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Editorial

THE lead article in this issue of the *Journal* is the "Engineer in Chief's Annual Report to the Corps". The report is wide-ranging and gives an excellent snapshot of the activities of the Corps in 2000. In order that it can be read more widely within the Corps family, a copy of the report is to be published as an insert in the January 2001 edition of *The Sapper* magazine.

The Corps and Army are presently faced with unprecedented changes in peacetime and they will not be to the liking of everyone. Private public partnership, or PPP as it is best known, will have a far-reaching effect on the RSME when it is implemented in the next year or so. It's all a far cry from the Army most readers will remember but with defence policy significantly realigned following the strategic defence review, radical changes are demanded in the way we recruit, train and operate in the future. The Corps is well placed to meet these challenges but rationalization of some functions, as has already happened with command and staff training and also to Military Survey (now called Defence Geographic and Intelligence Imagery Agency), is likely to continue.

Recent operations in the Balkans have given impetus to the development of infrastructure doctrine and policy within the Corps and the Army. The importance of making sure that such doctrine is widely known is highlighted in a letter in the correspondence section commenting on the article "Operational Expeditionary Infrastructure Works, The Air Support Way" published in the August 2000 *Journal*. The debate is to be welcomed. We may not all agree with certain procedures, whether financial or technical, imposed upon us but it is incumbent upon all of us to work together to achieve the best way forward. A "them and us" attitude between designers and constructors persisted for far too long in the construction industry and has now, to a great extent, been overcome with the introduction of the "design and build" concept now becoming widely adopted in major commercial projects. The parallel with current doctrine in the Corps is not quite so clear cut but the principle remains important.

Many readers will no doubt have read with some interest the article in the December 1999 *Journal* proposing a new mess kit for officers and the letters which have been published in response to it. Launching Nose, an erudite and knowledgeable person on matters of dress, adds to the debate with an informative and amusing article, "In No Disorder – Right Dress!"

I regret that I haven't space to comment on the other articles in this *Journal* but I would like to say that the Publications Committee continues to be impressed with the range and high standard of articles submitted for publication. I would like to express my thanks and gratitude to all those who have given us the benefit of their wisdom and experience and without whose contributions the *Journal* would be that much the poorer.

After six years as Secretary of the Institution, I have now handed over to my successor, Lieutenant Colonel David Hamilton. He also takes on the job of Corps Secretary. I will however continue for a little longer as editor of the *Journal* and *The Sapper* magazine and will also take on the job of coordinating book reviews and memoirs from Colonel Gerald Napier. Colonel Napier will continue to be the project manager for the next volume of Corps history and has set himself the task of compiling a short illustrated history of the Corps, both of which are planned to be published in the next three to four years.

A strategic review of the Museum has now been completed which is linked to a 50-year lease negotiated with Defence Estates. The Museum continues to be the focus of the Corps' fund-raising effort with added impetus being given to it in order to safeguard many of the heavy equipments which form part of the collection and now need to be moved from storage in the RSME estate to a display area in the Museum, and also to meet the expected increase in running costs as the MOD's contribution is progressively reduced. An article about the Museum, to bring it to the attention of more members of the Corps, will appear in the March issue of *The Sapper* magazine.

The President and Council of the Institution join me in wishing all members of the Institution a happy Christmas and a prosperous New Year.

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Introduction

THE Corps can again be proud of yet another highly successful year that has seen our stock within the armed forces and the Ministry of Defence rise still further. We are clearly being seen as a defence-level asset and our work across the board has left a very wide range of delighted customers. Not the least of these has been the Minister of State for the armed forces who was very interested in our message at the joint professional meeting between the Institution of Civil Engineers and our own Institution, on the potential for engineering to assist further in promoting the wider interests of UK plc. Our wider utility, particularly on expeditionary operations, has been a theme that I have pursued this year and we have seen developments in the areas of infrastructure and the better use of the unique capabilities of the Engineer and Logistic Staff Corps RE (V). The balance of utilization between our technical and combat capabilities has shifted significantly since the demise of the Cold War, although our capability to meet the high end demands of warfighting will always be our acid test.

The operational tempo may well have eased slightly over the past year, but the pace of change continues to be fierce. We have seen the first tranche of the new SDR units forming and, in the case of the UK units, deploying out to the Balkans. HQ EinC(A) has emerged significantly stronger after the General Staff Review (GSR) both in personnel and with a more focussed role under ACGS. There have been two major studies into EOD, which have resulted in my appointment as the Army EOD proponent. Whole Fleet Management of our equipment will be a major culture change. The Defence Training Review is a root and branch study of training that will affect all aspects of our training, and the RSME PPP (public private partnership) continues to progress.

Most encouragingly, the very positive message that I was able to give the Corps on my roadshow earlier this year has been realized by significant increases in soldier promotions this year, and much effort has gone into retention particularly at the sapper and JNCO level. I have switched the Corps' main effort to manning the SDR implementation phase, which will not be without pain. An unprecedented fall in recruiting this year, and increased competition for initial training funding Army wide, led me to take urgent remedial action this summer. This action is starting to show dividends.

Organization

LAST year, I briefed in detail on the impressive SDR increases in the Corps which amounted to a 13 per cent increase in regular manpower and a 20 per cent increase in the number of sub-units. I am pleased to report that the Manpower Establishment Review, which examined these changes in detail, concluded successfully. It also endorsed our key additional enhancement of more manpower for 33 Engineer Regiment (EOD), that is to be met from headroom created through the current Non-Deployable Establishment Review. The requirement for an additional air support regiment was noted, as was the cadreisation of field sections in 3 (UK) Division. The new SDR establishments are now live, and the focus has switched to the manning of the new units in line with the HQ LAND plan. The five year ramp-up process is being steered by the need to meet operational commitments, the barrack plot and the availability of manpower.

As I have alluded to, the availability of manpower is the key. Whilst our PVR rate remains stable, it has not matched the improvements elsewhere in the Army. Additionally, we had an unprecedented 36 per cent shortfall in soldier recruiting so far this year and, if this were to continue, we could be significantly undermanned by 2003. The key issue is securing the necessary resources from the Army Training and Recruiting Agency (ATRA) to recruit and train sufficient soldiers, but I have also put initiatives in hand for the Corps to address the problem through use of the black economy. What we as a Corps view as significant undermanning is, however, better than the norm in other areas of the Army. Nevertheless, I am determined to meet our SDR ramp-up although remedial action may take some years to bear full fruit. I have every confidence that the inherent attractiveness of a career in our Corps, and our more positive recruiting drive, will prevail.

OPERATIONS

LAST year I reported that the Corps' inter-tour interval had reduced from around 17 to 10 months. The interval has now increased slightly to 13 months and, if the level of operational commitments remains constant, the interval will continue to lengthen. Our TA units are producing a steady flow of officers and soldiers for operational deployments (for example in excess of 40 are currently deployed in Kosovo) and this support helps to relieve the pressure on heavily committed regular units and reinforces the "One Army Concept."

Kosovo. A steady state has now developed since the height of activity in 1999. Force reductions saw 23 Amphibious Engineer Squadron and 69 Gurkha Field Squadron withdraw late last year once the majority of enabling works for the Temporary Field Accommodation project were complete. The ORBAT of a RHQ, HQ squadron, close support squadron and field support squadron is now well proven and is supplemented by a HQ CRE (Works) and STRE (Works), a geographic detachment and an EOD detachment. 38 Engineer Regiment was replaced in the spring by 32 Engineer Regiment which adopted the mantle of the pan-Balkans engineer regiment with responsibility for Bosnia as well as Kosovo. 32 Engineer Regiment was replaced in August by 26 Engineer Regiment, which had only just reformed in Larkhill on 1 April 2000. The recently reformed 70 Gurkha Field Support Squadron is also included in this regimental grouping.

The 20-man works project management team, which superbly managed the provision of temporary field accommodation, recovered in May after spending nine months in theatre. Provision of good quality accommodation in Kosovo was a very high MOD priority and a contract, valued at approximately £110M, was let with Hunting Engineering Ltd in July 1999 (see article this *Journal* by Lt Col C M Cockerill). The team was responsible for managing the construction and subsequent acceptance phase of this unique pathfinder contract, which is being used as the model for the future employment of contractors on deployed operations. In-theatre management of the operation and maintenance phase is the responsibility of the deployed CRE (Works). Some 900 UK-based and local contractors' personnel are employed with a total monthly spend in excess of £1.5M.

Internal security has become an important part of operations in Kosovo, and in March a search cell was established consisting of the SO3 EOD/Search and a RE search advisor from 33 Engineer Regiment (EOD). A Multinational Brigade (Centre) search strategy has been established and, with considerable support from the National Search Centre at RSME, all arms search teams have been trained. Brigade level operations assisted by search specialists reinforced from 33 Engineer Regiment (EOD) have been very successful in uncovering large caches of ammunition, weapons and explosives. The use of search in this theatre as an offensive weapon reinforces the utility of search within the UK's armoury.

Within HQ KFOR, the post of chief engineer has been established as a UK tied post. Col D C Stevens OBE was the first incumbent and currently Colonel I M Caws OBE is in post prior to his appointment as CRE 3 (UK) Division.

Bosnia. As a result of the review of force levels in Bosnia, RHQ 35 Engineer Regiment withdrew early this year leaving 37 Field Squadron to complete their tour in March. UK engineer support now consists of a close support squadron seasonally adjusted to support an armoured or mechanized battlegroup, with 4 Armoured Engineer Squadron being the first squadron to be deployed under these arrangements. 59 Independent Commando Squadron has replaced them, and this is the first time the squadron has deployed to the Balkans. Unlike other national engineer contingents which only provide support to their own battle groups, the command arrangements for the UK engineer squadron allow it to undertake construction tasks in support of Commander MND(SW) who will be appointed on a rotational basis from the UK, Canada and the Netherlands. A Canadian is currently commander. Additional engineer support to MND(SW) is provided by an EOD detachment and an STRE (Works), currently 527 STRE (Works). SO1 G4 Estates, with staff from the deployed STRE (Works) and Defence Estates, employs 160 contractors' personnel and manages works services with a current monthly spend of just below £1M.

Pan Balkans. The pan-Balkans engineer regiment concept is developing well. A realignment of the roulement in Kosovo next year from February/August to May/November has been agreed. The major advantages will be a more equitable division of block leave periods, more

efficient support to rear parties, engineer support for the Balkan theatre provided by one regiment with the ability to move assets between Bosnia and Kosovo, and it will allow regiments to support their parent brigades in the SDR formation readiness cycle other-tasks year.

Falkland Islands. It is now almost a year since the reduction in the engineer deployment to the Falkland Islands. A small maintenance section now deploys for six months and there has been good progress in reducing the quantities of engineer vehicles and equipment and the associated maintenance burden. In place of a permanent commitment, there is now an annual squadron-level construction project and regular in-theatre exercising of the 39 Engineer Regiment lead air support squadron.

Northern Ireland. Events have overtaken the, still extant, initiative to rear base the roulement engineer squadron in the UK, or Germany, with 51 Field Squadron (Air Assault) spending much of the latter part of their tour forward based. 9 Parachute Squadron assumed the role in May and have been forward based throughout their tour due to increased activity. An additional troop from 51 Field Squadron (Air Assault) and plant operators from 1 (UK) Armoured Division were also deployed in the summer to cover the marching season. Although deconstruction work has taken place, most notably the destruction of the Buruki Sangar in Crossmaglen, increased unrest currently makes the future uncertain.

East Timor. RE support to Operation *Langar* ended in January. Two clerks of works deployed from MES (Works) Brunei to assist with the provision of power, water and other facilities for the troops in East Timor. An EOD SNCO and JNCO were joined by an electrician and plumber who provided key support to the national contingent command. The tradesmen were described as "strategic soldiers" in the post operational report, which serves to emphasize the contribution individual Sappers can make to an operation.

Sierra Leone. In response to a non-combatant evacuation operation in May, elements of the spearhead land element from 20 Field Squadron and 33 Engineer Regiment (EOD), and a MWF team with key specialists, deployed to Sierra Leone as part of Operation *Palliser*. Late in May these were replaced by a troop from 59 Independent Commando Squadron. Their role throughout was to provide field defences and simple infrastructure. Operations then switched to providing short term training teams to train the Sierra Leone Army, on Operation *Basilica*. Support has been provided by way of a large artisan section from 36 Engineer Regiment and a bomb disposal team from 33 Engineer Regiment (EOD). There may be a requirement for further engineer effort to improve in-theatre facilities in due course.

RAF Operations. RAF deployments have continued to be supported by 12 (Air Support) Engineer Brigade, which routinely undertake a wide variety of important tasks in the Middle East and Balkans. A small maintenance team is permanently based at each deployed operating base supporting operations enforcing the Iraqi "No Fly Zone" and teams have ranged worldwide as required. With their ability to deploy elements capable of undertaking all aspects of design, resourcing and construction, 12 (Air Support) Engineer Brigade has continued to provide a shining example of the benefits of integrating all three functions into one team.

Collective Training and Exercises. Overseas training exercises have continued apace amidst the operational commitments. The range of exercises has been as varied as ever and all participants have, as usual, made significant contributions to the Corps' standing, as well as undertaking most valuable and worthwhile training.

The list of combined arms and special-to-arm exercises is growing and Sapper units have again deployed on exercises across the world. We have participated in exercise deployments to North America, both Canada and the US, Belize, the South Atlantic, both Falkland Islands and South Georgia, Ascension Island, Gibraltar, Kenya, Cyprus, Italy, Norway, Germany, Poland and the Czech Republic.

Worthy of special mention for 2001 is Exercise *Saif Sereea II*, a joint rapid reaction force brigade level exercise to be held in the Oman in the autumn. It is the largest and most comprehensive overseas deployment for some time and marks the coming of age of the Joint Rapid Reaction Force that was formed under SDR. The engineer support will be commanded by 12 (Air Support) Engineer Brigade, and many Sappers have already been on recces. Although the exercise itself will only be of a relatively short duration, RE units will be in theatre from May until the end of the year. The considerable enabling works will be a challenging and lengthy project and all aspects of combat engineering will be exercised.

At its height, approximately five squadron's worth of Sappers will be engaged in theatre.

Reserve Forces and the TA

I am delighted with the way that our TA officers and soldiers have risen to the challenges of seeing through the very large SDR reductions. Their commitment has ensured that the post-SDR restructuring of the RE TA was successfully completed in April. Subsequent re-roling has continued in most units throughout the year. Very significantly, all five regiments have a firm operational role at regimental level, either supporting the ARRC or the RAF, and this is reflected in an impressive 93 per cent recruited figure. This is not the case for most of the rest of the TA.

We have led the way with a new training plan that was implemented as a full trial across the RE TA in 1999 and 2000. This allies all training to regular training objectives, focuses training on the military capability required and matches capability to resources for the first time. The initial success of the regime has been such that it is now to be implemented by LAND across the whole of the TA along with an associated training management information system. New JNCO and SNCO command courses have been implemented at the RSME.

Over the past year, some 122 individuals have undertaken a period of regular service either on operations, primarily in the Balkans, on full time reserve service worldwide or on a short service volunteer commission. In addition, a team from MWF (V) deployed for four weeks on Operation *Tosca* to Cyprus to carry out electrical work on the demarkation line between north and south and individuals from the Civil Affairs Group have deployed on operations to the Balkans, East Timor and Sierra Leone.

Engineer Logistics

It has been another busy year for our Sapper logisticians, although the pan-Balkans support concept has eased the pressure in that theatre. Elsewhere, however, there has been no let up in the operational tempo and considerable short notice logistic support was provided to operations in East Timor and Sierra Leone. Once again, the Engineer Resources Management Cell within the Supply Chain Operations Centre at Bicester has played a pivotal role in supporting the troops on the ground by processing over £11M of construction stores in the last twelve months.

The structure of the Corps' logistics capability has been developed and enhanced at several levels. At HQ LAND, Engineer Division has taken an important interfacing role within the SMART Procurement initiative by providing the link between the equipment managers and the equipment users on the ground. In Germany, plans have developed to incorporate the non-deployable elements of the field support squadrons in Hameln into a static engineer park thus freeing the squadrons from this non-operational responsibility.

Major logistic lessons have been learnt from operations and are being acted on urgently. Probably the lesson of greatest importance is the need to draw together the inter-linked disciplines of design, resources and construction; poor communication between these three can cause unnecessary friction.

On the equipment side £5M has been earmarked to procure a deployable engineer workshop capability for the field support squadrons. This is a long overdue, but nonetheless welcome development, and units will receive the new equipment in about three years' time. In the meantime it will remain difficult for engineer workshops to repair the 650 different types of equipment for which they are responsible on operations.

The use of contractors to provide logistic support and reserve stocks is being driven hard by the Defence Logistic Organisation; the Corps is playing a leading role in reducing war reserves and is considering the option of equipment support through "the man in a white van" concept. The Whole Fleet Management initiative, which envisages the overall quantity of equipment being reduced by providing only what is absolutely necessary, is proceeding apace. A, B and C vehicles are being examined as a matter of course and the Corps is looking at other high volume equipments to see if they can be managed more cost effectively without detriment to operational capability.

Military Engineer Services

MES is now incorporated into the G4 Estates and Works Organisation of HQ LAND, under ACOS Estates and Works, from which command of the MWF is exercised. It is my intention to move the doctrine, policy making and Group B Military

Secretary function to my HQ in due course in order to give the Corps a single military engineering focus. Meanwhile:

- MES at LAND has made considerable strides in developing infrastructure doctrine and policy, and works management and inspection.
- The importance of delivering an effective infrastructure capability has been recognized with the establishment of a SO1 J4 Infrastructure in the PJHQ at Northwood.
- MES personnel have been given unprecedented financial and contractual delegations to manage and procure works, greatly enhancing the delivery of infrastructure capability.
- The MWF remains heavily committed and the requirement to support two lines of communication continuously has produced a demanding 12-month inter-tour interval. The scope of its military design authority responsibility is huge and the SDR reinforcements are urgently required. The early formation of HQ 63 CRE (Works) and 518 STRE (Works) has, however, already made a significant impact.
- Ministerial approval has been given for CRE (Airfields), a Strike Command commanded and funded unit, to re-role to provide full works services management at six selected airfields in the UK and on deployed operating bases when required.

Infrastructure management is a growth area and, in the overseas garrisons of Cyprus, Gibraltar, the Falkland Islands, Belize, Brunei, Kenya and Nepal, is led by RE personnel. Meanwhile, their activities have been complemented at home with four chartered engineer colonels involved in PPP/PFI (private finance initiative) projects at Colchester, Aldershot, Salisbury Plain and the new Army Foundation College at Harrogate. Two garrison engineer lieutenant colonels are also engaged in PPP work in London and with the Defence Communications Support Agency. The remainder of the SDR barrack plot is being overseen by a chartered engineer lieutenant colonel in G4 Estates who chairs the SDR Works Integrated Project Team in HQ LAND and he is also HQ LAND's point of contact for prime contracting, which is the new, and government preferred, procurement strategy for works capital projects. The synergy between peace and operational infrastructure activity is well demonstrated by MES involvement in a number of these initiatives including the Army's second highest spend priority: a "quick and dirty" study on single living accommodation in the UK with three identified packages of work totalling £17M currently awaiting ministerial approval. The requirement for additional specialist engineer involvement in prime contracting, probably with links to the provision of operational infrastructure and contractors on deployed operations is a distinct possibility. This is an opportunity for the Corps to become a major player in the delivery of defence infrastructure.

ROYAL ENGINEERS (GEOGRAPHIC)

SIGNIFICANT change has taken place in survey this year evidenced by the fact that military survey as an entity and title no longer exists. Geographic support to defence is provided through the Defence Geographic and Imagery Intelligence Agency (DGIA), commanded by Brigadier A P Walker OBE. The three units that form the DGIA include the Defence Geographic Centre (DGC), the Joint Air Reconnaissance Intelligence Centre and 42 Survey Engineer Group, soon to be re-titled the Geographic Engineer Group. The DGC provides the base plant geospatial data capture, map production, library and distribution capabilities. The Joint Air Reconnaissance Intelligence Centre provides defence with strategic imagery analysis. The Geographic Engineer Group is commanded by Colonel R N Rigby and provides the field deployable geographic support to defence operations and training. Due to the formation of the DGIA, the field deployable elements are increasingly using and exploiting imagery on a wide range of tasks, providing a major increase in operational capability.

To reflect changes in the way in which geographic staff meet defence requirements, in an increasingly complex and digital environment, the three former trades of topographic technician, terrain analyst and reproduction technician, have been revised. Trade retraining is on-going through 2000 to early 2001, and will produce technicians better able to cope with increasing operational demands for "high tech" geographic support. The new trade titles are data technician, terrain analyst, and production technician.

The number of geographic technicians deployed on operations has fallen significantly this year, in part because the Canadians are taking an increasingly active role in Bosnia. There are currently ten geographic personnel deployed in Bosnia and Kosovo.

Manning and Career Management

THE scale of change underway within the Corps is immense and, as I have already said, the manning challenges are very significant. Last year I noted that RE Manning and Career Management Division (RE MCM Division) was significantly under-resourced and they remain under great pressure. However, the establishment of the regimental career management officer, who will be the focus for communications between the unit and the Army Personnel Centre, will help.

Soldier Issues. The Corps' SDR establishment increases, without a corresponding increase in the number of soldiers, have resulted in the Corps being undermanned for the first time in a number of years. Soldier manning has fallen to 3.1 per cent below the manpower planning target 2000 figure of 7508 and the Corps still has to fill many slots for which there is no authorized establishment. The manning and training margin still provides insufficient cover for higher employment training courses longer than 3½ months. Unfortunately, the net result is increasing gaps at unit level across the Corps. This has resulted in my having to develop a strategy for planned undermanning. With the exception of the ATRA, units will be required to stand shortfalls much lower than the target manning levels and in certain trades the shortfalls in units will be considerably worse. The good news is that the new SDR liabilities have also created the requirement for additional promotions with the most significant, this year, being:

LCpl	to	Cpl	:	46 per cent increase
Cpl	to	Sgt	:	58 per cent increase
Sgt	to	SSgt	:	27 per cent increase
SSgt	to	WO2	:	38 per cent increase

This is retention positive, and I know that the message is getting through to our soldiers.

With the increase in trade posts within the Corps, post manpower establishment review and the career structure study, sapper to lance corporal promotions become key to maintaining the Corps' structure and so RE MCM Division have had to take back control from COs. A board sits biannually in Glasgow and promotes from submissions made by units on the basis of the needs of the Corps for each career employment group. COs will retain an annual allocation to promote individuals as they see fit. Generally I would expect to see these used at the end of unit cadres. Despite the move of the control of lance corporal promotions to MCM Division, it remains the CO's prerogative to decide who is fit to be promoted.

Officers. The Corps remains an exceptionally popular choice for cadets at RMAS and Director of Manning (Army) authorized an additional quota this year, resulting in 63 acceptances from 141 candidates. Commissions allocated were in the proportions of regular commission 10 per cent, intermediate regular commission 4 per cent and short service commission 86 per cent. During the year we have had two officers reinstate their commissions after a period away from the Corps and three transferees, with another eight in the pipeline, including four TA officers. Professional engineer training is also proving popular with ten officers starting training in 1999 and eight officers in 2000. This is a big growth area within the Corps and a very smart career move for suitably qualified individuals. Staff College selection is healthy with 15 officers selected in 1999, some 14 per cent of the course. In 2000, eleven officers were selected, some 9 per cent of the intake. The zone to be selected for Staff College will now start from when an officer is promoted to major and will last for three years. Key officer issues are:

- The SDR ramp-up is well underway and as a result, in this transitional period, the officer roster is experiencing gapping across the board. In order to ease the situation, RE MCM Division is trying to offer alternative means of bridging the gap, such as flexing more late entry officers into mainstream posts, widening the employment of warrant officers class 1 into officer posts and stepping-up capable, but less experienced officers to fill more senior posts.
- One of the most significant changes to the officer career structure for many years was introduced in April 2000. Rather than officers being commissioned into an age-based career structure, officers commissioned from April 2000 are commissioned into a length of service structure. This means that officers will not now enter the zone for promotion to major until they have completed eleven years of reckonable service (including antedated seniority). For our officers, this will provide the very important opportunity to complete a further tour before entering the promotion zone, thereby reducing the pressure to shorten troop command tours and better preparing officers for the Joint Command and Staff Course.
- The stepping stone approach to commissioning was introduced in early 1999 to improve the junior officer career structure, thus creating fairer competition for regular commission vacancies by increasing the

emphasis on the intermediate regular commissions. The Army-wide conversion rate should increase over six years to 85 per cent to intermediate regular commissions and 75 per cent to regular commissions (approximately double the current rates). The RE Arms Selection Board in 1999 achieved a conversion rate of 90 per cent to intermediate regular commission. Scope to convert to intermediate regular commission remains high. Despite a reduction in the number of regular commission vacancies available to the Board, Director of Manning (Army) is looking favourably on overbearing to a limited extent.

- Through SDR, the Sapper late entry career structure has been greatly enhanced particularly through the securing of additional lieutenant colonel posts. The stepping stone approach to commissions now gives the majority of officers a certain career up to the age of 50 with the more successful moving on to regular commission and continued service up to the age of 55. Continued rapid growth within certain parts of the late entry structure has opened up the opportunity for limited continuance over the age of 55 years of age. The wider employability of the late entry officer has resulted in a number of individuals being employed in more demanding and varied posts to the benefit of both the officer and the Corps. This is set to increase.

Individual Training

INDIVIDUAL training continues to be a most dynamic area and I take great comfort from the fact that all of our training is underpinned by the RE Employment Structure Review (REESR), which in turn has helped us to shape our greatly improved career structures following SDR. The ACGS's training study at the start of the year has led to HQ LAND taking a direct customer role with ATRA and will allow operational priorities to drive the training requirement more directly. The Defence Training Review is examining all aspects of training with a view to rationalizing provision of training at defence, rather than corps or army, level. There has been considerable work undertaken on defining, and hence gaining funding for, our statement of training requirement, which is a key area in providing the additional trained manpower needed for our SDR increases. This planning has been complicated by the current shortfall in recruits, particularly in the more academic trades.

Turning to the RSME:

- The PPP process progresses with three contractors, Carillion, Holdfast (Hunting Contract Services) and Vosper Thornycroft, being issued invitations to negotiate. Responses are due by December and the aim is to award a contract a year later, with PPP going live in June 2002. I am all too aware of the significant additional work this is causing the RSME military and civilian staff, and also of the uncertainty felt by the civilian staff. I am extremely grateful for the dedication shown by both.
- Much work has been done to bring down the number of soldiers awaiting completion of Phase 2 training. LAND provided temporary instructors for six to nine months to boost outputs in the four trades with the longest waiting lists and achieved a reduction of 89 students as a result. The trained soldier backlog has been reduced from 330 in August 1999 to 70 today.
- RSME has recently introduced a new assessment and foundation course for design trades, following the successful introduction of this course for fitter and electrical trades, which has this year reduced the loss to training from 50 per cent to 7 per cent and 35 per cent to 15 per cent respectively.
- The implementation of REESR is nearing completion with the new 2-1 courses and most of the specialist qualifications coming on stream this year and next. A recent audit of the REESR process confirmed that, despite a growth in new topics due to legislation, the REESR savings are largely intact.
- The first of the new accommodation blocks in Brompton Barracks is now in use. Work continues on the RE HQ Mess and other accommodation units. Initial reports indicate that students are very pleased with the move away from 1935 barrack standards.

The Royal Engineers Training Development Team (RETDT) continues to play a key role in providing the analytical base for our training requirements. Highlights of their recent work are:

- The training requirement of the joint service EOD operator has been developed into a set of longer, but more comprehensive and operationally relevant, DEODS courses.
- The job analysis on work in confined spaces. This affects many parts of the Corps and the Army, and training is required to meet new legislation.
- Running in tandem with the Army Command, Leadership and Management Study, RETDT will undertake an in-depth external validation of RE command courses.
- Superintendent of Diving (Army) has utilized RETDT job analyses to drive two important initiatives; the restructuring of courses and qualifications, and ensuring that the Royal Navy/Army buy of new equipment meets the Corps' operational needs.
- Operations in the Balkans have reinforced the need for high-grade resources specialists and RETDT has assisted the School of Logistics by producing a systems approach to training and a full job analysis of the trade.

The Corps has recently made major progress on the introduction of National Vocational

Qualifications (NVQ), largely as a result of work at the RSME driven by EinC(A)'s Vocational Qualifications Officer, Major (retired) C N D Capel. The Construction Engineer School has introduced NVQs at level 2 for seven class 2 trade courses, with an eighth due to come on stream shortly. Over the coming 18 months, level 3 NVQs will be introduced for ten of the class 1 courses. At the Combat Engineer School, a level 2 NVQ in safety, security and loss prevention (guarding) has been piloted successfully and will continue to be offered. A trial of the key skills qualification, an NVQ-style award for generic employment skills such as communication and working as a member of a team, is now underway with a class 3 combat engineer course. Additionally, all regular soldiers will be issued with a personal development record (PDR) from September 2000 that will allow them to track their careers and record NVQs. The PDR and NVQ initiatives will help soldiers recognize the value of whole career training packages in terms of transferable skills. The aim is to provide a clear incentive for JNCOs to serve a full career.

EQUIPMENT

WE have made significant progress on the engineer equipment programme over the past year and I am particularly pleased with the major step forward in the engineer tank programme. Over the year, my role as second customer, arising from Smart Procurement, has firmed up and I have been able to establish a colonel force development post and two additional staff officers 2 in HQ EinC(A) through the GSR. Smart Procurement requires a central customer (the old LSOR branches), which identifies what equipment capabilities are required and the supplier (the Defence Procurement Agency at Abbeywood) which procures the equipment from industry. I, as second customer, will focus on the doctrine and user issues of new equipment.

- I do not need to remind anyone that our Chieftain fleet is wholly inadequate, but this is widely recognized and the introduction into service of a new engineer tank is the top priority of both GOC 1 (UK) Armoured Division and GOC 3 (UK) Division. Trojan, the replacement AVRE, and Titan the AVLB, each now have an in-service date (ISD) of 2006 (although through Smart Procurement we are attempting to bring it forward to May 2005). Ministers have appointed Vickers Defence Systems as the preferred bidder to produce a Challenger 2-based vehicle. Funding has been approved for 66 vehicles (33 Titan and 33 Trojan) and the plan is to let a contract in February 2001 with the first prototypes available for trialling in December 2002. This is superb news.
- Terrier, the replacement for the combat engineer tractor, is on track for an ISD in December 2007. It will have the necessary armoured protection to operate in the indirect fire zone and will field a multi-purpose 3 in 1 bucket system and a backhoe excavator with lift attachment.
- The air portable ferry bridge has an ISD of February 2003. It will be an MLC 35 system based on an upgraded version of the medium girder bridge and be air transportable in a C130. The system will provide three capability configurations: a light bridge up to 28m, a powered roll-on, roll-off ferry and a fly-forward bridge of up to 14m.
- Procurement of the logistic support bridge from Mabey & Johnson Ltd is proceeding well with an ISD of 2001. It will span a gap of 39m at MLC 80(T) and 110(W).
- The requirement for vehicle-based mine detection, neutralization and marking is divided into route proving (RP) and recce. It is intended that Minder (RP) (ISD 2005) will provide an integrated capability to detect, neutralize and mark mines, in support of route opening and proving operations. Minder (Recce) (ISD 2010) will provide the capability for engineer recce vehicles to locate the edge of mined areas and act as pathfinders for critical equipments.
- Turning to counter mobility, the bulk of the Shielder vehicle launched scatterable mine system vehicles have been delivered from industry and the first two are fielded with 21 Engineer Regiment in Germany. Troop trials are being undertaken to enable initial operating capability to be declared.
- The aimed controlled effect anti-tank mine (ACEATM) aims to provide a quickly emplaced side attack anti-tank mine capability for light and heavy forces. It has an ISD of December 2006. The area defence weapon system (ADW), with an ISD of September 2006, will provide a rapidly emplaced top attack anti-tank mine capability for light and heavy forces. It will include a remote control capability. As with all munitions that can be target initiated, there is concern at the possibility of civilians being placed at risk either during or after a conflict. Great care is being taken to ensure that both these systems comply with all relevant legislation both in terms of their design and employment.
- Developments are underway in the plant world with the C vehicle PFI, which has a service provision date of November 2003. The aim is to reduce the current support burden of our plant fleet, much of which is held out of use in barracks. Nevertheless, I am determined that the PFI solution must provide

levels of reliability, availability, mobility (tactical and strategic) and survivability commensurate with the current fleet.
- The lack of a modern accommodation system for troops deployed on operations was once again demonstrated in Kosovo. This is being remedied through the expeditionary campaign infrastructure project which has an ISD of July 2004. Tier 1 of this project is based on an improved tented camp system and will provide accommodation and domestic facilities for up to 28,000 personnel. Tier 2 (extended stay package) is limited to non-warfighting operations and may be deployed if troops stay over eight months.
- The new combat support boat will provide support to river crossing operations, inshore support of ship to shore operations including fuel supply, and act as a floating working platform for engineer tasks and for divers. A user trial was conducted by RETDU in March 2000, and the boat produced a very impressive performance fully meeting our requirements.
- Although Archer Communication Systems Ltd has been deselected as the preferred bidder, the Bowman project remains very much alive and digitization a key issue. It is anticipated that a new contractor will be selected and the contract awarded by mid-2001. The ISD of late 2003/early 2004 remains extant. Preparations for the engineer battlefield information system application (now renamed Makefast) continues with the aim of introducing the software into service with Bowman and its associated battle management systems.

DOCTRINE

IN addition to the second customer activities, I have taken on the responsibility from DGD&D for the development of all engineer aspects of special to arm doctrine. Conducted within the framework of DGD&D Future Army concept papers, the work will shape how we organize, train and equip ourselves into the next decade and beyond.

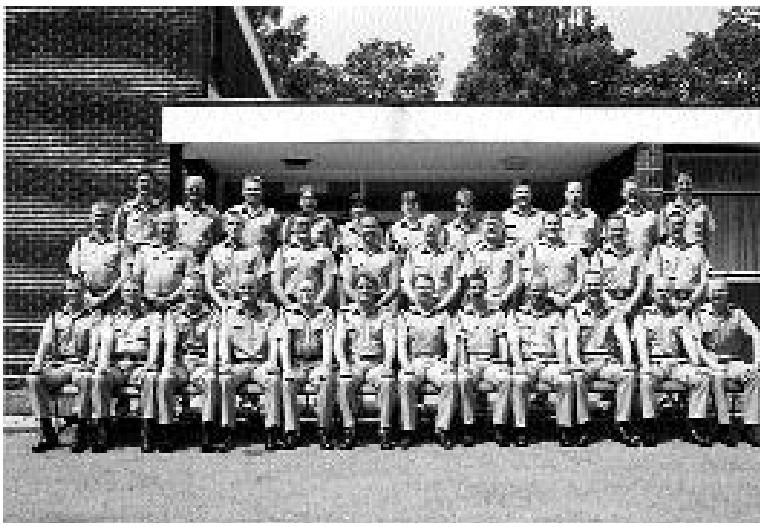
- Work is being undertaken to ensure that we are fully integrated at all levels of the "intelligence cycle.'
- Engineer logistics is also topical and I am keen to ensure that we keep pace with technological change and Army-level aspirations to simplify the logistic system.
- Concepts for supporting the Apache attach helicopter and 16 Air Assault Brigade are being reviewed.
- Counter mobility (in particular mine warfare) continues to be a sensitive issue both nationally and internationally. NATO is producing a new publication (STANAG 2485) which provides a review of countermine operations, both in general war and other operations (previously called operations other than war). In addition, the UK has submitted a general reservation to all STANAGs, which refers to the use of anti-personnel mines stating that the UN Protocol and Ottawa II Treaty take precedence.
- Another area of rapidly developing doctrine is military operations in complex terrain which includes military operations in urban terrain. In the latter, the use of the so-called "blast" or "volumetric" weapons by the Russians in Grozny to attack the city has caused some interest. Work is being undertaken to examine the issues both from an equipment perspective and doctrinal aspect in respect of fortifications. There is a draft doctrine note in circulation on blast weapons.
- As the Army proponent for EOD, I have become the focus for Army EOD doctrine, and the GSR has established an RLC SO3 ammunition technical officer post in HQ EinC(A). Following the recommendations of a Directorate of Operational Capability audit and a joint service study, I now represent the Army on the Defence EOD Capability Development Group chaired by the Assistant Chief of the Defence Staff (Operations). Accordingly, I have been nominated as the joint service lead on the development of structures, training and personnel, along with a role to assist the Joint Doctrine and Concepts Centre in producing Joint Service EOD doctrine. EOD is a very active area and will continue to be so over the next year.
- MES is leading on infrastructure doctrine by producing *Joint Warfare Publication 4-05 Infrastructure*, the developing of the policy for the use of contractors on deployed operations, tri-service water supply, field electrical power, bulk fuel engineering and fortifications.

REGIMENTAL AFFAIRS

RE MUSEUM. Together with the chairman of the Museum Executive and Library Committee, I have written a strategy paper setting out the future of the Museum. Formal approval will be sought from the Chief Royal Engineer's committee by the end of this year. Corps funds, and therefore all of us, contribute to the running costs of the Museum but few of us take an active interest in it. The MOD, in cash and kind, pay the lion's share but we cannot hope for this to continue forever. I have pre-empted one of the recommendations of the strategy paper and written to all serving officers of the Corps to invite them to take a more active interest in the Museum and particularly to help us build up the Museum endowment fund to safeguard and preserve our splendid heritage by making an annual donation. Many retired officers already do this and I am looking to the serving Corps to play their part. The initial response has been very encouraging.

We have now been granted, at a pepper corn rent, a 50-year lease by Defence Estates for the

Ravelin Building which houses the Museum. Apart from securing the future of the Museum on its present site, it will also ensure that we meet the criteria for future bids for lottery grants. The designated status achieved by the Museum in 1999 has given it national recognition which has already attracted a grant of £150,000 from the Government Challenge Fund to help improve the display of our exhibits. All this gives us the confidence to look ahead and plan, with the encouragement and support of the RE Museum Fund Raising Committee and the Friends of the RE Museum, an extension to the Ravelin Building to help display more of our collection.



The band of the Corps of Royal Engineers on the occasion of their 150th anniversary in July 2000.

RE Band. We are fortunate indeed to have an excellent band which, despite being reduced from a major staff band to a regimental sized band under Options for Change, has maintained the excellence of the big band and continues to give enjoyment to the Corps and to promote the name of the Royal Engineers in far flung places. Over the past year the band has undertaken 101 military band engagements, 79 orchestral engagements and 14 fanfares. It represented the UK at the International Tattoo in Korea in October as part of the 50th anniversary commemoration of the Korean War. Arromanches and Dubai are amongst other overseas engagements it has fulfilled. This year is also the 150th anniversary of the formation of the Corps Band and to mark the occasion, a new trophy has been instituted to be presented to the most improved string player of the year and I am delighted that Musician Fomes was its first recipient.

RE Association. Major General Grove handed over the reins of the REA in October and we have much to thank him for. His successor is Major General Wood and we wish him every success in the future. The REA has continued to provide the vital support needed by those members of the Corps family less fortunate than ourselves, dealing with over 1200 individual applications in the past year. More than 50 per cent of the money donated by officers and soldiers, through the day's pay scheme, provided the necessary funding, which last year exceeded £300,000. The REA opened a new website earlier this year, which includes a job-search page for those who have left, or are about to leave the Corps.

Recruiting. It has been a bumper year for officer recruiting with the Corps currently attracting one third of all university cadetship and one sixth of all university bursary award holders. Over one fifth of all officer cadets at Sandhurst are selecting the Corps as their first or second choice. This is excellent news but is in stark contrast to our soldier recruiting which, for reasons not yet clear, has dropped significantly this year. We are addressing the recruiting of soldiers as a matter of urgency and extra recruiters have been trained and deployed to local recruiting offices. While continuing to use our youth liaison team to recruit youngsters in schools throughout the UK, our special recruiters will target 6th form colleges in order to attract more recruits into the technical trades. ERLO and the RE youth liaison team are moving from Chatham to Minley where we have set up an operations centre to ensure that I can closely monitor the situation. Because an increasing number of applicants are using the internet, we have also now updated and revitalized our own website to make use of this important recruiting tool and collocated it with ERLS.

The Millennium Sundial, Royal Engineers' Museum, Chatham.

Millennium Activities. £20,000 was allocated from Corps funds to support a variety of activities to mark the Millennium. Corps tradesmen constructed three sundials in conjunction with the Worshipful Company of Tylers and Bricklayers, which were unveiled in November and December last year in the grounds of the RE Museum, on the Meridian Line at Greenwich and on the Embankment in London. Each contains a time capsule with lists of all officers and soldiers of the Corps serving at the time. Sapper 2000, a sponsored run by RE runners round the UK ended up at Greenwich on 31 December 1999, coinciding with the Dome's opening, but avoiding the ticket debacle, and raised the splendid sum of £20,000 for the Army Benevolent Fund and Children's Promise charities. Finally, epitomizing the spirit of Sappers everywhere, three expeditions were mounted and proved enormously successful. An expedition to Sabah was mounted by 25 Engineer Regiment (see article this *Journal* by Capt M H W Workman*)* to further scientific knowledge in a less well-known part of the world which tested the skills of the members of the expedition in a challenging environment. An expedition mounted by 36 Engineer Regiment canoed and navigated its way 900km down the length of the Volta River in Ghana, and a mountaineering expedition was mounted by Military Survey to Kazakstan which achieved a number of first ascents in a remote and forbidding part of the world.

Arromanches. It is usually the retired members of the Corps who take the lead in encouraging and supporting commemorative events and the erection of a memorial at Arromanches to commemorate the RE Transportation Branch involvement in the construction of the Mulberry Harbour shortly after D-Day was no exception. Major (retired) W M Moncur, with the support of the RE Transportation Club and the serving Corps, almost single-handedly developed the concept, had the bronze memorial plaques cast, liaised with the French authorities, raised over £60,000 and arranged for Lady Soames, the daughter of Sir Winston Churchill, to unveil the memorial on the seafront at Arromanches on 6 June this year. The Chief Royal Engineer attended as did 200 veterans of the Mulberry Harbour and their families.

Corps Sport. At a time when the Corps has seldom been busier, sports teams continue to excel at Army level. 42 Svy Engineer Group, a minor unit for sporting competitions competed in the Major Unit Army Hockey Championships and beat 7 RHA in the final to become Army champions. They also won the Army Cricket Cup.

As past winners of the FA cup in 1875, the Corps can still produce and find fine football players, and few can match those from 28 Engineer Regiment who once again beat off the opposition to become Army Football Major Unit champions in the 100th year of this competition. 35 Engineer Regiment won the Princess Marina Trophy for the 6th year in a row and the Sappers in Germany won the inter-Corps cricket competition, the first time this has been achieved since at least 1978. The Corps shooting team had a most successful season at Bisley gaining their highest position in the Methuen Cup since 1970, five members of the Corps made the Army Hundred and RSME won the Army Pistol Championship. The Corps parachute team won the prestigious Army and Joint Services Sky

Diving Championships in September. The Corps officers' golf A, B and C teams made a clean sweep of the inter-corps championships in June. 59 Independent Commando Squadron retained their Army Minor Units Boxing title and on the individual side, Corporal James retained his Army light heavyweight title and next season will compete at ABA level. Corporals Cooper and Innes have gained selection for the UK National Amateur Rugby League side. These are all magnificent achievements and reflect the work hard, play hard ethos of units in the Corps.

Adventurous Training. Over the past year members of the Corps have taken part in 108 adventurous training expeditions and challenging pursuits. These have included Operation *Raleigh* projects in Chile, Ghana and Namibia; skiing in Bavaria, Canada, France, Norway and Sweden; sailing off the coast of East Africa and Portugal; Kayaking in Alaska, Nepal and South Africa; Mountain climbing in Alaska, Bolivia, Kenya, Nepal, Spain and Thailand; sky diving in Australia and America; sub aqua in Belize, Egypt, Jordan, the Red Sea and the Solomon Islands; and finally trekking in Borneo, Canada, Italy, India, Jamaica, Nepal, Peru and Tanzania. Most readers will have heard of the Marathon Des Sables, an international competition run across 150km of Sahara desert. This year, three RE subaltern troop commanders distinguished themselves by being the first all-women team to enter and complete the race.

Military Secretary Appointments and Honours and Awards. Colonel Commandant Royal Engineers: Major General P J Russell-Jones OBE in January 2000 and Major General C L Elliott CB MBE in November 2000. Military Secretary appointments of senior officers: Major General P J Russell-Jones OBE, Senior Army Member of the Royal College of Defence Studies in November 2000; Brigadier J P Hoskinson OBE, President RCB and Brigadier R A M S Melvin OBE, Chief Engineer ARRC in August 2000; Brigadier C M Sexton, Commandant RSME in October 2000; and Brigadier D R Burns OBE, Deputy Chief of Staff Support HQ ARRC (after six months as Chief of Staff in HQ KFOR 4) and Brigadier P A Wall OBE as Chief of Joint Force Operations in April 2001.

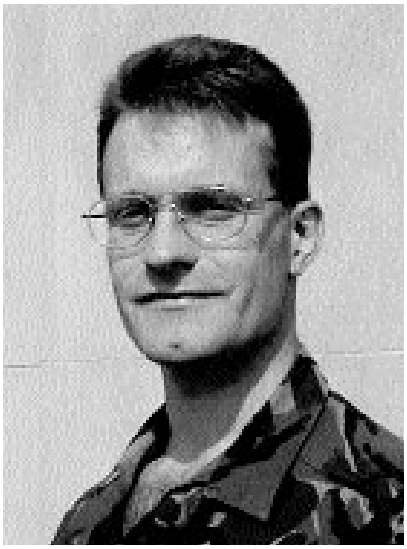
During the past twelve months the number of honours and awards conferred on serving members of the Corps includes: the award of the MC to WO2 Clark; the CMG to Major General K J Drewienkiewicz CB; 6 OBE, 23 MBE, 18 QCVS and 1 QCB; the Institution of Civil Engineers International Medal to Colonel G B Grossmith MBE.

Conclusion

THIS has been another most successful year for the Corps and our standing in the defence community has never been higher. The reason for this, of course, is that our high quality young men and women in both the regular Army and TA continue to excel on operations, and training, worldwide. Our Corps is expanding, and that is the best sort of business to be in, and we look forward to a future where Sappers are more in demand than ever before. However, we must cherish and nurture our most valuable assets, the officers and soldiers of our Corps, and we must guide them so that they fulfil their potential, which under SDR has increased very significantly. The future will be full of opportunities for the Corps to make an increased contribution to defence and I approach 2001 with great confidence and enthusiasm.

Infrastructure Operations in Sierra Leone

MAJOR M P WALTON-KNIGHT BEng(Hons) CEng EurIng MICE MCIWEM



The author read civil engineering at the university of Birmingham before completing Sandhurst and his young officers' course. After three years as a troop commander, which included a deployment on Operation Granby, *he attended professional engineer training (civil) and qualified as a chartered engineer. He was second in command of 45 Field Support Squadron on Operations* Resolute/Lodestar *and later* Palatine *before being posted to the Military Works Force as second in command of 527 Specialist Team Royal Engineers (Works). Deploying to Macedonia for two months on Operation* Upminster *in late 1998, he returned eight months later after also serving in Albania, Bulgaria, Greece and Kosovo on Operation* Agricola. *Earlier this year, he was in Kenya for a month and was then looking forward to a period of stability prior to a winter deployment to Operation* Palatine. *On 8 May he flew to Sierra Leone, returning on 7 June. He then deployed to Banja Luka on 15 September, and is now halfway through his five-month tour.*

Background

Sierra Leone is located on the West Coast of Africa, to the north of Liberia and south of Guinea. The country is a former British protectorate. In 1997, the World Bank confirmed Sierra Leone as one of the poorest countries in the world, and its people also had the shortest life expectancy. The recent history of Sierra Leone has been characterized by instability brought about by several military coups, an eight-year war fought by the Revolutionary United Front (RUF) and widespread human rights abuses leaving tens of thousands of people killed and thousands more maimed.

In July 1999, the Lomé Agreement between the government of Sierra Leone and the RUF was implemented. Part of the agreement included the disarmament of the RUF and its limited integration into the Sierra Leone Army. It was agreed that a UN force would oversee the disarmament and integration. Some 11,000 UN military personnel were allocated to assist the UN mission in Sierra Leone; almost three-quarters of them had arrived by spring 2000.

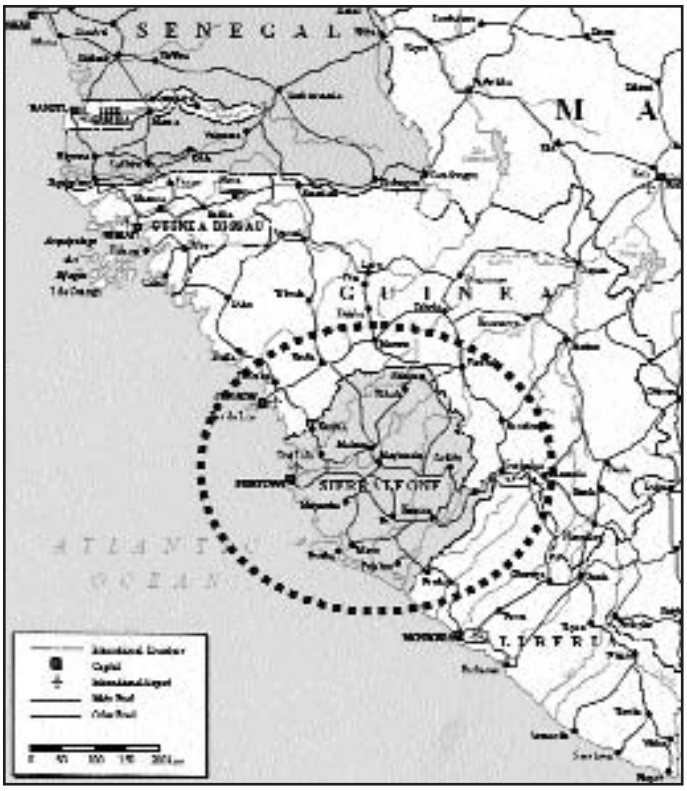
In May 2000, after ten months of relative stability, the RUF attacked UN personnel and disarmament camps in central and eastern Sierra Leone. A number of UN personnel and journalists were killed, and more than 200 others were detained. The situation was deteriorating. In response, the UK initiated Operation *Palliser*, a non-combatants evacuation operation (NEO).

Operation Palliser – A Resume

On 8 May 2000, the 1st Battalion The Parachute Regiment Battle Group (1 Para BG) and supporting units deployed to Sierra Leone as the spearhead lead element (SLE) to evacuate UK and other entitled citizens. A Royal Navy amphibious reaction group (ARG) was also despatched to the region, which included *HMS Ocean* and 42 Commando Royal Marines. The SLE was supported by a battle group engineer, Capt Chris Warhurst, and a RE field troop commanded by 2Lt Richard Lawes, both from 36 Engineer Regiment. A commando engineer troop commanded by Capt Brad Hardwick supported the ARG. The UK's Permanent Joint Headquarters (PJHQ) Joint Force HQ also deployed to become the Joint Task Force HQ (JTFHQ). The SLE was also supported in Sierra Leone by a two-man team from 527 Specialist Team Royal Engineers (Works) from the Military Works Force. Initially the STRE (Wks) worked to the SLE as TACOM CO 1 Para BG, but on 10th May they cut to JTFHQ control as,

eventually, OPCOM Comd JTF and TACOM DCOS JTF.

The SLE deployed personnel to both Lungi International Airfield[1] and the Aberdeen Peninsula to the west of Freetown, the capital of Sierra Leone. JTFHQ was based initially at Dakar in Senegal but within a few days JTFHQ Forward was established at the British High Commission (BHC) in Freetown; in time this grew to become JTFHQ Main. JTFHQ Rear moved to Lungi Airfield on 18 May. The initial objective of the 1 Para BG was the NEO; later objectives included creating the conditions for UN forces to reinforce itself (with the implied task of ensuring the security of the Lungi Airfield), conducting information operations and conducting enabling works for the short-term training team (STTT). A relief-in-place was undertaken by 42 Commando after two weeks, allowing most of the 1 Para BG and supporting elements to return to the UK. By early June the withdrawal of JTFHQ and 42 Commando was in hand with all UK personnel due out of Sierra Leone by the 15 June[2]. All that would remain would be the STTT, initially based on the 2nd Battalion The Royal Anglian Regiment[3], located at Benguema Training Camp, and a few elements at the BHC.



Map of Western Africa showing Sierra Leone.

J4 Infrastructure Organization

Shown in the diagram below is the JTF organization whilst 1 Para BG was in-theatre. All JF contingents were represented in Sierra Leone, less a JF logistic contingent. The terrain in Sierra Leone dictated that JTFHQ was to split into two HQs which were separated by 14kms of water: HQ Main at Freetown with overall control and HQ Rear at Lungi Airfield with primacy for J1[4] (including medical), J4[4] , J6[4] and J8[4] matters. It was at HQ Rear that DCOS, the author, the civil secretariat and commander medical were located. It was this group that had significant input into infrastructure plans. SO2 Engrs was based at HQ Main. So, if Sappers were needed for an infrastructure task there had to be liaison between the two HQs, to gain both J3 and SO2 Engrs approval before they could be tasked. This

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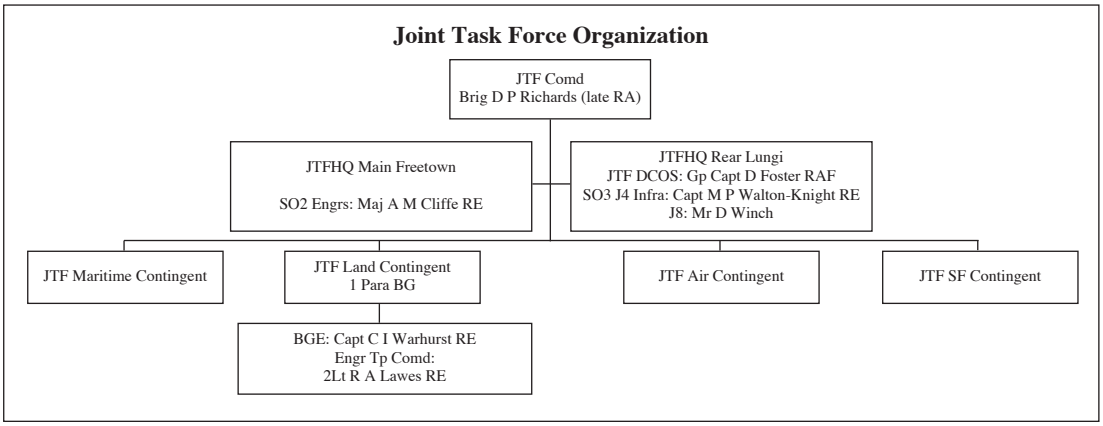
1 Initially there was over 600 UK military personnel in the vicinity of the airfield.
2 A detachment remained at Lungi Airfield until Maj A Harrison, PARA, a UK hostage, was recovered in mid-July.
3 The Royal Irish Regiment, which was the lead unit for the second STTT and had a patrol taken hostage, took over from the Royal Anglian Regiment in late July.
4 J1: principally personnel matters.
Commander medical has overall responsibility for all environmental health matters.
J4: principally logistics matters.
J6: (communications and information systems).
J8: (finance) is also known as the civil secretariat (Civ Sec).



process was hindered because of the geographic separation of the two elements of the HQ.

Role of SO3 J4 Infra in Sierra Leone

The principal role of the chartered engineer in the J4 Infra appointment is to advise on the management and development of infrastructure within the area of operations. I found myself advising on the provision of mains electrical power[5] to Lungi Airfield, back-up power, airfield lighting and on the provision of bulk water, which included assessing the existing water treatment works. I conducted pre- and post-occupation surveys of the buildings that UK forces used, and was the UK infrastructure representative both to the UN and to the Lungi Airfield Authority. I even gave guidance on physical security measures at the main entrance of the BHC in Freetown. All of the JTF contingents, less Maritime, had infrastructure support requirements.

Infrastructure assessment. As 1 Para BG started its reconnaissance of the terrain for the defence of Lungi Airfield, I started mine on the infrastructure. My concern was not in buildings for shelter but the basics: water, sanitation and power.

Water. The problem of providing an adequate water supply was more one of logistic movement rather than production[6], though when water was scarce logistic movement always seemed to become a Sapper problem as well! There were many deep hand-dug wells in the Lungi area providing water for the local population, though several were dry. The existing water treatment works at Sanda to the north of Lungi had been constructed with international aid; it was relatively modern and effective, but although only 4km to the north it was 7km by road. Unfortunately, due to a lack of electrical power, the piped water pressure was completely inadequate. The airfield received its water supply via a bowser that often lacked diesel fuel and which was driven by operators who, when I arrived, were not being paid. The bowser had to travel along insecure and low grade mud tracks. Two weeks into the operation the rainy season started causing further deterioration and it became obvious that this method of supply was not going to be suitable for anything other than the short term. The medium to long term solution was to establish a water production facility using the sea as the source. Lungi Airfield is on the coast but utilising the sea obviously presented the problem of desalination. 521 STRE (Water Development) deployed to verify my assessment at Lungi Airfield and to conduct a detailed reconnaissance of the provisions at Benguema Training Camp.

Water quantity. The quantity of potable water required by UK forces varied daily, because total numbers of personnel were small but also because of the nature of the operation: deployed personnel were on a minimum water-use regime, but when they returned to the airfield they would shower and wash clothing. Water consumption rates were very fluid (no pun intended) and were very difficult to predict. My planning figures for water usage were initially 25 litres per man per day, increasing to 70 litres after

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[5] Fortunately SSgt Coley, a clerk of works (electrical), who deployed with me for the first ten days, guided me on electrical matters.

[6] This is a demonstration of why Sappers need to have representatives integrated into J4 branches.

Water filters at the Sanda Water Treatment Works.

Main inlet transformer at Lungi Airfield.

the first week, with 120 litres per bed in medical facilities[7]. It was these figures that dictated storage and daily supply rates for individual sub unit locations, although the overall production rate was based on the total number of UK personnel. My planning figure for Benguema Training Camp was higher at 100 litres per man per day.

Water quality. The Royal Army Medical Corps' environmental health technicians (EHT) are responsible for verifying that water is potable. One EHT deployed with the SLE but without any chemical or microbiological water test equipment. This meant that the only RE water production equipment that could reliably be used was expensive reverse osmosis equipment (RO). Initially, until RO equipment could be brought into theatre, fixed dose chlorination (to at least 2.5mg/litre of residual chlorine) was used to purify water.

Sanitation. The sanitation system at Lungi Airfield was inadequate. It was based on a wet collection system that suffered from a lack of water to transport waste and from low-capacity sceptic tanks. The UN forces[8] already deployed at the airfield had constructed squat trench latrines but they were very shallow, lacked fly screens and were in areas allocated to other national contingents. The solution for UK forces was a dry system utilising pedestal (seated) deep trench latrines.

Power. The provision of electrical power is essential in re-establishing the infrastructure of an area. Lack of power usually means a lack of water, because electricity is often required for pumping water. Airfields need power for runway lighting and aircraft control systems. Lungi Airfield was not a quiet backwater; it was a busy multinational military and UN airfield. On the second day of the operation SSgt Coley (clerk of works (electrical)) and I assessed the 1000kVA inlet transformer and 250kVA stand-by generator. Unfortunately, there was no incoming power to the transformer as the local power station was in a state of disrepair. The stand-by generator was in effect the "main" generator and there was only a much smaller and older 160kVA generator to cope with the frequent shut-downs of the "main" generator. Also, both generators had a fuel supply problem for although the "main" generator had an 8000-litre fuel tank, it was never more than a quarter full. Financial constraints at the airfield meant that diesel was only purchased when there was roughly a day's worth of fuel left. We monitored the state of the generators on a daily basis, although it was never necessary for the UK to provide fuel.

Establishing infrastructure policy. When I arrived in Sierra Leone there was no infrastructure policy or directive for the operation from PJHQ. Without such directives[9] attaining J8 funding for works, even for the construction of latrines, was difficult. On 15 May, the CO of 64 CRE (Wks), Lt Col Alastair

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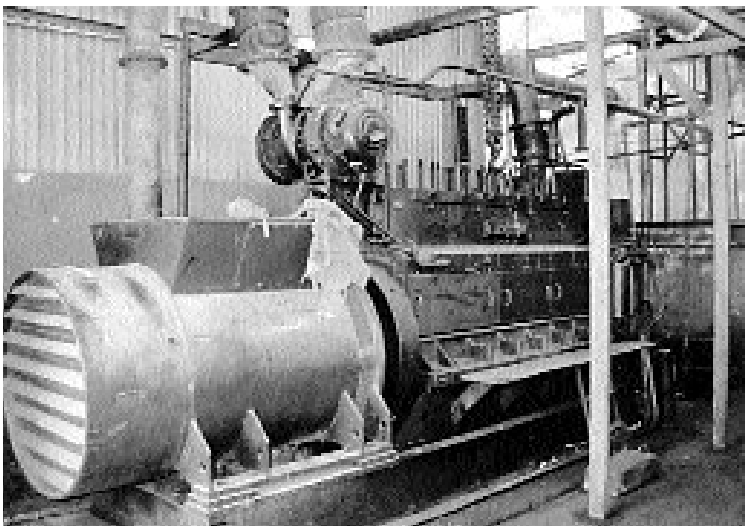
[7] Planning figures for water consumption were taken from "Military Engineering" Volume 2 Field Engineering Pamphlet 9 *Water Supply*.

[8] Initially there were two battalions of UN military forces at Lungi Airfield but that later increased to six.

[9] At the time of Operation *Palliser* there was no infrastructure staff at PJHQ. This has been rectified with the appointment of a SO1 J4 Infra. PJHQ are now able to set general and operation-specific infrastructure policy.



Generator at the Lungi Electrical Generation Station.

Strong, deployed to theatre for two days on a reconnaissance principally to set an infrastructure policy for the theatre for the short, medium and long terms. This policy was later accepted as the executive authority to which an infrastructure development plan could be linked and to which J8 was prepared to finance without further justification[10]. Once the infrastructure policy was set, in consultation with DCOS JTF and J8, I was able to produce the detailed infrastructure development plan both for Lungi Airfield and later for Benguema Training Camp. The infrastructure tasks to be undertaken by the SLE and ARG engineer troops, the Royal Logistic Corps (RLC) pioneers and 521 STRE (WD) came directly from this plan.

Design of infrastructure tasks. Once tasks had been identified they had to be designed. The use of standard designs means that in-theatre design is almost negligible, but many of the designs in military engineer (ME) pamphlets of basic camp structures (such as latrines, showers and urinals) are lacking in adequate detail for construction by engineer troops. It was often necessary for me to give advice on the construction of these structures. I was also responsible for approving all materials lists for the RLC supply section to procure; I was acting in an engineer logistic role[11], which continued until Sgt Carty, a RE resources specialist deployed to theatre. Whilst not the usual employment of a chartered engineer, the small size of this operation meant that there was no one else able to act in the engineer logistic role, one which the RLC logistic staff seldom fully appreciated.

Initiating deployment of specialist personnel. Engineering is a complex field; an important characteristic of chartered engineers is for them to be aware of their limitations and to recognize when greater experience is necessary. The key person I requested assistance from was the CO of my CRE (Wks) who is a highly experienced chartered engineer. I also requested personnel from 521 STRE (WD) to conduct a detailed reconnaissance, a resources specialist who deployed to support the engineer troops and a surveyor who deployed to prepare plans for current works, as-built drawings and contingency planning. 516 STRE (BP) and 529 STRE (Air Sp) received warning orders for contingency plan deployments, in order to keep Lungi Airfield operating if the civil airport structure disintegrated further.

Real estate management at Lungi Airfield. Lungi Airfield was the air point of disembarkation not only for UK personnel but also for all UN forces entering Sierra Leone. It was where each national UN contingent wanted to maintain their national support element, yet it had limited usable buildings and services. There was considerable demand on its infrastructure by JTF contingents that required control at JTFHQ level. I was, by appointment, the UK real estate manager and became *de facto* international infrastructure facilitator for UN forces as they arrived at the airfield. I had initiated contact with the airport support services and procured plans of the airfield and all its services. The UN camp manager was a Palestinian who openly admitted that he was in-theatre solely for his US$50,000 plus salary. He was responsible for all infrastructure and engineering although he was a not an engineer. I therefore assisted him on infrastructure matters principally to ensure that UK needs were met, but also to support the UN and to help return normality to the airfield.

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[10] Once an infrastructure policy was established the Civ Sec was content to authorize expenditure that was in agreement with the policy, even if the financial authority was granted retrospectively. Although this is not as ideal as J4 Infra staff being granted their own financial delegations, the J4/J8 relationship was such that infrastructure works were never delayed through having to wait for financial authority.

[11] This demonstrates the intimate link between engineer design, resourcing and logistics.

INFRASTRUCTURE TASKS

SEVENTY-seven separate RE section-sized infrastructure tasks fell out of the infrastructure development plan. Almost three-quarters of these were completed in the first month of the operation. Many tasks were only the construction of basic camp structures, but they also included establishing a desalination water production site and bridge assessments.

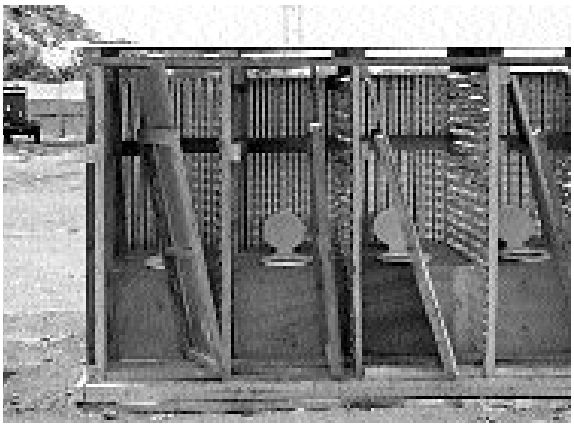
ARG engineer troop desalination water production site using WPU (NBC) Saline.

Camp structures. The construction of latrines, showers and urinals which were undertaken by both the SLE and ARG engineer troops, is not at the glamorous end of the engineering spectrum but it is an essential force protection measure where there are concentrations of personnel, such as at Lungi Airfield. Neither the SLE nor the ARG brought significant quantities of engineer construction materials into theatre. Some materials were available locally but often critical items were either not available at all, or were not available in an acceptable time frame. As a result engineer troops had to improvise, which often resulted in a less than ideal end product.

Military desalination site. The medium-term solution for desalination was the deployment of WPU (NBC) Saline equipments. The Corps has seven of these, one of which is used exclusively for training purposes. The ARG engineer troop established a desalination production site on the coast near Lungi Airfield. Two WPU (NBC) Saline were deployed to provide 40,000 litres per day, one to be the primary plant and one as a reserve. Unfortunately their low production rate (which appeared to be due to the high salinity of the sea water in that region) of approximately 20,000 litres per day meant that both were needed to provide the required production capacity. A third unit was therefore required to be the reserve plant but was not deployed as the pace of the operation changed and personnel prepared to withdraw from the vicinity of the airfield.

Bridge assessments. Mobility support and the classification of bridges are classic tasks undertaken by all units in the Corps. Chartered engineers normally only get involved where a task is a little more complex. The Mabang Bridge is a complex bridge. It is located more than 40kms inland from Freetown and was formerly a railway crossing over the fast flowing River Ribi. It is a 202m-long steel truss bridge with nine spans, including a 64m central span. The bridge had once been decked in timber but that had since been stolen. As a temporary measure the local population had, literally, balanced cut timber between the bridge beams to form a primitive and unstable deck. As a vehicle crossed the deck the timbers bowed, lifted and occasional dropped into the water below. Even when crossing the bridge on foot extreme care was needed for timbers would shift leaving holes large enough for a man to drop through. Comd JTF wanted to know what vehicles could cross the bridge immediately, with what level of risk and what remedial works would be required to allow it to be used by civilian relief convoys. I answered his questions, specified the necessary upgrading works and costed them at £65,000 to £90,000. The European Union has now funded the upgrading works, which are being undertaken by Indian Army engineers.

Pedestal deep trench latrine constructed of plywood when corrugated iron sheeting was in short supply.



Pedestal deep trench latrine awaiting the delivery of hinges that were in short supply.

INFRASTRUCTURE LESSONS LEARNT

DESPITE the rapid nature and short duration of Operation *Palliser,* a number of lessons were learnt that would be applicable to future operations. These lessons are currently being considered by HQ LAND G4 Military Engineer Services, although it is likely that they have been previously identified.

Infrastructure HQ. Initially the STRE (Wks) deployed as part of 1 Para BG although the JTFHQ also deployed. After three days it moved to the JTFHQ to man the J4 desk. This was a more appropriate place to provide infrastructure advice to all four contingents. A STRE (Wks) should typically work to the operational or logistic HQ, rather than the tactical HQ[12]. JTFHQ already has a J4 Infra post that should be occupied by an augmentee, but it has never previously been filled.

Theatre infrastructure policy. Clear guidance on the standard of infrastructure to be developed in-theatre was not available until CO 64 CRE (Wks) conducted a reconnaissance. Direction from PJHQ would simplify infrastructure financial appraisals for J8 approval, as well as clarifying the standards to which a Military Design Authority and Military Construction Force should work. The reconnaissance by a senior chartered engineer should not be to establish infrastructure policy, rather to confirm the methods of meeting that policy using RE and civilian personnel. Generic policy[13] on the infrastructure that should be provided to support different phases of an operation should be encapsulated in the Joint Service Publication 4.05 "Management of Infrastructure on Operations". More specific guidance could then be given by the SO1 J4 Infra at PJHQ on the initiation of a specific operation.

Status of the SLE STRE (Wks) officer. The SLE STRE (Wks) officer works at formation and unit HQ level. To ease acceptance within HQs and to function effectively the SLE STRE (Wks) officer should work at SO2 level and so hold the rank of major.

Role of the SLE STRE (Wks). There was a lack of awareness within the force, including JTFHQ, about the role of an STRE (Wks), of J4 Infra and also their relationship with the engineer troops. The in-role Joint Rapid Reaction Force STRE (Wks) that provides the SLE STRE (Wks) should establish closer links with the SLE battalion, the ARG and the JFHQ, with the intent of increasing force awareness.

Resources accounting and the management of construction materials. Whilst the RLC supply section purchased engineer construction materials in-theatre, it could not identify sources, specify, manage or account for them. There are no resources specialists on the SLE engineer troop ORBAT but there was a requirement for two. A single resources specialist deployed in late May, but he still had to rely on the RLC supply section for the purchase of materials. Two resources specialists with the necessary delegations should deploy with both the SLE and the ARG engineer troops.

Engineer construction packs. No engineer construction packs were deployed to support troops in-theatre. Some of the stores held in the construction packs were not available in-theatre so it was necessary to improvise, resulting in low-quality end products. The construction packs are established in standard ISO containers. They are therefore not transportable by C-130 aircraft, but the ARG engineer troop should have them in its support ship. Construction packs should also be deployed as soon as possible by sea or road, if a future SLE operation is not to be supported by the ARG.

Standard designs of camp structures. The main infrastructure requirement in-theatre was for camp structures, particularly latrines, ablutions and showers. The designs currently in ME pamphlets are inadequate for construction purposes by engineer troops. The preference for pedestal latrines over squat latrines should also be re-evaluated, for they

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[12] As is the case in a divisional war-fighting scenario, where CO CRE (Wks) with organic STsRE would typically be TACOM Divisional HQ Rear, or if that HQ had not deployed, the divisional logistic brigade.

[13] This would, in effect, be the infrastructure doctrine for expeditionary operations.

are so much harder to keep clean. Standard designs of camp structures, together with materials lists, should be produced by MWF, and made available to all RE units. Copies should also be kept with the engineer construction packs.

Water testing. The RAMC's EHT from the SLE deployed without any chemical or microbiological water test equipment. The provision of safe potable water is an essential force protection measure and the EHT must be properly equipped. The EHT supporting any expeditionary operation should deploy with a Palintest Set or equivalent for chemical analysis, and a Millipore OM 143 Set or equivalent for microbiological analysis. Both of these are field capable equipments.

SUMMARY

OPERATION *Palliser* was a short operation with rapid tempo; nevertheless J4 Infra played an important role in its success, especially in the provision of potable water and of sanitation systems. The operation again validated J4 Infra doctrine and many important lessons were learnt that are currently being implemented. The most important lesson, that of establishing infrastructure policy for a specific operation, will be eased with the recent appointment of a SO1 J4 Infra at PJHQ. The operation also saw the first operational use of the WPU (NBC) Saline to provide potable water to a deployed force.

Journal Awards

The Budget, Investments, Membership, Scholarship, Memorial and Publications Committee announces the following awards for articles of special merit published in the August 2000 issue:

GUGGI JOBS AND GREEN KIT
Second Lieutenant J C K Jones – £100

EXERCISE CAPITAL DRAGON, BATTLEFIELD TOUR OF VIETNAM DECEMBER 1999
Lieutenant Colonel J M Gunns MBE – £75

COMBAT ENGINEERING ON A WING AND A PRAYER –
POST-TSUNAMI RELIEF OPERATIONS IN PAPUA NEW GUINEA
Major D C Wren Royal Australian Engineers – £75

OPERATIONAL EXPEDITIONARY INFRASTRUCTURE WORKS, THE AIR SUPPORT WAY
Major M A P J Sullivan – £75

" ... IN MY ARMY?"
Lieutenant Colonel A J Willis TD – £50

ENGINEER OFFICERS' TRAINING WITH THE MADRAS SAPPERS 1944
Captain John Irwin – £50

In No Disorder – Right Dress!

A THINK PIECE BY LAUNCHING NOSE

Introduction

You'll conquer the present
suspiciously fast
If you smell of the future
and stink of the past

Piet Hein, Danish Scientist-Poet

MOST readers will know of the lively article written by Matthew Whitchurch – "Dressed to Kill"[1] - and the various letters supporting him in the last two *Journals*. We are being urged to re-introduce the "1897 pattern" RE Mess dress. This single, very specific proposal takes us into a narrow debate that could simply divide and polarize opinion – just by providing something that is easy for some officers to reject. After almost 100 years of the current mess dress, introduced in 1904, there appears to be no immediate hurry to change it. Launching Nose seeks to draw out some more general themes – aimed at placing any further debate in its full historical context. Hopefully, better-informed discussion might lead to wider acceptance of the need to consider change. Whether change should indeed result from those considerations is a matter of Corps policy, the formulation of which is well catered for in the regimental structure of the Corps. Before we focus on any specifics, some broad brushstrokes are required just to set the scene.

Messes in the Army and Corps

THE Army spent much of the Georgian period effectively "mobilized", in uniform and on operations or in transit between them. Officers attending a formal social occasion on military duty simply wore the most appropriate order of uniform – usually full dress. Otherwise they wore the required civilian clothes, if they had them to hand. At night this would be the simplified evening dress made fashionable by the Prince Regent and George "Beau" Brummell – the forerunners of "white tie", and later "black tie". RE officers in those days were spread about the Army and colonies, with many being seconded as officers to the companies of the Royal Sappers and Miners. Officers usually messed with their commander, by invitation in other messes, or simply and economically in their lodgings or at home with their families. In 1807 the first mess room was built at Brompton Barracks, initially a RE/RA combined mess, becoming an independent RE mess in 1848. As the in-camp and in-barracks routines of the Army evolved, there was a proliferation in the various orders of dress required by officers. Some were obviously necessary, others were simply not much other than what modern PR would call a "branding exercise", aimed at promoting "smartness" in all of its military and social forms.

The General Character of the Victorian Corps

ROYAL Engineers[2] officers did not purchase their commissions, nor could they sell them. The basic cost of commissions was officially regulated but they really sold at whatever they would fetch. It was in the interests of regiments and their colonels to drive up the cost of commissions and to attract rich and socially distinguished officers as a source of added prestige and "added value". By the 1860s the Corps drew its officers from families representing the well-established professions, and the various levels of the somewhat vaguely defined "gentry" of those times, with the odd baronet or peer's younger son appearing occasionally[3]. The Corps was also an "early

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[1] *RE Journal*, December 1999.

[2] And also the Navy, the Royal Artillery, and the militarized parts of some of the Army's departments. The practice ended as recently as 1871 when the government bought back these commissions – for £7 million!

[3] This was not always considered impressive. In his diary of 31 August 1861, the increasingly snobbish Quartermaster Connolly, described the newly-arrived RE subaltern, Sir Arthur Mackworth Bt, as: "he looks and speaks, notwithstanding his high birth and title, as other men and quite as common." Sir Arthur became the first RE adjutant of the (then) Royal Monmouth Engineer Militia, in 1877.

mover" in commissioning high quality men from its ranks. It had earned a generally solid operational reputation in the Crimea and India, to which it constantly added. However, its real standing was based on increasing professional excellence, its leadership in the military applications of the new technologies of those days, and the growing numbers of Royal Engineers in prominent positions. There were great opportunities for self-advancement and to serve in the more agreeable colonies; always an attractive feature to the ambitious Victorian and to those who tried to live a champagne life on a beer income.

The Corps took its collective military and professional smartness very seriously as we see in the surviving photographs of 19th century parades at Brompton and Aldershot. Whereas the ordinary soldier had his clothes and equipment provided under regulation and controlled by inspection, officers were expected to provide all of theirs at their own expense. High standards were demanded and achieved. Orders of dress in the Corps for officers, and what was traditionally called its "rank and file", compared very favourably in style and appearance with those of the Army in general.

Many familiar features of the approved RE dress of the 1850s, began life in the early 1800s or late 1700s. The distinctive scarlet dress coat[4], the gold epaulettes and embroidery, the use of garter blue[5] velvet on cuffs and collars, the embroidered grenade, became constant features of the dress uniform for officers. In 1813, the colour of the uniform coat for the Royal Sappers and Miners was also changed from blue to scarlet with blue facings. So, at last, RE officers and the men they commanded had similar uniforms and these were to develop together in close coordination.

The Evolution of Mess Dress and Other Undress Uniforms

RE Corps' mess dress, even today's, did not start out the way that some might think. It began as a fairly utilitarian item, based on practical necessity and common sense. By 1818, the Corps was already suffering from those officers who wanted to "dress up" in their own way. This prompted Lieutenant Colonel C W Pasley, at the Establishment at Chatham, to remind officers of their obligations to conform strictly to the general orders of the Corps of 26 March 1817:[6]

> "The dress uniform is intended to be worn at dress reviews, birthdays, and on other particular occasions. The full dress, when officers attend the drawing room, or levee, and on occasions of a similar nature. The undress is to be adopted for general use, and is to be worn on all occasions not specified above."

The principles advanced here by Pasley took on fundamental significance and led to the "undress" uniform of the Corps becoming its customary mess dress from then onwards, except where formality required otherwise. The first comprehensive set of RE Corps dress regulations was issued by the Inspector General of Fortifications at Horse Guards on 1 April 1857, after Royal approval. Confirming the decision of King William IV[7], Queen Victoria directed that the badge of the Corps should be: "The Royal Arms and Supporters, with the motto, *"Ubique; Quo fas et gloria ducunt*" (underneath). This distinction is shared only with the Royal Artillery, but survives on no current order of Corps dress – except in the RE Band, none of whose members, very sadly, are actually serving Royal Engineers these days. A form of scarlet "undress jacket" was again approved in 1857 and was described as:

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[4] On 2 April 1812, Capt W Nicholas RE had written, from outside Badajoz: "Our uniform is changed to scarlet with a gold laced dress coat. I dislike the change on account of the colour and the expense." He died of wounds received in the assault of Badajoz on 6 April.

[5] This is the distinctive dark blue of the garter itself, not to be confused with the paler, mid blue of the ribbon of the order.

[6] Orders chiefly related to "The General Discipline of the Establishment", by Lieutenant Colonel CW Pasley. The "birthdays" and "drawing rooms" referred to were those of the court.

[7] In the *London Gazette* of 10 July 1832, King William IV granted: "…to the Royal Regiment of Artillery and the Corps of Royal Engineers His Majesty's permission to wear on their appointments the Royal Arms and Supporters, together with a cannon and the motto, '*Ubique quo fas et gloria ducunt.*'" The second form of representation of the same single motto authorized by Queen Victoria, and its form of display on items of uniforms, has led to the Corps' "error" of describing this as "the Corps' two mottoes". The error is perpetuated in the current *RE Corps Memoranda*. The use of the cannon was discontinued by the Corps in 1868, having been retained only while we had sole responsibility for the preparation and installation of gun platforms for the RA.

> "Scarlet cloth, single breasted, to hook and eye, and with gilt studs down the front; plain gold braid all round, and on collar seam, finished with a crow's foot at centre of waist and collar seam. Shoulder cord, a single twist, Collar, garter blue velvet rounded in front. Cuffs, garter blue velvet, pointed, 5 inches deep; for a lieutenant, edged with plain gold braid, and a crow's foot at point; for a Captain, an additional row of small figured braiding; for a Field Officer, a chevron of gold lace (Corps pattern), 1 inch wide, edged with plain braid and crow's feet at points. Field officers only to wear the collar badges (the grenade), and these to be embroidered in gold."

The undress jacket was worn with a waistcoat, described as follows:

> "Scarlet cloth, single breasted to hook and eye, and with gilt studs down the front; plain gold braid all round on collar and seam; pockets edged top and bottom with gold braid, crow's foot at each end, and treble twist in centre."

In the April 1857 regulations, the jacket and waistcoat were worn with undress "trowsers" – of dark Oxford (blue) mixture, with a scarlet stripe 1¾ inches wide down the outer seam; but only for drill order, orderly duty, and (with jacket unbuttoned) in the mess. For mess use, the RE Corps' "dress trowsers" were to be worn. These had a 1¾ inch stripe of RE Corps' gold lace and were worn with Wellington boots and 2 inch brass spurs. This dress was also worn as a form of working dress for drill (which in those days included field works) and duties in barracks – but with undress "trowsers". Except in mess dress, the RE pouch and belt would be worn over the undress jacket. The 1857 regulations already admonished: "Trinkets and long watch chains are forbidden to be worn with uniform".

So, with only minor modifications in later years the "1897 mess dress" can actually be traced in essence to the 1857 dress regulations as the first approved mess dress of the Corps, and perpetuated in an adapted form, the undress uniform of the early 1800s.

The regulations of 1874 replaced the scarlet shell jacket with a blue cloth patrol jacket for drill order, but it survived until nearly the end of the century being worn for drill by officers serving with the "RE Troops" at mounted duty at Chatham and Aldershot. The RE Library collection has a photograph of Captain Anthony Durnford and his brother Arthur (then a lieutenant), both smartly dressed in the day undress uniform of the early 1860s – the RE blue frock coat worn over the same undress scarlet waistcoat, and blue trousers with scarlet stripe. The waistcoat was a commonly worn undress item for several decades. Lieutenant Colonel Anthony Durnford was still wearing his when he died, fighting bravely to the end, on the slopes of Isandlwana on 22 January 1879.

Until about 1880, RE officer uniforms generally were fairly loosely tailored or "full in chest" by the standards of today, very practically allowing extra layers of clothing to be worn under them whenever the climate demanded. In 1880 the wearing of emblems of rank on shoulder straps, and the grenade on the collar of all forms of dress, was introduced in the Corps, but not formalized until the 17 May 1883 regulations. Around this time we also see the two different embroidered grenade designs emerging, seven flames for the RA and nine for the RE – with motto *Ubique* – originally worn on the folding field cap only. This badge had a scarlet background to the motto scroll for the RA, and a "light blue" background for RE. This cap was not authorized to be worn with mess dress.

As well as the standard army system of rank badges, based on combinations of stars and crowns, the Corps maintained other distinctions of rank. These included the different forms of lace embroidery worn on the cuffs of the frock coat and the undress jacket by lieutenants, captains and field officers. These elaborately embroidered collars and cuffs, shoulder cords and cross belts certainly made their decorative contribution to "smartness". But, they were also partly designed to provide a modest level of protection against the "principal sword cuts". In those days a RE officer had a decent chance of confronting the more irate and less willing subjects of Her Majesty in close combat with edged weapons. Until reliable pistols became universal the officer was expected to "get stuck in", watched keenly by his admiring Sappers!

The Acceleration of Change

The Transvaal rebellion of 1880 to 1881 was effectively the death knell for scarlet field uniforms. The Army started to fight resolute opponents who unhelpfully "fired back" to good effect over increasingly long ranges. The first large field force deployment from the United Kingdom in which most wore khaki uniform was in the 1882 Egyptian campaign – the change driven by the

very high temperatures in which operations had to be conducted. By the start of the Boer War in 1899, khaki field uniform was universal for operations "overseas", as it had been in India since about the mid-1870s. We also had the arrival from the Indian Army of the leather Sam Browne belt[8] – which was really no more than a kind of "1898 Pattern Webbing". There were other more practical developments in the Corps – a blue frock was introduced in the 1870s for men employed in the Postal Telegraphs because climbing creosoted telegraph poles spoiled the scarlet frock. Also, officers on ballooning duties wore blue puttees, over the undress uniform, above laced boots. They were required to wear hunting spurs when actually mounted, but not while in their balloons. Dress for mounted officers increasingly reflected the amount of leaping about involved. In a corps now more interested in what a shovel could do, rather than how it was pronounced, grubbier circumstances required more practically coloured kit and blue undress tended to replace scarlet, except for barrack routines.

The Turning Point

For the regulations of 1900[9] significant change was expected. Regiments and corps were invited to offer up sealed patterns[10] for approval well in advance of the projected publication date and the Corps did this for all new items of dress in mid-1897, and to confirm the design and quality of some that were to be kept. The Army was still very reluctant to give up its massive investment in scarlet and blue. The scarlet coat was retained as full dress – it was, after all, originally based on the old livery of the house of Hanover and these things mattered in a Europe of emperors, kings and grand dukes. To confirm its use solely as the RE Corps mess dress, a sealed pattern of the long-standing design had to be offered for approval, and to establish the right quality of uniform. It is apparently the details of this submission that have become known to its advocates as the "1897 pattern", but it was really just a confirmation of the earlier form of mess undress. However, this 1900 mess dress was still to be worn with the gold-lace striped dress trousers, and brass box spurs with "dumb[11] rowels". Amazingly, red was also kept for "home service", although a much simplified serge jacket had become standard from the 1894 dress regulations onwards. By 1900, all orders of undress required for field or minor barracks duties at home stations, had been reworked into a simplified red serge frock, or blue cloth.

The 1899 and early 1900 battles of the Boer War had reinforced the need for many reforms, not just in the field uniforms of the Army but in the upper layers of the command of the Army itself. These eventually led amongst other things to the institution of the general staff in 1904. In the dress regulations of 1904 the "subalterns pattern" tunic was adopted for all ranks,

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[8] We no longer wear the pattern originally adopted for RE use, having progressively got rid of redundant fixtures and fittings for the second brace, pistol case and the small strap intended to keep the sword hilt steady. The sword frog has also been simplified. Officers in "RE Troops" and the first field squadron (formed in 1914), generally wore a pattern locally approved in Aldershot which incorporated a whistle and leather strap into the left brace – worn with the revolver. Sam Brownes, described in the 1900 dress regulations, were made of ordinary brown bridle leather, the belt being lined inside with "faced basil" intended to separate the leather from the jacket to reduce staining. Belts were originally polished to the same standards as the tack on the officer's charger – in the RE of those days, very highly polished indeed. Most officers had several belts, those for field duty being kept more supple than polished. The long leather sword knot is the 1900 Army universal pattern for this belt. The Corps has always let this fall over the left of the sword basket enabling it to be used for its proper operational function, providing a strap to secure the drawn sword to the wrist.

[9] "Dress Regulations for the Officers of the Army (including the Militia)", dated 9 July 1900.

[10] Sealed patterns of garments, buttons, lace, embroidery, badges of rank, special badges, devices, horse furniture and appointments, were deposited at the War Office for reference and guidance. In providing themselves with uniform and equipment, in case of any doubt arising as to correct pattern, officers were to make sure (if possible, by personal inspection) that articles according to sealed pattern were being supplied to them.

[11] Steel spurs were generally worn, except on state occasions, in the evening when review order was worn, and in mess order, when brass spurs with dumb rowels were worn. The rowels, in this case were the flat, but patterned, circular disc set into the tips of each spur. They moved slightly as the spur was applied. They were made "dumb" by being seized firmly in place so that they did not "clink" as the wearer walked about.

the differences in rank being shown by the badges only. The old, traditional shell jacket mess dress with its red waistcoat disappeared, and in its place came the first version of today's mess dress with roll collar. The gold lace stripe on the mess overalls was replaced by the present scarlet stripe. The timing of this change was driven by opportunity, and pragmatism. It just happened that the new pattern of mess dress for the general staff, and general officers, was to be based on a scarlet jacket with roll collar, blue facings, blue waistcoat, and mess overalls with a red stripe. Originally, and as what we might now call a "branding" exercise to promote a new image, regimental officers for employment on the General Staff were to be required to adopt its uniforms and badges and then to revert to regimental orders of dress on returning to appointments with troops[12]. It was quickly realized that adoption of this basic general staff design as RE Corps mess dress required only the simplest changes of badges and buttons for service on the general staff – avoiding officers having to maintain two sets of mess dress. There were other contributory factors that made change *per se* easier to effect. An atmosphere of radical change drove the Army, and the newer officers in a larger corps, drawn from a broader section of society, were apparently content to adopt something simpler and cheaper – and more modern.

The roll-collared jacket was not new in itself. Between 1880 and 1900 the foot guards, infantry of the line and RAMC, had already adopted it. In the 1900 regulations, the so called "stand up" collar was kept by the RE (for only four more years), miscellaneous cavalry, the Somerset Light Infantry, rifle and highland regiments, the RA[13] and the medical staff, pay, ordnance, veterinaries, and provosts marshal. The 1904 mess dress was originally tailored to be worn routinely with a stiff fronted shirt and high collar, the wing collar and "soft" shirt following later. Early versions were of fairly loose fit, it being intended as a comfortable form of dress. There were minor refinements of detail that now appear to have vanished as tailors, and officers, were permitted to cut corners. The embroidered grenades were once made so that the tip of the top flame curved inwards, and the buttons were originally gilt with the other detail applied in pierced gilt metal – none of today's "staybrite" thank you.

The patrol jacket and scarlet serge frock disappeared from general use and a khaki drab "service dress" was adopted, the material being a special mixture of serge but different to the type now worn. The jacket originally had a stand up folding collar, but in 1913 the open collar style was adopted – similar to today's version, but worn with a flannel shirt and tie. The Sam Browne belt formally became part of service dress and the whole lot was worn in the opening battles of WW1 in the scorching August heat outside Mons. It later became the habit of officers at the RE Mounted Depot to wear two smaller cuff buttons on each jacket sleeve. Before WW1 the two great RE centres of excellence were the depots at Chatham and Aldershot, both having powerful influence over the maintenance of extremely high standards in the Corps generally. It was never to be quite the same again.

Mess dress came and went at various stages as the effects of two world wars, conscription, austerity and rationing were felt. Reintroduced after WW2, mess dress became what was called a "voluntary item" of dress, ultimately because the various allowances (for example on commissioning) were not intended to provide it from public funds. Nevertheless by the 1960s its possession was firmly expected, and every new officer simply bought one – or wriggled into a second-hand one. For periods of time, especially after WW2 and until mess dress was restored, No 1 dress was worn as "blue patrols" for dining in, and in some regiments and at RSME by the orderly officer. Generally though, trousers were worn below field rank until overalls, mess wellingtons and spurs, were reintroduced as part of mess dress for all officers irrespective of rank. The Corps had no collective enthusiasm for No 1 dress, once it was no longer a MOD-funded Army

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12 It would have meant that captains might have to purchase two mess dresses. This obviously daft arrangement staggered on for about two years.

13 The RA changed to a modified version of the roll collar after WW1, and considered readopting the stand up collar in the mid-1980s, but decided not to do so after consulting Commanders RA.

order of dress. For a period after WW2 the stiff shirt was worn with mess dress on all occasions, then only for formal occasions such as Corps guest nights. A soft shirt was later generally allowed at the discretion of COs. Part way through the 1970s the corps abandoned the stiff shirt, though it lives on in the R Mon RE(M) whose officers have been politely raising their eyebrows to any questionable change since 1539! The end of the stiff shirt was really not much mourned. Some more senior officers considered that its demise really began when the Corps drew in fewer officers used to wearing wing collars at school!

In the 1970s wearing mess dress was mostly confined to mess guest nights, balls at Chatham, boxing matches, and those privileged occasions when one was invited to a major event in the Warrant Officers' and Sergeants' Mess. Otherwise, being associated with duty and the grisly panoply of rank, it was fairly unpopular and most people preferred to wear dinner jackets to mess parties, or something very much less formal. The dinner jacket in those more settled days was to parties and comfortable eating what the set of coveralls still is to the repairing of cars. They did not cost much, everyone had one, and they easily survived the occasional swim. As time passed, the dinner jacket began to fade from the scene to an extent, and mess dress became the preferred dress for the comparatively few formal mess occasions that survived in increasingly busy units. The susceptible began to believe that mess dress was somehow a multi-purpose Army substitute for both black tie and white tie – rather in the way that some still believe that No 1 dress is a sort of *de rigueur* RE Corps alternative to getting married in a morning coat. But, the times they were a changing, and our once very dress conscious Corps has drifted towards "moving with the times", or, "failing to maintain standards" dependent on the viewpoint of the individual. It was ever thus. As a measure of the evolving informality of messes, Lieutenant Colonel JA Coombs recorded[14] that in the REHQ Mess of 1948, clearly still very much influenced by the high standards of the 1920s and 30s:

> "…dinner at 2000hrs was formal. We wore dinner jackets except on Thursdays, when Blue Patrols were worn for the weekly regimental dinner night, and at weekends."

Lest this all be thought of as the last vestige of something very much grander from the previous century let us reflect on the remarks of Colonel AJ Hepper DSO, a "YO" in 1860 and Deputy Commandant in 1890, who wrote:

> "I found Chatham much improved since I had been there as a subaltern, the tone and tastes of the young officers were especially so," "In my time …afternoon tea was unknown and would have been thought effeminate." "It was quite refreshing to me to see many young fellows having afternoon tea in the ante room; in my time it would have been brandy and soda, or sherry and bitter."

New times required new things and a few old things simply got dumped – all for very good reasons at the time, even if they were reasons of realism, economy or compromise. The Corps, and the Army, were busily occupied and frequently subject to reorganization and new or extra roles and commitments. The increasing operational tempo, once it began to bite, never really relented apart from a few years in the late 1920s and early 1930s when some of the "old style" was clawed back. As a curious example, the RE busby was reintroduced into ceremonial full dress in 1929. The post-WW1 and WW2 periods of austerity were hardly times in which to be seeking greater elaboration of dress. Also, the strong influence of the Chatham Depot had weakened as the Corps was eventually dispersed across an increasing number of permanent UK and overseas stations.

Another consequence of the demise of No 1 dress was the universal adoption of mess dress by the sergeants' messes of the Corps, initially with only warrant officers class 1 wearing the mess waistcoat, whilst other mess members wore the scarlet RE cummerbund. The waistcoat was fully adopted in the 1980s.

The only other revival of note was the effort gone to by enterprising staff officers at the RSME in the 1960s to restore scarlet ceremonial dress to the two RE bands, at that stage totalling some 100 musicians. They were sadly not able

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[14] RE Journal, Sep 96, "Now, Then and Before Then, Royal Engineers Headquarters Mess." At this time, clothing rationing still applied and mess dress had not yet been re-introduced.

to reinstate their bearskin caps (authorized in 1861) or the distinctive sword bayonets[15], taken into ordnance storage in 1914. As time has passed, the ceremonial dress of the band has become less and less authentic with such changes as the abandonment of waistbelts, the adoption of the black and gold pouch belt, and other differences. The band uniform is thus now a "pastiche", representing no particular complete historical order of dress at all.

The Corps has also had some exotic flirtations with variety. As recently as the early 1970s, its officers wore an attractive grey-green, "V" necked lightweight merino wool pullover, intended to be worn tucked into the service dress trousers, and thus capable of being worn under the service dress jacket. For a time we also wore dark khaki braid ties with service dress (and a curious pale green shirt) and a light khaki tie with combat dress. Officers were not allowed to wear combat dress in the mess, and visiting armoured engineers in their coveralls were sometimes regarded as if equating to bin men!

The service dress hat seems to have died out – at least mine looks rather dead – and was once even worn with combat dress by some people. At least two RE officers won bravery awards after WW2 whilst wearing one. Towards its demise, very few people in their right minds actually bought the two-foot malacca cane that was rather apologetically described as a compulsory item as recently as the late 1960s. In the early 1970s there was briefly talk of introducing a blue pullover, but this was stifled. Few bought the later "Groom Pullover", on which one need not dwell. Until it was considered to be too expensive – by the usual tribe of field officers who could most afford them – the Corps wore, in shirtsleeve and pullover order only, a very attractive "stone grey" shirt.

Perhaps the most misunderstood, but most cherished, remaining dress item is the braided RE blue lanyard, really introduced in 1951 as a form of easily identified distinction while walking out in battledress. Plain cord lanyards had been worn for decades, as a purely functional item. These usually held a jack knife, whistle or folding hoof pick, and provided a good length of strong cord often used as an easy way of pulling together damaged harness. Braiding the cord of a lanyard simply compressed its bulk until it was unravelled for use. However, the RE lanyard is still surrounded by weird and wildly untrue mythology to do with "saving the RA's guns" which no amount of factual explanation can contradict. Some form of simplification is long overdue but Sappers seem fiercely attached to keeping it just as it is.

JOLLY GOOD, BUT SO WHAT?

WELL, we really ought to ask ourselves the very basic question: "Why on earth do we still wear most of our orders of uniform dress in the Corps today – and what working principles should actually drive us in future?" It is a good question, because much of what we wear is just some sort of left-over from orders of dress used for quite specific but mostly now redundant purposes a very long time ago, or from some half-hearted change after WW2.

Are we doing it for a commemorative reason and, if so, why do we not make that clear. For example, everybody continuing to wear a braided blue lanyard just because we started doing so in the 1950s is not much of a reason. But, if we continued to do so "in memory of all those Royal Engineers who were killed or became casualties during the period that battledress was worn by the Corps", then we have a substantial and thought-provoking "walking memorial" to those who served from WW2 onwards until battledress was withdrawn. This would include the Korean War, and some of the nastier, counter-terrorist operations of the 1950s and early 1960s.

Similarly, our regimental sergeant majors, or just the Corps RSM perhaps, could start to wear the RE Corps Badge of the Royal Arms with Supporters and the motto *"Ubique quo fas et gloria ducunt"* on all forms of dress, instead of

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[15] The 1861 RE band uniform was designed by the Prince Consort at the invitation of HRH George Duke of Cambridge, Colonel of the Corps from 1861 until 1904. Originally white with gold cord facings, the colour of the tunic was changed to scarlet. The sword bayonets are understood to have fallen into the hands of the RA, who put their three bands into ceremonial dress earlier. Although the bayonets might have been recovered as the RA reduced to one band, the Corps band had ceased to wear waistbelts on which to hang them! London District opposed re-issue of the bearskin caps at the time of the coronation of King George VI.

the normal badge of a warrant officer class 1. You can see an example of this on the cover of every *RE Journal*.

Do we still need to totter on with our 1898 pattern webbing? It is a fundamental anachronism in the first place, and might just as well be replaced by another fundamental anachronism which does not require to be laboriously polished if it is to look presentable. The historical alternatives exist and can easily be adapted to any modern requirement using suitably selected materials. Victorian Sappers must roll with laughter in their graves at the prospect of today's "servant-less" officers having to spend more time preparing for a parade than anyone else. We also might consider providing our warrant officers class 2, sergeants, and junior ranks, with something smarter to wear with No 2 dress than their current green plastic belts. If we ever consider a blue pullover again, then why not simply negotiate permission to use that already issued to the RN – whom we also support – at great economy. A smarter pullover might usefully meet several modern needs.

One could easily build a raft of simple and thoughtful measures to introduce a theme of appropriate historical commemoration, without drifting towards frippery, the hopelessly "Ruritanian," or wild expense. The Corps' committees are organized to put such ideas together, if directed to do so.

We Have Been Very Patient, What About the mess dress?

This recent "mess dress proposal" indicates a curious paradox. A strong desire is seemingly being expressed for a single high profile change, by an apparently small minority (so far anyhow), in a Corps not otherwise appearing to be much interested in uniformity of dress or "smartness", in an Army fairly stuck in the mud of long standing dress conventions. All of this whilst advocating only the return of an elaborate form of dress abandoned almost a century ago. If we sense a mood genuinely in favour of change, is it enough just to examine changing mess dress. If we are going to change anything substantial, then is mess dress the first priority for change, or even a high priority. Is the sense of some kind of change being required a universal one – throughout the whole Corps. Should it need to be so universal before we contemplate it.

As for the rest of it, what else do we really need. That grand debate can flow, and much of the outcome will be pre-determined because the Army itself perpetuates a number of orders of dress which corps and regiments are then required to wear. However, we do have influence over when we wear them in-house, at Corps and regimental duty, and it might be wise to overhaul this area to see what useful and sensible rationalizations or improvements might be made, and indeed proposed to the Army authorities. Generally, officers do not pay for any of the uniforms that they need for their operational military duties and related training. These are churned out at adequate quality and if we have the wit to wear them properly they also let us know just how quickly our soldiers are getting wet and cold so that we can then do something about it. The area requiring consideration is the other forms of dress.

We have seen how mess dress began, and was then changed when it was thought necessary to do it. Its origins were in an Army that took all forms of uniform dress very seriously. Are we to return to that basic position ourselves as a Corps with the firm policies and controls on standards and smartness that would clearly be required? Or, and as an illustration of current grey areas, is something actually an authorized item of RE Corps dress just because Corps Enterprises – or the regimental PRI – decides to sell it? Are we sponsoring informal "street fashions" in this way?

There is also a case for arguing (albeit provocatively) that any officer over 45 should no longer be part of the main argument – which should centre on those officers in the younger age groups, at RE duty. After all, they have the main responsibility for the current reputation of the Corps, because they create and sustain it, and for developing a vision for its future. Anyone above the rank of lieutenant colonel, apart from "Corps family" considerations, is arguably not really in the Corps anyhow but is actually a member of "the staff".

Some officers are telling us that a new mess dress might attract officer recruits. Should we just ignore that, or is it really so? Launching Nose passed the original "Dressed to Kill" article to a French officer colleague. He was much taken by the remark: "It will impress others, including the opposite sex." and drily commented that most French officers would rather command a unit whose officers impressed the opposite sex by taking their clothes off!

Where do we wear mess dress these days, and why? Are it, and other types of uniform, already being worn inappropriately on occasions where "modern manners" in general, and Army security and discipline in particular, require appropriate civilian dress? Do we really need to consider our social image and how to maintain or project it? If we need to project an image as such, then which one, where, and how? Is there much point in smartening up our mess dress without also smartening up our messes; some of which are, frankly, fairly ordinary and not always good value for money. We also need to consider the difference between the presentational image created by smart appearance and professional bearing – in all forms of military and civilian dress – and the potentially risible effect of just appearing to "dress up, and prance about". Rather as in the old confidential report chestnut, are we beginning to attract – or retain – some officers who would be happiest commanding "a unit comprising just an officers' mess and a band".

Some important practicalities have so far been glanced at rather than addressed. The issue of cost needs greater consideration – and for the sake of argument, let us assume that the proposed mess jacket, waistcoat and overalls turn out to cost some £800(+) to buy. Compared with other commonly bought "essential items", such as: holidays, cars and PCs, and the cost of current mess dress, this is not a huge amount of money. Currently, officers get a substantial uniform allowance on first commissioning – but that does not include a deliberate allowance for the cost of providing mess dress, which is still not provided at public expense. So, officers feeling the pressure to buy a more expensive mess dress might simply skimp elsewhere. Once serving, officers have an annual tax allowance for the maintenance of their uniforms. If a five-year period of transition were allowed then this could offset the cost of change. Most regiments and corps who have made the change have done it that way (such as the RTR, RRF, AGC and RLC).

We should also consider the interests and circumstances of officers of the Territorial Army, as well as those members of the regular and TA warrant officers and sergeants messes of the Corps – who receive no financial help whatsoever yet very commendably maintain themselves in mess dress. Are we to have several types of mess dress: regular and TA, or officers and sergeants? If we do, then what about the respectable number of our warrant officers who achieve commissioned rank, and would then face extra costs?

We can usefully dismiss the problem of those who are promoted above the rank of lieutenant colonel. Only a few are promoted each year, they would have to change mess dress in most regiments and corps anyhow, they get the same allowances on promotion as those who do so, and they can easily afford it, or can organize themselves to afford it. Every episode of change has its own spirit of ruthlessness and, in their case, as François, duc de La Rochefoucauld tells us:

> "We all have strength enough to endure
> the troubles of others."
>
> *Maxims, 19*

We also need to consider our women officers, and their current and future non-commissioned counterparts. Mess dress for women officers can be adapted to the pre-1904 pattern, as has already been done in the RLC for example. However, if there is to be change, then other options deserve consideration, including allowing for periodic changes in civilian fashions for women to be reflected in modifications to RE women's mess dress as these occur over time. The extent to which civilian fashions can become ridiculous should not be underestimated; ask the wife, and remember flared trousers!

A recent letters' exchange in the *Journal* amusingly handled the sensitive subject (to some anyhow) of the dynamics of the stomach and waistline. A Household Cavalry colleague swears by what he calls the "mess kit diet" which he has scrupulously followed since getting married as a young captain. Every time he feels the urge for "more cake" he remembers the likely £1200 or so that a new mess kit might cost him and resists temptation. Maybe that is a good enough reason in itself to be "Dressed to Kill".

Handling Change

We were not born yesterday, and we can look forward with modest confidence to some continued existence in future. If we are to talk about change, then let us consider all of the possible dynamics of change. The "mess dress debate" is worthwhile, but we should not limit ourselves to it. That said, there is a wise, and long-standing, system for taking soundings on these matters, and a

top structure of robust regimental committees is specifically designed to consider any change of Corps policy. These include the Corps' Dress Committee headed by the Regimental Colonel. But, it is ultimately the Chief Royal Engineer and the Engineer in Chief who direct policy development. It is surely not an issue that needs to be resolved by "clamour" or the artificial hiatus of "voting".

It may also be that we do not wish to preoccupy ourselves with something as specific as previous designs. Each change needs to be good enough for at least fifty years, by which time we could be merrily clanking our way along the queue in the REHQ cafeteria at Brompton, thanks to some even more relentless PPP initiative. In terms of relative formality, the old Victorian RE Corps undress jacket and waistcoat effectively started off as the "woolly pully" working dress of its day, and perhaps we really should not see it so solemnly or glamorously now. Do we really need to be "Dressed to Kill", or is it simply that:

Solutions to problems
are easy to find
the problem's a great contribution.
What is truly an art
is to wring from your mind
a problem to fit
a solution.

Piet Hein, Danish Scientist-Poet

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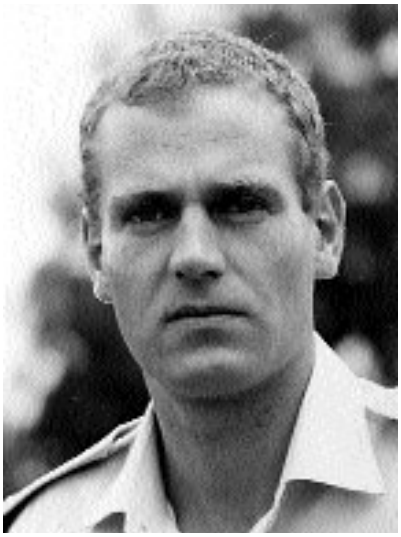
Myths Of and Insights Into Temporary Field Accommodation

LIEUTENANT COLONEL C M COCKERILL BSc CEng MICE

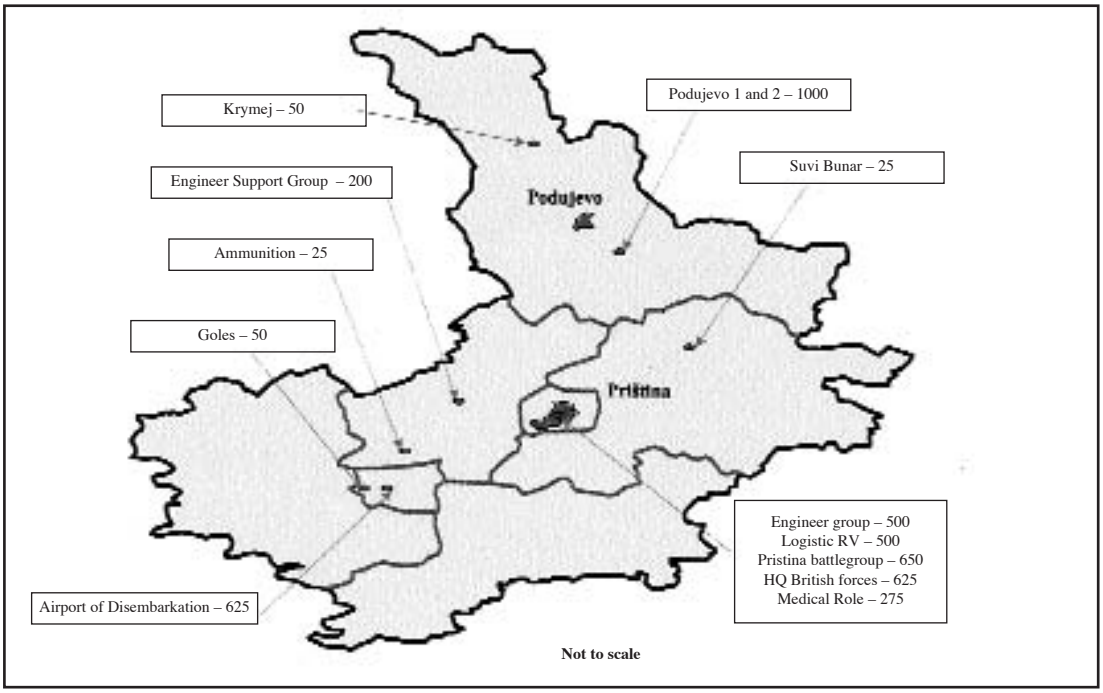


The author was commissioned into the Corps in 1979. After initial training he served with the Junior Leaders Regiment at Dover as a troop commander before attending the Royal Military College Shrivenham to obtain a degree in civil engineering. He then served with the Queen's Gurkha Engineers in Hong Kong as a troop commander and squadron second in command undertaking projects in Nepal and Fiji. In 1986 he was posted as adjutant, 12 RSME Regiment, and in 1998 was selected to undertake the two-year professional engineer training course with attachments to Nuttalls, as a site engineer on the Isle of Grain, and Maunsells, as a consultant engineer in their Maidstone office. Posted to the Military Works Force, he was appointed staff officer engineer logistic operations in the Joint Headquarters at High Wycombe during Operation Granby, *and was awarded a joint commander's commendation. Subsequently he filled posts as a second in command and officer commanding a specialist team Royal Engineers and saw service in Gibraltar, Bosnia, the Falkland Islands, Norway, Hong Kong, Germany, Cyprus, the United States and Saudi Arabia. In 1993 he assumed command of 15 Field Park Squadron and during this tour he took the squadron twice to Bosnia on Operations* Grapple *3 and 7. From 1996 he was the staff officer infrastructure in the Directorate of Engineer Support (Army) at Andover where he became staff qualified (weapons) and in May 1998 he was posted to the Superintendent Ships Devonport as deputy project manager dealing with nuclear submarine facilities. In July 1999 he was appointed, on promotion, as the works project manager for the temporary field accommodation contract. He is now serving as the staff officer grade 1 for fuel handling equipment in the Defence Fuels Group.*

THIS article is written to help dispel some of the myths published about the provision of temporary field accommodation (TFA) in Kosovo from August 1999 to May 2000 and to provide a brief insight into the in-theatre project management of this unique prestigious "pathfinder" project.

BACKGROUND

EARLY in 1999 the possibility of an extended stay in Kosovo led to the identification of a need to provide deployed British forces with suitable accommodation. This accommodation had to be capable of withstanding the extremes of temperature in the region in order to maintain the troops' health, welfare and operational effectiveness. This resulted in an urgent operational requirement (UOR) for TFA for 5000 troops being drawn up by DDOR (Engr & NBC) (now DEC(CSS)). This UOR was based on work previously developed for expeditionary campaign infrastructure. In parallel with the requirement being developed, the Defence Procurement Agency (DPA) initiated informal talks with industry over possible solutions and their likely costs. After ministerial approval of the UOR, DPA issued an invitation to tender to four bidders on 24 May. A scenario for deployment of the camps was used as the basis for tendering as we did not know which country they would be constructed in. Also, to produce a "level playing field", tenderers were to assume that groundworks and provision of raw water to the sites would be undertaken outside the contract. Tenders were received three weeks later with tender assessments undertaken over the following three weeks. Secretary of State and Treasury approval to place the contract was finally given on



Locations and sizes of TFA sites.
To give some idea of the scale the distance from Pristina to Krymej, the most northerly camp, is about 40 kms and from Pristina to Goles to the west is about 18 kms.

23 July 1999. Military Engineer Services (MES) personnel were imbedded in the DPA team to provide works input to all stages of the process.

The above sequence of events demonstrates the particularly short time-frame achieved from project identification to contract award which was a remarkable feat by all concerned considering the size and complexity of the project.

On the same day as the Secretary of State and Treasury approval was given, a prime contract was let to Hunting Engineering Limited (HEL) in the order of £110M. The original contract covered the design, integration, manufacture, shipping, transportation, construction and commissioning of camp accommodation for 5000 troops. Additionally the contract covered the subsequent operation and maintenance of the camps for a three-year period. The rough order of costs were £50M for the asset procurement and delivery, £30M for the construction and £30M for three years' operation and maintenance. The approved in-service date was 31 January 2000 with HEL's original programme giving accommodation for 2000 personnel by the end of October and the remaining 3000 by 11 December 1999. The contract was initially for 22 camps based on designs for 25, 125, 250 and 500-man camps. Whilst some regarded the project as ambitious within the contracted time-frames, the realities were that the system was specified to be modular, rapidly erectable and redeployable, and therefore the project was considered achievable.

The Works Project Management Team

It was recognized that expert customer representation and expertize in works construction management were needed in theatre. The novel solution was the creation of a team with the requisite expertize – the works project management team (WPMT). Operating under formal delegations from the DPA and with UK-based support from HQ MES, the WPMT was responsible for actively managing the in-theatre construction and acceptance off contract* of the TFA in a well engineered, safe, cost effective and timely manner. The team was 21 strong with members

* "Off contract" is a term used when accepting the contract has been completed to specification.

trawled from across the Corps. It comprised professionally qualified engineers, garrison engineers and clerks of works from engineer regiments, garrison works liaison offices, the Military Works Force and MES (Wks) (Tech Skills). Additionally a military management accountant from Management Accountancy Services (Army) provided the team with financial advice and support on all aspects of the contract. Although rouled every three or four months the management accountant provided essential continuity from construction through to the operation and maintenance phase and captured all costs associated with the project. This was the first time that a management accountant had been used in this way on operations and it has hopefully set a precedent as they are a highly versatile and professional resource. There is one in the Military Works Force post-SDR establishment.

The team provided engineering, commercial and contractual scrutiny as well as monitoring the contractor's performance and compliance with the specification. One of their most important functions was to provide the essential interfaces between the contractor, the key stakeholders, and military commanders and units in-theatre. This sometimes required considerable patience, tact and diplomacy. The works project plan was put together by G4 MES HQ LAND and was approved by the Permanent Joint Headquarters (PJHQ) staff before distribution. It covered the complex command, financial and contractual arrangements in theatre. In essence my team was under command CinC LAND (through Colonel Engineer Services), under operational command of the chief joint operations PJHQ, and in theatre under operational control of the double-hatted CO of the CRE(Wks)/SO1 J4 Infrastructure.

The financial and contractual arrangements were just a little more complex. Suffice to say that I and no one else received delegations from DPA, and the WPMT was the only organization in theatre empowered to deal with the contractor over all issues to do with in-theatre construction and acceptance off contract of TFA.

To carry out the necessary monitoring and auditing functions during the operation and maintenance of the contract, a separate team, the property management monitoring and auditing team (PMAT), was formed and deployed to Kosovo to provide a seamless transition from the construction phase. The team worked directly to CO CRE(Wks). Although this worked adequately, in hindsight greater continuity and therefore corporate knowledge would have resulted if the PMAT had been part of the WPMT until all the camps had been handed over.

The Reality

As my team was forming up in UK a joint reconnaissance with HEL took place to Kosovo early in August 1999 where the Commander's requirements driven by operational circumstances and articulated by J3 (operations and training) staff led to changes in the original requirement. In hindsight it was regrettable that I had not deployed earlier to give advice on the full commercial and contractual implications resulting from choosing any particular site. These changes reduced the number of camps to 14, which subsequently became 13 in September, lowering the number able to be accommodated to 4525 personnel. The reductions meant extra camp sizes and configurations of 50, 200, 275, 625 and 650-man camps. Additionally new

625 man camp at APOD, Pristina.

camp completion priorities were agreed. Unfortunately the changes also necessitated a contract amendment which contributed to initial delays in the project start date.

HEL's partners were substantial and included WS Atkins as the designers, a Mowlem/J&P Alliance responsible for the civil works and Hiberna, a joint venture between Hunting Contract Services and WS Atkins, undertaking the build and operation and maintenance phases of the project. It was interesting to note that HEL took back responsibility for the construction after things started to go wrong in December. The logistic and supply management aspects were provided by the MACE Partnership and lastly there were numerous equipment subcontractors including Premier Modular Buildings, PKL and PreMac. Local Kosovar civilians were employed in theatre as the workforce and supported all phases of the project. At its peak in February/March 2000 there were nearly 300 ex-patriots and 650 locally employed civilians working on TFA.

Contract Provision

THE contract provided: living, domestic and administrative accommodation including latrine and ablution units; cookhouse and dining halls; offices, guardrooms and unit stores; laundries; sewage/waste treatment and disposal; power generation and distribution; workshops; potable water; fencing and lighting; and armouries and ammunition storage. All the units were environmentally controlled and connected to a fire detection and alarm system. Included in TFA were all the fundamental elements required to ensure an adequate standard of comfort for the troops.

Phases of the Project

THE phases of the project were comparatively straightforward and included procurement of the materiel and its delivery to Kosovo by sea and road. The only real uncertainty to be overcome was the operational situation that would be encountered when troops entered Kosovo and how this might affect the position of contractors in theatre. To negate any risks it was decided early on during the tendering phase that the Corps would undertake the enabling works for all TFA sites in Kosovo in advance of the contractor. These works involved the clearance of any unexploded ordnance, ground works and drainage and the provision by 521 STRE (WD) of a raw water source to the site perimeter.

Interestingly, attributable delay in terms of costs and time against the MOD was included in the contract. To ensure that this did not happen the CRE contracted the ground works, drainage and concrete workshops hardstanding at Podujevo, one of the largest sites, to Zafer, a Turkish sub-contractor. These works were managed by the WPMT, and all were concluded to time and specification.

Formal handovers of the enabling works from the Corps to the WPMT were initiated and the sites transferred to HEL.

Units requested beneficial occupancy of some sites during the ground works and construction phases, particularly at the airport of disembarkation. However, the practicalities of this were recognized as being unworkable and these requests were strongly resisted unless a clear working demarcation could be established on site. This was to ensure that there were no contractual avenues open to HEL for extensions of time and additional costs.

Kudos living accommodation.

Once the necessary testing, commissioning, snagging and production of documentation had been completed for each TFA to the satisfaction of the WPMT, formal handover boards were convened. After acceptance the camps were transferred to the property manager (a major garrison engineer on SO1 J4 Infrastructure's staff) and unit for occupation. This also initiated the formal start of the operation and maintenance phase for each camp.

Risks

THERE were considerable risks associated with the contract. However, after the initial changes the main risks that materialized, which had consequences for the project completion date, were the difficulties associated with the set up, design and construction of the camps. The initial delay attracted some media attention mainly because of concerns that troops were not being properly housed during the harsh Kosovar winter. However, the MOD had also embarked on a separate project, called Improved Tented Camps, which provided the deployed force with an adequate standard of comfort, albeit not as good as that which would be provided by TFA. In the event the first TFA camp was not handed over until early February 2000 with the last camp completed in late May. Fortunately the winter weather, which can be extreme in the Balkans, never really materialized and although there were concerns that the movement of contractor's materiel would be impeded after the initial confusion and chaos at the border crossing points, movement into Kosovo was generally unhindered.

In my view the delays that the project suffered highlighted the need for projects of this nature to be managed on-site by experienced and knowledgeable construction experts. This was especially relevant with regard to construction managers and specialist electrical and mechanical sub-contractors. Projects of this type, particularly where there are long lines of communication, need all parties involved to have visibility of well-found plans to ensure that the right resources, of both people and materiel, are available for each phase of the project. It is also important not to underestimate the resources needed to properly prepare for camp hand-overs including preparation of the necessary commissioning and safety documentation. It was these aspects of the project that contributed significantly to the delays.

Prime Contractor's Performance

WHILST there were very many aspects of the project that worked well, especially the work of some of the sub-contractors, and the end product was to a very high standard, there is little doubt in my mind that HEL's overall performance could have been better. Crucially it wasn't until early January 2000 that HEL properly resourced the project; however, by this stage it was far too late to redeem the delivery programme. The areas that caused concern were: lack of fully resourced and levelled construction sites; poor equipment selection and integration; inappropriate level of site management, expat supervision of locally employed civilians, skilled tradesmen and specialist electrical and mechanical sub-contractors; insufficient specialist equipment, craneage and mechanical handling equipment; and uncoordinated activities of sub-contractors. Most importantly there was also an underestimation of the time and resources required for the mobilization phase; construction activities excluding the ground works; testing, commissioning and snagging; preparation of documentation and presentation of camps for handover. Lastly HEL's materiel management was unpredictable.

Conclusion

THE Corps has gained a considerable amount of quality project management knowledge including financial, commercial and contractual experience not normally associated with operational deployments. More importantly the clerks of work had to quickly learn and understand the implications of any decisions or instructions they gave to the contractors. Although acting in a resident engineer's capacity they were the envy of HEL. For the first time in my career I really appreciated the true worth of our clerks of work, garrison engineers and professionally qualified engineers when compared to our civilian counterparts. The team was continually exposed to significant media, ministerial and senior officer interest and all team members hosted high level visits on a regular basis. Team members learned how to deal and interface with a multitude of key stakeholders which required considerable patience, tact and diplomacy. They gained professionally from dealing face to face with the contractor on a daily basis. For the record, the site diaries produced by the clerks of work are some of the best I have seen.

The lessons identified from TFA have been fully captured and will be incorporated into the

development of expeditionary campaign infrastructure. Whilst there were considerable difficulties in the delivery of the contract, the end product is to a very high standard and a considerable improvement on anything provided before for British troops on operations. Some even argue that aspects of the facilities provided are better than certain barrack accommodation in the UK and Germany. The Corps completed the enabling works to time and specification. The deployment of a properly manned, resourced and supported WPMT was a significant success, and ensured the necessary compliance and value for money. Committed, conscientious and enthusiastic, the WPMT undoubtedly made a significant contribution to the provision of TFA. The project management experience gained, including the financial, commercial and contractual aspects, is extensive, and the Corps is now well placed to play a major role in defence prime contracting and the employment of contractors on deployed operations.

50-man camp at Goles hill site.

A Collaboration of Multidisciplinary Scientific Research and British Military Training in Sabah

CAPTAIN M H W WORKMAN BSc PhD FRGS

The author attended the University of Southampton between 1990 and 1996 and gained two degrees before being commissioned into the Corps in December 1997. After attending RE Troop Commanders' Course 120, he was posted to 25 Engineer Regiment as a troop commander, and from February to March 2000 led Exercise Pelopor Finn which is described in the following article.

Earlier this year, in May, he was posted to 69 Gurkha Field Squadron as operations officer, and is due to undertake a six-month tour of the Falklands.

Introduction

In December 1999 over £150,000-worth of materials, rations and scientific equipment were shipped from the UK, America and Australia to the Far East. In January 2000, 34 people came together from all over the UK to undertake two weeks' training in skills ranging from jungle survival to single rope climbing technique, and satellite communications to heli-extraction drills, and to form a team which then flew 8000 miles (with another £275,000-worth of equipment) to Kota Kinabalu (Sabah, Eastern Malaysia) to join 28 people from Australia and Malaysia for Exercise *Pelopor Finn*.

The team carried out environmental infrastructure improvements and conducted scientific research within the tropical rainforest during a five-week period, undertaking a multiplicity of projects. Members travelled over 15,000km by road and dirt track; consumed over 1250 ration packs and 12,000 litres of self-purified water; man-packed over 4 tonnes of stores and materials into the heart of the rainforest; collected over 138 flora samples and made over 5000 physiological and psychological tests. Members cumulatively ascended over 7000m using single rope technique; collected survey data for over 30 features of global scientific importance and conducted 49 hours of continuous global positioned satellite (GPS) surveying; ascended the highest peak in South East Asia, Mount Kinabalu (4101m); and white-water rafted down 9km of the Padas Gorge.

The aim of the exercise was to assess the ability of a military expedition to collaborate with civilian scientists in order to undertake multidisciplinary scientific research and British military training in an extreme environment.

The objectives were:

- to cut a 12km ecological trail in order to allow access for scientists to study the unique tropical flora and fauna within previously isolated regions of the rainforest. Concurrent to this the collecting of flora samples and the testing of the new British Army boot would be undertaken;
- to undertake a physiological and psychological-based (P&P) research programme. This would involve a number of research organizations such as the Defence Evaluation Research Agency (DERA (UK)), the Defence Nutrition Research Centre (DNRC (Australia)), the Defence Science and Technology Centre (DSTC (Malaysia)) and a number of universities, both British and Malaysian;
- to undertake a GPS-based survey programme in order to set up a system of ground control at the Danum Valley Field Centre (DVFC);
- to undertake a construction programme which involved the manufacture of a number of tree-top canopy sampling towers and a weir at the DVFC;
- to undertake a venture package consisting of climbing Mount Kinabalu, white-water rafting and snorkelling.

With the progressive closure of British overseas bases, the ability to carry out imaginative, challenging and worthwhile adventure training\expeditions to extreme environments has become increasingly difficult. The demise of the Cold War has also had a marked effect by substantially reducing defence spending in the West, including Britain, and reducing defence research spending which is likely to lead to reduced effectiveness when our fighting forces are asked to undertake operations that require rapid adaptation. Poor field testing is likely to lead to mis-evaluation of defence products and procedures.

However, to overcome these difficulties a mutually beneficial relationship could be formed by British military training in extreme environments being used as a vehicle to conduct defence-based research field trails. There are a number of possible benefits to be gained from this partnership. For example, substantial cost reductions due to rationalization of travel and logistics, and for defence research establishments the added advantage that the testing population is likely to be representative of the end user.

Exercise *Pelopor Finn* was proposed to develop, apply and assess a number of scientific research and military training collaborations in the extreme environment of the tropical rainforest with a view to establishing procedures and protocols for more such work in the future. With this in mind the progressively integrated scientific and military relationships outlined below were established:

- The execution of engineering tasks for scientific ends. This was facilitated by the trail, tower and survey projects. The scientists stating their requirement based on their needs and experience, the military executing the projects using their expertise.
- The complete independence of military and scientific objectives, the latter using the former' expertise and logistics chain for their own means. This was realized by the recruiting of a botanist from the Royal Botanical Gardens, Edinburgh. The botanist collected specimens along the trail cut by the army but effectively operated independently of them to fulfil her objectives.
- The need for co-operation between scientific and military expertise to achieve a single objective. On the expedition this was realized by the survey team that comprised two members from 42 Survey Group and two academics from the University of Southampton. The team was to introduce a system of ground control at the DVFC as well as survey in sample plots which required the identification of flora; the military were to provide the GPS equipment and survey knowledge, the academics the knowledge of flora.
- The complete integration of scientific and military personnel. The DERA, DNRC and DSTC physiological and psychological study used the military as a test population and required continuous interfacing and feedback between the two parties throughout the expedition whilst the men undertook their expedition objectives. The testing of the new British Army warm weather boot also loosely falls into this category.

Physical training. Trail and survey teams undertake a stretcher and log race whilst single rope technique is practised by the tower team.

Assessment of the ability of these relationships to function effectively formed the basis upon which this exercise was set up. The ability to execute the objectives, though crucial, was seen as a vehicle to test the collaboration between civilian and defence research scientists and the military.

Planning and Execution

Planning for the exercise began in November 1998. A proposal was put to 25 Engineer Regiment and the Corps of Royal Engineers to secure formal backing and a working budget. Eminent patrons (General Sir John Stibbon KCB OBE and Professor Sir Ghillean Prance MA DPhil FRS FLS), were recruited, a number of

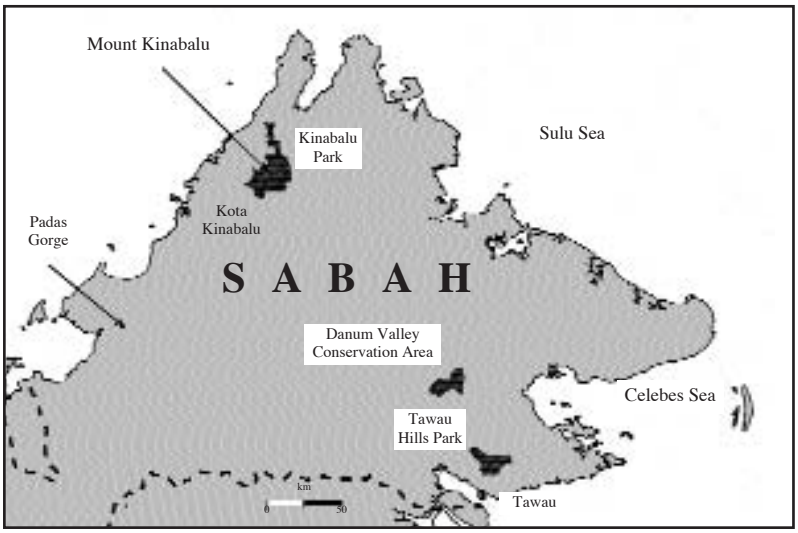


Figure 1. Map of Sabah showing expedition and adventure sites.

recces conducted, a website set-up and a planning team assembled by September 1999. The expedition concept and objectives were mapped out and from these the roles of the management team were devised, planning targets set and the planning procedure commenced.

Recruitment for the expedition started (to fill the trail, tower construction and survey teams) and training was set up. The training programme reflected the mixed skill levels and experience of expedition members, the hostile nature of the tropical environment (seldom less than 27^{O}C, 80 to 95 per cent humidity and over 2m of annual rainfall) and the need to integrate civilians into a military-run expedition environment. Training consisted of the following:

- Treatment of casualties.
- Jungle helicopter casualty evacuation procedures.
- Communications training.
- Living and operating in the jungle.
- Use of basic engineer equipment.
- Information recording, including diary writing, photography and video footage collection.
- Single rope technique (SRT) for tower team only.
- Survey training for survey team only.
- Photography.
- Adventure training qualifications.
- Two to four hours daily arduous physical training.

In addition to the all this, two fund raising activities were undertaken. A 4100m endurance SRT climb at the Europa Hotel, Belfast, which enabled the tower team to get some extra training at heights of over 120m. The second, an endurance dive in Lough Neagh (County Antrim), involved three members of the trail team undertaking an underwater swim with a cumulative distance of 27.6km. Funds were raised for the expedition and for a local charity.

Expedition Deployment

THE expedition was based at two locations: the Tawau Hills Park (THP) and the Danum Valley Field Centre for a period of three weeks (22 Feb to 15 Mar 00), see Figure 1.

The Tawau Hills Park Site

At the park the following projects were undertaken: trail cutting, flora sampling, P&P testing, and the testing of the new British Army warm weather boot.

At any one time 36 expedition personnel were located at the site, including the HQ element, and it was from here that the expedition was co-ordinated and commanded through the HF net at the Ranger's Station *(see Figure 2)*. Also located at the Ranger's Station was the expedition supplies, science laboratory, botanists' store, medical centre and equipment storeroom. Scientists prepared their equipment at the Station and walked into (or stayed in) the jungle to join the trail cutting team to carry out observations at one of the five camps along the trail route.

Trail Cutting. This project was lead by Sgt Franklin and his command team of Cpl Thorne, Cpl Johnson, LCpl Milligan and LCpl Vasey. The team cut a two to three-metre wide trail into the heart of the rainforest along a steep ridgeline involving an accumulative ascent of over 792m, clearing on route thick vegetation, deadfall and traversing washed out shallow ravines. In addition they had to construct engineer targets such as steps (over 400), three bridges, walkways and

a helicopter landing site.

The men lived in one of five camps along the route. Each man belonged to one of four, four-man patrol teams (each with a specialist role – signaller, medic, chainsaw operator and team commander) which were co-ordinated by Sgt Franklin. A survivability team ensured that there was sufficient purified water.

Flora Sampling. This aspect of the expedition required the recruiting of a civilian expedition member, Vlasta Jamnicky, from the Royal Botanic Garden Edinburgh (RBGE). This botanist provided an excellent opportunity for fieldwork. Using the logistical support of the military ensured that botanical research could be carried out under the best possible conditions and it is felt that the military and scientific aspects integrated well. Given the RBGE's limited research funds this particular field trip would not have been possible without the military's support and co-operation.

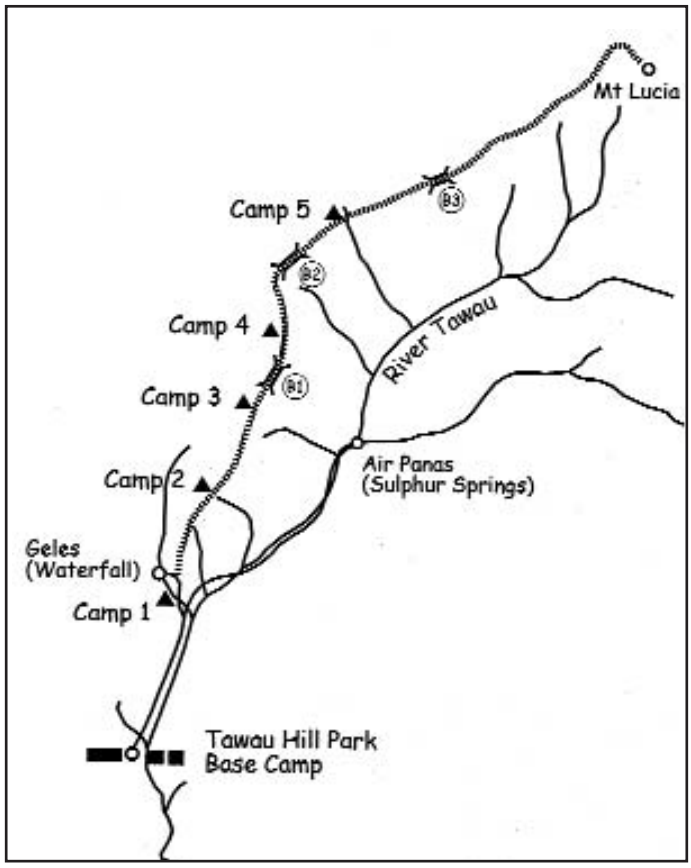


Figure 2. Schematic of the trail site showing the Ranger's Station (Base Camp) five trail camp sites, engineer targets (B1 to B3 – the HLS was at B2) and significant features.

The botanical work was undertaken with collaboration of Malaysian botanists from Kinabalu Parks and the Danum Valley Field Centre. The work consisted of collecting plant material of special research interest at the RBGE on and around the trail cut by the Army. Herbarium material was collected in addition to silica gel dried leaf material for DNA analysis. These collections contributed directly to several key research projects currently in progress at the RBGE. The material also made a general contribution to southeast Asian botanical studies, a subject of intense study for over 30 years at RBGE. The Malaysian State Herbarium Sandakan at the Forest Research Centre in Sepilok, and the herbarium of Sabah Parks (all in Sabah, Eastern Malaysia) received duplicates of all collected specimens for their own collections.

Physiological and Psychological Research. This required the recruiting of MOD research civilians. The exercise provided the defence science community with an opportunity to study human performance in an extreme environment. The outcome was international collaboration between The Technical Co-operation Program (TTCP) countries, Britain, USA and Australia, and collaboration between Australia and Malaysia. The scientific team was drawn from the DERA (UK) and DNRC (Australia). DSTC (Malaysia) provided scientific observers and limited logistic scientific support. By providing food, this scientific collaboration was a major financial contributor to the expedition.

The aim of their research was to document the effects of arduous exercise in an extreme environment on physical and mental health and to evaluate combat rations and a new carbohydrate supplement as suitable nutrition for such conditions.

Zulu bridge, a 10m long non equipment bridge, is being constructed together with steps.

DNRC contributed three scientists and up to £80,000 towards the scientific programme. DERA UK provided two team members and up to £14,000 of financial support which came in the form of fresh rations, equipment and consumables. The programme attracted logistic support from the US Army Systems, Natick USA (carbohydrate supplements, HooAh® and Ergo®, value £8000), Australian Army Support Command (combat rations, value £9600) and RAAF air freight. Many leading scientists provided academic direction for the programme.

The programme was the most detailed evaluation of combat rations to be conducted in a tropical environment. Scientific testing for each of the 35 participants (including those at the DVFC) included a minimum of 170 tests, including urine, saliva, skin and blood tests as well as physical (fitness, body composition) and psychology testing. A smaller number of participants were fitted with heart-rate monitors and radio pills for measurement of energy expenditure and body temperature. Fluid balance was measured by recording water consumption and urine volumes. In all, over 5000 individual tests were conducted. And, to add to this workload, the dietary intake of all subjects was recorded. Team members were actively involved in the analysis of data over the following six months and the first draft findings should be available by the end of this year.

Equipment Trials. Like the P&P research, the exercise provided another defence organization, the Defence Clothing and Textile Agency (DCTA), with an opportunity for a user development trial. During the expedition, £3000-worth of boots were issued to personnel with the aim of assessing the boot's performance under tropical conditions and producing a recommendation for introduction into service. Each trialist was requested to wear one of the four boot types and while doing so to maintain a weekly diary stating the amount of time that the boot was worn, his/her opinion of the boot, and the state of user's foot during use.

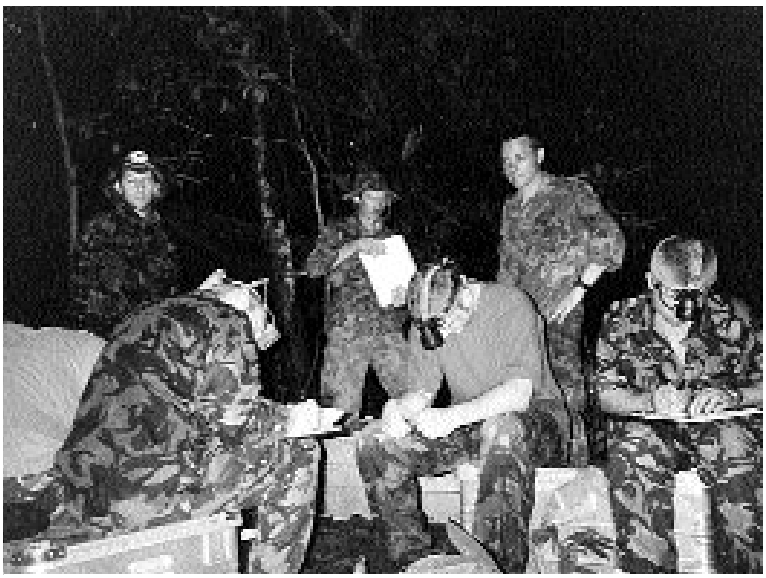
The Danum Valley Field Centre

At the DVFC the following projects were undertaken concurrent with work at the THP: Construction, a GPS survey programme and P&P testing. At any one time there were 19 expedition members at the site. There were also lab facilities, medical and equipment stores, a survey office and transport and guides provided by the Royal Society.

Construction of Sampling Towers and Bridging. The DVFC had a single, 40m-high, vertical sampling tower from which tropical rainforest canopy processes and phenomenon could be observed and recorded. The Royal Society had stated that a number of other such towers would be of great benefit to add appreciation of spatial variation in canopy processes. Designs were drawn, individuals trained in SRT and a rehearsal build was undertaken in the UK, before a decision

was taken to construct two towers. All materials except the bolts were to be provided by the Royal Society and the Royal Engineers would provide the expertise, bolts and enabling equipment.

Due to heavy rainfall water levels in the River Segama rose by 5m and a number of bridges were washed away. The weir project was therefore abandoned in order to construct a major bridge for vehicular access for the team and other researchers to a substantial portion of the conservation area that had been cut off.



Members of the trail team undertaking psychological tests under the supervision of the research scientists from DERA and DSTO.

Surveying. As apart of the global carbon survey called Indforsus, at the DVFC a number of 30 by 30m plots were sampled from which data on the species content, biomass and canopy damage were recorded. It was intended that these plots would then be used to calibrate satellite imagery of the area to extrapolate country-wide carbon budgets. This has, however, not been possible as all the plot locations recorded at the centre have been made using arbitrary bench marks bearing little relationship to international positioning systems\protocol. Therefore, there was a need for a better system of ground control in order to improve the quality of all survey data at the centre.

The survey team proposed to provide a survey of ground control by using state of the art GPS equipment. They covered a 15 by 15 km area from which a map and database could be created with a drag and drop facility to detail all the control points and important features/facilities in the DVFC area.

Once expedition activities were completed the expedition undertook a number of venture activities. Conducted over five days, these included the climbing of Mount Kinabalu, white-water rafting down the Padas Gorge and snorkelling at Mamutik Island.

Discussion and Conclusions

THIS exercise was without a doubt an extremely ambitious undertaking – planned in a short period of time, it involved a large number of agencies, both civilian and military, from four different nations and a logistic undertaking that involved sending over £425,000-worth of equipment half way around the world. Using British military training requirements and assessment of the fulfilment of the scientific objectives as criteria of the expedition's success the following may be concluded:

- Though the benefit to the military of the training conducted is difficult to quantify, due to the non-tangible nature of such objectives, it is without doubt that the expedition created the "sort of challenging situations, stresses and dangers inherent in military operations"[1]. The remote dispositions of the project teams, limited resources available and nature of the tropical environment more than fulfilled these requirements. Individuals had to develop mental robustness through humour, initiative, physical and psychological endurance; self reliance, and trust in the team and the leader – not once did expeditions members as a whole express the possibility of failure despite some

[1] Extracts from "British Military Adventure Training Doctrine" in "Army Training and Recruiting Agency News" December 1997.

Setting up towers requires two members of the trail team to mark out at height. The men often had to work at heights of 40 to 70m in the tropical canopy for six to eight hours at a time.

extreme conditions and situations.

- With respect to the expedition's objectives, all were completed successfully: the trail was cut complete with engineering works; the survey work will introduce ground control at the DVFC; all three construction tasks at the DVFC were completed; the physiological and psychological testing resulted in 5000 unique measurements; the botanist fulfilled all sampling requirements; the DCTA boot study was completed and venture activities were carried out without incident.
- With respect to the assessment of the expedition aim – preliminary findings indicate that civilian, MOD scientists and military personnel from a number of research agencies/projects can collaborate on a multidisciplinary research project, and produce worthwhile data/research. That this is a mutually beneficial relationship resulting in substantial cost reduction, the transfer of knowledge and representative, constructive feedback from service personnel.
- Finally, military expeditions are able to attract substantial participation from the scientific community. For example, it is estimated that if the turnover of all agencies is considered Exercise *Pelopor Finn* has resulted in the generation of over £250,000 of expenditure as a direct result of expedition activities. This not only goes someway to substantiating the hypothesis but also, most encouragingly, suggests that there is a **need** from the research establishment to undertake such similar work in the future.

Greater detail and in-depth analysis of the procedures and protocols that enabled the expedition to be successful are analysed in the *Post Expedition Report* produced for the Royal Geographic Society.

Follow The Sapper

LIEUTENANT COLONEL M C MCCABE BSC(ENG)

LIEUTENANT Colonel Mike McCabe was raised in South Africa and England. At regimental duty he has served in Germany, Northern Ireland, the United Kingdom, Cyprus, and the Gulf. Various staff appointments have taken him to the Ministry of Defence (three times, once as a pleasure), Headquarters 2 Armoured Division, Bosnia, the Netherlands, and Italy. On Operation Granby *he served as second in command of 21 Engineer Regiment, then based in Nienburg. He was also "the First of the Few" to command 77 Engineer Regiment (Volunteers).*

LIFE is full of surprises; at least mine is. When I went to Nienburg as second in command of 21 Engineer Regiment in 1990, the Berlin Wall was still firmly in place and anyone predicting that the regiment would deploy to Kuwait via Saudi Arabia and Iraq would have been gently helped into a waiting ambulance. We now look back across ten busy years to that extraordinary war, which effectively ended for us with the cease-fire of 28 February 1991. It was a clear victory, and the end of a six-month period of considerable endeavour and impressive achievement for the whole regiment, and particularly for its field squadrons. The privilege of telling the regiment's story quite properly rests with our commanding officer and his squadron commanders, and their (now not so) young troop and section commanders, who so ably led the way. I will just touch on a little known "domestic" detail which reinforces, to me anyhow, the usefulness of knowing a bit of Corps history. As always, reduced explanation leads to sweeping generalizations.

The regiment was originally intended to provide support to a reinforced 7 Armoured Brigade, rather than to the division which followed. At first it was a "rate-capped" grouping of: our own RHQ, most of 1 and 4 Field Squadrons, and 45 Field Sp Squadron. To this was added two thirds of 26 Armoured Engineer Squadron, but disappointingly not its OC or squadron HQ who we knew well, and various very valuable individual reinforcements. 49 Field Squadron (EOD) temporarily joined us in theatre. After elementary beginnings we soon benefited from increasingly valuable brigade work-up training which progressively emphasized vigorous fire and manoeuvre in a bold attacking spirit. By the time that 1 (UK) Armoured Division had arrived, with its hybrid divisional engineer structure, some asset-stripping became inevitable and the regiment regrouped itself accordingly, doing whatever it could to make the best of things.

More live fire and manoeuvre and obstacle breaching exercises demonstrated that the dust, smoke and gunfire from our own and enemy actions would generate considerable obscuration on and near objectives, and in the run-up to them. After one completely dark night, with no ambient light, and we also had to work out better methods of improving coordination without breaking our very effective light discipline. We simply had to be able to find our own regimental vehicles very quickly in all circumstances. Most of everything that made us Sappers was on them. This was no easy matter in the mixed and widely dispersed blocks of vehicles that made up a battle group or echelon halted on the line of march, or when standing by as an attack went in.

Our two field squadrons also had to support three "battle groups" (ageing terminology even then), based on two Challenger regiments and one Warrior battalion. The squadrons themselves had to be as strong and flexible as possible but capable of regrouping quickly as the CO or OC judged necessary, including to support the third battle group or to reinforce or relieve each other as required, or potentially even the other brigade. However, regrouping in close contact was generally undesirable and whatever could be held forward in the field squadrons by way of task vehicles or mines and explosives needed to be with them from the outset. If they suffered casualties, mechanical or otherwise, then we had to be able to extract them or aid them, or replace them from a mobile regimental reserve held as far forward as possible while accepting, but limiting, the tactical and technical risks of doing so.

Challenger and Warrior could manoeuvre like fast frigates at sea on the hard desert of Iraq and

Major Barry Le Grys briefs Captain Phil Gill of
26 Armoured Engineer Squadron Echelon, and others.
Note the corner markings on the stowage boxes and hull of the right-hand vehicle.

Kuwait. With few exceptions our 430 series, Centurion-based, and wheeled task vehicles and plant generally could not match this performance. CVR(T) could, up to a point, but within the limits of the physical endurance and skill of the driver. Drivers nevertheless showed gritty persistence and determination, and much of what was achieved stemmed from their tough spirit and dedication.

Our basic regimental organization was an expedient compromise but squadron commanders were able to task organize fairly effectively from their simple, flexible and robust squadron organizations based on two field troops and one armoured troop and the other first line assets grouped with them. Reserve assets were held regimentally in an improvised HQ squadron, until released by the CO, and included one field troop, the armoured engineer echelon with extra mobility assets and [1]Giant Viper, [2]VLSMS, mines and explosives and wheeled plant. However, in the open desert – all of which was a potential field of fire to the enemy until they were removed in detail – any possible source of confusion or delay had to be eliminated. We could not afford "wasted journeys", "lost travellers", or to risk personnel or vehicle casualties needlessly.

The drivers and commanders of incoming task vehicles of all kinds had to be able to locate their destination in the receiving RE sub unit as soon as possible on the way in. Complementary drills and systems were needed; including some sort of easily visible markings. Our squadrons applied their considerable ingenuity to solving this knotty problem. There are also times when even the second in command comes in useful, and two things sprang to my mind.

Firstly, the regiment had organized coach trips to the former German Democratic Republic soon after the inner German border was opened. I had guided two of these and was struck by the way in which Russian trucks in the Potsdam garrison all had white panels painted onto the corners of their tailboards. This simple but clever idea enabled trucks to be seen more easily by those behind them and this obviously helped convoy drills and manoeuvre at night.

Secondly, I remembered my Corps history. During the siege of Sebastopol, in the Crimean War, the fire of the Russian guns played havoc with the army's earthworks and fortifications, which then needed the constant attention of the men of the Royal Sappers and Miners. They not only had to repair existing works but to create new ones; often at enormous risk of injury or death. And, they had to be prepared to beat off sorties by the besieged garrison and provide guides for the infantry units, constantly moving up through the maze of trenches and saps to their position in the front line. Sappers also acted as supervisors to the British and Turkish working parties by day and night and were distinguished from other troops by a white band worn around their forage caps or shakos. This was sometimes just simply made from a knotted length of the white cloth tracing tape, of the type used even then to mark

[1] Explosive mine-clearance device.
[2] Vehicle Launched Scatterable Mine System.

out earthworks, defiles or start lines. "Follow the Sapper, Quick March!", became a well known order. Attacking troops also followed them at that chilling time when they led the way forward with their scaling ladders and breaching charges, or even with axes and grapnels. Many a "forlorn hope" was led this way in the Peninsula or Crimea by a keen RE officer or an intrepid military artificer or sapper and miner. Apart from needing to be able to find each other in the swirl of battle, some equally lucky RE vehicle commander or driver might also just have to go where right and glory lead by resorting to the good old cry of "Follow Me!".

Stimulated by the Reverend Broddle's technical advice, Major Le Grys loads up a six-foot table. Note the markings on the rear of the Landover.

So, we would exploit the idea – it was an old trick, and it might just work. Obviously, we had to choose our timing carefully; otherwise everybody in the brigade, and the other RE regiments, would probably also do it and the whole point of the thing would be defeated. We waited until a carefully judged "last safe moment" and then marked regimental vehicles in a few days, without telling other units beforehand, by simply painting white diagonal lines or triangles at the outer corners of the flat rear surfaces of all our vehicles. The photographs show two examples of this. It was quite effective, once you knew what to look for – which we did.

Come the ground war itself, the real event was different in many ways to what we had been expecting – for which I think, even now, those of us who were there remain deeply grateful. It was not just a matter of white markings of course; it was also the spirit of the thing that mattered. Under its commanders at all levels the regiment had steeled itself to see the brigade through whatever might come its way. It was quite a thing to see.

But, I also think it shows that Corps history still lives and breathes and is worthwhile reading in some of the spare time that remains as everyone bustles about filling the next great big volume of it. Marking the vehicles was just a minor example of the many tricks held up various sleeves, the rest being very much more ingenious and useful than that. I hope that others, better qualified, will now write about them.

Infrastructure For Fuel

MAJOR STEVEN BOYD BSc CEng MIMechE

Until recently Steven Boyd was Officer Commanding 60 Headquarters and Support Squadron (Air Support), but earlier this year he moved to the Military Works Force. Having previously been the second in command of a works team, he is now thoroughly enjoying his appointment as Officer Commanding 516 Specialist Team (Bulk Petroleum). As the only specialist fuel engineering unit in the forces, his team is busy supporting a wide range of operations and exercises. This article seeks to highlight some of the engineering involved in the design and construction of fuel infrastructure.

Introduction

In today's turbulent political environment it is hard to predict where the next armed conflict or humanitarian disaster will occur. Anywhere and at any time the armed forces may be asked to deploy to some foreign shore to provide assistance, to keep the peace, or to fight to make peace. The skills of our soldiers, sailors and airmen are recognized throughout the world. But just like anyone else, they are unable to function for an extended period without the appropriate infrastructure to support them. In many cases this infrastructure of ports, airfields, roads, bridges and utilities may simply not exist or may have been destroyed.

The Corps of Royal Engineers is responsible for the assessment and repair of existing facilities, and the construction of temporary or permanent installations as required. Whilst much of this capability is regularly used to the full on operations, there remains a requirement to exercise the full range of skills. In June this year, Exercise *Mini Flamingo* led by 516 Specialist Team Royal Engineers (Bulk Petroleum) practised the Corps' ability to move bulk aviation fuel from a simulated ship anchored off shore to an airfield in Cyprus to refuel the Royal Air Force's thirsty aircraft. A temporary fuel system incorporating barges, storage, a cross-country pipeline and aircraft hydrant refuelling equipment was constructed, commissioned and handed over to members of the Royal Logistic Corps and the RAF to operate.

The exercise was carried out at RAF Akrotiri, Cyprus, which provides a good location for exercising capabilities in hot, dry climates as temperatures in June are typically around 30^{o}C. Support Troop, 48 Field Squadron (Air Support) provided the construction force for the exercise which with its plant-heavy mix of military engineer trades proved ideal for the work. Fuel operators from the RAF's Expeditionary Logistics Squadron and from 93 Petroleum Squadron, RLC also supported the exercise.

The Fuel System

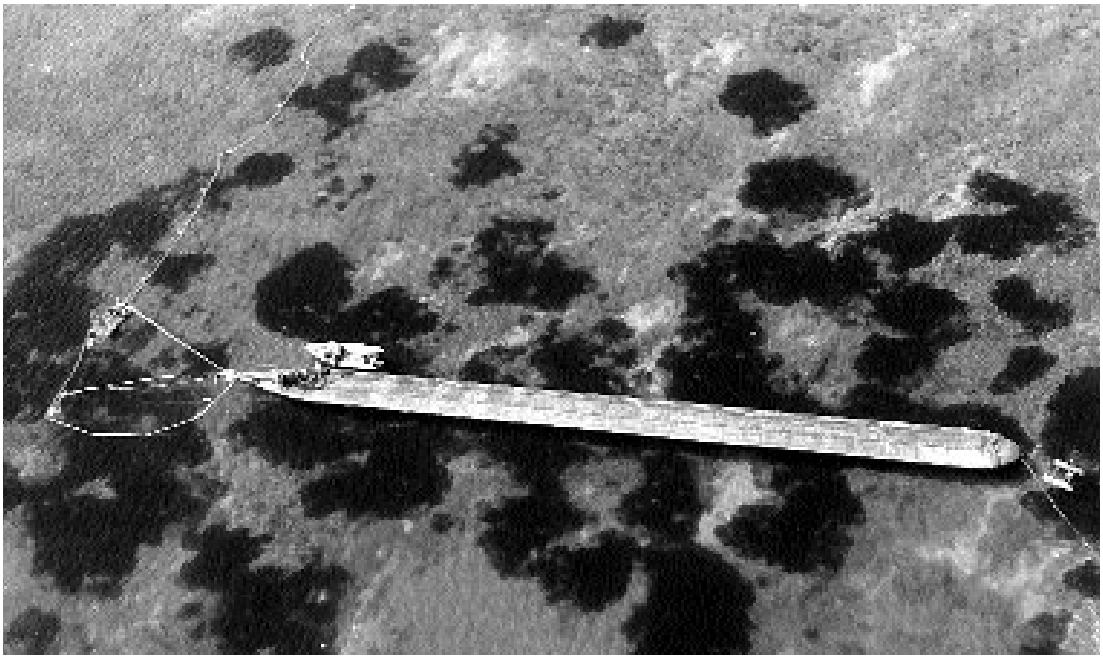
Tactical Fuel Handling Equipment was used to construct the temporary fuel system. The equipment has largely been in service since the late 1960s and is due for replacement soon. Although it is manpower intensive, it is still effective and was used successfully to achieve the aim in this case, as it has been in a range of conflicts and exercises over the years. The current equipment is component-based allowing reconfiguration to meet a range of different circumstances. Future equipments are likely to be procured to deliver complete fuel systems with increased use of skid-mounted or containerized equipment.

Towed Flexible Barge being unrolled.

Ship to Shore. Towed flexible barges, or dracones, which are approximately 70m long and hold 300m^3 of fuel each, were used to move fuel at sea to a point close to the shore. Manufactured by Dunlop GRG Ltd from a thick nitrile rubber/nylon/neoprene laminate, the barges are used by industry for a range of purposes including the transportation of petroleum waste and fuel slops at sea. They arrive on site rolled up, are launched into sea and, once filled, they float largely due to the lower relative density of fuel. (Aviation fuel has a density of approximately 825 kg/m^3.) Filled barges are then towed by boat to a point close to the shore where they are moored to a raft which is provided with hydraulic power from the beach. The barge discharge hose is then connected to pipework on the raft, which is manufactured by Alan Cobham Engineering Ltd. A hydraulically driven pump in the nose of the barge, powered from the raft, is used to pump the fuel contents to storage on the beach. The additional complexity of placing the transfer pump on the barge rather than on the raft is justified as the weight of the pump in the water deforms the end of the barge into a natural sump into which fuel flows allowing almost all the contents to be removed.

Storage. Fuel was stored both at the beach and at the airfield in flexible fabric tanks, also manufactured by Dunlop. The tanks can store 136m^3 (30,000 gallons) each and are placed within earthwork bunds provided with a liner. The purpose of this bund is to provide ballistic and fire protection for the fuel, but it has an important secondary use in providing environmental protection. Interconnecting pipework of aluminium alloy is used to allow for receipt, inter-tank transfer and delivery.

Pipeline. A surface-laid cross-county pipeline was constructed in two material types. 150mm nominal diameter aluminium alloy pipe manufactured by Victaulic in 6m lengths, suitable for



Towed flexible barge positioned at the raft.

40-bar and with the company's proprietary jointing system was used in those sections of the pipeline exposed to greater pressures. Whilst the joints in this alloy pipe have some degree of flexibility, care is needed to ensure that the line has only gradual changes in horizontal and vertical profile. In other areas, 150mm flexible hose in 50m lengths, suitable for 12 bar was used. The pipeline was driven by Tangie Deutz $2m^3$/minute @ 28 bar pumps. Testing was closely controlled using compressed air at 0.6-bar and with water to 1½ times the intended operating pressure.

Hydrant Refuelling Equipment. Aircraft refuelling must be conducted within closely defined flow and pressure conditions to suit the aircraft. For obvious flight safety reasons the highest standards of fuel quality are required and exact fuel quantities must be measured and compared with the on-aircraft gauges. Flow was adjusted to suit demand at the delivery pump and Alan Cobham Hydrant Control Valves were used to limit pressure to between 1.7 to 3.8 bar. Accurate fuel bulk meters were included in the system and regular quality checks were carried out.

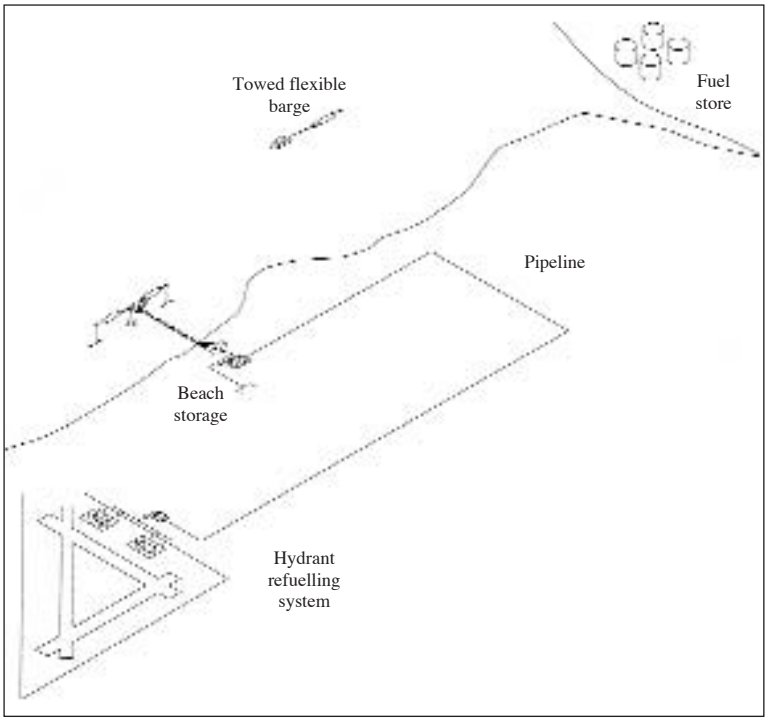
Design Considerations

Increased evaporation. The air temperature in Cyprus in June varies between approximately $10^{o}C$ at night and $30^{o}C$ plus during the day. All the fuel equipment in use was out in the open and in direct sunlight. These high temperatures affect the rate of evaporation from fuel in storage. The flash point of aviation fuel is in the region of $38^{o}C$. So whilst a Class II fuel under normal conditions, in the heat of the day the fire and explosion risk presented at the storage locations was almost that of a Class I product.

Thermal Expansion. As the temperature varies, thermal expansion effects also occur in a pipeline:

- The pipeline increases in length. For alloy pipe in the sort of conditions experienced in Cyprus, this can be as much as 200mm per 100m. This can lead to the pipe buckling and breaking like a thin strut if it is not free to move. This problem was overcome by the incorporation of expansion loops at intervals along the pipeline.
- There is a volumetric increase in the storage capacity of the pipeline and of the fuel it contains. This is the more significant effect from the designer's point of view. A $10^{o}C$ temperature rise will lead to a 0.9 per

cent increase in fuel volume, but only a 0.07 per cent increase in the internal volume of the aluminium alloy pipe. If the fuel is constrained between closed valves as the pipe and its contents are warmed, then the resulting thermal expansion can lead to large increases in pressure that are more than enough to rupture the pipe. In practice, the theoretical increase is not observed due to leakage across valves and movements at joints, but amelioration measures are still required. Two measures were used: a system of pressure relief valves, and close control of operation to ensure that when not pumping a route for fuel expansion to storage was always available.



Schematic of Fuel System.

Transient Conditions. Sudden changes in velocity lead to a transient condition in which a pressure wave travels at high velocity along the pipeline and is continually reflected from end to end whilst concurrently reducing in magnitude. Instantaneous velocity changes are possible on valve opening/closure or on pump failure. The magnitude of the pressure wave can be considerable and in fuel will travel at a speed of approximately 1,300m/second. The use of a low fluid velocity and valves with ratchet handles to prevent fast opening/closure controlled these unwelcome pressure surges. In addition, the anticipated maximum pressures due to the sum of surge and operating pressures were designed to be within the system safe pressure.

Static Electricity. Static electricity can present a problem in two areas and is potentially very hazardous as its presence could lead to the possibility of a spark occurring in a fuel/air atmosphere:

- The movement of fuel in the pipeline generates an electrical charge. This is unavoidable and occurs both in alloy pipe and in the flexible hose. Its effects are minimized by the use of a fluid velocity around 2m/second. In the case of the alloy pipe, the charge readily escapes to ground, but the effect is more pronounced in the non-conducting flexible hose. A 30m run of alloy pipe with appropriate earthing was employed at the end of the flexible hose before the fuel entered the pipeline termination storage to provide a good route to earth.
- Incoming aircraft, particularly helicopters with their large rotating blades, can have a significant electric charge on arrival at the refuelling point. To ensure safe refuelling, two safety measures were used: the aircraft were earthed, and the aircraft and refuelling equipment were equipotentially bonded together.

Anchors and Pipe Guides. The alloy section of the pipeline was designed to be free moving longitudinally between expansion loops with pipe guides being used at these points to prevent bending stresses being introduced at the joints. Pipe anchors were constructed at bends of 45 degrees or more and on sloping ground with a gradient in excess of 1:10, as the friction between the ground and the pipe is insufficient to restrain it adequately. The force at 90 degree bends can be in the region of 7 tonnes force at 28 bar.

Entrained Air. The creation of pockets of air within the pipeline is inevitable when it is filled prior to hydrostatic testing. Even when water is

Hercules aircraft being refuelled.

introduced slowly, air gathers at high points and becomes trapped and compressed. It is important to allow this air to escape before pressurising the line to prevent pockets of air being raised to dangerously high pressures. Automatic air release valves for use at high points used to be available for this purpose, but these are apparently no longer in service. As an alternative, a fuel sampling cock, manually operated by a sapper, was used at each high point and a small quantity of water was pumped through the line before testing began to clear any trapped air. Similar pockets of air/fuel vapour are formed in the line as it is packed with fuel and the same process was used to eliminate them. The creation of air/vapour pockets during decommissioning was avoided by pigging the pipeline. This involves forcing a foam cylinder, the "pig", through the line under controlled pressure conditions.

Fuel Quality. Quality concerns in respect of fuel for aircraft are paramount. A stone and sand trap was used at the beginning and end of the pipeline to provide a coarse filter. In addition, fuel was filtered and stripped of water by being passed through a filter water separator both at the beach storage area and directly prior to entering the aircraft hydrant refuelling system. Quality checks were also carried out by RAF fuel operators from the Expeditionary Logistics Wing at points throughout the system in order to ensure appropriate standards.

Environmental Issues. A fuel exercise of this type clearly attracts attention and great care must be taken to minimize the potential for pollution and to plan appropriate responses should it occur. In particular, careful consideration was given to how the fuel could be successfully removed from the system during decommissioning. This was achieved by pipeline pigging and careful placement of fittings to allow withdrawal of residual fuel. There was only one very minor loss of fuel into the environment during the exercise and that was quickly cleaned up.

Infrastructure Delivery

THE design, construction and commissioning of fuel infrastructure of the type used during Exercise Mini Flamingo is not a straight-forward

Flexible fabric tank storage.

task and has a number of inherent dangers. It is appropriate, therefore, for this type of work to be controlled by appropriately trained and experienced engineers. The design and commissioning of the fuel system were carried out directly by 516 STRE (BP). Construction was completed by Support Troop, 48 Field Squadron (Air Support) under the command of the specialist team. Whilst it is accepted that this is an unusual arrangement, it is felt to be the correct one for complex fuel infrastructure and worked well on the exercise.

Having completed the construction and commissioning of the fuel system, it was handed over to RLC and RAF fuel operators to run. The process of formally handing over fuel infrastructure to its operators is not exercised often, nor is it well understood by either the RAF or RLC. There can, therefore, be some resistance to the process, but it is essential for both safety and materiel accounting purposes. The temporary infrastructure completed during the exercise was effectively used to deliver fuel to the airfield and to refuel Hercules C-130 transport aircraft operating from Cyprus over a period of two days.

Summary

Exercise *Mini Flamingo* was a great success. It proved the ability of the Royal Engineers design and construction force, working together with RLC and RAF fuel operators, to provide safe fuel to land-based aircraft from a source at sea. The in-service equipment was effective, if manpower intensive and, in the hands of the Sappers, proved capable of providing the fuel infrastructure our armed forces need to carry out their missions.

The Inspectorate of Engineer Resources, Past, Present and Future

LIEUTENANT COLONEL N A JORDAN

LIEUTENANT Colonel Neil Jordan joined the Corps 1965 and served 21 years in the ranks as a plant operator mechanic and military plant foreman. He was commissioned from the ranks in 1986 and his plant background ensured he would be well qualified to fill any of the appointments he might be given.

He has served as the administrative officer of 23 Amphibious Engineer Squadron, Hameln Sapper Shop manager, Staff Officer 3 Automatic Data Processing at Headquarters Engineer Resources, the information technology officer in 65 Corps Support Squadron and as the Staff Officer 2 (Weapons) Command, Control and Communications Information Systems within the Engineer in Chief's (Army) headquarters where he was responsible for engineer digitization and development of the engineer battlefield information system application. He is currently the Staff Officer 1 Inspectorate of Engineer Resources at Engineer Division, Headquarters Land Command, and after 18 months in the job, he feels almost qualified to write about the Inspectorate.

INTRODUCTION

FOR many units, the annual visits from the Inspectorate of Engineer Resources (IER) for management and technical inspections are just additional events in what might, for some, seem like an increasingly bureaucratic system. Regardless of the heads nodding in agreement, the IER in its various forms has been in existence for close on 50 years and has clearly proved itself an effective organization. Apart from those regular visits to units, few people are aware of the IER organization or the work it carries out. This article is intended to provide some background to the IER, look at its current organization and role and finally describe how IER can influence many aspects of future engineer equipment.

IER BACKGROUND

THE history of what is now known as the IER is somewhat lacking in detail. Sufficient documentation remains, however, to provide an overview of the IER's past.

In 1953, two units, one in Germany and one in the UK, were established to inspect bridging equipment and pontoons. In Germany the unit was called the Royal Engineers Bridging Inspection Team, and in the UK the unit was called the Bridging Equipment Inspection Section. Each unit came under command of the chief engineer of the theatre in which it was located, but the focus for providing common doctrine and inspection standards was the Headquarters Engineer Stores Establishment, based at Woolwich.

By 1963 the Germany organization had changed its name to the Royal Engineers Stores and Bridging Inspection Unit, and as with the UK unit, in addition to bridging equipment, was now responsible for the technical inspection of general stores and engineer construction plant. By 1967 the inspection responsibility of both units was further extended to include C vehicles, minelayers, outboard motors, bridging and ferrying trailers and heavy ferry power units.

Engineer equipment was, by the end of the 1960s, becoming more complex: the introduction of M2 and medium girder bridge are examples. There was the additional burden of health and safety legislation, which was becoming more intrusive, and a concern that the technical inspection regime lacked an essential management link. In order to resolve these concerns the Park Methods Inspection (now Management

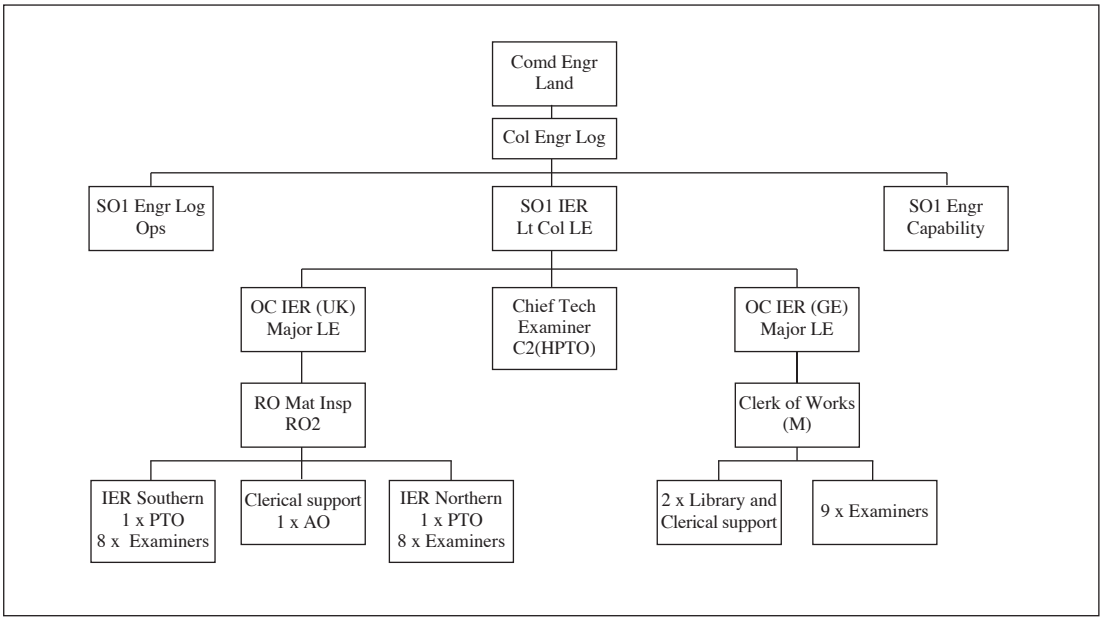


Figure 1.

Inspections) was created. The inspection, carried out by a separate organization, would examine the management of units and provide the necessary link to technical inspections. Curiously though, it was not until 1984 that the management and materiel inspection functions in the UK were combined in a single organization. That same year the inspection organizations in the UK and Germany became known collectively as the Inspectorate of Engineer Resources and their responsibility to inspect C vehicles, outboard motors and bridging trailers was removed. They still continued to be commanded separately in-theatre, but had technical links with the Director Engineer Services, HQ EinC(A).

It seems odd now that two organizations, carrying out exactly the same activity, were not commanded by a single authority and that their activities were not coordinated. But it was not until 1996 that the IER organization in Hameln, Germany, joined the UK based IER under command of Commander Engineer Resources, Long Marston. In early 1997, in anticipation of the closure of Long Marston, the engineer resources power base, including the UK IER organization, moved to Andover, still as part of Director Engineer Support (Army). In typical military fashion, the demise of Director Engineer Support (Army) was shortly to follow, and on 1 April 1999 the Engineer Resources organization became part of Engineer Division, HQ Land Command at Wilton. The current organization of the IER is shown in Figure 1 above.

Present IER Organization and Responsibilities

Commander Engineer Land is the Inspector of Engineer Resources. One of his key objectives is to monitor the management, accounting and the condition of engineer materiel[1] held by units in accordance with current regulations. In order that this can be achieved, the inspectorate has the following objectives:

- Monitor the effectiveness and efficiency of engineer stockholding units worldwide in respect of accounting, procedures and compliance with regulations.
- Ensure the physical condition of engineer materiel held by units of all three services worldwide is maintained in accordance with current regulations.
- Ensure the recommendations of the management and materiel reports are analysed and recommend changes to policy and practice.
- Advise the future equipment programme of the IER requirements.

[1] The definition of engineer materiel is long and complex. "Materiel Regulations" Vol 7 Pam 1 Sect 1 is a good starting point.

The IER (UK) and the IER (Germany), each commanded by a late entry (LE) major, have clear geographic areas of responsibility. The IER(Germany), collocated with 28 Engineer Regiment in Hameln, has two military and eleven civilian staff, and is responsible for management and technical inspections of units in Germany, Canada, Poland and the Balkans. The IER (UK), with its HQ at Wilton has one military and twenty civilian staff and is responsible for the remainder of the world. The majority of the UK civilian examination staff are located in a further eight detachments throughout England. Both organizations are flexible enough to respond to shortfalls of examiners, worldwide, if required.

In June 1999, implementation of an earlier internal establishment review saw the appointment of a chief technical examiner. The appointment, with the rank of HPTO (higher professional and technical office), is responsible for all technical issues across the whole of the IER. The chief technical examiner is the equipment support focal point and represents IER on many committees, particularly within the Defence Procurement Agency and Defence Logistics Organisation. In these areas IER has provided valuable input to current and future engineer equipment programmes.

Technical inspections are carried out by civilian examination staff, and they deploy worldwide to meet IER commitments. With a few exceptions the examination staff have MOD backgrounds, many having served in the Corps or with REME. Each is highly trained to enable them to comprehensively examine equipment currently managed by the Corps. Where necessary, this includes qualifications in non destructive testing using ultrasonic equipment and the operation of computer software to assist in detecting structural weld failures. Many of the examination staff have over 20 years service with the IER, their technical knowledge and experience is considerable.

Whilst civilian staff do not carry out technical inspections in life threatening operational environments, they do deploy to operational theatres once the situation has stabilized. A good example of this was during Operation *Agricola* in 1999, when three civilian examiners from Germany deployed to Macedonia just prior to the NATO bombing campaign. As with the deployed military, they also lived in tented accommodation. The responsibility for inspecting engineer equipment in life threatening operational environments, where it would be unsafe to send civilians, falls to the IER WO1 clerk of works (mechanical). He is also the 2IC of IER (Germany).

Management inspections are normally carried out by the two OCs IER within their geographic areas of responsibility, although the SO1 IER is occasional entrusted with the less exotic and less demanding units. Operational environments are also visited, normally as soon as it is operationally acceptable to do so. Most recently, the OC IER (UK) carried out an advisory visit to Sierra Leone.

If carried out near the beginning of a tour, a management inspection is considered by many support squadron commanders to be the single most important inspection during their tour. Like technical inspections, management inspections are classed as annual staff inspections and carry considerable weight. Unlike technical inspections, management inspections, at whichever level, do not require additional host unit manpower to complete. The inspections are extremely comprehensive and cover every aspect of logistics management including associated health and safety and environmental management checks. There is also considerable cooperation with both the Inspectorate of Works[2] and the Corps' health and safety officer.

Where a technical inspection has been carried out prior to the management inspection, this is taken into consideration and, if necessary, advice on equipment husbandry will be given to improve serviceability. Unit problems are not always identified during management inspection; units themselves will often identify problem areas and need logistics management advice on an ad hoc basis. To meet this need and to put units back on the straight and narrow, a quick call to HQ IER can secure advice or an IER advisory visit.

Management and technical inspections, in the vast majority of cases, generate inspection reports. The reports will comment on areas where all is not as it should be and make recommendations to the appropriate organization. Technical inspection reports also provide a grading to advise unit commanders how effective their equipment husbandry system is. IER can use both types of inspection report to highlight

[2] HQ Land Command G4 MES.

trends, spot potential equipment problems, advise units on logistics management, inform changes to policy and practice and for assessing the quality of resources specialist training.

The structure of the engineer logistics branch within HQ Land Command is ideal for supporting IER activities. As can be seen from Figure 1, IER sits alongside engineer logistics operations and capability staff. It is a powerful and effective combination that has, in past engineer logistic organizations, been lacking. Its location with other engineer divisional staff ensures the appropriate desk officer deals with issues raised during IER management and technical inspections speedily and effectively.

THE FUTURE

IN conjunction with the Engineer Systems Support Integrated Project Team (formerly ES 42, Engineer 3) the inspectorate is playing a greater role in defining the maintenance requirements of new engineer equipment. As an IPT advisor, the inspectorate will have access to the "main players", be better placed to influence technical decisions and itself then become a proactive and necessary part of the procurement process for engineer equipments. The process of formalizing inspectorate involvement in IPT work will continue. The areas where the inspectorate can provide valuable input to IPTs are:

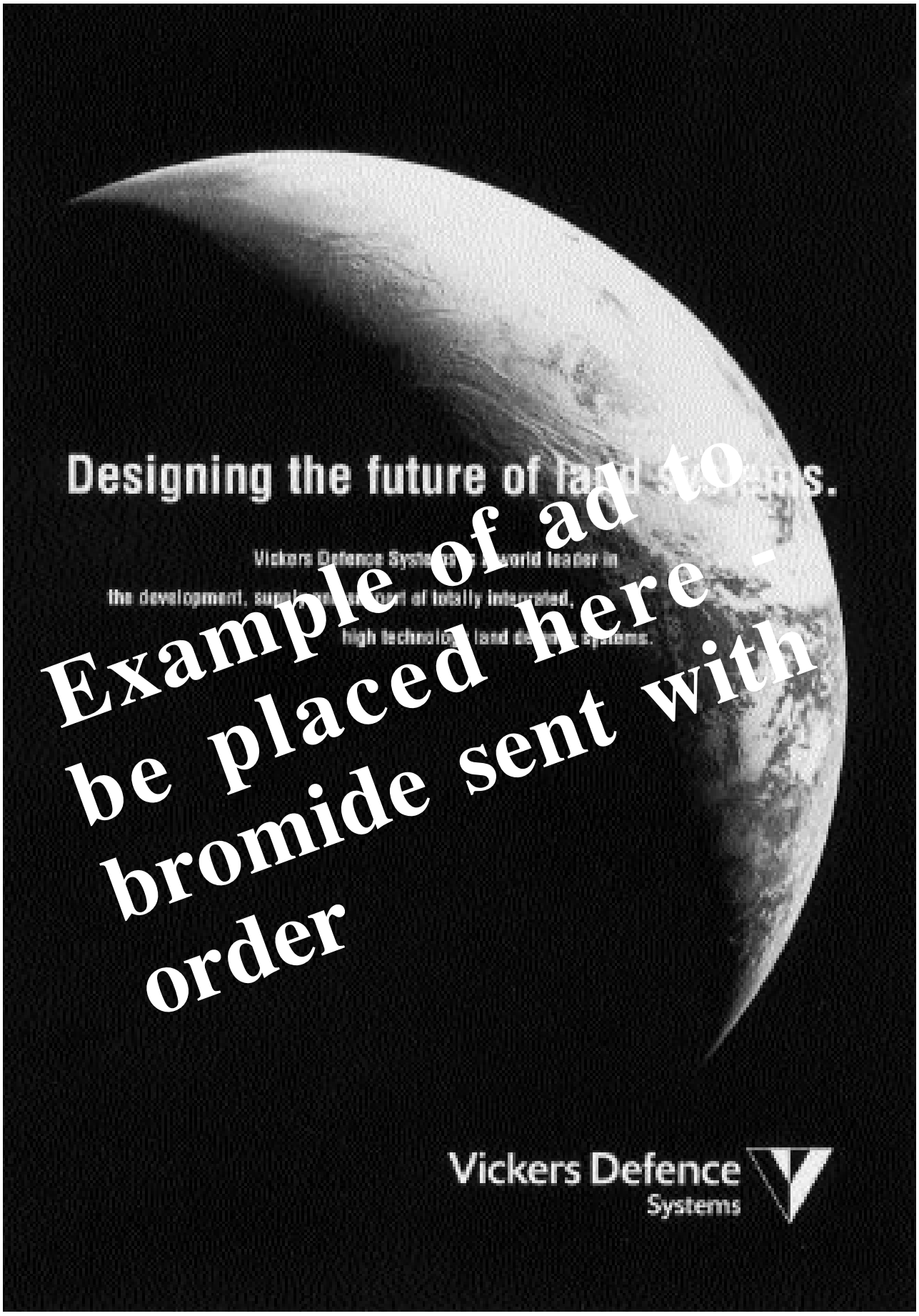
Publications. Evaluation of publications, in particular Army Equipment Support Publication inspection procedures.

Support and Test Equipment. The evaluation of support and test equipment against procedures in support publications.

Training. Ensuring that inspectorate training requirements, including funding, are covered in the contract.

Ease of Maintenance Assessment. Practical evaluation of the inspection procedures in conjunction with support and test equipment.

Finally, in this age of change, nothing is ever certain, but whilst there is RE-provisioned materiel, there will be an IER.



Example of ad to be placed here - bromide sent with order

Rust and Rotten Eggs

LIEUTENANT COLONEL J F PELTON MBE BSc(Eng) MA(H) CEng ACGI EurIng MICE
CAPTAIN P L DICKERSON IEng MIIE(Mech)

Lieutenant Colonel Pelton was Officer Commanding 524 Specialist Team Royal Engineers (Works) from October 1999 until June 2000. He commanded the team in Bosnia during Operation Palatine 3 *from October 1999 to March 1999 during which time the team was involved in a wide range of design and other specialist engineer tasks. On promotion he moved to Headquarters Adjutant General as the Staff Officer1 Estates, but has many cherished memories of a busy and challenging operational tour with 524 Specialist Team Royal Engineers (Works).*

Captain Phil Dickerson was commissioned into the Corps in 1999. He joined 524 Specialist Team Royal Engineers (Works) as the Garrison Engineer (Mechanical) in September 1999 and deployed with the team on Operation Palatine 3. *His 23 years' service have included tours with 30 Field Squadron, 38 Engineer Regiment Workshop, 32 Field Squadron, Royal School of Military Engineering, Military Works Force, 65 Field Park Squadron and, just prior to commissioning, with 529 Specialist Team Royal Engineers (Air Support). He has deployed on threeoperational tours to Bosnia and during his time with 529 Specialist Team Royal Engineers (Air Support) to Saudi Arabia and Kuwait. Having returned from Bosnia he is now committed to a series of public utility training and design exercises before deploying to Kosovo with the team in February 2001.*

Introduction

During Operation *Palatine 3* 524 STRE (Wks) undertook the project management of the Banja Luka Metal Factory (BLMF) bore-hole water treatment plant. Whilst neither the largest nor the most imposing task carried out by the Corps in Bosnia, it nevertheless incorporated some innovative techniques during design and construction. This article describes the project and highlights lessons learned.

The requirement for a bore-hole water source at the BLMF had been identified soon after the British Army occupied the site in 1996. Two bore-holes were eventually sunk, the first of which produced too low a yield and was closed off. The main bore-hole penetrates 84m below the ground surface level and can produce up to 475 m^3/day of water, depending on the pump output. When first used the water gave off a foul smell similar to rotten eggs,

closely resembling the stink bombs smell produced in schoolboy chemistry classes. This was caused by the presence of hydrogen sulphide (H_2S) in the water. It also contained oxidized iron (rust) which gave the water a brown/orange tint.

Initial Design

THE initial proposal for a containerized water treatment plant, at £250,000, was rejected as being too expensive. However, the cost of water delivered by tanker[1] began to mount. In addition the heightened tension during the Kosovo crisis emphasized the operational risks of being dependent on locally-supplied water, particularly during the summer. Therefore, the requirement for a bore-hole water source was reinstated in June 1999. 522 STRE (Wks) completed the design whilst 22 Engr Regt initiated the procurement of major components through the DCTA[2]. The procurement process lost momentum during the autumn roulement and by the time 524 STRE (Wks) had deployed it was some 18 months since the start of the project and no work had yet started on site. The BLMF bore-hole was fast becoming an embarrassment.

Review

524 STRE (Wks)'s involvement began with a review of progress following the roulement. The first task was a closed circuit television survey of the bore-hole to assess its condition and that of the equipment within it. The survey revealed that the bore-hole was heavily silted up (to 14m from the bottom of the bore-hole) and would require scouring, an essential precursor to ensure the required yield.

The scouring was done using an airlift system[3] improvized from locally manufactured or supplied equipment. A compressed air-line was connected to a 2-inch galvanized pipe connected in turn to the end of a 90m-length of 50mm medium density polyethylene pipe before the whole equipment was fed into the bore-hole. A compressor was found from Banja Luka Municipal Services that had a pressure rating over 9-bar and could deliver air[4] with sufficient throughput to maintain a flow of aerated water up the bore-hole. In addition to aerating the water, the injected air disturbed the silt at the bottom of the bore-hole which was then removed in suspension with the aerated water.

The procurement process was also hastened to try and recover some of the time lost. Once DCTA became aware of the renewed urgency, contracts were let and the first items began to move. A search also took place to find any stores which had already been procured in-theatre and, with considerable help from 35 Engr Regt, an ISO container's worth of stores was delivered to Banja Luka. At this stage £66,000 had been committed to the project.

Project Management

DURING this period 524 STRE (Wks)'s main effort was the Bosnia Estate Rationalisation Plan[5]. The work carried out at the BLMF had revealed a design population of 1304 compared with the 300 on which the original 522 STRE (Wks) design had been based. Initial checks of this design were carried out which confirmed that it had insufficient residual capacity to support the increased demand. Fortunately 522 STRE (Wks) had demonstrated great foresight in allowing sufficient spare capacity in most of the major components to allow them to be reused in the redesign. The money already invested was not, therefore, wasted although some items, in particular the pumps, had to be reordered (the original pumps were reallocated to other bore-holes in theatre.) As 524 STRE (Wks) was already heavily committed and lacked the detailed expertize required to design the treatment plant, 521 STRE (WD) was tasked to provide a small design team. At the same time it became apparent that the large number of organizations becoming involved in the project needed a central focus and that is when 524 STRE (Wks) therefore took on the project

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[1] DM4000 to DM6000 per 30 m^3 tanker.

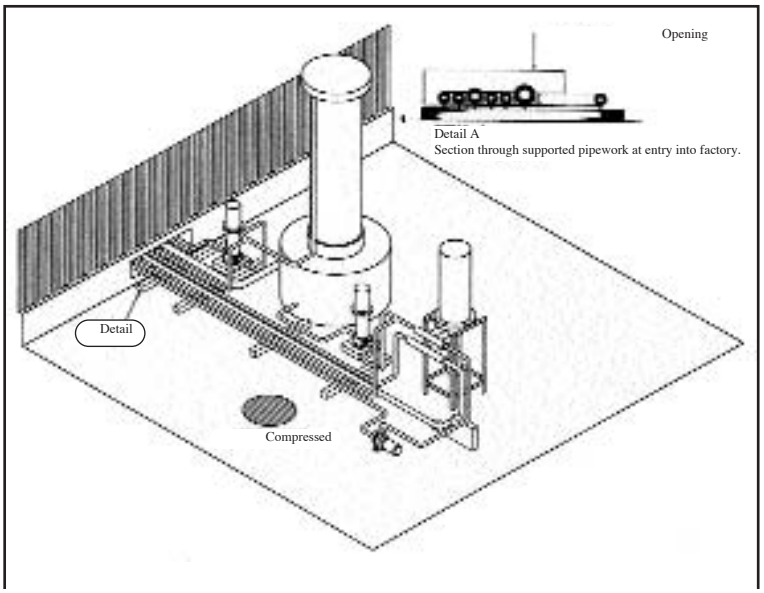
[2] Defence Clothing and Textiles Agency – the organization which handles all Royal Engineers construction stores not locally purchased.

[3] An air-lift operates on the principle that, when air is injected into one limb of a U-tube containing water, the mixture of air and water in that limb, being lighter than plain water, rises to a higher level than water in the other limb. Further details are contained in "Military Engineering" volume 2, pamphlet 9.

[4] 120 1/s @ 10-bar.

[5] 524 STRE (Wks) 524/1002 dated 10 Feb 00.

management for the bore-hole water treatment plant project. A project directive was published on 14 Jan 00[6] which identified the client as HQ BRITFOR G4 Estates, a combined 524/521 STRE design team, a construction force comprising 37 AES and 521 STRE (WD) personnel, the planning supervisor as OC 524 STRE (Wks) and the procurement route via the property manager through TFM[7]. The directive incorporated a works programme based on completion by the end of 524 STRE (Wks)'s tour in late March 2000 to avoid any further difficulties associated with end of tour hand-overs. Even allowing for the fastest procurement times it was clear that the project had to be "fast track" if it was to stand a chance of meeting a very tight deadline. Therefore, construction would start during the design, some risks would be taken in starting work in time to allow, for example, concrete curing to take place, and bore-hole stores procurement became the highest priority in theatre. The construction force from 37 AES and 521 STRE (WD) were placed under OPCON OC 524 STRE (Wks). Good briefing combined with a well thought through works method statement and health and safety plan (construction, design and management in practice) meant that high standards of work were produced. For example, the concrete base of the 50,000-litre water tank was poured level and no "shimming" was subsequently required beneath the water tank.



The plant room design.

Design

521 STRE (WD) spent just under two weeks in theatre completing the initial design work, effectively a detailed reconnaissance report in draft, returning to the UK to complete the report but leaving a detailed stores list and a draft copy of the drawings. Although this stores list was subsequently amended, it allowed the procurement of the main long-lead stores to start as early as possible. Amendments to the drawings were made both in theatre and, by 521 STRE (WD), in Chilwell. Communications became a key issue and the internet an invaluable tool for passing amendments to and from theatre. 521 STRE (WD) also liaised directly with manufacturers both in refining their design and in facilitating the procurement process, a key benefit of operating from the UK.

The system devised to remove the H_2S involved a degassing tower which cascades the water down through a vertical column and over a media with a large surface area. Air is forced in the opposite direction to the cascading water thus exposing the water to as much air as possible and speeding up the degassing process. In addition the degassing process enriches the water with oxygen to ensure that any iron is oxidized to allow it to be removed by a high efficiency filter, the next stage in the process. These two processes, together with a resized bore-hole pump, two new heavy-duty transfer pumps and backwash pump were controlled by a series of sensors and electronic control panels. The filter unit also had a fully automatic backwash and

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6 524 STRE (Wks) 33/580 dated 14 Jan 00.
7 Turner Facilities Management, the works services manager in Bosnia.

filter media flushing system controlled by pressure differential switches that signalled ¼-turn air operated valves and worm and screw motors that revolved the filter media through the backwash flow. The system was designed to produce 326 m^3/day[8] to meet the increased BLMF demand.

Construction Materiel

THE closure of the engineer resources yard in Split towards the end of 1999 meant that for the first time TFM was used to procure construction stores for a RE construction project. A resources specialist SSgt was deployed from MWF to provide liaison: essentially a facilitator, acting between the TFM stores organization and the STRE. He ensured that stores lists were translated into the format required by TFM, brought the TFM people on side, resolved any problems and generally eased the whole contract through whilst, critically, maintaining the necessary sense of urgency. As a result the first stores began arriving from the UK within three weeks, allowing work to continue almost without a break. The most critical items proved to be the electronic control panels for the treatment plant which took six weeks to manufacture. Whilst these were immediately air freighted once completed, the lead time still delayed the final stages of the project until May 00. Therefore, one clerk of works remained in theatre for a further month to provide continuity and a small team of tradesmen were deployed to complete the construction. 37 AES personnel were released to other tasks for periods when there were no stores. This, together with an early decision to place the treatment plant inside the factory, thus providing a good working and operating environment, allowed high standards and rates of work. Constant supervision was still required to maintain the necessary work standards; the temptation to cut corners, particularly on external pipe-work during bad weather remained.

Lessons Learned

THE main lessons identified are set out below:

- The project demonstrated that an STRE can easily take RE tradesmen under OPCON/TACOM, as appropriate, for a construction task. Such task organization entirely reflects the Army's mission command ethos which promotes task orientated grouping and regrouping as required by the operational situation. This inherent flexibility should not be stifled by over prescriptive so-called "default settings" for operational relationships between the STsRE/CsRE and squadrons/regiments.
- The project documentation set out in *RE Training Directive 2* provides a good mechanism for planning and executing engineering works in an operational environment. However, it is already five years out of date, not formally incorporated into Corps' construction doctrine and not backed by current working-level doctrine. It is vital that engineer commanders at all levels are trained in project management techniques and that there is a clear, up to date engineer doctrine for planning and executing engineer tasks for them to turn to. Peace time construction exercises should be used as a formal mechanism for applying the doctrine and, certainly for STsRE, should be linked to developing operational capability in the same way that the training year generates readiness for the JRRF.
- Procurement of construction materiel through a contractor can work as well as the best examples of the military system. However, to ensure a high level of performance requires input from a resources specialist of the appropriate rank and experience for the task.
- The use of 521 STRE (WD) specialists deployed as required demonstrated the strength of a rear-based capability. The reconnaissance forward was vital: equally access to contractors, design support and other teams' design experience at MWF was also critical and would not have been possible had the whole unit deployed in theatre. The administrative support in theatre from 524 STRE (Wks) was useful but not essential. The model used for construction exercises could be usefully applied to operations to allow rear basing to be routinely extended to the STRE (Wks) as well.
- The lack of a suitable checking organization in theatre and hence the inability of deployed teams to meet ISO 9001 quality assurance standards further militates against forward deployments.
- Clerks of work should be actively involved in the training of tradesmen as an integral part of unit training programmes. Public Utility Team exercises are a good example of trade specific training carried out using specialists from MWF and tradesmen during their Class 1 or 2 training. Similar training, perhaps linked to industry, could allow artisan skills to be maintained whilst broadening tradesmen's experience prior to a squadron/regiment either achieving high readiness for or actually deploying to an operational task.

Despite all the team's efforts to complete the project before the end of its tour, the lead time for

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[8] 326,000 litres/day = 250 litres/man/day for 1304 personnel.

the control panels ultimately prevented this. Fortunately the close co-operation with 521 STRE (WD) and TFM meant that the momentum was not entirely lost and the final stages of the work leading up to the testing, commissioning and completion of the H&S file were completed. Following testing and inspection the water treatment plant was handed over to the works services manager and went into full production on 3 Jul 00. The system controls and chlorine dosage rates required some fine tuning to establish a steady operational and maintenance regime and to allow for increases in the population of the BLMF, beyond even the Estate Rationalisation Plan level.

The BLMF bore-hole task proved a challenge to all involved. Successful completion was only achieved by stint of much hard work, commitment and innovation to ensure that very tight timelines were met. The project also highlighted some areas, particularly in terms of construction project management on operations, which could be usefully developed within the Corps.

An Assessment of Blame for British Casualties in World War One

LIEUTENANT COLONEL P R BURLEIGH BA

Peter Burleigh joined the Corps as a sapper in 1950 and was commissioned in 1952. His first posting was to 32 Assault Engineer Regiment, followed by three years as Plant Officer and 2IC in 410 Independent Plant Troop during the Malayan Emergency. Back in Aldershot he commanded a squadron as Boys Squadron expanded to become Junior Leaders Regiment in Dover, where he became Training Adjutant. He then went to Germany as 2IC of 30 Field Squadron before attending Staff College. Next came a stint in the Ministry of Defence as GSO2 in the Army Equipment Directorate before becoming an instructor in the Tactics School at the Royal School of Military Engineering. In 1967 he commanded 4 Field Squadron in Germany, returning to the Ministry of Defence in 1969 as GSO1 in the Defence Secretariat.

In 1971 Peter retired and went to work in the Home Office as Principal in the Prisons, Race Relations and Police Departments and Assistant Secretary in the Fire and Immigration Departments. He retired from the Home Office in 1991 after three years as Secretary of the Gaming Board for Great Britain. Six years later he obtained a history degree from the Open University.

MUCH blame for the heavy casualties in the 1914 to 1918 war has been laid on the generals. The essence of the indictment of the British generals is, in Liddell Hart's words, "attacks that are inherently vain are ordered merely because if they succeed they would be useful."[1] The total figure for military casualties in the First World War is uncertain. The United States War Department estimates it as about 37.5 million, of whom about 8.5 million died, 21.2 million were wounded, and 7.7 million were taken prisoner or missing. Of those nations which mobilized, more than 7 million men, rates of those mobilized who died vary from 10.2 per cent (about 908,000 men) for the British Empire to 16.1 per cent for France and Germany. Perhaps because the form of the war varied so much from expectations, early commentaries tended to seek scapegoats and blame the incompetence of the generals. The emergence of the official history between 1922 and 1948, and later primary sources, have thrown fresh light on the matter. Advances in military technology and industrial capacity undoubtedly resulted in weapons capable of increased killing power, but can the blame for the loss of life they caused be placed on inanimate objects? In defence of British generals, from the figures given above, they, among the major combatants, suffered the lowest casualty rate. This points to factors applicable to all the armies being at work, but this article's assessment is limited to the losses suffered by the British on the Western Front.

Corelli Barnett has described the British Expeditionary Force (BEF) of 1916 as "the largest, most complicated, and most comprehensive single organization ever evolved by the British nation."[2] By 1918 the management of this large organization was decreed a failure having suffered casualties of about two million in a war of attrition.

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[1] L Hart "History of the First World War" (London 1965) 1992 paperback edition p192.

[2] "Britain and Her Army 1509-1970" (London 1970) p392.

To examine the apparent failure of the management team it is first necessary to examine its task and the preparations made for it.

General Money, who served throughout the war on the Western Front, described the task there to be: "how to surprise, overrun, and penetrate a well-sited defence system some four miles deep, the front edge of which was only a short distance from one's own, protected by massive wire-entanglements and covered by the flanking fire of machine-guns and a wall of fire from artillery and mortars of all calibres sited in depth."[3] This situation was the result of the German failure to defeat the French within the 42 days set in the *Schlieffen Plan*, and their subsequent establishment of a strong defensive position from Switzerland to the Channel in Belgium. It was very different from the decisive "over by Christmas" war on which the British, their generals and Allies had embarked in August 1914.

It has been said of the British Army that it plans to fight the last war. This must have been true of this Edwardian army, officered in its senior ranks by men who had some colonial war experience, but none of war on the continent of Europe against a large professional army, and who were not known for their powers of innovation and lateral thinking. Junior officers had no war experience and in training relied on, and generally were reluctant to contest, the tactical theories of their seniors. All were slaves of a system, operating in an army in transition, which reflected the society and era in which they lived. What Tim Travers has described as the "personalised" aspect of army culture influenced officer promotions and the hierarchical structure with its proteges and protectors, intrigues and rivalries, and fears of disagreeing with senior officers, all leading to cover-ups and whitewashes to preserve reputations. An amateur and anti-intellectual approach to soldiering also reflected the privileges, social networks and traditional attitudes operating in society at large.[4] The leadership, with few outside influences to correct such dangerous attitudes in an army, went to war in 1914 not best equipped to deal with either the professional or intellectual challenges it had to face.

The major operational challenge for the leadership was the modern form of siege warfare with which it was confronted. Pre-war tactical study recognized the devastating fire-power weapons such as the machine-gun and modern artillery would bring to the battlefield, but took little interest in other technological advances. There was talk of the effect of fire-power on tactics but instead of official doctrine there developed two connected ideas; the cult of the offensive and the importance of human qualities.[5] The cult of the offensive, or attack at all costs, was seen, in common with most European armies, as the means of quickly defeating the enemy army in the field. It adhered to the traditional idea of a structured battle and seemed to fit with a pessimistic evaluation of city-bred recruits common at the time. Attacks would be sustained, in the face of heavy losses, by instilling in the troops a high standard of discipline and moral and physical courage. Experience of the fire-power of the Boer War seems to have been dismissed as "peculiar conditions"[6], and the success of the Japanese, despite high losses, against the Russians in Manchuria in 1904/05 was cited in support of the cult of the offensive.[7] So the unofficial doctrine of the British army came to be, as General Sir Ivor Maxse, who later became one of Britain's most enlightened and successful senior commanders, put it a few years before the war, "masses of men in sufficient lines one behind the other will go through anything"[8] and, from a War Office training manual, "moral force in modern war predominates over physical force as greatly as formerly."[9] In other words the bayonet in the hands of troops with courage, willpower and stamina would defeat the gun.

The cult of the offensive was deeply imbued in Sir Douglas Haig, commander of the BEF for most of the war, who has borne the bulk of the blame for the casualties. He was a typical cautious Victorian gentleman of great self-discipline,

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[3] E K G Sixsmith, "British Generalship in the Twentieth Century" (London 1970) p157.

[4] T Travers, "The Killing Ground" (London 1987) Part I, Chapter 1.

[5] *Ibid* p37.

[6] G F R Henderson, "Science of War" (London 1905) pp 369-381.

[7] Gen A E Altham, "The Principles of War Historically Illustrated" (London 1914) p205.

[8] Gen Maxse, *Notes on Company Training: 3rd Lecture* c1910-11, 69/53/1 Maxse Papers.

[9] WO "Training and Manoeuvre Regulations 1909" (London) p4.

self-control and an almost obsessive need for order. He was a cavalryman and had a poor understanding of the use of other arms, particularly artillery. He lacked a critical mind and did not easily accept innovation and change, but ideas once accepted, such as those learned at Staff college in 1896/7, were held tenaciously. These included the need for commanders to display singleness of purpose, the rejection of advice from subordinates which might undermine authority, and a demand for unanimity within headquarters' staffs. These traits, a rigid personality and aloofness, led to his isolation, and that of his headquarters, which, in turn, resulted in a vacuum between him and his subordinates and their staffs. Nor was he well served by his staff until new men replaced them in 1918. Failures of communication seemed to occur at all levels down to brigades, and shortcomings such as misuse of artillery, lack of flexibility and exploitation of success, failure to use surprise, reinforcement of failure, and inattention to logistic and training needs were common to commanders and their staffs.[10] A lack of understanding of the use of artillery was one of the most serious. Artillery was the primary cause of casualties on the Western Front (58.51 per cent of all British wounds were from shell or mortar bombs, 38.98 per cent were from machine-gun or rifle bullets).[11] It was essentially a defensive weapon effective against troops in the open, but this was not appreciated by Haig and his subordinates who saw it as a means of preparing the way for attacking troops. Two million shells were fired over seven days before the infantry assault on the Somme in 1916. The ineffectiveness of this barrage against the well dug in enemy resulted in 57,470 British casualties on the first day of the assault[12]; even this did not stop this same pattern from being repeated throughout the war.

These were serious shortcomings in the leadership of the BEF in 1914 to 18, but should the blame for the casualties end there? Military effectiveness in modern war is a complex matter, especially in a war of the novelty and totality which Britain faced in 1914. It involves the extent to which the resources of the nation as a whole, at all levels, political, strategic, operational, tactical, and, perhaps most vital, home front, are converted into fighting power. Seldom is any nation completely effective at all levels and each level can have an important bearing on the other.[13] Some of the tactical problems of the Western Front have been mentioned. The operational difficulties were, primarily, the formidable German army entrenched in a strong defensive position with, in the early stages, substantial trained reserves, and operating on interior lines with well-prepared communications. The British were not prepared for this situation and it led to confusion over the objectives and tactics to be employed. Cooperation between arms and armies, including those of their Allies, was crude, ad hoc and simplistic, and although a means of handling communication between the BEF and military and civilian offices in London existed, when war came it almost broke down.[14] Better joint organization and increased confidence between Allies might have led to better overall management at the operational and tactical levels. This ought to have been controlled by those responsible for the strategic direction of the war, but at this level too there was lack of preparation and matters remained on an ad hoc basis for far too long. There seemed to be little experience or understanding of the need for such matters in any of the Allied governments, although this, like other aspects of war management was to improve late in the war. In the meantime each nation tended to go its own way in strategy and operations.

In Britain's case there was an absence of political realism and a failure to appreciate the nature of the war into which the country had been led. It took about a year from the outbreak of war for the government to begin to provide an effective structure for political control, strategic deliberation and executive authority over the war effort at large. In June 1915 Haig wrote "To the onlooker here there seems no supreme control exercised over the war as a whole."[15] Until then the cabinet's attitude seemed to have been to let the service ministries, especially the new War

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10 T Travers "The Killing Ground" (London 1987) Part II, Chapter 5.
11 J Terraine, "White Heat" (London 1982) p96.
12 *Ibid* p209.
13 Millett & Murray, "Military Effectiveness Vol I" (Winchester Mass 1988) p3.
14 *Ibid* P Kennedy paper p40.
15 R Blake, "The Private Papers of Douglas Haig 1914-1919" (London 1952) p96.

Minister, Kitchener, get on with the war while they tackled the mammoth task of mobilizing the nation to provide the necessary resources. Following shortcomings in diplomatic intelligence, they had no strategic plan, the country's large industrial capacity had not been geared to the needs of a large modern army, there was little organization to manage the huge effort required, and many of their military leaders, selected not by merit but by a personalised, parochial system, left a great deal to be desired. In 1914, for example, munitions production was 0.5 million shells; in February 1915 shortages resulted in each gun being rationed to 10 rounds per gun per day; not until 1917 did production reach a high point of 76.2 million.[16] The failure to have reserves of trained manpower available in 1914 had perhaps the greatest effect on the field commanders. Even though recruits came forward, when called by Kitchener, there were not enough barracks, rifles or uniforms for them, there were bottlenecks in training and, critically for the unprepared armaments industry, they caused the loss of between 16 and 24 per cent of its work-force by the summer of 1915.[17] Apart from the Western Front, other land campaigns in the Middle East, including Gallipoli, and the German colonies, and the formidable U-boat menace at sea, all exposed the nation's lack of preparedness for the war.

The First World War was a huge shock for the nation. It introduced warfare on a scale and of a nature not previously experienced in history, and in a form which few of any influence had foreseen. It caught British political and army leaders unprepared. On the Western Front the killing power of modern weapons demanded unimagined levels of men and materials and new organizational and professional skills, both military and civilian, which were not available. Had the nation and its resources (and those of its Allies) been prepared, and the means of fighting the war been developed, the heavy loss of life which occurred might have been greatly reduced. Technology changed the nature of the war, and was the cause of the killing, but it was the inability of the nation as a whole to adapt to its use which must bear the blame for the loss of life. The failures of the generals had a direct impact on the scale of the killing and they must bear their share of the responsibility. Their incompetence was matched, however, at national leadership level. War of the nature, and on the scale, of that which came in 1914 was new and demanded preparation, management and involvement of the nation's total resources. This was not recognized in time. As Liddell Hart put it, "The old order had broken down and the new one had not yet evolved."[18] Ultimately, in a quasi-democratic state, such as Britain was at the beginning of the twentieth century, preparation for, and conduct of, such a war, and responsibility for it, including the casualties, must rest with the government, parliament and people, and not just the generals.

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16 G Hardach, "The First World War 1914-1918" (London 1977) p87.

17 *Ibid* p79.

18 Hart, "History of the First World War" (London 1930) paperback edition 1992 p28.

Memoirs

MAJOR GENERAL J M L GAVIN CB CBE

Born 28 July 1911, died 21 August 2000, aged 89.

MAJOR General Jim Gavin's distinguished career in the Corps included wartime service, much of it spent exploiting his aptitude for unconventional methods of waging war, and major contributions to the sports of mountaineering and sailing.

Jim Gavin was born at Antafogasta, Chile, of Scottish parents and from St Peter's School there went on to Uppingham. He was commissioned from the Shop in August 1931 and during his YO Course went up to Trinity College, Cambridge, where he took a 2nd Class Honours Degree in the Mechanical Science Tripos, and began his life-long interest in mountaineering, skiing and sailing. Tours in England with 1 Field Squadron, in the Training Brigade and as an instructor at the Shop were marked by two adventures. In 1935 he was selected to join the fifth attempt on the summit of Mount Everest, the 1936 expedition led by Eric Shipton. Frank Smythe who led the climbing team, had been impressed by Jim Gavin's capabilities when climbing together in the Alps the previous year. During the attempt Gavin, the only newcomer to the Himalayas in the party, accompanied Smythe leading the traverse and the final steep 300ft climb to the North Col, preparing the route to Camp IV. The weather then deteriorated and, despite efforts to establish an alternative route in continuing blizzard conditions, the attempt was called off. In Jim Gavin's own words "…[we] did not reach the summit but it was a wonderful experience and a lesson in organisation and administration." Shortly after this, with two other friends he helped his new squadron commander, Millis Jefferis, build a 36-foot yacht, *Prelude*. He told the story in the *Journal* (March 1939). After their first season: "…*Prelude* has sailed the Channel from Harwich to Falmouth, and twice been in French waters. She has stood up to rough weather and ghosted along in fine. She has raced, and won prizes, including the RORC Points Cup … But, far more than this, she is our ship and we know her so well – every piece of timber, every joint and every fastening. We know that it was worth it, every time."

Adventure was also to characterize his wartime experiences. He was among those who volunteered for the 5th Scots Guards ski battalion, training for winter warfare in Finland. When the battalion was disbanded before it could be employed, Gavin was sent off with a small party in a submarine loaded with "…a wonderful mixture of skis, explosive and bren guns…" to land behind the enemy lines. The submarine was disabled but while waiting for further orders the party began to train in the mountains of Scotland. Out of this the Special Training Centre at Lochailort was born.

After a year spent training special forces Gavin was sent to Malaya in the summer of 1941 (where he met his future wife Barbara Murray) to set up and command a similar establishment for the Far East, No 101 Special Training School. They trained both military and civilians for participation in irregular warfare and were able to place many small groups in Malaya, Burma, Thailand and China. The Japanese invasion

brought this work to an end. He escaped to Java just before the fall of Singapore and there he was able to get married after a brief and interrupted courtship. He became very ill with diphtheria while on the voyage to Ceylon and ended up in an isolation hospital in the jungle. After convalescence in Kashmir he returned to England and spent some time as SO1 RE in SOE (Special Operations Executive) research establishments designing equipment for operations in Northwest Europe. When fully fit he went to the Middle East and from there, was dropped into Yugoslavia. Almost immediately the party he was with were tipped off that British support had switched to Tito and they made their escape. He was then (in 1944) sent to SHAEF in Versailles.

There followed three years at the War Office as SORE 1 E3, in charge of RE organization. The lessons of the war were being digested, and the engineer regiment was born. Then, by way of the JSSC, he was posted as GSO 1 Intelligence in the British Joint Services Mission at Washington. He returned to command 36 Engineer Regiment, then at Ripon, a period that included the East Coast floods and the Coronation camps in London. Six months at the NATO Defence College preceded three years instructing at the Staff College, Camberley. Two happy years followed commanding 11 Engineer Group in BAOR, then three as Commandant of the Intelligence Centre at Maresfield and two as Chief Engineer, Eastern Command. His final appointment was as Assistant Chief of Staff (Intelligence) under General Lemnitzer at SHAPE.

After retirement in 1967 Jim Gavin became Technical Director of the British Standards Institution until 1976 where he was for some time involved in planning for the introduction of metrication into British industry. Later he became Chairman of the British Standards Society. He and his wife settled at Milland in Sussex where he became involved in several local organizations. It was a highly active form of retirement. He was on the Board of Governors of Hollycombe School, Chairman of the local branch of the Conservative party, and a member of the local Cricket Club. He and Barbara spent many happy years cruising and ocean racing firstly *Prelude* and later their Nicholson 36 Corunna. During this time he managed the successful 1975 Admiral's Cup team. He also hunted, shot and beagled with the Aldershot beagles.

Barbara Gavin died in 1994. Jim Gavin had lived his life according to the highest principles which he himself had recorded in his journal: "My belief: of this I am certain: there is no true happiness in life except in unselfish, devoted service – to one's God, to one's King, to one's love, to one's true friends – a service that gives all, not as a bargain but as a gift, expecting nothing in return; a devotion that can never fail." Two daughters and a son survive them.

MWB LJ

COLONEL A W KIGGELL OBE

Born 28 July 1903, died 22 June 2000, aged 96.

COLONEL Arundel William (Rundy) Kiggell, was the son of Lieutenant General Sir Launcelot Kiggell, who was General Haig's Chief of Staff during the First World War. Rundy was educated at Charterhouse where he made a name for himself as an outstanding games player. He became captain of soccer at the age of 16, and played cricket for the school. He later became a scratch golfer. He went from Charterhouse to Woolwich where he was awarded both the King's Medal and the Pollock Medal. He was commissioned in August 1924.

After two years in the United Kingdom he went to India where he spent seven happy years with the Bengal Sappers and Miners. On returning home in 1934 he married Katherine Humphrey, and after four years in England, (including a year at the Staff College, Camberley), he was posted to Malaya in October 1938. When the Japanese invaded he was a GSO3 on General Percival's staff in Singapore. He was highly critical of the absence of preparations to defend the island but it seems that his reports, prepared for the War Office, were normally "watered down" to give an impression that the situation was under control.

Singapore fell on 14 February 1942, and two weeks before this Katherine and her two small children were packed into an overcrowded ship bound for England. Rundy thought he was destined to be a Japanese prisoner, but on 13 February he was ordered to leave Singapore along with others selected because of their future potential for the war effort. The escape was hazardous. His party were first taken to Sumatra, and then, with the aid of the Dutch, crossed the island by train and bus to Padang, where they were picked up by a Royal Navy cruiser, but were given no idea where they were being taken. To their consternation they were disembarked in Java, then in imminent danger of Japanese invasion. Desperate measures were called for, so they requisitioned a flat-bottomed Chinese riverboat and set off for Ceylon with an amateur crew and only the stars for navigation. Three weeks later they arrived safely in Ceylon despite being attacked by a Japanese submarine, with one torpedo going under the flat-bottomed boat.

Rundy remained in the Far East for the rest of the war being mainly employed as a staff officer. However, in 1944/1945 he was placed in charge of the building of a large airfield on Ramree Island, required for the supply of Burma. He was by then a colonel, having under his command a force of two engineer regiments and 8000 civilians. For this work he was awarded the OBE

In 1948 he was appointed CRE 1st Infantry Division and CO 22 Field Engineer Regiment which was then in Palestine. Shortly after his arrival the regiment was moved to Benghazi with 17 Field Squadron in Derna. This was the first time the regiment was brought together, and it required considerable enterprise to attain minimum standards of comfort for the soldiers and their families in an old Italian barracks and houses that had long been empty.

After some months in Benghazi the regiment was set the formidable task of rebuilding three very large bridges that had been demolished by the German Army, in the Wadi El Kuff, some 80 miles out of Benghazi on the Tobruk road. The bridges were in use in 1995. Perhaps they still are.

With this satisfying work, all forms of sport which Rundy, as a keen and able games player

himself encouraged and an active social life, he built a regiment that had a wonderful atmosphere and a fine family spirit. In this he was supported magnificently by his charming, energetic and resourceful wife, Katherine.

In 1953 he was invited to retire from the Army to become Commandant of the Duke of York's Royal Military School, Dover. He was required to continue the process begun by his predecessor of transforming the school from its former limited aims to produce soldiers for the Army, to one in which boys were able to develop their natural talents and to prepare them for careers of their own choice. Rundy's appointment proved an inspired one. Under his guidance it went from strength to strength and, in his final year, six pupils went on to Oxford and Cambridge. When he retired in 1961, an article in the school magazine spoke in glowing terms about Rundy and Katherine. Rundy was said not only to have maintained progress but ensured its acceleration- "To every boy, every parent, every teacher, to everyone who worked in the school he was always readily accessible with his wise and firm attention to their problems. He has earned the gratitude and respect of all." The last sentence reads "They may surely count on the love, friendship and gratitude of the school they have served so well."

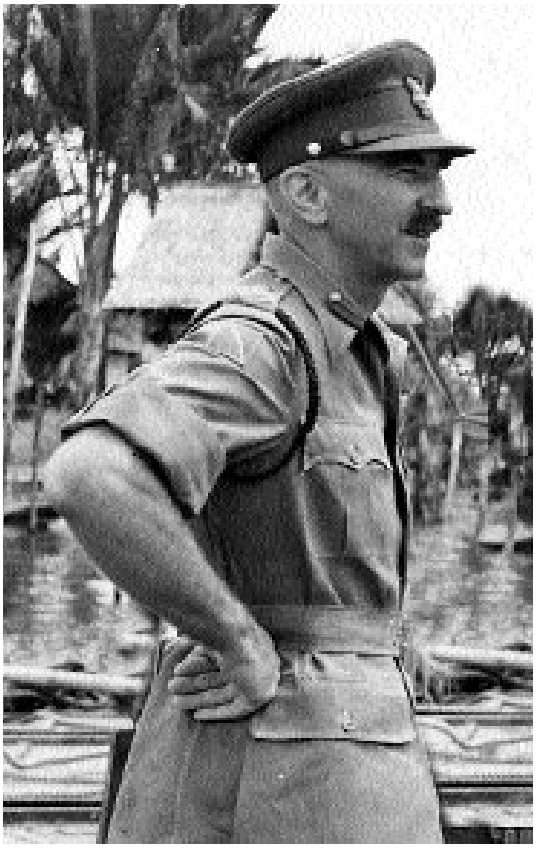
Rundy and Katherine retired to Hampshire and later moved to London. Katherine died in 1988, which was a devastating blow. His last days were spent in a nursing home close to his son. He remained totally clear in mind to the end and won the affection of all who looked after him. Being born in l903, Rundy was instilled with some of the best old world virtues, such as duty, integrity, loyalty, patriotism, courtesy and belief in God. He never forgot them or allowed his standards to slip. He had fine talents, intellectual and sporting, yet he took modesty almost to self-deprecation. He loved good literature and poetry. When reading became difficult he would enjoy reciting from the wide repertoire of poems he had learned in his youth. He always saw the best in others and had great generosity of spirit and kindness. He was totally unambitious for himself. He was devoted to his family, and his children and grandchildren brought him great joy. His son, David, became a Sapper officer, but elected to leave early. Like his father he was awarded the Queen's Medal at RMA Sandhurst.

Rundy had a remarkable degree of natural authority, and inspired the loyalty, love and affection of many. He brought grace to every organization with which he was involved.

RWML

BRIGADIER J T S TUTTON CBE

Born 15 February 1907, died 15 January 2000, aged 92.



JOHN Tutton was commissioned into the Sappers from the Royal Military Academy Woolwich on 30 August 1926. Afterwards he went to Trinity College, Cambridge, to read mechanical sciences and completed the Royal Engineer Young Officers' Course at Chatham. Whilst on that course both he and his lifelong friend, Mervyn Walter (later brigadier of Mulberry Harbour fame) became victims of a serious accident at Aylesford in December 1927. They were taking part in a project which involved being carried to the top of a near vertical 100ft cliff in a muck tub hooked to a cable powered by the engine of a digger. When it was John Tutton's turn with Walter and a third YO, a hook attached to the cable slipped. Lieutenant Walter was severely injured in the resulting accident, spending six months in hospital. John Tutton suffered a very nasty head injury. Luckily he had landed in mud – not on rock, and survived. The word went round the Brompton Mess that YOs were indestructible!

Like many who served before World War Two, he travelled to some remote parts of the former Empire. For two years (1933 to 1935) he was Assistant Civil Engineer seconded to the Air Ministry working in the Near East, mainly in Iraq, building roads, bridges, landing grounds and associated infrastructure for the Royal Air Force which at that time were responsible for policing Iraq.

In 1935 he returned to Chatham to serve as an Assistant Instructor Fieldworks. Whilst at Chatham in 1940, he married Diana, daughter of Mr & Mrs Henry Godfrey-Faussett-Osborne also of Chatham. (Her three sisters were also to marry Sappers). His next appointment, after attending the Staff College, was to HQRE Eastern Command to advise on and construct coastal defences in East Anglia. For this he was subsequently Mentioned in Despatches.

He was then posted to Kenya to be the Chief Instructor, East Africa Fieldworks' School. Here he was able to impart much of his expertize gained from his time at Chatham. In February 1942, as a temporary major, he took over command of 58 (East African) Field Company, part of 11th East African Division. While en route to Burma he was selected and promoted to become an acting lieutenant colonel, as CRE of the division.

In Burma 11th East African Division relieved the 23rd Indian Division. Following the capture of Tamu, the division led the advance down the Kabaw valley and towards Sittaung on the River Chindwin. It was on that advance that the engineers of 11th East African Division under John Tutton gave such a magnificent and versatile performance. There was no serviceable road, as the monsoon, with a rainfall in a few months of over 100 inches, the encroaching jungle and the demolitions of the Japanese Army had obliterated most of it. The division advanced mainly on foot through dense jungle or flooded paddy fields in one of the worst areas for malaria and tick typhus in Burma. Through this unpromising terrain the divisional Sappers cut tracks, built bridges, cleared mines and enabled the division to fight its way forward against two Japanese divisions. However the monsoon proved that it was impossible to keep open a maintenance route. Consequently the division had to be supplied by

air. John Tutton's Sappers, in addition to their existing work, then constructed landing strips for Dakotas to bring in supplies, to increase the quantities already being airdropped, and to evacuate casualties. After months of bitter fighting in a thoroughly hostile terrain against a tenacious enemy, the division finally linked up with the 5th Indian Division near Kalemyo. The Kabaw valley had been cleared. In recognition of his numerous achievements as CRE 11th East African Division, John Tutton was subsequently twice Mentioned in Despatches.

After VJ Day he returned once more to Chatham to become GSO 1 at the School of Military Engineering. Two years later he was posted back to Far East Land Forces as AA&QMG North Malaya District at the time when the communist insurgency to Malaya was becoming a serious threat. In recognition of his superb contribution there he was appointed OBE in December 1949 and was again Mentioned in Despatches. Once again he returned to Chatham and became CRE Kent. On promotion to colonel in 1951 he joined the staff of the Engineer in Chief in the War Office, but the Military Secretary appreciated his considerable jungle experience so he was appointed CRE 17th Gurkha Division. Later in 1957, on promotion to brigadier, he became Chief Engineer to HQ Malaya Command.

On his return to the UK in 1959 he served in the Ministry of Supply as Director RE Equipment before completing his career on the staff of the Master General of the Ordnance where he was promoted to CBE and became ADC to HM the Queen.

He retired from the Army on 15 December 1961 and became a much loved mathematics master at Tettenhall College, near Wolverhampton before settling in Awre in Gloucestershire where he developed, with his wife, a magnificent garden and cared deeply for the welfare of his parish church. His much-loved wife, who was an author, sadly predeceased him. He is survived by his two daughters.

John Tutton was the epitome of a kind, reticent man with a remarkable memory. He rarely spoke about himself but devoted his life to the service of others, often with great generosity.

PIC

MAJOR (V) T B GILLETT TD

Born 13 March 1935, died 5 July 2000, aged 65.

MAJOR T B Gillett TD BSc MIMechE AMCT (Tom to the Army, Brian to his family) served in the Royal Engineers in the TA and the TAVR, from 1959 to 1985. He was born in Shanghai in 1935, where his father was a miller, stemming from the Faversham family of Gilletts, millers since the sixteenth century. He was evacuated to Australia during the War, and returned to England in 1948, to Dover College, where he won prizes for mathematics and science.

After National Service in the RAOC, he read engineering at Manchester University, where he joined the OTC and took his basic parachute course. He served in 123 Field Engineer Regiment TA before seeing the light and transferring to 131 Parachute Engineer Regiment TA, where his troop of 299 Parachute Squadron was located, somewhat bizarrely, in Liverpool Tramways Terminus (fortunately not the end of the line for him!).

He remained in 131 Regiment and when, on the reorganization of the Reserves in 1967 it was reduced to 131 Independent Parachute Squadron (V), he continued to serve in various appointments, culminating in becoming OC in 1973, until retiring at the end of his tour in 1976. He knew his soldiers well, and was popular with them because, while their training and efficiency were essential to the squadron, their well-being was paramount.

He was deeply affected by the tragedy of 27 September 1975, when ten soldiers of 300 Troop (Grangemouth) were drowned on a night exercise on the River Trent, and was active in raising and administering the Trust for their dependants.

He was delighted that 131 survived TA restructuring and played a major part in its conversion to a commando squadron with a challenging role in support of the Royal Marines. He then continued to serve in the Central Volunteer HQ Pool of Watchkeepers until 1985.

In 1958 he had joined Joseph Rank Ltd (to become Rank Hovis McDougall (RHM), and later Rank Hovis Ltd) as a management trainee, and stayed with that company for the whole of his working life, becoming chief engineer of the largest flour milling company in Europe in 1981, until his retirement in 1993. His wide-ranging duties with RHM enabled him to keep in touch with his far-flung troops (London, Birmingham, Hull and Grangemouth), and the management of RHM were tolerant and understanding of the demands of his Service duties.

As a bachelor, he had no direct dependants, but was a caring and generous uncle and godfather, and was able to pursue his many interests: adventurous travel, from walking (over a number of years) the whole length of the Pyrenees, trekking in the Himalayas, and visiting Antarctica; music; malt whisky and fine wines; and perhaps most importantly of all, masterminding the reconstruction, over many years, of a derelict Welsh farmhouse, to the great benefit of his family and friends.

JRH

CAPTAIN N V R OAK-RHIND

Born 4 November 1955, died 22 March 2000, aged 44.

CAPTAIN Nigel Oak-Rhind, formerly Adjutant of 32 Armoured Engineer Regiment, died of leishmaniasis, a parasitic disease which he contracted in Spain after he retired early from the Army. He was a very confident, talented and personable officer with a great sense of humour, and the large number of brother officers who attended his funeral service bore eloquent testimony to the regard in which he was held. He was well-known to a wide circle of officers as an accomplished offshore sailor. Nigel Oak-Rhind's widow, Penny, was the Assistant Adjutant of 32 Armoured Engineer Regiment when they married, and they had one daughter, Alexandra, who is now seven.

Nigel was born in Cairo but his family left Egypt following the nationalization of the Suez Canal by Nasser and the subsequent British/French military action. The family moved to Kenya for the next few years before returning to England, where Nigel went to prep school and then on to Eton.

He went to Sandhurst and was commissioned into the Royal Engineers in 1974. After a short tour in Germany he undertook his degree training at the Royal Military College of Science at Shrivenham. That was one of the happiest times of his life during which he made lifelong friends. His first full posting was to 39 Engineer Regiment near Cambridge. From there, he led an epic six-month deployment to the island of South Georgia in 1980, without any resupply or outside support during the whole project. He built a jetty which should have been of great value to the Argentinians in their subsequent 1982 invasion. However, a submarine hit the jetty and ran aground, so Nigel may be the only young Army officer in that or any other war to sink an enemy submarine. He also served in Belize and Northern Ireland, and was then posted to 32 Armoured Engineer Regiment.

In Munsterlager, Nigel was very clearly the leader of a talented and sociable group of young officers, who together formed a most lively and united officers mess, full of fun and laughter. Officers will remember their receptions in the regiment – invariably with an elaborate practical joke ranging from being sent out on non-existent exercises, to the occasion when one young officer was apparently shot and wounded on the night of the arrival of another subaltern.

After one more posting in Colchester, Nigel and Penny left to make their fortune in Spain. That was not to be, but we should still celebrate a rich life, though short, filled with achievement, love and happiness. Captain Oak-Rhind was a lively personality, and a resolute and professional soldier. His friends were struck by his immense dignity in his final, difficult months, even at the end in a hospice. From his great strength of character, more of his qualities came to the fore. He showed great humility and gentleness. He was truly a gentleman.

JHM

BRIAN MEIRIC ROBERTS

Born 1917, died 14 August 2000, aged 83.

BRIAN Roberts was born in South Wales and grew up to be trained as a Civil Engineer. In the late 1930s, together with many young men of his generation, he joined the TA in Cardiff. At the outbreak of the Second World War he was posted as a second lieutenant to 4th Division RE with whom he served throughout the greater part of the war, finishing up as a captain. In 1943 and 1944 he saw service with 7 Field Company in 4th Division in the closing stages of the North African Campaign followed by the long slog up the leg of Italy. He took part in the bridging of the Rapido River during the battle for Cassino in May 1944. Later on, unfortunately, on 25 June, on the route to Florence his Daimler Dingo, in which he was on reconnaissance, hit a mine and turned over severing his right hand.

His next posting was to the RE Officer Cadet Training Unit at Newark where he joined the Fieldworks staff, training young RE officers as an instructor on mine warfare.

After demobilization he joined the newly formed Crawley Development Corporation as Chief Engineer, which appointment he held until the new town was finished and the Corporation disbanded. Whereupon, having served Crawley with distinction, he was appointed Chief Engineer of the New Towns Commission, which post he held until retirement at 65. He was rightly proud of his service, spanning four decades, to the New Towns movement, never allowing the loss of his right hand to hinder his work.

Brian never married and throughout the whole of this period he played a significant part in the social life of the growing New Town of Crawley. He was directly involved in the restoration and administration of the Old Barn at Ifield into a thriving theatre club as well as acting in many of its shows. As a keen supporter of the Crawley Rugby Club, he saw it prosper under his stewardship. He was a Rotarian, a member of Probus and throughout the whole of his career he was an active member of the Crawley Branch of the Royal Engineers Association, living modestly in one of the first flats to be completed in the New Town.

Brian Roberts was a professional in every sense of the word and a strict upholder of the values that our generation was taught, now considered old fashioned. He will be greatly missed in Crawley. As a mark of the respect in which he was held, his funeral was attended by representatives of every organization with which he was connected and a guard of honour was provided by the Crawley Branch of the Royal Engineers Association.

APdeTD

MAJOR D N MOORES ERD

Born 2 June 1911, died 30 August 2000, aged 89.

DENNIS Moores was commissioned in the Supplementary Reserve in 1934. Mobilized in 1939, he went to France with the BEF and was evacuated from Dunkirk in May 1940. His war service took him in 1941 to the Middle East and included a tour as Second-in-Command of 24 Fortress Company in Malta in 1942/43.

Returning to the UK in 1943, he was appointed OC 55 Field Company, with whom he remained from Normandy to the River Weser, before taking over his former company, by then 24 Field.

On returning to civilian life, he became a senior manager with British Ropes at Doncaster.

Dennis was a past-president of the Harleston (Norfolk) branch of the Royal British Legion, past branch chairman and almoner of the Fellowship of the Services, served fifteen years as a case worker for Doncaster branch SSAFA, a member of Doncaster War Pensions Committee and he also found time to serve as churchwarden of Cantley Parish Church and as a member of the General Synod.

He was a fine christian gentleman and an excellent friend and messmate.

His wife Elizabeth, one son, three daughters, six grandchildren and three great-grandchildren survive him.

DRV

Memoirs in Brief

Brief memoirs are published below of distinguished men whose deaths have been notified recently in the press and who served in the Royal Engineers.

Denis Haviland CB, who died this year aged 89, enlisted as a Sapper at the beginning of the Second World War. Although a graduate of Cambridge University, he had embarked on a career with the London, Midland and Scottish Railway, starting as a porter. His qualifications discovered, he was commissioned and he ran a railway centre in Lille as the Germans advanced. Later in the war he was involved with the Iraq–Russia rail aid programme, rising to the rank of colonel. After the war he joined the Foreign Office, transferring to the Civil Service and eventually the Ministry of Aviation. On leaving the Civil Service, he accepted an appointment in the Machine Tool Company, Staveley Industries and became its chairman in 1965. "Haviland had a brilliant mind, a gift for languages and a very tough reputation in Whitehall." He also led an adventurous and active sporting life and, having benefited from the attentions of a gifted healer following a skiing accident, developed a deep interest in the subject and in 1981 became chairman of the Confederation of Healing Organisations.

Lord Harmar-Nicholls, who died on 15 September 2000, served in the Corps during the Second World War in India and Burma. He came from a mining background, went to grammar school in Walsall and, after studying law, was called to the Bar in 1941. However, he never practised as a lawyer and after the war went straight into politics. He was member of parliament for Peterborough from 1950 to 1974 and became famous for the hair's breath margins by which he won and, finally lost, his seat. During the nine elections he fought there were no fewer than 21 counts. From 1979 to 1984 he was also an member of the European parliament, having opposed joining the Common Market preferring the idea of an Atlantic Free Trade Area. Harmar Nicholls was an energetic enterprising man with extensive business interests and also a great supporter of provincial theatre.

Philip Bays GM, who died earlier this year, won his medal as a lieutenant in the Royal Engineers during the Second World War, for displaying "…ingenuity, presence of mind and outstanding courage…" while engaged on bomb disposal work all over the south and west of England, including disarming mines underwater by touch alone. A Peterborough man, he qualified after apprenticeship with the local borough engineer and then joined No 6 Bomb Disposal Company in December 1942. After the war he had a spell at Eastbourne before joining the Ministry of Transport at Guildford in 1962. His work there included drawing up plans for the M25.

Jim Rogers, who died in August this year aged 93, was a mining engineer who was commissioned into the Corps at the beginning of the Second World War. He went to France with the BEF as a member of 170 Tunnelling Company for whom a role similar to the tunnelling of the First World War was presumably envisaged. The Blitzkrieg proved, however, that the nature of warfare had moved on. While his unit survived to win distinction in Gibraltar, Rogers was captured and thereafter applied his skills in support of various enterprises for prisoner of war escapes in Laufen, Colditz and Spangerberg near Kassel. He was demobbed in 1945 and resumed his engineering career becoming president of the Institute of Mining and Metallurgy in 1969 to 1970.

Correspondence

COL A W KIGGELL

From: Lieutenant Colonel P V Huyshe
Sir, – I was sorry to see that Col A W Kiggell died in June but glad to read that it was a sudden and peaceful death. He resurrected the RE Golf Society after the second great war. He was at the SME at Ripon and captained and organized a team of four who won the Army Team Championship in 1946 at Camberley Heath and were runners up in 1947 to the Seaforths at St Andrews' old course. He did a great deal to get the golf society reflourishing. I recall that in the late fifties he was the "boss" of the Duke of Yorks Military School at Dover where he kindly accommodated some of us who came over from Germany to play at Royal St Georges Golf Club in our annual contest against the Gunners. Yours sincerely – Pat Huyshe.

THE BANK STATION BRIDGE – 1941

From: Major A G Marsden
Sir, – In his article in the August issue, Captain Frost says that a Bailey bridge was built at Bank Station in January/February 1941. This cannot have been so, as the Bailey did not become available till late spring or early summer 1942.

The bridge might have been a large box girder, up to 120 feet (I think), Class 24, or small box girder, 48 feet Class 24 or 32 feet Class 30. It might have been an Ingles, or a railway bridge converted for road use. Yours faithfully – Major A G Marsden.

COLONEL R L WILLOTT DSO OBE TD

From: Major R E Ward
Sir, – You published the memoir for Colonel Willott in June 1985, based partly on my contribution sent in in 1984. However, I left out an account of one of his most remarkable deeds at the demolition of the great 'J' Bridge at Tournai in May 1940 because, although I had been told about it later by my sergeant who was NCO in charge of the firing party, no-one I knew could corroborate the story. I since have heard from his escort, then Sapper Kenneth Mackenzie, and he has sent me the following account which I think is worthy of publication, even at this late date:

> "Yes,I was with Major Willott at Tournai in 1940. The company had laid demolition charges at the Tournai Bridge; I had been directed to accompany him throughout that particular day, to carry messages and generally to attend to his bidding.
>
> I was with him the whole of the day that we blew the last and final bridge at Tournai. I witnessed, and have told the story dozens of times, his presence of mind and courage and humanity as we came under direct fire, I think from enemy tanks as they approached the bridge on the far side. Together with a handful of other military we were both standing bang in the middle of the bridge as waves of retreating peasants struggled over with bundles and packs and children. A steam of shells and tracers virtually singed our heads burying themselves into the high ground on our side and, of course, those of us on the bridge immediately turned for home and fled at top speed for the safety of our side of the bridge. Not so Major Willott – at least not immediately. Seeing a very old woman some yards distant and approaching the middle of the bridge, he moved towards her, picked her up bodily in his arms and carried her all of some 40 – 50 yards across the bridge before dropping her safely on our side.
>
> As he did so I think he must have raised his hand as a signal to the firing party, for up went the bridge in an enormous cloud of debris and dirt. For a long time the air was black. Somehow I found my way to the OC's small truck and waited until, some time later, he appeared. A number of fleeing refugees went up, sadly, with the bridge.
>
> Later, on approaching Dunkirk, he calmly, in a field, divested himself of his battledress, donned his best tunic, Sam Brown and best shoes and prepared himself for whatever may have been ahead – properly dressed! Typically him!
>
> We were but a small party of 201 Field Company troops on the beach – a handful. A very close chum, George Chapman, a Scot from Glasgow, lost his life. I visited his grave in Dunkirk Military Cemetery. I have no idea how or exactly where he died."

Although it was said in his memoir that Colonel Willott subsequently became CRE of 50(TT) Division in time for D-Day, nothing was said about his actions in that division, or later on

when he was subsequently CRE of the 53rd (Welsh) Division. Ken Mackenzie has frequently asked me if I knew how he got on after he left us in 1944 but I have never met anyone who could tell me.

So I am now wondering if any of your readers who served with him in the campaign in North West Europe in either 50 (TT) Division or 53 (W) Division could enlighten us. Yours sincerely – Roland Ward. (Served under RLW from 1940-1944.)

GOZO AIRFIELD

From: Major R J deV Wade

Sir, – I read, in Arthur Bryant's "The Turn of the Tide" (1st Edition, p667) that, in June 1943, "the little rock island of Gozo off Malta was miraculously turned into an air base by American engineers working at unheard-of speed after the more hidebound British had declared the feat impossible."

This may be an unfair slur on Sappers (who "make a speciality of the impossible") which needs correcting – if not already done in a later edition of the book.

I wonder if anyone knows the background to the quotation as, if uncorrected, it will be taken as factual by future historians. Yours sincerely, James Wade.

DRESSED TO KILL?

From: Colonel Rob Hyde-Bales

Sir, – It is good to note that Matthew Whitchurch has not lost his ability to encourage lively correspondence in the *Journal*. Few topics apart from a proposal to issue a new medal, are guaranteed to engender more debate than that of uniform, as evidenced by his recent proposal for a new mess kit.

I have followed the debate with interest from the Caribbean, where I am currently stationed in Jamaica. In this part of the world I am fortunate enough to be able to wear tropical mess kit when the need arises. It is a pleasure to be able to wear the lightweight type of mess kit, which is considerably more comfortable than its temperate counterpart. Inter alia, it is as comfortable worn when sitting down as standing up. In the British Army we have traditionally designed uniforms that are best worn when standing outside and preferably either in winter or, at most, spring. The advent in Europe of central heating and double glazing, combined with an almost total lack of air conditioning, seems to have long escaped the attention of Army uniform designers. As an example, the heavy wool pullover was clearly never suited for indoor wear, unless one is based in the Kola Peninsula. If we ever do get a new style mess kit, then let it be lightweight. In my experience, all our most comfortable uniforms are lightweight.

Finally, I support Matthew's questioning as to whether we really do need to wear combat kit and boots in all offices and barracks. Perhaps that will be the "joined up" mess kit of the future – Army wide. Yours sincerely, Rob Hyde-Bales.

OPERATIONAL EXPEDITIONARY INFRASTRUCTURE WORKS THE AIR SUPPORT WAY

From: Lt Col S J Ruxton

Sir, – Having read Maj M A P J Sullivan's article (August 2000) on Operational Expeditionary Infrastructure Works the Air Support Way, I would like to raise two issues:

Firstly, I find Maj Sullivan's arguments for the design and build approach to "Operational Expeditionary Infrastructure Works the Air Support Way" unconvincing as the article is not clear about what the rest of us in the Corps are doing wrong. I fully support the design and build approach to infrastructure works and believe that is what we have within the Corps at the moment. As we are all from the same Corps, our current approach, with Military Works Force undertaking the design and engineer regiments undertaking the construction, both supervised by a project manager from within the Corps, is about as close to the design-and-build concept as you are likely to get.

The examples given by Maj Sullivan of his successes in Corsica and frustrations in Kosovo appear to be more to do with funding availability than with the way the Corps undertakes project work. These projects appear to be examples of a nationally funded project versus a NATO funded project. Generally, nationally funded projects stand a better chance of proceeding more smoothly than NATO funded projects, as the procedures for authorizing funds are simpler.

With lessons learned from Bosnia and Kosovo, the procedures for financial and contractual delegations within the Corps are being improved and will be encapsulated in doctrine with the publication of JWP 4.05. With the doctrine giving clear national guidance on financial and contractual delegations on deployed operations, the Corps should be able to get on with its job quicker than has perhaps been possible in recent times.

Funding NATO infrastructure projects is a more complex procedure and severe limits can be placed on financial and contractual delegations, if such delegations are allowed at all. Inevitably, these restrictions can delay a project and lead to frustrations on site. However, this is a problem that the Corps will not be able to solve, but one that NATO itself is going to have to address. Enhanced engineer representation within NATO's permanent and deployed HQs, to provide the appropriate engineer planning staff, should overcome most of these difficulties. However, until such time as NATO changes its procedures, the Corps will have to work within the imposed restrictions, as it is NATO that controls the funding.

Secondly, I disagree with Maj Sullivan's view on command of specialist teams. Experience has shown that the delivery of effective infrastructure engineering capability can suffer when STsRE are under the command of squadron (or regimental) HQs. It is naive to assume that a STRE (Works) is a completely self-contained consultancy, project management and design cell, because it is not. A STRE (Works) is dependent upon the technical support and guidance provided by its HQ CRE (Works), HQ MWF and, on occasions, HQ Military Engineer Services. This is especially true where other specialist engineering input, such as water development, bulk petroleum, materials testing, public utilities, railways, airfields and contracts, is required. It is also naive to assume that a squadron HQ has the engineering experience or ability to guide the work of a STRE (Works). The STRE (Works), wherever possible, should remain under the command and control of a senior specialist engineer, such as a CO CRE (Works). The senior specialist engineer is responsible for guiding the work of a STRE (Works) and ensuring that the appropriate specialist engineer assets and advice are made available to the team in order to allow it to complete its tasks. These additional resources may be allocated from within the CRE (Works) or MWF. However, experience has shown that it is often necessary to seek support or advice from additional assets that HQ MES is able to engage. Such assets may include the Works Inspectorate, CRE (Airfields), the Engineer and Logistic Staff Corps, Defence Estates, Work Services managers, the Defence Evaluation and Research Agency, Defence Procurement Agency, contract staff and other personnel in technical, infrastructure, estate and acquisition posts around the world. Only by keeping a STRE (Works) within a "specialist" chain of command can it be properly tasked, properly resourced and its output properly monitored. Compromising the command and control of a STRE (Works) will almost certainly compromise its effectiveness. Yours faithfully, S J Ruxton.

Reviews

TOWERS OF STRENGTH, MARTELLO TOWERS WORLDWIDE

W H CLEMENTS

Published by Pen & Sword Books (Leo Cooper), 47 Church Street, Barnsley, S70 2AS. Price £19.95. ISBN 0 85052 679 5

THIS is a most apt title. Almost 200 years after the construction of the Martello Towers along the coast of south and southeast England, many of these fine fortifications are still in existence, despite the constant battering of the forces of nature. No doubt Napoleon would have had difficulty in overcoming these well constructed defences if he had decided to launch an invasion. This is a fascinating, carefully researched book, which will be of interest both to the military fortifications specialist and to a wider military history readership. The name Martello Tower is surely well known to all of us. Memories of rather forbidding, stark forts dotted along the coastline around the Lydd/Hythe ranges, come to mind. This work by Bill Clements, a retired Army officer – but not a Sapper – explains all.

He starts by describing the possible origins of the name. Many, including your reviewer might have thought that they were named after some eminent military engineer. Not so, it seems! Clements describes a number of options, but favours the idea that Martello may well be a corrupted version of "Mortella", the name of a headland in Corsica where a forerunner of the towers we have come to know, successfully withstood a bombardment by the Royal Navy in 1794. So the story unfolds from its portable start point in the Mediterranean, through to the construction of these fortifications during the early 19th Century along the coast from Seaford in Sussex to Aldeburgh in Suffolk. The author describes in detail the different designs. Useful maps and clear sketches of plans, elevations and sections of the different types support the text. The photographs are black and white. The close involvement of Royal Engineers is comprehensively described and Second Lieutenant Charles Pasley has more than a passing mention.

It is interesting to learn that Martello Towers are not confined to England; they are to be found worldwide; Ireland, Canada, the Channel Islands, Sicily, India, South Africa, the West Indies and even Sydney Harbour may boast of their own. Examples are covered in detail, should the reader feel the urge to investigate. However, for those who wish to visit the sites in this country and Ireland, there is an excellent table, which summarizes the facts on those towers that remain to this day. Its worth was confirmed by your reviewer on holiday recently in Suffolk whilst walking the coast and indulging in his pastime of Martello Tower spotting.

This book can be fully recommended. It is an interesting addition to the library of the military engineer.

RJDR

MIDDLE EAST MOVERS

HUGH MACKINTOSH

Published by North Kent Books Rochester, Kent. Softback, Price £5.00 (plus £1 p&p) 72 pages, illustrated. ISBN 0948305 10 Copies are available from the RE Museum (to whom cheques may be made out) or from Lt Col E Ll V Wall, 19 Park Avenue, Camberley, GU15 2NG.

THIS is a captivating little book recording in vivid and entertaining style the activities of the sapper railwaymen, port operators and inland water transport men who made such a critical contribution to operations life in the Middle East during the postwar years up to the evacuation of the Canal Zone in 1956. The book has been beautifully produced on good quality paper with an attractive laminated cover in colour. Clear maps support the explanation of the background to the whole episode. The main text, contributed to by many former members of the transportation service, tells the story of their fine achievements in frequently hazardous conditions. It is a timely reminder of an emergency in the days of national service under conditions that would be quite unacceptable today except on operational service and yet never qualified for grant of the General Service Medal.

Hugh Mackintosh, who wrote the book on the initiative of the Friends of the Royal Engineers Museum, unfortunately never lived to see its publication but has left us a delightful legacy.

GWAN

MILITARY AND NAVAL SILVER

ROGER PERKINS

Published by Roger Perkins,
PO Box 29, Newton Abbot,
Devon, TQ12 1XO.
Price £39.50
ISBN: 0 9506429 4 0

WHEN starting to write this book the author realized that it was never realistic to think of including representative pieces of silver from every mess, be it regular Army, volunteers, territorials or others, all of whom have their treasures. So this is not a reference book. Problems met included the availability of photographs of publishable quality and the time available to custodians, regimental secretaries and curators to help him in his research. The author, in describing the silver of many different types, seeks to demonstrate that the silver owned by the armed services is more than craftsmanship of a piece of metal, that military and naval silver is unique and that each piece is a symbol or icon of the regiment's or unit's history and achievements. The author, an experienced historian, is in his element when writing this book, as every piece of silver mentioned is accompanied by its story.

The book opens with a chapter entitled "The Spirit of the Regiment" showing how and why a regiment's silver means so much to it. This sets the tone for the rest of the book. This is followed by a look at the possessions of three representative regiments, a Scottish Highland regiment, a cavalry regiment and an English county regiment, and, in a separate chapter, those of the Gunners and Sappers. The Indian Army is not neglected, and other chapters describe the treasures of the Royal Navy and Royal Marines, and much more. The chapter headed "Lost and Found" is different in that it records tragedies over the years that befell the silver of some regiments and ships, many during World War II but the latest during the Falkland Islands Campaign. On the other hand the chapter headed "Collecting Military Silver" seems to lie uneasily in his book.

Turning to the Sapper silver, the author has selected mainly the more modern silver. Apart from describing the Crimean War centrepiece, the pieces are all made since World War II. Indeed, little other modern silver is included in the book. The history related is interesting, and accurate except where describing the Frigate bird, the centrepiece of 25 Engineer Regiment. In this the author has made the old mistake of mixing up the two Christmas Islands. The species *Frigata andrewsi* inhabits the Christmas Island in the Indian Ocean, not that in the Pacific Ocean, the latter being inhabited by *Frigata ariel* and the more readily seen *Frigata minor*. Also, whereas each section in the book includes the cap badge of the regiment concerned, one wonders why for the Sappers he has selected the badge worn during the reign of King George V rather than that currently worn. Other minor comments could be made but they do not detract from the enjoyment of the book.

The reader will find that the book is well researched and packed with stories that are fascinating to those who have an interest in historical detail. The photographs used are of excellent quality. In fact the author has succeeded in breathing life into what might otherwise have just been pieces of silver.

AHB

MEDITERRANEAN SAFARI

COLONEL A P DE T DANIELL OBE MC TD DL

Privately published. Price £10.
From: RE Corps Enterprises Shop, Brompton Barracks, Chatham, Kent, ME4 4UG.

MANY members of the Institution will remember Colonel Tony Daniell's popular book which describes 59 Field Company operations in North Africa and Italy 1943 to 1944 and was first published in 1990. As the first edition is well out of print, the Institution of Royal Engineers has sponsored a reprint of a good quality paperback which is now on sale. This excellent book, by a distinguished wartime OC of 59 Field Company, gives a very good picture of life in divisional engineers during operations, which will continue to appeal to today's officers and senior NCOs. It is amusingly written in a light style and implicitly shows how Sappers fit in the all arms battle at the sharp end. In particular, 59 Field Company's distinguished

part in the construction of "Amazon" bridge over the River Rapido (together with 7 and 225 Field Companies) during the battle for Cassino is well described.

DJNG

THE WILMINGTON CAMPAIGN AND THE BATTLES FOR FORT FISHER

MARK A MOORE

Published by the Savas Publishing Company, distributed in the UK by Greenhill Books, Park House, 1 Russell Gardens, London, NW11 9NN. Price £8.50 – ISBN 1-882810-19-8

"THE Wilmington Campaign" describes the American Civil War's amphibious operation to close the last remaining Confederate Sea Port once Mobile, (on the Gulf of Mexico) was denied to the South. It covers the construction and subsequent capture of fortifications, followed by the capture of the port itself, on the North Carolina Coast, early in 1865.

By this stage the Federal blockade of the South was very effective throughout American coastal waters. The main thrust of the book is to set out and describes the two Union sea-borne assaults on the forts, in December 1864 and January 1865. The author stresses the extent to which the defences of the outermost fort, Fort Fisher, were inspired by the defences of Sebastopol in the Crimean War. It is established that the Garrison Commander was familiar with Crimean sieges and the designs of defences used there. It is also true that the Crimean War was studied by the American military. Both Generals McDowell and McClellan, who were on the Federal side, went to the Crimea to observe the War and to report back on lessons learned. When, in 1862, McClellan subsequently encountered what he took to be a well fortified position on the Williamsburg Peninsula, his reaction was to send home for his Crimea notebooks and settle down for a formal siege in order to reduce the entrenchments. So the link is established, which will be of interest to students of the Crimean War.

Particularly significant and worthy of mention is the impressive scale of the firepower used by the Union Navy against the fort. In each of two assaults 20,000 shells, with a combined weight of 1,200,000 pounds, were fired into the fort in the space of a few hours. This was a formidable barrage, and must represent the heaviest concentrated bombardment of the war. By way of comparison, around 55,000 artillery rounds were fired at Gettysburg over three days and over a four mile frontage, but there the average weight of projectile was no more than 12 pounds, so the total weight of fire from both sides cannot have been more than 600,000 pounds. Little wonder that the defenders of Fort Fisher were a bit slow in emerging from their "bomb-proofs", and that resistance to the subsequent Union infantry attack from the landward side was muted.

The engagement is also of interest for the inclusion of characters well known from other theatres of the war. Most notably, we find General Braxton Bragg and General W H C Whiting in the Confederate high command. Bragg, a notoriously unlucky general, stayed true to form at Fort Fisher, declining to believe the reports of the gravity of the situation until the day was lost. Whiting, relegated from his 1862 divisional command outside Richmond to command of State troops in North Carolina, put in a strong performance, but was mortally wounded and captured.

The book is well illustrated, with maps depicting "then and now", and the narrative is brought alive with eyewitness accounts. It leaves the reader inspired to walk the ground with book in hand, but sadly not all of the ground is available. More than two thirds of the seaward defences of Fort Fisher have been eroded by the sea, so that "few visible traces remain". The landward face of the fort has survived in better shape, and judicious reconstruction and a Visitor Centre ensure that visitors can orientate themselves. However, with Wilmington around 250 miles south of Richmond and Petersburg, it is a long way to come to inspect a relatively minor battlefield.

In summary, this is an interesting book, but really only relevant to those with a deep interest in the American Civil War. Isolated from the main stream of Eastern Theatre battles as it is, it is very much in the third division of sites to visit. The book is well written and splendidly presented, far better than many monographs. However, for the average reader with less than, say, thirty books on the American Civil War on his bookshelves, this is probably of limited appeal.

KJD

SOLDIER ARTIST IN WARTIME INDIA

JAMES FLETCHER-WATSON

Published by Country Heritage, Windrush House, Windrush, Oxon, OX18 4TU. Price £19.99. 159 pages incl 60 colour illustrations. ISBN 0 9538491 0 4

THIS account by a young wartime Sapper officer of his experiences in India in 1941-45 is interesting in itself. What makes it exceptional, however, are the beautifully reproduced coloured illustrations, for James Fletcher-Watson, already trained as an architect, was (and is) a very gifted artist.

His narrative covers his journeys to and from India, the frantic rush to build modern defence works on India's North West Frontier in 1941–42, and then his years spent as a camouflage expert. This latter posting enabled him to travel much more widely in the sub-continent than most were able to do, and he took full advantage of this to indulge his passion for painting whenever time allowed. He writes in a delightfully easy and open style, and his amusing and sympathetic comments on wartime life in India will strike a chord with many readers, even if his spelling of Indian words is sometimes a little original. From a professional point of view, his account of the invention and development of prefabricated bituminous surfacing, with which he was involved, is of considerable historical interest, for in Burma this material, used for the rapid construction of airfields and roads, was almost as much a war-winning weapon as was the Bailey bridge in Europe.

It is difficult not to feel, however, that his time spent on camouflage was a waste of a rare talent. How much better if he had been employed as an official wartime artist in India and Burma. His watercolour drawings would have given to the British public a far better idea of the drama of the Far Eastern campaign than the rather soulless black and white photographs which were all that were then available. For the author had a very good eye for unusual and memorable scenes, allied to a wonderful sense of colour. Indeed watercolour is the medium which seems to suit best the bright light of India, and the colours alone in his drawings are powerfully evocative of the regions they portray.

This book, which carries a perceptive foreword from General Sir John Stibbon, is strongly recommended to anyone who is interested in India, Sapper history or painting.

IHLG

Explanation of Abbreviations Used in This Journal

110(W) ..... 110 (wheels)
2Lt ..... second lieutenant
AA&QMG ..... assistant adjutant and quarter master general
AES ..... armoured engineer squadron
ACGS ..... assistant chief of general staff
AGC ..... Adjutant General's Corps
Amph ..... amphibious
AVLB ..... armoured vehicle-launched bridge: or armoured vehicle launcher bridge
AVRE ..... armoured vehicle RE
Assault ..... assault
BEF ..... British Expeditionary Force
BG ..... battle group
BP ..... bulk petroleum
Brig ..... brigadier
Bt ..... baronet
Cdo ..... commando
CinC ..... commander in chief
CO ..... commanding officer
comd ..... commander
CRE ..... Commander RE
CVR(T) ..... combat vehicle, reconnaissance (tracked)
DCOS ..... deputy chief of staff
DEC(CSS) ..... Directorate Equipment Capability (Combat Service Support)
DDOR (Engr and NBC) ..... Deputy Directorate Operational Requirements (Engineering and Nuclear Biological and Chemical Defence Equipment)
DGD&D ..... Director General Development & Doctrine
DNA ..... deoxyribonucleic acid
EinC (A) ..... Engineer in Chief (Army)
Engr ..... engineer
EOD ..... explosive ordnance disposal
ERLO ..... engineer recruiting liaison officer
ERLS ..... engineer recruiting liaison staff
GOC ..... general officer commanding
Gp ..... group
HF ..... high frequency
HQ ..... headquarter/s
HM ..... His/Her Majesty
HPTO ..... higher professional and technical officer
Indep ..... independant
Infra ..... infrastructure
ISO ..... International Standards Organization
J4 ..... principally logistics matters
JCSC ..... joint command and staff course
JNCO ..... junior non commissioned officer
JRRF ..... joint rapid reaction force
JSSC ..... Joint Service Staff College
KFOR ..... Kosovo force
kVA ..... kilovolt-amperes
LAND ..... Land Command
Log ..... logistic/s
LSOR ..... Land Systems Operational Requirements
ME ..... military engineer
MGB ..... medium girder bridge
MLC(T) ..... military load class (tracks)
MND(SW) ..... Multinational Division (Southwest)
MOD ..... Ministry of Defence
MWF ..... Military Works Force
NATO ..... North Atlantic Treaty Organisation
OPCOM ..... operational command
ORBAT ..... order of battle
OTC ..... officer training centre
Pam ..... pamphlet
plc ..... public limited company
PPP ..... public private partnership
PR ..... public relations
PRI ..... President of the Regimental Institute
PVR ..... premature voluntary retirement
RA ..... Royal Artillery
RAF ..... Royal Air Force
RAMC ..... Royal Army Medical Corps
RAOC ..... Royal Army Ordnance Corps
RE ..... Royal Engineers
REME ..... Royal Electrical and Mechanical Engineers
RHA ..... Royal Horse Artillery
RHQ ..... regimental HQ
RLC ..... Royal Logistics Corps
R Mon RE (M) ..... Royal Monmouthshire RE (Militia)
RMAS ..... Royal Military College of Science
RRF ..... rapid reaction force
RSM ..... regimental sergeant major
RSME ..... Royal School of Military Engineering
RTR ..... Royal Tank Regiment
SDR ..... strategic defence review
Sect ..... section
SF ..... security force
SHAEF ..... Supreme HQ Allied Expeditionary Forces
SNCO ..... senior non commissioned officer
SO ..... staff officer
Sp ..... support
SSAFA ..... Soldiers, Sailors and Air Force Association
STANAGS ..... Standardization Agreements
STRE ..... specialist team RE
TA ..... Territorial Army
TACOM ..... tactical command
Tech ..... technical
UK ..... United Kingdom
UN ..... United Nations
(V) ..... volunteer
VJ ..... victory in Japan
VLSMS ..... vehicle launched scatterable mine system
WD ..... water development
Wks ..... works
WW2 ..... World War Two
YO ..... young officer