km in a straight line) from the great reservoir fed by another spring system at Arrub (810 ASL) in the South, before the hills fall away down to Hebron and the desert. The duct is usually around 50cm wide and 50-60cm high and varies from a channel hewn in bedrock, through part carved and part built-up conduit, to full construction on high foundation walls, often solid dams crossing walls to withstand winter spates. The other, higher, system comes only 5km from Bir el Darij (870 ASL) and is Roman in construction, running first through a 3km tunnel along Wadi Bijar, the Wadi of the Wells, accessed through fifty vertical square shafts, a work of high technology modelled on Persian *quanats* whose use is typical of engineering standards of the middle Roman Empire, then running almost directly in a tunnel sustained by nine vertical shafts for 500m through a hill running to the Upper Pool. Neither of the two incoming aqueducts has supplied water in quantity to the Pools for many years. The lower system was kept in some order by the Mameluks but fell into disuse under the early and middle years of the Turks who had no incentive to forstall or repair guerilla raids on the exposed and isolated lengths of the aqueducts and tunnels. The higher system's capacity is now mainly absorbed by local farmers for irrigation and the Pools now only partly fill from local springs and from a very limited flow from the quanats.

Of the three outgoing aqueducts, two fed Jerusalem. The first, supplying the increasing need for water and probably started during the Israelite monarchy (7), was a simple gravity supply at 1/375 to the Temple Site (at 640 ASL) via a tunnel under Bethlehem and Bir es Sultan by the Jaffa Gate through capped stone channels and contour chasing like its associated Herodian system above the pools from Arrub. The second, probably built by Pontius Pilate whom Josephus (8) records as misappropriating Temple funds to build aqueducts in AD 26, used syphon systems to avoid the contour contortions of the earlier open channel distribution. Traces of these syphons can still be found in the refugee camp of Aida, where some structures have used the great rebated blocks as their foundations (Photo 2). This 3km down-hill length probably produced enough pressure to overcome the saddle between Tantur, where I now sit, and Mar Elias, through the now almost deserted village of Beit Safafa, the centre of which was the Arab-Israeli border between 1948 and



Photo 2. Syphon used as foundations for structures at Aida Refugee Camp

1967. Lamentations (Rabba 4:4) records the destruction of this system by the Sicarii in the First Revolt. A check of the individual parts of the syphon reveals segments of bore 40em and length 60em, enclosed in a one metre source block (Photo 3).

of bore 40cm and length 60cm, enclosed in a one metre square block (Photo 3). The third aqueduct below the Pools supplied Herodion (670 ASL) mainly through springs at Artas at 690 ASL and a few hundred metres down the wadi; whether the Jerusalem and Herodion supplies were interconnected is not now determinable from the evidence but the Herodion aqueduct ran a 9km relatively uncomplicated course (5km for the crows) cascading downhill at a drop of 1/450 to provide the water gardens and swimming pools of the lower palaces with a lush envelope in a region where the average rainfall is usually below an annual 200mm. Of the three outgoing systems the Herodion branch, although substantially pre-



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served, has not been used since Herodion fell in 135 AD in the latter stages of the Bar Kokhba rebellion: the waters will certainly have been promptly restored to the village of Artaa whose agriculture and lifestyle must have suffered badly in supporting the water sports of Herod's hangers-on down at Herodion. The Roman high aqueduct will almost certainly have deteriorated fast when Byzantine rule ended; a similar system at Caesarea, Roman high technology again, had fallen into disuse for many years before the arrival of the Crusaders but the low level, simpler open gravity systems at both Caesarea and Acre had survived. The low level, Herod-built, Solomon's-Pools-to-Jerusalem aqueduct had also survived (see Wilson's description later) although in Turkish times the water was running in earthenware pipes laid in the aqueduct itself (Photo 4).

In 1917 the steady decline through 300 years of Arab, Mameluk and Ottoman neglect changed with the conquest of lower Palestine and the occupation of Jerusalem by Allenby's Army. The state of the Jerusalem water supply, with Allenby's occupation force to add to the city's problems, was now critical. Jerusalem has always been short of water. The one good spring of Gihon, outside the old city of David on the Ophel Spur and diverted to Siloam through Hezekia's 701 BC rock cut tunnel (Chronicles 32.3) gushes periodically for forty minutes with a six to eight hour gap, to produce between 200-1200m³ per day-enough for a village only. So the city used underground cisterns like that of the Antonia Fortress, now part of Ecce Homo or those below the Crusader churches at St Anne's and surface pools. In 1917 there were around 7000 cisterns in the city. The biggest group was under the Temple Mount, including the one called the "Great Sea", able to hold 9,000m3. Then there was another group under the Latin Convent in St Francis Road. Perhaps one and a half million m3 in all. But hand-working by bucket, lack of opportunity or incentive to drain and clear. long hot summers and years of neglect had made these sources increasingly malaria ridden, unpalatable and dangerous even to the inhabitants; to the Allied Forces, fresh from the desert and still faced with the Turks in Damascus, Homs and Aleppo, it would have been disastrous. The state of the various static pools, at this stage reduced to four, was far worse than that of the cisterns. They were stagnant, disease-ridden, bug laden. Charles Wilson, the Royal Engineer whose survey and archaeological excavations in the Holy Land did so much to put Palestine exploration on a firm and scientific footing. described and illustrated in his Picturesque Palestine, published in 1880, the state of



Photo 4. Earthenware pipe mortared into aqueduct at Mt Zion

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Hezekiah's Pool, the only one left in the Old City under the Turks. "Hezekiah's Pool is an open tank surrounded by houses, which is supplied by an aqueduct from a reservoir outside the city. It is capable of containing 3 million gallons of water but is in very bad repair. The bottom is covered by a thick deposit of vegetable mould and one corner is no more than an open cesspit of the foulest description; the water, nominally, is only used for washing purposes but the poorer classes often draw it for drinking during summer and hence arises much fever and sickness". So the first act of the military government was to order the cisterns and pools emptied and cleaned; they would be refilled by installing a modern piped and pumped supply.

The report of the officer in charge of the project, Major F W Stephens, RE, dated 20 July 1918 is detailed and concise. The Palestine Exploration Fund, an organization started in 1865, mainly as a result of Charles Wilson's work, and publishing the Palestine Exploration Quarterly, obtained War Office permission to publish the report in PEQ 1919 and in the introduction puts "on record the latest service to Jerusalem of the Royal Engineers whose close connection with the Holy Land has lasted through peace and war for over half a century". Stephens, as his predecessors, found no useable sources N, E or W of Jerusalem, so concentrated on Southern sources, especially the Arrub group of springs. He calculated a January yield of 14,000gph could be improved substantially by cleaning existing channels to provide 250,000gpd, pumping a 12-hour day. The great pool Birket Arrub would be patched to act as a 41/2 million gallon balance. This would give the estimated military and civilian population of 50,000 around five gallons each per day, a little more than the modern emergency planning-figure of 20 litres per head per day. For this he planned the pumping station at Arrub to have two Hornsby 66HP engines driving a three-row ram pump to deliver 20,000gph against a head of 410 feet. The pipe was twin six inch-the largest size that was available in the Middle East and the main reservoir was established at Kilometre 19 on the Jerusalem to Hebron Road at what is now the corner of the Kfar Etzion Block. The buildings exist today 31/2km from the Arrub pool, exactly as Stephens records, but the difference in levels cannot be reconciled with his 350 feet (height at Kilo 19 given as 3083 feet). The small scale maps of the Israel Ordnance are accurate and they show a height difference of 70 metres; even allowing for a substantial depth at intake and the maximum height of the reservoir, the difference is still well over 100ft and the Kfar Etzion Field School confirm the map figures from their surveys. The Etzion masonry reservoir of 300,000 gallons, with two equal compartments, allowed a gravity feed from Kilo 19 to Jerusalem (790-800 metres) by a single six inch pipe for twenty kilometres.

But differences over heights notwithstanding, the system worked and the whole project was completed in two months after centuries of shilly-shally and many half hearted improvisations. The last recorded attempt was the inauguration of a meagre supply (planned at 50,000gpd) from the Solomon's Pools' springs to Bethlehem in the low level aqueduct, thence by the old duct supplemented by a four inch iron pipe (NE and then N) to a new reservoir in the old tunnel under the Hill of Evil Council (now UNHQ!). Major General (by now) Sir Charles Wilson in PEQ 1902(p5) was scathing about this "unnecessary cost when a simple repair to the old system was all that was needed". Even so, the supply fell well short of that planned, as Bethlehem, under which the system ran in a 430m tunnel, extracted what they wanted and nomads and farmers along the route did the same. There was an attempt to repair the system at the time of Kaiser Wilhelm's visit, reported by D Yellim Hamelitz in 1898 and, in 1861, Pierotti (6) tells of attempts to induce a limited channel flow to alleviate the plight of Jerusalem in drought conditions.

The great pool at Arrub survives today though it's little more than a rubbish dump for Arrub refugee camp. The pumphouses store winter cattle fodder and not much else. The equipment that Stephens installed has gone. Arab women wash clothes in the running water of the South outlet, as no doubt they did in the time of Turk and Mameluk and far farther back before the reservoirs and aqueducts were built.

After long search and much talk. I have persuaded the official guardian to open the pump houses at Solomon's Pools that have been idle since June 1967. They lie between the middle and lower pools, the main and oldest one a sturdy masonry single story building just like Stephen's pumphouse at Arrub and the other a timber and brick structure holding the later equipment. The springs at the Pools had been refurbished by the military and later again by the Mandatory authorities, as had the Wadi Bijar aqueduct after Stephen's emergency Arrub pipeline was built. The Bijar duct was now seen to be more than springs and aqueducts, as the Romans knew well. It was the superb exploitation of the meeting of an aquifer with an aquiclud, so that water is gathered over every inch of the 3km system. This renewed flow from the two sources justified a pumping station, along the lines of the Arrub one, being established here by Solomon's Pools to supply the local towns andagain-Jerusalem, although firm evidence of the distribution system is hard to find. The fighting in the area in 1948 saw the Arab Legion firmly in command of all of this part of the Judean hills including the watershed as far as Ramat Rahel, so allowing them to cut off any supply to West Jerusalem but maintain an increased supply to the three closely associated West Bank towns of Bet Jala. Bet Lehem, Bet Sahur and the Old City. Thus things continued until 1967 when the Israelis eliminated the Jordanian Army as a West Bank factor, the whole water supply system was closed down, perhaps never to flow again, but that also is another sad and very complicated story.

Issa Yusef Shahim abu Halil, a native of Arras below the Pools, has been associated with the place since boyhood. He was engine minder since middle Mandate and now is semi-retired guard and keeper of the mechanics. His memory is strong in parts—in places and faces and even English names associated with control of the installation—and weak, indeed very suspect, in others. He remembers "heating up the engine heads with a kerosene burner for half-an-hour, then moving this rod and that lever and the machines started!" But he had no idea of power sources, mumbled something I couldn't understand about kerosene and, when pressed, about oil. There was no trace of fuel tanks; they would in any case have been outside and vulnerable to looting.



Photo 5. Solomon's Pools pumphouse, main engine

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We went first to the newer installation. Here an eight cylinder Deutz drove an inline cyclical pump through any two of four large cast iron filters marked only "Manchester 1927" and pumped the water through a six inch cast iron main to Jerusalem along the watershed. There was a beautiful little Crosby 4HP to charge the filter beds with "Pure English sand, still in the store!" As far as I could gather this system had superceded the old one in 1934 and worked well until June 1967. So then we opened up the sturdy older building and 1 was awash in half light on yellow stone and cobwebs and the mellow ochreous rust beauty of old machinery, frozen in its last working throes at some sad date in 1934.

The layout here at the Pools is just as I imagined it from Stephen's description and a photograph of the Arrub pumphouse under construction. The main engines were two Stamford Blackstones (MCG 8306 and 8307) (Photo 5) providing horizontal reciprocating drive to a balance shaft with two eight-foot diameter cast flywheels and two four-foot spindle spoked driving wheels. Heavy woven canvas belts (with spares on the walls) carried the drive back over the engines to a threerow ram pump, the only identification of which, on the main valve system, was Darling R and M Co Williamsport USA. All engine plates and other identity or capacity information have gone. All that remains is that which the makers cast ineradicably into engine beds and blocks. And again the 6in pipes fish in the run-off from the middle pool and disappear off to abu Halil's "Al Quds" (Jerusalem to us).

That brings it up-to-date, I'm sorry to say. Jerusalem old and new, and her now considerable environs, pipe in water from the Israeli National Carrier—basically Jordan headwater extracted from Kinneret (Lake Galilee) and pumped to the coast below Haifa and then throughout Israel's plains, hills and deserts. But Solomon's Pools and the springs and the incoming and outgoing aqueducts and more modern pipelines, although mostly disused, seem to me to mark man's environmental and social struggles and structures more clearly than any other artefacts do.

NOTES (see Bibliography)

- (1) The Jewish War, Chap 5, p112 (Biblio 7)
- (2) *ibid* Chap 3, p77 (Biblio 7)
- (3) Antiquities of the Jews. Book 8, Chap 7-3 (Biblio 1)
- (4) Jerusalem Explored. Pierotti refers to a 12th or 13th Century fort "Kalat el Burak" (Fort of Lightning); but there is now no evidence of Crusader or Seljuk influence here. (Biblio 12)
- (5) PEQ. Canon John Wilkinson in PEQ (74–5), quoting Professor Amiran and SWPIII '89 and C Schick ZDVPI (1878). The flow in heavy winter rain conditions could be five times this quantity. (Biblio 13)
- (6) Jerusalem Explored. (Biblio 12)
- (7) PEQ. 74-5, p37 (Biblio 13)
- (8) The Jewish War, Chap 7, p127 (Biblio 7)

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The Squadron Sergeant Major— A Suitable Case for Treatment

MAJOR A D BOYD-HERON RE MBIM

It is debatable that a Squadron may stand or fall on the experience and knowledge of its Sergeant Major and, therefore, that his is one of the most important jobs in the Corps. It is undeniably a sad but true fact that, despite having what is probably the finest selection system of any Army, a number of Sergeant Majors fail. Is the system at fault or can we do something about it? If it is at fault then clearly those who do fail should never have been selected in the first place, yet we do nothing specific to prepare a man for this most vital of appointments; he is simply expected to fill it.

The Corps recognises the importance of preparing a man for certain appointments and promotions. Field Section Commanders, Field Sergeants, QMSIs and RSMs all have their own courses; why not the SSM? Sceptics will say that we already take too long to train our soldiers, that they spend too great an amount of time away from their units. It is difficult to argue against this viewpoint. Perhaps, though, it is a question of priorities. An examination of the RSMs course syllabus, which covers two weeks, reveals quite considerable quantities of material which would be of value to the Sergeant Major, indeed many would say of more value than to the RSM.

The proposal to run a Sergeant Majors Course is not new. It has been suggested on a number of occasions and turned down, most recently last year when in the opinion of the SCOREE combat sub-committee it was deemed unnecessary once again. Whilst one must respect the decisions of this august body. I am not convinced that the matter has been given sufficient airing. As a senior instructor at the RSME and, in particular, as sponsor of the QMSI courses for the last two years, I believe I am in a better position that most to discuss the problems that potential Sergeant Majors have. The views expressed in this article are principally my own but have been coloured by numerous conversations with Warrant Officers, some with Squadron Commanders and a few with those who have commanded Regiments.

I doubt that we can teach a man to be a successful SSM. Success is so often all about personality, leadership and the ability to communicate, but we can, and should, allow him to start the job from a position of strength, confident that he fully understands his responsibilities, sure that he has an adequate knowledge of manmanagement, discipline and administration.

The systems approach to training demands that a rigorous analysis of the job must be carried out before the training objectives can be derived. These in turn will eventually lead to a course programme. One could be forgiven for dismissing the production of a job description. Everyone knows the responsibilities of the SSM. Or do they? They do not appear to be written down anywhere. Perhaps it is not possible to be so specific as to produce a catalogue of his duties. After all, it is more than likely that they will vary from Squadron to Squadron, and certainly from OC to OC. Even more reason for giving the man a few guidelines and for providing a basic grounding in some of those less well defined subjects that he is likely to have to spend time researching, time that could be better spent developing a close working relationship with his OC. A sound knowledge on arrival is likely to impress the Squadron Commander, and first impressions often count.

There are four main areas where the potential Sergeant Major is unlikely to have collected sufficient knowledge throughout his career for him to feel entirely confident on appointment. These are Discipline, Welfare, Corps Matters and General Administration. There are other perhaps less significant subjects where revision might be welcome. I propose examining the main areas in more detail first and then discussing some of the secondary subjects.

First DISCIPLINE, which is intended to cover all matters connected with Orderly Room procedure and to include a detailed knowledge of certain parts of the Manual of Military Law and Queen's Regulations. The newly appointed SSM who makes a fundamental error, either in the charge sheet or in the Orderly Room procedure, is unlikely to create a good first impression, quite apart from the fact that if a charge is not framed correctly the culprit may get away with it. Therefore, it would seem sensible to spend some time going through the MML, taking perhaps the ten most commonly used sections and pointing out the differences between them. As far as punishments are concerned the Sergeant Major must know what powers his OC has: he should know the minor punishments listed in QRs, and he needs to have the attraction of "other" punishments pointed out to him as a substitute to the formal charge. He has a duty to brief every soldier on his rights when charged with an offence. There is an extremely good guide published by the Defence Council under Army Code No 12730 (Revised 1981) which should be on every SSM's desk. I wonder how many have a copy, or even know that it exists.

Next WELFARE, which has become increasingly a part of the Sergeant Major's responsibilities. The OC can come to rely quite heavily on a man who has the necessary depth of knowledge and the right attitude. A correct reaction at the start of a crisis is all important. Since it is the SSM who primarily looks inward, he should be able to recognise potential problems and nip them in the bud. But what must he know to do this? A basic idea of the welfare organisations available to him and the way they work would be a good start. For the UK based Sergeant Major, he should know something of the Families. Housing and Welfare Scheme and in particular about the irregular occupancy of quarters. If in Germany, he might find it useful to know that there is a rent allowance available for hirings. He should also know about the Royal Engineers Association, the help it can offer and how to apply for it. He ought to know the rules for running Messes and Clubs and whether, for example, he must use NAAFI as the supply agency. It would certainly help if he understood the barrack damages system.

Thirdly CORPS MATTERS. RE Records run a course for Warrant Officers which lasts four days. I wonder how many Sergeant Majors attend it before taking up the appointment? I guarantee not many do afterwards, simply because, once in post, their OCs are loath to let them away on courses. Yet there can be little doubt that a man who fully understands the career structure will find it invaluable when he comes to discuss the careers of his NCOs and soldiers, as he inevitably will, if only over a pint of beer in the Squadron bar. A knowledge of the Customs of the Service and an awareness of Corps Memorandum and Dress Regulations, although perhaps not essential, would probably be helpful. He should also have a basic grounding in Corps History. There does not appear to be any course which specifically sets out to bring our history to the attention of its members, except possibly the RSMs course. We have a tremendous amount to be proud of and it is in the Squadron where this can best be fostered. A visit to the Museum which, surprisingly, many senior ranks have never stepped inside, would give a good grounding.

Lastly, and by no means least, there are a number of GENERAL ADMINISTRATION topics which should be included on any course. Squadrons are notorious for getting their ration returns in a mess. Filling them in is something that the average Troop Staff Sergeant may never have to do, yet we clearly expect the Sergeant Major to be totally familiar with them. As a WO2, he may well be ordered to serve on a Board of Officers for the first time. It is a fundamental part of his job to record certain information in accordance with the requirements of the Director General of Army Training. What information, and where should it be recorded? A Sergeant Major cannot expect to complete a tour without becoming involved in an account of some sort. He will either have to run one, supervise the running of one, or at the very least, be a member of an audit board. Some basic instruction, which might include information on bar checks and daily stock sheets, would be useful together with advice on what to look for in the prevention of fraud. While on the subject of money matters, a brief on pay and allowances would allow him to discuss financial problems with his men. He may end up telling them to go to the Regimental Pay Office for expert advice but that isn't really the point. He will have been able to demonstrate to his soldiers that they may have the confidence to discuss their personal problems with him, and receive sensible and authoritative answers.

These are just a few examples under four main headings where. I believe, we can help prepare a man for his appointment. There are some others which may be considered less important, but nevertheless might help him to enter the Squadron brimming with confidence. Among these I would list an elementary reminder of service writing. It is a fact that today we are surrounded by paper and it is quite likely that the Sergeant Major may find he is expected to write routine letters on behalf of his OC. Despite having already spent a number of years in the Warrant Officers and Sergeants Mess he may not be so familiar with the duties of, for instance, the PMC, a role he may have to carry out from time to time in the absence of the RSM. He must also be in a position to advise his young and newly promoted SNCOs on Mess etiquette.

I strongly believe that a one week course should be put together covering all the subjects I have mentioned, and probably some that I haven't. By devoting approximately one day each to the main topics of discipline, welfare. Corps matters and general administration, the last day could be used to cover the less important subjects and to tie up the package with a talk by a Squadron Commander or Sergeant Major, emphasising the relationshp that it is necessary to achieve between the two to make a successful team.

In order not to "pinch" more time from Units it would be necessary to shorten the RSMs course by one week, with a consequent reduction in material covered, and reallocate the time to the Sergeant Majors course. I believe the course should be run at the RSME and should be mandatory. Warrant Officers should not attend until they have been nominated for SSM appointments. The inclusion of such a course in our training schedules could only serve to improve the efficiency and effectiveness of the Sergeant Major, and therefore the Squadron, and there is no time for inefficiency in the Corps today.

The Power of "A Press"—World War II

MAJOR A J HERBERT CBE, MA

WORLD WAR II had been an interesting one for 518 Field Survey Company Royal Engineers which contained within its ranks a wide range of unusual talent which concentrated in "off-duty hours" on the organisation and operation of a Concert Party of almost professional standards. This Party frequently provided a variety of entertainment ranging from Christmas "Pantos" to Patrick Hamilton's "Rope", and of course the unit dance band was a focal point for regular dances whenever possible which kept the morale of all ranks at a high level and enabled the unit to get to know the local people socially and, in particular, the local girls.

This Concert Party tradition had been started in 1940 when the Company was forming in a village in England and continued as the unit moved with the armies of war, first to North Africa, later to Italy. It was in Italy after some years away from the home country that the regular dances really got going, and wherever the unit moved Saturday night dances—war and weather permitting—were held, which gave the troops a few hours of feminine company and "a get-together" with the war-weary citizens of the occupied countries.

It was just after the end of the war in Italy in June 1945, while the Eighth Army was re-grouping that the Company found itself in Colloredo near Udine, a small

and attractive village which clustered round the old castle, at that time occupied by the local partisans. The Partisan Underground Movement in Italy had gathered strength following the capitulation of that country in 1943, and contained all shades of political opinion within the various groups—all were anti-German, but all were by no means necessarily well disposed to either each other or the Allied troops, and in particular many of the groups were Communist inspired and made it quite clear that they would have preferred the Russians to have beaten the British and Americans in the race for Northern Italy.

It was perhaps partly the political outlook of the local partisan group in Colloredo, but also undoubtedly a not unnatural resentment to "foreign soldiers" competing for the favours of the local girls, that lead to some friction between our Sappers and the partisans, and when the Saturday night dances were commenced in the village hall, there were no partners for our boys and for two weeks the band played to an attendance of frustrated British soldiers. Through local contacts, which some of our more attentive soldiery had established with the local signorinas, it was learnt that the partisans had threatened to shave the heads of any of the local girls who fratemised with the troops or who attended our dances. Such a position could not be allowed to continue! The troops were restless for their Saturday night "hop" so the Commanding Officer hit upon a plan of campaign.

As all Sappers will know Royal Engineer Field Survey Companies were special units, formed specifically to survey, draw and print maps for the Army in the field, and comprised an establishment of trained tradesmen including topographical surveyors, photo-draughtsmen, photographers and of course printers, the latter whose duties involved the operation of two mobile "double-demi" printing presses.

It was, then, the Commanding Officer of this Unit who one morning set off for a formal courtesy visit to the Commander of the Brigata Rosselli. No care had been spared on turnout, the green camouflaged jeep was shining with most unwarlike cleanliness, the Major in newly pressed Service Dress with gleaming Sam-Browne belt complete with .38 revolver in holster, two large Sappers with purposeful tommy-guns and the driver—they looked a small but formidable band when they swept through the castle gates, passing the lounging partisan sentry, and requested a meeting with the local Commandante. Ushered into the Grand Hall by untidy guards bristling with all types and condition of small arms and grenades, they were received by the partisan Commander and his staff.

After an exchange of salutes and pleasantries, the Major explained the reason for the visit. Partisans and Allied Forces had fought gallantly together as brothers-inarms in Italy to defeat the hated "Boche", and there had been great co-operation and understanding between the partisan fighters and our troops. It now appeared that some subversive elements were trying to drive a wedge between these comrades-in-arms by spreading false rumours that the partisans had forbidden local girls to fraternise and mix with the British soldiers and attend the dances at which it was hoped to foster better friendly relations between soldiers and villagers. The Brigata Rosseli were being blamed for this and he, the Major, felt that some joint action should be taken to dispel these rumours. The partisan Commander was shocked and horrified that such false statements were circulating-were his protestations of undying and everlasting friendship perhaps just a little too glib? The Major returned the compliments with feeling and suggested that perhaps a short note confirming this mutual understanding would be appropriate. The Commandante-was he a trifle puzzled? and unaware of the power of "A Press"?-readily agreed, called for his Secretary, dictated a statement which was quickly typed, stamped and signed with a flourish.

Further saluting and formal leave taking took place and the "Jeep Party" swept out of the castle gate, past the sentry now upright and presenting arms.

Back at the tented Headquarters of the Company no time was lost. Never before in the heat of battle had the production facilities of the Unit worked so speedily and smoothly. The photographic section quickly produced prints and enlargements of CORRESPONDENCE

C.V.L.

COMANDO PRESIDIO OCILOREDO DI M.A.

Colloredo di M.A. 15/6/45



 $\frac{10 \text{ fig} \cap \Omega}{20 \text{ side}}$ Side assicurazione al comando locale Inglece, che questo $\frac{20 \text{ signa}}{20 \text{ signa}}$ si de assicurazione al comando locale Inglece, che questo

civile e in special molo alle signorine di non frequentere i balli Inglesi pubblici, oppure Inglesi.

Viva la libertà!!!



Photo 1. Copy of the "Safe Conduct" printed by 518 Coy

the document and in an hour or so large poster reproductions showing every line of the Commandante's typed sheet complete with official stamp and signature were coming off the press, together with several hundred identical handbills, and shortly after that the posters appeared on buildings and hillboards throughout the village and the handouts were being circulated in the village and the surrounding country.

I conclude this story by saying that the dance on the following Saturday, attended incidentally by a number of the partisans, was a "sell out". A wonderful evening was had by all, with plenty of glamorous and smiling girls eager to dance with our troops—and they all brought with them their personal signed guarantee of safe conduct, from the Partisan Commander—Viva la liberta!

Correspondence

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MIRACLES DO HAPPEN!

Sir,—We landed on "Juno Beach", Courseulles to be exact, on D Day and I was with the Royal Engineers Port Operating Group whose job was to be the unloading of the beached coasters and craft with their supplies for the assault troops. The beach was mined and had spikes and other obstructions all over the beach area, and we held over our beaching until the spot assigned to us had been cleared, which took about two hours.

When he landed the CO, 2IC and myself in the middle, were standing in an open

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field when a German dive bomber or fighter plane dived at us with all guns firing and my CO and 2IC were hit and were eventually removed to "Blighty" leaving me in sole command of the situation and unit.

Every mined field seemed to have a warning notice, and I was careful to walk along the road which had barbed wire to keep people from wandering on to the fields. I saw a slight rise in a field on my right which did not have a warning notice, and with what appeared to be an observation post in it about 200 yards away, so I decided to climb through the barbed wire and investigate.

On arriving, I found a dugout shelter and in it a baby tank with a coil of electric wire on the back and an electric battery on each side. It was about 4ft long and I walked warily around it thinking how nice that would be running up and down our headquarters frontage (we had seized the German Admiral's house for our headquarters). Coming out I had some trouble releasing my foot from a wire on the ground which I had accidentally broken. I climbed out and crossed the field onto the roadway again and so back to my headquarters.

On arriving back I got hold of my Ordnance Officer and told him what I had found and of my intentions of bringing the tank back and setting it up outside our headquarters, and he promised to go out there right away.

It was that evening he got hold of me and taking my hand he shook it hard and said "The Lord must be with you; do you know that that tank was loaded with 600lb of TNT, it lay in the middle of a heavily mined field over which you walked twice, and and what is more you must have broken the booby trip wire which was lying on the ground". It was then that he told me the idea was to propel the tank into the enemy lines trailing the electric wire behind and then blow it up by means of electric current from the German positions.

There were many other miracles which I cannot go into here.—Yours sincerely, Sydney Barnett

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FORTY YEARS AGO-KOHIMA

Sir,—Major Charles Yule's excellent article in the June 1984 Journal in which he describes the role of the Second Infantry Division's Sappers at the Battle of Kohima rekindled many "nostalgic" memories. However forty years is a long time and memories tend to dim. Therefore in fairness to the sub units and individuals involved I believe one or two minor errors of detail should be corrected for the record.

506 Field Company was a Territorial Army unit, (as was 208 Field Company), having been formed at Tyneside in 1939. Incidentally both these units were well represented by Burma Veterans at the recent 40th Anniversary Commemorative Service at York Minster. Major Jimmy Landon, who, as Charles Yule indicates was killed some miles south of Kohima in early June 1944, was the OC of 506 Field Company. He had served in 208 Field Company but was posted to 506 in 1943, before the Division moved to the Burma front.

I doubt if the soldiers in 6 Infantry Brigade who provided the defence for Kohima Garrison itself, would agree with Charles Yule that water supply was simple. Although there may have been numerous mountain streams, pure and clean, it was not possible to reach them from inside the Garrison without sustaining heavy casualties. The Garrison was limited to one mug of water a day for brewing tea and shaving was forbidden.

The memorial at the Cemetery in Kohima, which has attracted a fair amount of publicity in subsequent years, was designed by Lieutenant James Ferrie of 506 Field

CORRESPONDENCE

Company. As I have mentioned previously memories grow dim and it is possible that "Buz" Bee may have assisted in the design. However the major credit must go to Jamie Ferrie. To the best of my knowledge Lawrence Binyon's well known verse was not inscribed on the memorial stone. The Second Division chose an old Greek couplet which had been suggested by the Brigade Major of 6 Infantry Brigade and which has been quoted at numerous Armistice Services throughout the World since the Second World War—"When you go home tell them of us and say for your tomorrow we gave our today".—Yours sincerely, Donald Good

> Major W E L Rees FIHE, MI Plant E Woodville Huish Episcopi Langport, Somerset TA10 9QY

LOADING FOR D DAY

Sir,—My Unit, 50 Mechanical Equipment Section, had been divided into three; one party to operate with 5 Beach Group, one with 6 Beach Group and a very small party with 1 Corps.

I had been in the Portsmouth loading area, and had already seen most of the ME Section backing on to the landing craft, when a Naval rating approached me and said, "Admiral Ramsay would like to see you at once". I had seen him twice before, once at Elgin swimming baths, where I had demonstrated my ideas on the wearing of the "Mae West" for assault troops, and once at Largs when copies of my training programmes had been distributed to illustrate imaginative training programmes.

He immediately asked me how many of my drivers and operators were available to take over from drivers who failed to back on to the landing craft first time. I said that most of my unit had already loaded, whereupon he arranged use of his barge for me to collect eighteen to twenty Driver/Operators. He had ready the necessary instruction cards for each operator on our return.

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We all worked flat out for two days until we were, literally, "black in the face", and we looked more like tramps than soldiers. As "briefed troops" we were not allowed "out in public" and our appearance was a "dead give away", so much so that we were twice picked up by the Military Police, once when we were having a meal in a public restaurant and again when I was buying some newspapers to take back to our landing craft. On both occasions we had to get the OC out of bed to "rescue" us.

When I arrived back on board my landing craft, unshaven and filthy, my batman had slung a tarpaulin underneath the load of Somerveld Track on a Multi-Wheel trailer, and after a clean up and shave I fell into bed and slept for nearly twentyfour hours, so the tarpaulin must have been very comfortable!

I landed on the extreme left flank very near to Ouistreham but unfortunately 1 did not last very long, my wounds kept me in hospital for best part of a year, starting off in the guinea-pig ward for the use of penicillin.—Yours sincerely, W Lundie Rees

Lt (V) R D Thomson 65 Pinewood Ave, Glasgow G66 4EB

BUZZ-PHRASE GENERATOR

Sir,—Regarding the source of the "Buzz-Phrase Generator", this is taken from *The Complete Plain Words* by Sir Ernest Gowers, a book which should be compulsory reading for all members of the Services, both Civil and Armed.—Yours faithfully, R D Thomson

Colonel G A D Young DSO 5 Morton Close Woking, Surrey

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"A PIECE OF HISTORY"

Sir,—With many recollections (still vivid) and with great interest, I read the above article in the March issue of the *RE Journal*, particularly the paragraphs describing the withdrawal from the north coast of Crete and subsequent evacuation from the south of the island.

The Author (Major Sloan) emphasizes the need for close co-operation between Sappers firing the demolition charges, and the retiring troops, especially the rearguard. Normally this is not too difficult. But in this sector of Crete when the withdrawal began, much of the covering work had to be done by units temporarily under command of the New Zealand division and organized into improvised formations with inadequate communications. The following episode shows how easily one thing can go wrong in an otherwise well planned and well executed operation.

- In this action the main units detailed as rearguard for the NZ Division were:
- (a) 2/7 Australian Infantry Battalion
- (b) No 7 Commando, newly arrived in Middle East from UK
- (c) Middle East Commando. This was an amalgamation of the original 50 and 52 Middle East Commandos, which had been raised and trained in the Middle East in 1940 and had seen service in the Dodecanese, Sudan, Eritrea and Abyssinia.

The Australians had just previously been evacuated from Greece with the loss of much of their heavy equipment. The two Commandos, though battalion sized units, did not carry any of the heavier infantry weapons—Mortars, Machine Guns—A/T guns etc and had no transport vehicles. All three units therefore were hardly equipped for a defensive operation such as a rearguard.

No 7 Commando, less its advance party which had already arrived in Crete, and ME Commando arrived at Suda Bay about 23.00hrs on 26 May, only to find that the situation had greatly deteriorated during the last twenty-four hours. So much so that withdrawal had already been authorized and would begin on the following day. After leaving Suda Bay the road via Stylos to the embarkation port at Spakhia would be followed.

2/7 Australian Battalion and No 7 Commando were to cover withdrawal of the main body from present positions. ME Commando was ordered to find a defensive position where, if necessary, the enemy advance could be held. After reconnaissance on 27 May, this was located on both sides of the road at Babali Hani, between Stylos and Vryses about fifteen miles from Suda, where the valley through which the road runs, narrows to about 2000 yards. That night, ME Commando moved south and occupied it.

The following morning, 28 May—near Stylos, 7 Commando were in contact with the enemy and beat off determined attempts by him to cut the road of retreat. In the early part of the morning therefore most of the NZ Division passed through the ME Commando position of Babali Hani unmolested except for spasmodic air attacks, and the Australians and 7 Commando, acting as rearguard, followed about 10,30hrs.

The German advanced guard from 5 Mountain Division began their attack on both sides of the road about 12.00hrs with Mortar and MG fire to which the Commando could make no reply. But all assaults on the position were repulsed by about 13.30hrs. Mortar and MG fire was continued at intervals, but no further assault was made until 15.00hrs. By now the enemy had been considerably reinforced and while continuing to attack frontally, began to work round the left flank of the Cormmando position, which was in the air.

However, 2/7 Australian Battalion which had been waiting in reserve moved up a

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detachment at Commando request, extended the defence line and with the left flank company restored the position. All other assaults were beaten off. Mortar, MG and later some light artillery continued to fire on the position, but when darkness fell the Commando was still the position they had occupied all day.

About 21.00hrs, ME Commando pulled out of their position and set off to follow the main body which of course by this time was well ahead. After about five miles it came to the expected bridge which was the largest on this road and had been blown.

The failure to wait for the rearguard to pass before firing under some circumstances might have caused a disaster, with a complete unit still on the enemy side of the obstacle. However, the Commando had no vehicles and were not under enemy pressure as the German advance had been stopped in its tracks at Babali Hani. The passage of the river bed on foot presented little difficulty except for the wounded (about twenty) but meant a considerable extra effort for tired men and a loss of popularity for the Sappers.

However, the error was probably due to unclear orders from above. This occurred frequently in the Crete battle and is always likely to happen when units are fighting in improvised formations and are not familiar with each other.—Yours sincerely, George Young

> Colonel J H Edwards B Sc AD Row D Cts (FE) CDS MOD Main Building Whitehall SW1A 2HB

APPOINTMENT ABBREVIATIONS

Sir,—I am writing in reply to David Seekings' letter in the June edition, and relying on his discretion, and that of your other readers. I am prepared to reveal the nature of my employment. In response to a number of unfortunate incidents in recent years, a branch dealing with the Chance of Departmental Scandal has been formed, hence CDS in the title. My particular concerns, as indicated by the initials to which David refers, are Arson, Drunkenness, Recidivism, Opprobrium, Waste and Doubtful Contracts. But we are not just a passive organisation charged only with preventing scandal in our own department, we also actively encourage it in others; hence the letters FE in brackets indicating Friendly and Enemy.

I am sure you will appreciate that this is very sensitive work, and as a cover therefore we have invented a Directorate of Commitments, forming part of the Central Defence Staff. This unlikely sounding organisation is divided into NATO and Rest of the World Sections. My personal cover is as Assistant Director in the Rest of the World Section, and in the interests of brevity in the title (!), the description of the area for which I am responsible has been reduced to FE, standing for Far East. In reality, apart from the Far East, I also cover SE Asia, Australasia and Sub-Saharan Africa. Discerning observers, amongst whom of course the readers of this Journal are numbered, would immediately see through this cover, and therefore to support it I spend a good deal of my time travelling in the areas of my concern.—Yours sincerely, J H Edwards

> Major B M Semple RE 39 Engineer Regiment Waterbeach Barracks Waterbeach, Cambs CB5 9PA

WHAT'S IN A NAME?

Sir,—There is no need for any suffix in our unit titles, the Squadron or Regiment number together with Royal Engineers is quite sufficient. Neither the Royal

THE ROYAL ENGINEERS JOURNAL

Armoured Corps nor the Infantry specify the unit's role in its title, indeed the Tanks may be equipped with reconnaissance vehicles and the Light Infantry may be mechanised. Even the Parachute Regiment last went into battle jumping from ships!

We do not need handles to our names; by our fruits shall we be known.-Yours sincerely, B M Semple

> Major T J Blad RE MA 48 Field Squadron (Construction) Waterbeach Barracks Waterbeach, Cambs CB5 9PA

WHAT'S IN A NAME?

Sir,—I would dispute Major Cedric Sloane's assertion that all field squadrons are, or even should be, interchangeable. Not all have the same capabilities and it would be a mistake to pretend otherwise; it would be particularly dangerous to give this impression outside the Corps. A squadron whose establishment is tailored to a specific role has limited capability for tasks for which it is not organised, conversely a "standard" field squadron cannot realistically be expected to undertake many of the responsibilities assumed by specialised squadrons.

I agree that the "Construction" title is inaccurate and misleading. "Airfields" is certainly an improvement but could still suggest a construction capability which cannot strictly be justified. "Airfield Damage Repair" is the operational role of the field squadrons (construction); why not, therefore, "Field Squadrons (ADR)"?---Yours sincerely, Tim Blad

Memoirs

BRIGADIER C H BARNETT MA. C Eng, MICE, FCIT

Born 21 October 1907, died 25 December 1983, aged 76

CECIL HUGH (JASPER) BARNETT, the elder son of Cecil Guy Barnett CIE, was born in Toungoo in Burma. He was educated at King's School Canterbury, where he became Head Boy, and RMA Woolwich. He was commissioned into the Corps in 1927 as "top of his intake". He gained his BA at Jesus College (commuted to MA in 1942) and also a half-blue for fencing. He trained in Railway Management with the Great Western Railway before going to the RE Transportation Centre at Longmoor. From 1935-38 he served in the Far East and on returning to UK was involved in the transportation planning prior to the Normandy landings. After the war he helped in



the reparation of the railway system in Italy before going to the Middle East as D Tn. From then onwards he spent most of his time at Longmoor becoming Commandant in 1953, with responsibilities for the Port and Inland Waterways Division at Marchwood in addition to the railway aspects of Longmoor. He was appointed Director of Transportation in the War Office in 1956 and remained in that appointment until his retirement from the Active List in 1959. He then joined the Ministry

Brigadier C H Barnett MA

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of Transport in an engineering capacity dealing with Highways, until his final retirement in 1972.

Many "Union Men" have contributed personal tributes to Jasper Barnett. Some extracts follow:

"During my period as Commandant at Longmoor I was fortunate to have Jasper as Chief Instructor. In those days he was concerned with both Regular and Supplementary Reserve Unit Training. Jasper's quiet and unassuming efficiency made for smooth running and the utmost value from these intensive periods. He had the enthusiasm for Longmoor which reflected in his work".

"I knew Jasper from about 1950 to 1963 when he was D Tn in Middle East, Commandant at Longmoor and the last RE Brigadier Tn at the War Office. In all the years I knew him he was a completely natural chap, kind and considerate at all times. He was always popular because of his happy personality".

"Jasper was the acknowledged expert in this branch of the Corps. As a man he was always kindly and approachable, ever ready to help and advise. Nevertheless he set high standards for himself and demanded the same from others. One particular project which he initiated and encouraged was the establishment of the Tn Museum at Longmoor".

"I remember him as a strong personality, decisive but sympathetic, generous and with a bright sense of humour".

"I remember him for his quiet thoroughness and patience, and help, at least for one member of his erstwhile technical staff".

"Throughout all his difficulties after his stroke he never lost his sense of humour as cheerfully and bravely he determinedly carried out local shopping under his own steam".

"I knew Jasper since his YO days. He was a complete all rounder. He was very thorough and did not suffer fools gladly. The way in which over the years he fought the effects of the stroke which eventually ended his life was a real inspiration to me".

BSA, GCLA, GJB, WHB, DGC, RHE, FMG, RG, CAL, DCM, FJJP, AEMW

BRIGADIER R L FRANCE CBE, MC*, BA

Born 13 July 1914, died 5 November 1983, aged 69

ROBERT LEONARD FRANCE. Bob to all who knew him, was commissioned in 1934. In his younger days he was a fine athlete playing Rugby for the Corps. Army and Combined Services, just missing a "Blue" at Cambridge at a time of exceptional talent—though he was a member of the Hawks Club, which perhaps indicates something of the esteem accorded to him as a man even in those early days. He was a splendid team captain who led by example. This characteristic was a central feature of all that he did throughout his life. Never particularly talkative he always inspired great confidence and affection. He was also an accomplished dinghy sailor and ocean racer.

He was a genuinely modest man with a very good war record about which he was reluctant to talk. After early service in France he went to Norway where he was one of the first Sappers into Narvik, making safe many of the demolition charges and booby-traps in the quayside area. In 1942 he embarked for the Middle East serving with the Eighth Army in North Africa and Italy. He was awarded his first MC in 1943 and the second in 1945. During this period he commanded three Cheshire Squadrons (2, 3 and 141).

After the war he served a tour in the Far East and in 1955 went to BAOR as CRE/CO 21 Field Engineer Regiment before returning to UK as CO Junior Leaders Regiment RE at Aldershot and later moving to Dover. As a Colonel he commanded 1 Engineer Stores Depot at Long Marston and on promotion to Brigadier he joined DREE (Directorate Royal Engineer Equipment) responsible, within the

Ministry of Supply, for the Research and Development of RE equipment. His final service appointment was Chief Engineer Western Command where he was awarded a CBE in 1966. During this tour one of his many notable achievements was the levelling and landscaping of many of the eyesore slag heaps at Landore, Swansea, Dudley, Channock Chase and Ince in Makerfield, in which his TA units played a significant part.

On leaving the Corps he settled in Chester and joined John Summers and Son (later to become the British Steel Corporation, Shotton) as a manager of the training side where he worked for nearly ten years. He took an active part in local life, particularly with the Youth and Boys Clubs, and was President of the Chester Branch of the REA.

The first onset of Alzheimers Disease is impossible to pinpoint but over the years it affected him to a noticeably increasing degree at a gathering pace and sad to see. A series of minor strokes in the final weeks reduced him physically but the same essential charm, modesty and good manners shone out as ever.

He was buried on 11 November, the Feast Day of St Martin of Tours, a soldier who became a Bishop. The Dean of Chester Cathedral, in his address, said "Today we remember another soldier. Bob France. He was not a Saint but he was a very good man". Let that be his epitaph.

To his wife Margaret, his daughters and grandchildren we extend our deepest sympathy.

RFNA, CO. EEP

LIEUT COLONEL J H BOND MC, BA

Born 8 December 1915, died 21 October 1983, aged 67

JAMES HUGH BOND entered the Corps from Radley College and the RMA Woolwich. He joined 34 YO Batch and after the usual course at Chatham and Trinity Hall, Cambridge, he was posted in 1938 to 26 Field Company in 1 Division. He went with them to France in 1940 and was evacuated from Dunkirk. He then became successively Adjutant 5 Div RE, Instructor at 142 OCTU and OC of a Field Company in the UK until embarking for North Africa in May 1943. He was OC 562 Field Company in North



Africa and Italy, including the Salerno landings, where he won the MC and was Mentioned in Despatches. Between 1944 and 1947 he held various staff appointments and attended the Staff College at Haifa.

Returning to the UK in 1947 he was in turn DAA and QMG at the War Office, Second-in-Command of 9 Training Regiment at Cove and DAAG, AG7 before being posted to Malta in May 1954 as CRE, Works Services. A friend and brother officer writes:

"I first knew James when he was the Adjutant 5 Div RE and I, his IO, was one of a number of very inexperienced subalterns who had joined the Division after Dunkirk. He was a formidable but very fair taskmaster, and I owe to him such ability as I ever acquired to arrive at the appointed place and time with all the belongings appropriate to the occasion.

"We met again in the early 1950s when he was the DAAG, AG7. From my perch in an AG policy branch it was clear that James secured for the Corps a high standing and a better deal than most of his colleagues. I did all I could to come up to his standards, but was surprised to find myself posted to Malta, whither he had gone as CRE.

Lieut Colonel J H Bond MC BA.

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"As in other backwaters at that time, the Army in Malta was not at its best. The CRE had a ramshackle works organisation, a Fortress Squadron manned by parttime Maltese (who had to have second jobs to sustain their families) and a vast accumulation of worn-out wartime equipment. James set about it with his usual thoroughness, and departed no whit from his standards. The results were startling, and the Maltese – soldiers and civilians – loved him. The end of his term coincided with the Suez emergency and they responded splendidly; every man in the outfit acknowledged that he alone had put things to right. When I revisited Malta in 1968 they still remembered him, and the hospitality which his wife Joan and he arranged so beautifully."

In December 1957 he was appointed to command the Royal Monmouthshire Royal Engineers (Militia), and the senior regiment of the Reserve Army, and retired on completion of his tenure in 1960. He had inherited his family property at Burford in Somerset and settled there on his retirement, devoting himself to the management and improvement of the estate. He set up an egg production unit and established a small private pheasant shoot, on which he took great pleasure in entertaining his friends and neighbours. He became Churchwarden of the parish church, and served on the Council for the Preservation of Rural England, the Parish Council and the Committee of the National Farmers Union. For these and other community activities he was highly esteemed in the locality.

His other love was golf and it was during a game at Burnham-on-Sea that he died. During his last years he had converted the former coach house into a charming "dower" house, designing and carrying out much of the work himself to the highest standards. He and Joan moved into it in 1982.

Bishop West, in his address at James' funeral, summed up his life as follows:

"James Bond was a devout, believing and practising Christian. A modest man, a man of integrity. How real was his love for his home at Burford, his land, his hobbies and, above all, his family, wife, children and grandchildren. His gentleness was deceptive, for he was a man of great courage whose valour was acknowledged and decorated in the darkest days of the war. His piety was exemplified by his care for this church. He was in everything a Christian gentleman. Quietly and unostentatiously he lived his life and quietly he left it."

CHC, ACL

Book Reviews

A GUIDE TO THE FORTIFICATIONS OF NORTHWESTERN EUROPE WILLIAM ALLCORN; edited and illustrated by QUENTIN HUGHES (Published by and available from Penpaled Books, 10A Fulwood Park, Liverpool L17 5AH. Price £8.00 post free)

THERE are plenty of guide books which describe the whereabouts and characteristics of medieval castles, country houses and chateaux, but this is the first one designed to help people find the forts and fortresses of NW Europe which grew up from the 15th Century onwards to combat the menace of the gunpowder firing cannon and its development into high explosive artillery.

In general each entry gives the location, date, type, condition, when open, the appropriate guide book references, how to get there and what to see. It covers over 100 forts and fortresses in Belgium, Denmark, France, Luxembourg, The Netherlands and West Germany. The book also includes a list of organisations and people who are willing to help researchers and travellers who need more information, as well as a list of useful guide, and general, books on fortifications and military architecture.

Most of the illustrations are good but some of them appear to be photocopies of

photographs which are of poor definition. This is the penalty paid to keep the price down.

It is good value for money-but it's a pity about those photographs!

EEP

THE KASHMIR GATE LIEUTENANT HOME AND THE DELHI VCs ROGER PERKINS (Published by Picton Publishing, Chippenham. £12.95)

This book is a definitive account of an episode which was described at the time as "one of the noblest on record in military history". The focal point of the narrative is the "forlorn hope" attack, by a small group of hand-picked British and Indian Sappers, on the Kashmir Gate, principal gateway to the city of Delhi. Apart from being a stirring account of one brief but intense moment in human experience, the book is intended as a reference source for military historians, medal collectors, genealogists and all those interested in the history of British India.



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