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Secretary & Editor RE Journal	Lieutenant Colonel D N	J Hamilton MRF	Tel: ATN (9) /661 (BT 0163/	82) 2208
Assistant Sac Publications:	Captain I E Borer		Tel: ATN (0) 4661 (BT 01634	842660/82) 2200
Datahasa Managani	Mag I Thomadials		Tel. ATN (9) 4001 (DT 01034	842009/82) 2299 82) 2200
Database Manager:	Mrs J Thornaick		Tel: ATN (9) 4001 (BT 01034	82) 2509
Administrative Officers:	Mrs J Ellender & Mrs I	VI Reddick	Tel: ATN (9) 4661 (BT 01634	82) 2298

All correspondence in connection with editorial matters should be addressed to the Secretary, Publications, Institution of Royal Engineers, Ravelin Building, Brompton Barracks, Chatham, Kent ME44UG. The Institution of Royal Engineers is Registered as a Charity Number 249882.

ATN (9) 4661 (BT 01634 82) 2397

Editorial

As can be seen, we have introduced some colour into this issue of the *Journal*. Clearly most "historic" images will be in monochrome, but the more up-to-date articles benefit enormously from being illustrated in colour. With this in mind, we have two requests. Firstly, if using a digital camera, please save your images at as large a size as possible, JPEGs at 400 dpi are ideal but please do not place them into your document. Secondly, if you are considering an article and know that maps and charts will have to be redrawn and coloured in, please submit your work as early as possible; our deadlines are generous but detail work is always very time consuming.

As always with the December edition, we start with the Engineer-in-Chief's Annual Report to the Corps, in which he summarizes the major developments over the past year and then looks ahead. This characterizes some of our other articles where ongoing projects and their development are described. Major Buckingham keeps us up to date on the BOWMAN programme, Major Tresidder does the same for the new Combined Arms Tactical Trainer and Major Hay has some thoughts on protection against the latest series of rocket propelled grenades. On the technical side, one of our SNCO readers, Staff Sergeant Peel has provided us with an easy to read and informative item on the use of CCTV in Northern Ireland and Colonel Rose and Oberstleutnant Willig complete their Geology series with the story of Operation Sealion, the proposed invasion of England. Major MacLachlan tells us all about the supply of Mines and Explosives and Major Tomlinson describes one of the "odd jobs" that come up from time to time – in his case to head up the Ugandan/Rwandan Joint Verification and Investigation Committee. Whilst we are in Africa, Lieutenant Millbank describes the work of Operation *Silkman*, the short term training teams in Sierra Leone. There is plenty on the historical side too with Brigadier Hooper, Lieutenant Colonel Hartley, Major Grant and Captain Fenwick all submitting stories, histories and anecdotes to fire up our own memories.

Our experiment of publishing letters in the Supplement first has not been an unqualified success – indeed some people have not even noticed the change! We shall persevere however and anyone who has strong views is asked to make them known to the editorial staff. The same applies to general comments on Institution publications. It is hoped that the long promised review of them will take place next year.

Finally, this is the last issue for which Colonel Mike Cooper has collated the Memoirs and the Book Reviews. Mike will now take up his position on Council where I am sure we will benefit from his past experience. From January Memoirs and Book Reviews will be coordinated by the Assistant Secretary, Captain John Borer. A very Merry Christmas to you all and please keep the articles coming. Ed

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Engineer in Chief's Annual Report to the Corps

INTRODUCTION

The Corps has had another truly impressive year during which it has been intimately involved in a range of challenging yet high successful operations. We are widely respected throughout Defence and Government, and we have excellent contacts with industry. It is therefore clear to me that no drastic changes are required, more a "touch on the tiller." In particular, I have identified two strategic themes that I intend to develop in the coming months; they are expeditionary warfare and change management.

Whilst I am confident that the majority of Sappers understand the significant infrastructure engineering capability that is required to enable expeditionary operations, it is not well understood by the wider defence community. The enabling capabilities required to deploy, sustain and recover our forces worldwide have yet to be fully developed and the Corps has a key educational role to play in this process. We will also have to conduct an internal re-balancing of the Corps, consolidating our specialist heavy warfighting capability whilst increasing the general support/infrastructure dimension and this is the subject of our on-going work.

My second area of concern is the large number of Army-wide initiatives due to be introduced over the next few years, each of which will have significant implications for both individuals and the Corps as a whole. These include Digitization, Whole Fleet Management, the Defence Training Review, the Review of Officer Career Courses, the Non Commissioned Engagement and Career Structure Study, and Command and Leadership Management for JNCOs, SNCOs and Warrant Officers. I do not believe that the full impact of the interaction of these various initiatives has been thought through and I have therefore initiated some work within the Corps to address the issue.

Notwithstanding the above, it is clear that the Corps has had another successful year but I am conscious that the pace of life has not slackened and that we all remain extremely busy. Tour intervals have reached more sustainable levels in much of the Corps, although I am acutely aware that a number of pinch points remain. Recruiting is strong and we can look forward to the Corps continuing to grow, if not perhaps as fast as we would wish, as we reach our full SDR orbat.

ORGANIZATION

THE implementation of SDR is nearing completion with the last three squadrons all forming up during 2003. The Regt HQ of 23 Engr Regt and 12 (Nova Scotia) HQ Sqn have begun to form at Waterbeach and an Initial Operating Capability will be declared in March with Full Operating Capability in August. In 2006 the whole Regiment will move to Woodbridge. 10 Fd Sqn (Air Sp) is forming now at RAF Leeming and 30 Fd Sqn will form up by Dec 03 ready to take part in the BOWMAN trial. On the MWF side 522 STRE has now moved to Chilwell and 517 STRE will form in Apr 03 as planned. 55 Sponsored Reserves will be used to form 515, 521 and 50 per cent of 528 STsRE with a target date of Nov 03.

52 Indep Fd Sqn (Air Sp) has become a casualty of the Army drive to reduce manpower liability, in recognition of achievable manning levels, and will not now form. On the positive side however, 33 Engr Regt (EOD) will receive an additional 72 posts over this year and next and DEODS will also grow by 12 posts including five RE. The RETDU will also receive manpower increments over the lifetime of the introduction of TITAN, TROJAN, TERRIER and MINDER.

It has now become clear that the rate at which the Corps will grow in terms of manpower liability over the next year cannot be matched by the throughput of the recruiting and training organizations, even though that continues to increase. We will, therefore, see a worsening of our manning situation until the end of 2003. By early 2004 the worst will be behind us, and things will steadily improve to a position of Manning Balance in 2006/07. My new Corps Manning Policy, published in November, describes in detail how we will manage the shortages that we will face. The policy will ensure that we use our manpower efficiently and effectively so as to minimize the impact of undermanning. This is a short-term problem brought about because the Corps is still growing as a result of SDR and I remain confident that we will ultimately meet our manpower liability.

OPERATIONS

THE average tour interval for the Corps has decreased from 13 to 10 months in the last year.

Given that the tour interval for CS Engr Regts is an average of 24 months (excluding 26 Engr Regt) it is clear to see the burden of pain has increased for the rest of the Corps in the Front Line Commands. TA units continue to produce a vital backfilling of officers and soldiers for deployment on enduring operations (for example, over 30 are currently deployed in the Balkans). Sensible contingency planning has begun to prepare for possible operations in the Middle East, although (at the time of writing) no decisions have been made to deploy UK forces. Preparations for operations in the event of a national Fire Brigade Union strike, OP *Fresco*, are also in hand.

Kosovo. To allow 22 Engr Regt to recover and train to support Op *Fresco* the changeover to 26 Engr Regt Group was advanced by four weeks to the beginning of October. The orbat has been refined and now consists of RHQ, HQ Sqn and a CS Sqn, supplemented by an EOD Tp, HQ CRE (Wks), STRE (Wks), and a Geo detachment. The pan-Balkans concept is proven and is continuing to be effective. The focus in Kosovo remains internal security with the Search Cell from 33 Engr Regt (EOD) controlling the operations of battle group all arms search teams.

Bosnia. A CS Sqn provides engineer support to both MND(SW) and the UK battle group. This is seasonally adjusted to support an armoured or mechanized battle group, and the changeovers occur in April and October. Additionally an EOD Tp and an STRE (Wks) (-) support MND(SW). Support manpower has been provided throughout the year, primarily from MWF, to assist in the continued infrastructure effort resulting from force structure and base rationalization.

Afghanistan. HQRE 3 (UK) Div and elements of 36 Engr Regt deployed on Op *Fingal* as part of the International Security Assistance Force (ISAF) to Afghanistan. They deployed at the turn of the year to assist in providing a secure environment for the Interim Administration, thereby allowing political and diplomatic dialogue to continue. Specialist support was provided by 34 Fd Sqn (Air Sp), as the Lead Air Support Squadron (LASS), 49 Fd Sqn (EOD) and a large component of MWF. 36 Engr Regt Group were relieved by 26 Engr Regt, who in turn handed over to 60 HQ Sqn and 48 Fd Sqn (Air Sp). It is planned at the time of writing that 45 Fd Sp Sqn will take over from them with the aim of maintaining or drawing down as appropriate the UK contribution to ISAF. Throughout this operations, the concept of a Joint Force Engineer has proved a success and the appointment has been double hatted as DCOMDBRITFOR for the second half of the year. In March, 59 Indep Cdo Sqn and 49 Fd Sqn (EOD)(-) deployed to Afghanistan on Op Jacana to provide close and general engineer support to 45 Cdo Gp, conducting warfighting operations against remaining pockets of Al-Qaida and Taliban (AQT) fighters. The force has now returned to the UK, after successfully dominating the hills of Afghanistan, and preventing AOT activity.

Falkland Islands. The maintenance section is due to increase to a level commensurate with the work required on the equipment held in theatre. The annual squadron level construction project for 2003 will not take place but one is still planned for 2004.

Northern Ireland. The pace of life and activity, with "normalization" works and support to Public Order, has resulted in the forward basing of the Roulement Engineer Squadron for both Summer and Winter tours. Roulement dates have been realigned to mid-March and mid-September to ensure that one squadron can cover all the marching seasons, thus reducing the training bill.

Sierra Leone. Op *Silkman* has now finished, and all UK operational support has been withdrawn. The UK led IMATT continues, with 3 x Clks of Wks serving in OCE posts. The Corps also provides the CO of the Sierra Leone Engr Regt, a one-year Loan Service post.

RAF Operations. RAF deployments have continued to be supported by 12 (Air Sp) Engr Bde, who provide a wide variety of vital support as required to RAF Deployed Operating Bases (DOB). A small maintenance team is permanently based at each Op *Resinate* DOB.

Collective Training. Combined arms training for many units is now directed by the FRC. Those 3 (UK) Div units in their Training Year carried through a demanding programme of training that progressed to formation level training at BATUS. However, 1 (UK) Div's planned training was severely disrupted for both financial reasons and the impact of preparations for the fireman's strike.

Great emphasis has been placed on the development of Joint, Combined Training. Although this has not led to joint or combined exercises this year I expect to see increasing opportunities for Sapper units to exercise in all components of a Joint Force, and alongside allies, in the future.

It is important to remember that exercises do not inevitably result in the most effective training, and studies are now underway which seek to ensure that the planned exercise programme offers maximum training value and not simply maximum time spent on exercise. The burden of a busy training year on units is fully recognized, particularly for the majority of units outside the FRC who support "training years" every year, as well as meeting operational commitments and maintaining force elements at high readiness.

The scope of the special-to-arm construction exercises, their austere conditions and remote locations, continue to provide units with challenging and worthwhile training. This year units exercised at Sqn or Sqn(-) level in Cyprus, Kenya, Belize and Norway. Nevertheless, LAND Command is under pressure to reduce its overall expenditure on these OTXs, and as a result the scope and number of RE special-to-arm OTXs will be under review over the coming months.

RESERVE FORCES AND THE TA

THE RE TA regiments and squadrons continue to train for their operational roles in support of the RN, the ARRC and the RAF. A review of the Post-SDR RE TA Establishments has been completed but the requirement for a third PSI in RE sub units was not agreed. Recruiting is picking up again with the RE TA currently at 88 per cent strength and the RE TA recruit courses (RESTART) well attended.

The RE TA Training Plan is beginning to show positive results with the first RE TA soldiers qualifying at Class 2 level under the new system. Building on this success a similar plan has been developed for RE TA officer training which will provide identifiable and achievable goals for all stages of a full career framework. Career courses continue to be well attended at RSME and the "training for appointment" aspect of the plan is taking effect.

The HQ RE TA main effort has been working to ensure as smooth a transition as possible to Pay 2000 for the TA. In addition to aspects peculiar to the RE TA, many lessons learned during the regular transition to Pay 2000 have been addressed.

Over the past year, 117 individuals (4 per cent

of the RE TA) have undertaken a period of mobilized service in support of operations, on Full Time Reserve Service (FTRS) or on "S" Type engagements. A strong team, under the command of MWF (V), deployed on Op *Tosca* to Cyprus to carry out essential health and safety work and construction tasks in support of HQ UNFICYP, and for the first time TA EOD personnel provided direct support to Op *Midway*.

ENGINEER LOGISTICS

THIS has been one of the most logistically demanding periods for the Corps since the Gulf War. The movement of men, equipment and materiel from Exercise Saif Sareea II straight into operations in Afghanistan proved particularly challenging. The airbridge to Afghanistan was the only viable conduit for engineer materiel to the theatre and throughout the operation engineer materiel has been high on the priority list for air movement with over 1000 tonnes of engineer construction materiel being flown into Kabul in the first six months. Afghanistan came in addition to other urgent and increasing support requirements for the Balkans, Northern Ireland, Cyprus, Oman and a number of other UK commitments.

Supporting these diverse and demanding commitments has meant that the Corps' logisticians within the supply chain have had to juggle resources and priorities throughout the busy year and it is a very real achievement that the vast majority of demands from front line units have been met on time. The period has demonstrated that the Corps must continue to place high calibre, operationally experienced personnel into key positions throughout the supply chain if it is to ensure that its tasks are properly resourced.

MILITARY ENGINEER SERVICES

OPERATIONS, particularly enduring commitments, remain a heavy commitment on the relatively small pool of MES and related units. Reductions in support to both the Balkans and Sierra Leone were overtaken by new MWF commitments to Afghanistan. Re-rolling of CRE (Airfields) is now complete and ahead of this process CRE (Airfields) has been fully engaged in supporting the RAF both on Main Operating Bases in the UK and on deployed operations. The current level of commitment to Military Works Areas will remain until the temporary field accommodation project in Kabul is complete and the future of the Balkans estate is decided. Property Management support continues to be provided to units in Belize, Brunei, Kenya and Nepal by MES personnel.

Prompted by the changes to the management of the MOD estate that will result from Project *Alexander*, I asked MES to conduct a review of CEng, GE and Clk Wks manning. This is to ensure that we have got the balance between experience gaining and operational posts right and that the Corps is positioned to meet not only the SDR enhancements as they come on line but also retain valuable experience gaining posts in the new Defence Estates organisation.

MES has been involved in the preparation of Joint Warfare Publications on Infrastructure on Operations and Joint Combat Service Support Functions. They have also been closely involved in the development of the Infrastructure User Requirement Definition for the Contractors on Deployed Operations project (CONDO). Internationally, close links have been forged through bi-national Logistics Working Groups with our French, Netherlands and German allies.

The Works Inspectorate continues to be heavily committed and future inspections are to be planned in conjunction with the Inspectorate of Engineer Resources in order to provide a more complete inspection.

ROYAL ENGINEERS (GEOGRAPHIC)

MUCH work is being done by the Geographic Engineer Group on developing new systems and methods of delivering geographic information which encompass advances in technology to meet evolving Defence requirements.

In addition the past year has been an extremely busy one for 42 Engr Regt (Geo) with personnel deploying to Op Veritas and support also being provided to Sierra Leone, Northern Ireland and the Balkans. In addition, the regiment has undertaken other live tasks with personnel deploying to Alaska to provide advice and final on-site quality control to US Army teams undertaking airfield surveys and 13 Geo Sqn carrying out a tasking for the Kenya Survey Department. 135 Indep Geo Sqn RE(V) carried out the Group's annual operational requirement to conduct a boundary survey for the British Sovereign Base Areas in Cyprus. The regiment has also deployed a squadron to Norway for a technical exercise working alongside the Norwegian Military Geographic Service.

The Royal School of Military Survey, in conjunction with the Group's Training Development Team, has been working with a number of universities to gain accreditation of Foundation Degrees for RE Geographic Technician trades. The intention is that Geographic Technicians commencing their initial Class 2 course in 2003 will be awarded a degree on the final completion of their Class 1 qualification.

RECRUITING, MANNING AND CAREER MANAGEMENT

Officer Recruiting. The popularity of the Corps as a career of first choice for high quality officer candidates, has increased in the last 18 months. This has been the direct result of the support that regiments have afforded to my recruiting strategy, for which I am grateful. We have also adjusted the method of attracting and nurturing the quality officer cadet at Sandhurst. Both the efforts made in the Regimental Visits and additional nurturing functions are, I am pleased to see, directly contributing to the Corps being the first choice for many at Sandhurst. We are currently reviewing the changes to the Choice of Arm Procedure for 2003 and they will no doubt bring a new set of challenges.

Soldier Recruiting. On the soldier side recruiting is also on the upturn. The Corps' Recruiting Action Plan (RERAP) and the setting up of three new Regimental Recruiting Teams (RRT) is having a positive influence on recruiting figures and I am pleased to report that currently we are recruiting above our target. This recruiting "success" however is tempered by the lack of recruits into technical employments. Our "Special Recruiters" continue to target those colleges and schools with a technical curriculum to increase the students' awarenes of what the Corps has to offer. Significantly, our target for the current year is the highest for some years and moreover, the Apprentice and Junior Entry target is over 100 per cent higher than previous years. Iniatives such as "Look At Life" courses and "Insight Days" are extremely worthwhile attractors to the Apprentice and Junior target group and I wish these to continue for the foreseeable future. I am most grateful to units for their support to these activities and to the manning of the RRTs and Special Recruiter posts.

Soldier Career Management. The reorganization, internal move and expansion of RE MCM Div's Soldier Wing into Secretariat, Posting and Employment Sections was finally completed earlier this year. The reorganization has included the introduction of a comprehensive Annual Career Review process which, combined with the establishment of Unit RCMOs, means that our soldiers now have access to the best career advice possible. In particular, the introduction over the past two years of the Annual Career Advice Notice (ACrAN), the product of the Career Review Panels (CRP), has been well received by Commanders, RCMOs and soldiers alike.

Soldier Manning. I have already made it clear that with the size of the Corps continuing to increase as a result of SDR significant undermanning within the lower ranks in units will remain. This will be most noticeable where restructuring has contributed to creating shortfall trades such as ME (Ftr), ME (C3S), ME (Elec) and ME (Res Spec). Spr and LCpl undermanning will rise to between 10 and 15 per cent in 2003 and 2004 before increased throughput within ATRA starts to improve the situation. Further improvement in retention will be one of the keys to re-establishing full manning.

Soldier Promotion. The overall volume of promotions continues to reflect the SDR increases. The total volume of promotions in the past three years, since ramp up began in 2000, has averaged 144 per cent of the similar average up to 1999; a total of 1314 promotions in 2002 compared to only 939 in 1999. I anticipate that promotion numbers will peak next year before stabilizing at a level similar to those of the step-change achieved in 2000; that is about 1200 annually (or about 134 per cent of pre-SDR volume).

Soldier Confidential Reports. Responsibility for generating, completing and submitting CRs rests with the chain of command. Whilst in most cases this responsibility is met there has been an increase in the number of CRs submitted later than the due date. This places an unacceptable burden on RE MCM Div that I look to the chain of command to redress.

Employment Regulations. The 2002 Career Employment Structure (The Blue Book) has recently been issued. Notably, it includes the requirement for most LCpls, who enlisted after 1 Jul 97 and who are in the Artisan Stream, to have two Class 1 trades before they can be promoted. Those affected will be advised by RE MCM Div in their ACrAN and should be encouraged and make every effort to attend HET early.

Notice of Posting. Over the past year 68 per

cent of posted soldiers have received more than four months notice (against the APC target figure of 65 per cent). This represents a significant improvement over recent years. RE MCM Div is poised to improve this still further.

Direct Entry Officers. This year the Corps again reached its target intake of 60 officers. The career environment for this new generation of officers is evolving rapidly and we have taken stock of junior officer manning policy. A new policy will provide a sound structure for career development and better meet the needs of the Corps. The focus now shifts to an examination of the career management of majors. Changes in promotion rules to major and lieutenant colonel, along with the introduction of the Initial Command and Staff Course will generate a more level playing field and we must ensure that we take advantage of the opportunities, irrespective of specialization. Recognizing the importance of this career stage, a fourth desk officer has been added to the Officer Wing to focus on majors. This enhancement will also allow the effective introduction of Formal Career Reviews in 2003 and other career management initiatives. Significant changes in officer career management and training opportunities are upon us. It is essential that serving members of the Corps understand the impact on themselves and on those officers for whom they are responsible. PVR is within forecasts at present although this may be as much a reflection of reduced civilian opportunities as the success of our retention efforts. Nevertheless, our people are as highly valued outside as within. We must ensure that we exploit the forthcoming changes to keep the Corps an organization of first choice.

Late Entry Officers. LE officers continue to make a significant contribution to the Corps, both in traditional employments and, increasingly, in hitherto "mainstream" posts as well helping us to meet current manning pressures. The LE career structure continues to evolve and will be enhanced, in time, by the best and most appropriate features of the changes being applied to the Direct Entry community.

INDIVIDUAL TRAINING

BUDGETARY pressures cause ever increasing scrutiny of Individual Training Requirements and this year the LAND Individual Training Board (LITB) tasked Arms Directors of the technical Corps (RE, R SIGNALS, REME and RLC) to review them and present the outcome to a one star tribunal. I presented the Corps' needs, based on the outcome REESR and supported by the evidence of the very high proportion of sappers on recent deployed operations when compared to the size of the Corps. I explained the need for multi-skilled military engineers so that units are capable of delivering both the flexible operational capabilities currently in such high demand and the engineer support required for warfighting. The tribunal accepted my assessment. However, ATRA, under more financial pressure than ever, has proposed that Phase 2b (artisan or trade) training could be delivered as Phase 3 training (after a soldier has been taken on the strength of a field unit). I will resist this proposal primarily on the grounds of its significant and damaging impact on the future operational capability of the Corps.

Key tasks completed by the Royal Engineers Training Development Team (RETDT) include External Validation of the Royal Engineers Troop Commanders Course, Job Analysis of the Professional Engineer Employment, and course design work on behalf of the RSME. Ongoing work includes the review of Close Support Training, Job Analyses of the Air Support role and the driver requirements for dump trucks and the mapping of the RSME delivered courses against the Joint Essential Task List and Mission Essential Task List (Land). RETDT is also becoming increasingly involved in supporting Training Needs Analysis (TNA) for new equipment programmes.

I include a short update of the following Army studies that will, or could, affect individual training:

- The Defence Training Review (DTR). DTR, completed last year, recommended a number of training rationalizations. One proposal was to establish what is now referred to as the Defence Explosives and Munitions School (DEMS) at Kineton as part of a wider Defence College of Logistics (DCL). Training requirements which might be delivered in these establishments are being examined. For DEMS this includes consideration of how DEODS courses and possibly National Search Centre courses might be delivered.
- Command Leadership and Management (CLM) Training. An Army review of CLM training for NCOs and WOs has been completed. The proposals will lead to the cessation of all EFP training in late 2003, and introduction of new CLM courses at three stages in a soldier's career (JNCO, SNCO and WO). New courses will begin in early 2004. RETDT are currently mapping the new training requirements against current course content. I anticipate that the

current content of JNCO Cadre, JCC and RE SNCO courses will meet most, if not all, of the requirements of CLM but there may be some reductions in course length as a result of those training elements being met centrally. CLM training for all WOs is a new requirement, so the outcome is less clear.

- Non Commissioned Engagements and Careers Study (NECSt). NECSt is reviewing terms and conditions of service and will compare existing arrangements based on the 22 year career with a number of alternative options such as staged or phased careers up to 35 years service (for some). Arms and Service Directors are being consulted throughout, and it is not intended to force a "one size fits all" solution. This is a long term Study and decisions on significant changes are not expected quickly.
- Army Wheeled Driver Training Study (The Balfour Study). The Balfour Study concluded that, despite past attempts to address the issue, wheeled driver training in the Army has lacked overall coordination, a clear focal point and a defined Statement of Training Requirement (SOTR). The study recommended that DRLC should become the Army's All Arms proponent and customer agent for all wheeled driver training and for compiling a pan-Army driver training SOTR. It recommended that, subject to the outcome of further work, a Defence Driving Authority should be established from Apr 03 to take on elements of road transport policy currently controlled within the DLO. It also recommended that all soldiers should gain a Category B licence as a core military skill. The resourcing for, and timing of, this training is still being staffed and this recommendation may take time to be delivered.

The Corps continues to make good progress with the introduction of NVQs and a number of other types of qualification. The provision of access to civilian accreditation in all its forms, including qualifications and professional body memberships, is important for the Corps, not least because of its impact on recruiting, retention, professionalism and resettlement. To ensure that it remains a growth area serving the Corps' needs and aspirations, I shall endeavour to retain it under my control once the RSME PPP process has been finalized.

RSME

THE RSME Main Effort (in common with the rest of the ATRA) is to meet the Army's requirements for trained Phase 2 students, soldiers who have recently passed out of basic training and who have yet to be posted to their first unit. The shortfall in recruiting last year is starting to

show through in RSME output this year, and despite low wastage rates and an excellent first time pass rate RSME output will fall short of targets by around 15 per cent in 2002/03.

- **RSME PPP.** Following a detailed evaluation of Best & Final Offers (BAFO) the RSME PPP Project Board was able to recommend a Preferred Bidder. At the time of writing, the recommendation to proceed into detailed negotiation with the Preferred Bidder is subject to MOD Investment Approvals Board (IAB) and Ministerial endorsement. Current planning assumes Financial Close in Autumn 2003 and Contract Implementation in early 2004. The identification of the preferred bidder required verv considerable effort from the RSME, undertaken without respite from the demands of normal business. PPP is a great opportunity for the RSME, and I am confident that it will provide a high quality, secure future for the Corps' individual training base.
- Professional Engineer Training (PET). The PET Courses continue to offer a route to Chartered Engineer (CEng) for officers with appropriate Bachelor degrees. I expect approval of the MSc in Construction Engineering for IMechE and CISBE. In addition a route to Incorporated Engineer (IEng) for Clk Wks (E) has been negotiated with the Institute of Incorporated Engineers. A similar scheme for Clk Wks (M) is currently under consideration by CIBSE.
- Combat Engineering. The Combat Engineer School continues to feature strongly as a leading ATRA School when measured against objective Performance Indicators. The delivery of ME (Cbt) Cl 3 recruit output has been particularly strong, based on improving Phase 1 output, an increased number of transferees, re-enlistments and low wastage rates. The ME (Cbt) Cl 3 is to be accredited to deliver a Civil Engineering Construction Operative NVQ for all Sappers.
- **Defence EOD School.** There is considerable operational pressure on the UK EOD community with a corresponding premium placed on EOD training. DEODS, already one of the busiest schools in the Army Training and Recruiting Agency (ATRA) has increased its Advanced EOD course places by 50 per cent to meet demand, primarily from 33 Engr Regt (EOD).
- Capital Works. Despite budgetary constraints, much effort has been directed towards maintaining and improving the infrastructure within Brompton Barracks. In particular, two new blocks of Single Living Accommodation (SLA), each with 36 bed spaces, and a new gymnasium and sports hall are due for completion in Dec 02, greatly improving the welfare of both students and permanent staff alike. Recent visitors will also have noted the new barracks entrance, enhancing the aesthetics.

DOCTRINE

I HAVE re-organized Engineer 2 with an SO1 Force Development (FD) replacing SO2 CMob. He will deal with doctrine and international work. The branch continues to ensure that appropriate engineer input is provided to the development of Army, joint and multinational doctrine and that our capabilities are understood and represented at all levels. Among the important areas covered this year have been:

- **Strategy for the Army.** SFTA work continues examining the future structure of the Army and the Royal Engineers.
- Future Rapid Effects System (FRES). The branch has been closely involved in work on developing concepts of employment for FRES, the equipment solution to providing a Rapid Intervention/Manoeuvre Support (RIMS) capability. The FRES ISD is 2008 for an initial capability. It is intended that Engineer capabilities provided for heavy forces (protected gap crossing, protected digging etc.) will also be provided for medium forces in RIMS.
- NATO Engineer Doctrine. Development of NATO Engineer Doctrine continues.
- Joint Engineer Doctrine. The preliminary Joint Force Engineer doctrine publication developed by HQRE Th Tps, whilst accepted by PJHQ as that required for operations, is awaiting endorsement pending publication of the NATO Engineer Doctrine.
- **Command and Control of Engineer Tasks.** A rewrite of Military Engineering Volume 1, Part 3 is currently underway. The revised document will provide an All Arms guide to the planning and control of RE tasks up to Divisional level.
- The Engineer Intelligence Handbook. The final draft is now on circulation.

A number of other papers on subjects as diverse as engineer recce, diving, urban operations and obstacles have been produced in order to inform all arms doctrine development.

EQUIPMENT

CLOSELY linked to doctrinal work is my role as Second Customer dealing with the user aspects of new equipment. Much progress has been made over the past year. The TITAN and TRO-JAN programme is progressing well and the first prototypes will be rolled out on 20 Feb 03. They will then go to RETDU for extensive trials; the ISD remains Dec 2006. TITAN and TROJAN are based upon an upgraded CR2 and will have many capabilities to which the rest of the CR2 fleet aspire. The Breaching and Dozing Capability (BaDC) programme is looking at a replacement for the in-service mineplough and though it is not as mature as the TITAN and TROJAN programme it is running in parallel and will have the same ISD.

- **TERRIER.** The air-transportable replacement for CET, TERRIER, has an ISD of 2008. In August this year a contract was let with Royal Ordnance Defence for 65 vehicles. The Corps will be getting a very capable and reliable vehicle.
- Air Portable Ferry Bridge (APFB). A contract has been let with Williams Fairey Engineering Limited for the APFB. It has had problems in User Trials and a "get well" package is in place. The system will enable light and medium forces to deploy an airportable/air droppable 14m bridge, an air transportable 28m bridge, and a RO/RO ferry, all at MLC 35. The complete system is based on MGB technology and carried on DROPS but the basic 14m bridge can be towed on special to role trailers behind light vehicles.
- Logistic Support Bridge (LSB). The LSB is based upon the Mabey Johnson Compact 200 bridge though with modified ramps. It was accepted into service in December 2001. A standard set provides crossings of 57.9m at MLC 80(T) and 51.8m at MLC 100(W). It also comes with a span junction set and a distribution beam to allow 2-span builds, although it does not have an integral pier or pontoon.
- Two Span Bridge (Pontoon) (TSB(P)). The development of the TSB(P) for use with general support BR90 is being carried out by Vickers Bridging and User Trials are underway. Its ISD is in 2004 and it will allow a 62m crossing at MLC 72(T) and MLC 110(W). It is moved on 4 DROPS from which it is launched and constructed by a team of 12 men.
- •MINDER. Our vehicle-based mine detection capability will be divided into Route Proving (RP) and Recce elements. It is intended that MINDER (RP) with an ISD of 2006 will provide an integrated capability to detect, neutralize and mark mines in support of route opening and proving operations. MINDER (Recce) with an ISD of 2010 will provide the capability for engineer recce to locate the edge of mined areas and to act as pathfinders for critical equipments.
- **Counter Mobility.** Turning to look at counter mobility the story is mixed. On the positive side the Area Defence Weapon programme continues with an ISD of Dec 05, though the numbers have been reduced as a savings measure. The results of the Counter Mobility Balance of Investments analysis made a compelling case for ATk mines but unfortunately this has not resulted in the recovery of any cancelled programmes. It is worth reminding you that under present plans the only AT mines in service post-2006 will be: SHIELDER, Area Defence Weapon, MLRSdelivered AT2 and SI Barmine for local protection.
- C Vehicle PFI. Contract award will be in Mar 03 and Full Service Commencement 12 months later in

Mar 04. During the 12 month interim period a closely managed Roll-Out-Plan will be in place designed to cause minimal disturbance to units or the FRC.

- C Vehicle Procurement. C Veh procurement has continued to run in parallel with the PFI and the average age of the Corps fleet is younger than ever before. MWT has been issued to units, MDT ISD was declared in August and is waiting issue. The new Plant Trailer is held in Ashchurch and the first units are receiving delivery. The LWT contract has been signed with JCB who begin manufacture before Christmas to meet an ISD of Jul 03.
- Temporary Deployable Accommodation (TDA). TDA, previously called Expeditionary Campaign Infrastructure, had been split into 2 Tiers. Tier 1, an early entry capability based on a modular tented system, and Tier 2, a long term capability based on semi-permanent structures similar to those now deployed in both Bosnia and Kosovo. Tier 2 has now been subsumed by the Contractors on Deployed Operations Project (CONDO). This leaves Tier 1 as the TDA early entry capability. It will be used for deployments exceeding 1 month and generally no more than 8 months up to a maximum of 18 months. Tier 2 will be expected to replace tier 1 at the 8month point if the deployment is deemed sufficiently enduring to warrant it. ISD remains 2004.
- **Deployable Engineer Workshop System (DEWS).** DEWS, ISD 2004, will provide a fully integrated modular system to be used by deployed Fd Sp Sqn for repair and manufacture in the field.
- **BOWMAN.** The BOWMAN and Digitization Stage 2 (DS2) programmes have gathered considerable momentum in the past 12 months. Considerable work has been done with HQRE Th Tps in order to prepare for 26 Engr Regt's conversion in early 2004 and subsequent units' conversions thereafter.
- MAKEFAST. The Engineer Battlefield Information System Application, MAKEFAST, will be a set of software tools hosted on BOWMAN infrastructure. It will assist combat engineers in the planning, recce, design and command and control of mobility, counter mobility and survivability/sustainability tasks. Its planned ISD is early 2006 in order to take advantage of the BOWMAN conversion programme.

REGIMENTAL AFFAIRS

RE Museum. Following extensive work in the last year, the Army Management Consultancy Services (AMCS) visited the Museum in June to brief its staff on the way ahead. They concluded it had inherent strengths in its Designated status, its reputation and the extent of the MOD's support, as well as that of its staff and supporting committees. They also recognized that it would take at least two years to implement a plan to enhance its

reputation. Work on this challenging project is now in hand. The tremendous fund raising efforts by the Corps, the Friends and the Foundation have enabled progress to be made and will continue to be central to the development of the Museum. Highlights of the year have been a visit by HRH The Duke of York, the very popular schools programme (which has attracted over 1000 children to date) and a busier than usual Chatham Veteran's weekend. As far as other routine business is concerned over 1000 research enquiries have been received and work continues on the audit of the 3300 items in the collection.

RE Band. Until September this year the Corps Band carried out 126 engagements before moving to Cyprus on a roulement tour. They return to UK just before Christmas. Three-quarters of their engagements are in direct support of the Corps. Highlights this year have been a Kneller Hall Orchestral Concert of The Messiah, a Grand Concert at Leeds Castle and Beating of Retreat at the Tower of London; the latter to raise funds for the RE Museum. The band was again in the recording studios to produce Bandstand Favourites III, the sequel to a popular series.

RE Association. The REA continues to provide support to the retired sapper, his spouse or widow and their dependent children who are experiencing hard times. Last year the number of cases the REA assisted was almost 1,100 at a cost of £390,000. About two-thirds of this comes from the serving soldier who through his generosity is helping those who are suffering "severe financial distress". The range of types of assistance given to those in need continues to grow. The purchase of electric-powered vehicles, bath lifts and stair lifts has helped to ease the suffering and discomfort of those elderly former Sappers who have served their Corps and country and are now asking for assistance to ease the difficulties experienced with old age. Apart from benevolence the REA continues to have Veteran Weekends and Family Events around the UK, which are much enjoyed by all who attend. The formation of "Functional" branches continues to broaden the REA membership base with many applications to join the new Junior Leaders, Survey, Armoured Engineers, Postal & Courier and Bomb Disposal branches.

Headquarter Mess. Following the refurbishment of the mess accommodation and the partial upgrading of the public rooms, subsequent work was found to be necessary to the lower anteroom. This involved major structural replacement of the ceiling and complete redecoration. Work commenced in January 2002 and was completed at the end of May 2002. Leading on from the structural refurbishment work the mess has increased the facilities it can offer. Officers can now take advantage of a fitness suite and sauna situated in the lower part of the mess and also an Internet room sited in a room behind the receptionist's office. A programme of repair and restoration of Corps silver and Corps paintings is in an advanced stage of progress. Sales of surplus port and wine have been very popular and once complete will bring stocks to the level required by the Corps for the foreseeable future.

Adventure Training. Over the past year the Corps has provided financial support to those taking part in adventurous training expeditions and challenging pursuits. At the time of writing over 35 trips have been mounted. These included trekking in South Africa, Kenya, the Atlas Mountains, Spain and France; skiing in Austria, Bavaria, Italy, and Canada; running in Morocco, Qatar, and Scotland; diving in Belize, the Red Sea, the Bahamas and Gibraltar; mountaineering and climbing in Peru, France, Switzerland, Italy, Swaziland and Spain; parachuting in the USA and sailing in the Scilly Isles, Kiel, Italy and the USA.

Corps Sport. In football 28 Engr Regt won and retained the Major Units cup, defeating The Kings Regiment 2-1 in a hard fought final. 42 Engr Regt (Geo) again reached the Minor Units Final going on to defeat JSU NI 1-0. The Corps team also had a very successful year culminating in the winning of the Corps League and the Quadrangular Trophy. 42 Engr Regt (Geo), last year's Major Unit hockey champions again reached the final but were sadly beaten by the Royal Irish Regiment 2-1. In rugby 42 Engr Regt (Geo) once again reached the Army Minor Units final but went one better than last year, beating the RAC Centre 24-15. Corps boxing continues to prosper under WO2 Chadwick's stewardship with a number of high profile matches during the year culminating in an invitation to join the British Police team on its 2003 tours of Canada and Spain. Unfortunately 9 Para Sqn were unable to defend their Army Minor Units boxing title due to operational commitments. In individual skiing, Spr Gilbert won the National & Army junior 15km biathlon title and Spr Allen won the Army men's 10km individual. Both soldiers are from 28 Engr Regt. The Corps skiing team triumphed in the Inter-Corps 15km cross country championships with 35 Engr Regt placed 2nd in the Major Units. Moving on to running, SSgt Murney won the Army individual marathon at Manchester in a time of 2hr 36mins. In the Army Golf Championships Cpl Loome of 39 Engr Regt defeated LCpl Churchill, also of 39 Engr Regt, to become the Army Matchplay Champion for 2002 in the first ever all sapper final. This is certainly the golf title to win! The Inter-Corps team championships followed and again the Corps triumphed beating the RLC in the final four matches to one. The team was Lt Cols Dick Jenkinson and Martyn Allen, SSgt Lazlet of 32 Regt and Cpls Loome and Churchill. In Rugby Union a Corps women's team for the first time entered the Army 7 a-side event. Corps shooting had another busy and successful season with a second in the Inter-Corps Target Rifle competition. Cpl Griffiths was selected for the Army shooting team that toured Canada and the veteran Capt Camp retained his place in the Army pistol team at the age of 59! In the minor sports the Corps basketball team in Germany won the Inter-Corps event. Corps tennis is flourishing and bade farewell recently to one of its longest serving and key members in Brig Craig. The Corps Windsurfing team led by Maj Gidney, won the Army championships at Weymouth with WO2 Brooks of 101 Engr Regt (V) taking individual honours. Finally, a new sport has been accepted into the fold, the Corps Motorbike club based at Minley but open to all, plans to race in 2003.

Military Secretary Appointments, Honours and Awards. HM The Queen has approved the appointments of Lieutenant General K O'Donoghue as Colonel Commandant in April 2002 in succession to Major General J A J P Barr CB CBE, Major General J D Moore-Bick as a Colonel Commandant in Jul 02 in succession to Major General M P B G Wilson and Air Marshal Sir Jock Stirrup KCB AFC as Honorary Colonel 73 Engineer Regiment (V) in Apr 02 in succession to Air Chief Marshal Sir Richard Johns GCB CBE LVO. Brigadier D R ff Innes, Engineer in Chief (Army) was appointed Aide de Camp to The Queen on 11 Feb 02.

Military Secretary appointments of senior officers were: Lieutenant General K O'Donoghue CBE to be Deputy Chief of the Defence Staff (Health) in October - a new appointment. Brigadier P A Wall CBE to be GOC 1st UK) Armoured Division in January 2003 and Brigadier D R Bill to be GOC UK Support Command (Germany) in succession to Major General J D Moore-Bick CBE in late 2003. Brigadier A E Whitley CBE to be Comd Liaison Team ARCENT in Nov 02, Brigadier J P Hoskinson OBE to be ACOS Pers HQ LAND in Dec 02 and Brigadier A C Mantell OBE to be Director "Pay as you Dine" from Dec 02. On promotion to Brigadier: J W R Thorn to be Chief Engineer HQ ARRC, S F Sherry OBE to be Military Special Defence Advisor to the Czech Republic, I M Caws OBE to be Director Army Estates Organisation, J R Durance to be Director Academic Operations NATO Defence College and A D Macklin to be Director Deepening Smart Acquisition.

During the past twelve months the number of honours and awards conferred on serving members of the Corps includes: the award of a KCVO to Col Sir John Timmins OBE TD, the CBE to Brigadier P A Wall and 3 x OBE, 18 x MBE, 1 QGM, 1 QCVS and 1 QCB.

CONCLUSION

At the time of writing it remains unclear what challenges we are likely to face in the year ahead. Our success has, I believe, always been based on three key factors: solid foundations, sound preparation and first class leadership at all levels. These remain our strengths and I am confident that the Corps is well placed to meet whatever comes our way.

A Visit to Indo-China

LIEUTENANT COLONEL A J HARTLEY



The author was a wartime engineering cadet at Loughborough and was commissioned into the Corps in 1947. After a tour in South Wales as a GE, and completing No 18 Supplementary Course, he was posted to Malaya in 1951 as GE (Negri Sembilan) and later as No 1 Tp Comd, 75 Malayan Engr Sqn. It was whilst in this latter post that he was attached to the French Engineers in Indo-China shortly before the battle of Dien Bien Phu. The next few years were mainly academic; instructing at AAS Chepstow and then doing the Long Engineering Course at Chatham followed by an instructional tour with the E&M School. He then became OIC Engr Base Wksp in Singapore and worked on tasks for Op CROWN and the Borneo campaign. He then served in Barton Stacey, Gibraltar, Hong Kong and East Anglia before going to NATO HQ at Naples as Lands Officer (Pipelines). He retired in 1980 and he and his wife formed a company that was hired to assist with MoD pipeline projects in the UK. He finally retired in 1993.

INTRODUCTION

ON seeing the requests in The *Journal* and The Pickaxe for "50 Years On" articles, most people will immediately have thought "Korea".

In 1952, I was in FARELF based in Malaya which of course had its own problems at that time. There was however another war going on although admittedly the UK had no involvement. The French were fighting the Vietminh (The Vietnamese Independence League), in their colony of French Indo-China. Although a simplistic explanation, this eventually escalated into the Vietnam War with the United States assisting South Vietnamese forces to try to oust the Viet Cong (The Vietnamese communist guerrilla forces). Once again there was no British involvement, although Australia and New Zealand both sent significant forces to assist – a Victoria Cross being won by the Australian WO2 Keith Payne.

I was attached to the French Engineers in Indo-China for four weeks from 17 May to 12 Jun 52 for what was described as an Engineer Tour. The objective was to look at the ongoing field engineering and works. At the time, Indo-China was working towards full independence, but even so, France intended to retain several permanent military bases and was undertaking a large construction programme with this in mind. On my return to Malaya, I submitted a report to the Chief Engineer FARELF, Brigadier MRR Prentice CBE. This report forms the basis of this article. Although 50 years, a different country and a different enemy now separate events, the French problems in Indo-China, engineerwise, were not so very different from those in Kosovo described by Capt Arnaud Le Gal in the April *Journal*.

GENERAL

THE areas which I visited were Saigon (now known as Ho Chi Minh City), Cochin China, Tourane (now known as Da Nang) and the Tonkin Delta.

At any one time, all field engineer battalions had three ongoing major tasks; operational, fortifications and sector. The Works Organisation's main task was the construction of the permanent military bases already mentioned at Saigon, Tourane and Haiphong. These were very lavish constructions designed as much as anything to impress upon the Vietnamese that even when they had full independence, the French were determined to retain a foothold. In the shorter term, if and when the Chinese attacked Indo-China, the bases at Haiphong and Tourane would help delay them until outside assistance arrived, or until the majority of French troops were evacuated from the Tonkin Delta area.

A VISIT TO INDO-CHINA



SAIGON

THE main works here were the construction of the new permanent base at Tan-Son-Nhut. The designs were very ambitious and extremely expensive and illustrate the extent of the French determination to stay in the area. The site was based upon the existing civil and military airfield and contained:

- New HQ Indo-China building.
- Accommodation for an Infantry Brigade.
- Accommodation for a Parachute Battalion complete with 'chute packing, drying and storage facilities.
- Ordnance Stores and Engineer Workshop Area.
- Fuel Dump, Munitions Depot and POW Compound.
- A comprehensive road network.
- Strategic Blockhouses.

I visited various other locations in the area, notably Bien Hoa and Tan Tuy Ha. The Engineer Corps in these areas was engaged in a host of diverse activities ranging from lengthening runways to hardening airfields, clearing jungle, supplying stores by river, dredging rivers, repairing road and rail bridges, building bomb depots. The timber felled during jungle clearance was utilized, using engr coy sawmills, for bridging and building blockhouses. It was interesting that all engineer shipping and plant was operated by Legionnaires under Sapper officers.

TOURANE

THE French attached considerable importance to the base at Tourane as it was halfway between Saigon and Hanoi, and also Singapore and Hong Kong. The main work ongoing during my visit was the construction of a completely new military air base, centred on a 2,400 metres by 60 metres runway with concrete end pads for jet take-offs. Another Works Unit in the meantime was constructing a joint military and naval base using the Presqu'ile de Tien Sha as a fortified strong point. This involved opening up the area by constructing roads and bridges including one large steel bridge. The works on site included concrete blockhouse perimeter defences, a complete engineer barracks, and ordnance depot and a munitions depot. The Vietnamese coastal water is very shallow in this area, so an LCT unloading site and jetty was being constructed on the edge of the bay to allow large ships out in the deeper waters to be unloaded.

QUARRYING AT TOURANE

As can be imagined, an immense amount of hardcore was needed for the work. Near Tourane, there were two 'marble mountains' although in reality, they were more like pimples! One had been hollowed out, forming a huge cavern which was used as a Buddhist Temple and therefore sacrosanct. The other however was completely blasted level by the engineers to provide the rock and rubble required for all the tasks in hand.



The new steel bridge.

THE TONKIN DELTA

THE French engineers maintained a very large presence in the Delta. This consisted of:

- Three full battalions.
- Two independent road companies.
- A Legionnaire Vehicle Company.
- A River Company.
- Two works "chefferies" at Hanoi and Haiphong including an airfield company.
- Two independent Vietnamese companies.

As previously mentioned, each battalion had three major tasks ongoing at any one time. Fortifications included assisting works units in the construction of perimeter, town, village and pillbox defences. Sector work involved road and bridge repairs and the construction of small airfields for observation planes. Large road projects and repairs were handled by the road companies. Operational work included mine clearance, re-opening roads destroyed by the Vietminh, breaching Vietminh village defences and afterwards destroying them.

These operations took place within the delta perimeter against enemy units who had infiltrated and formed resistance areas in the rice villages. They were extremely good infantry soldiers and dug themselves into the villages, mining and cutting approach routes. To deal with them, the French formed Mobile Groups, and it was to these groups that the engineers were attached for operations. Whilst the operations were ongoing, sector and fortification work was suspended due to a lack of men and equipment.

MINE WARFARE - VIETMINH STYLE

I was shown many exhibits of enemy mines and grenades at the Engineering School, Haiphong. Remembering that this was 1952, I judged the Viet knowledge of mechanisms to be equal to the British standard in 1940. The manufacture was very crude, but the mechanisms were very effective. There were plenty of pressure ignition mines, but what they really liked was the pull method, whereby a soldier hid in a rice field and pulled the wire attached to his bomb at an appropriate moment!

A favourite Vietminh method of providing obstacles to deal with vehicles was the "piano effect". This consisted of cutting ditches 1 yard wide and 1 yard deep at irregular intervals across a road. The Tonkinites were exceptionally quick at this type of work and one sapper company that I visited complained that prior to one operation, 50 yards of road had been completely removed, leaving a muddy



Coolies filling in the muddy gaps.

gap which took some time to close. The methodology for this was to round up as many nearby coolies as possible, and force them to fetch mud and earth in their little baskets until the gap was closed.

OPERATION KANGAROO

OP *KANGAROO* was designed to destroy Vietminh units and organisation and regain control of about 20 square miles of flat rice land in the Van Dinh area which is 30 kilometres south-west of Hanoi.

The proposed method was to encircle the area at night with infantry on three sides and armour on the fourth. Commencing at dawn, the infantry, with assistance from the air force and artillery, would attempt to squeeze the enemy from three sides and force them on to the waiting tanks. If the enemy were not surprised and managed to escape before the trap closed, then the operation was to switch to another nearby area.

The enemy consisted in this case of three battalions of Vietminh dug into positions in the rice villages, with the main concentration to the south of the area.

The French force was a Mobile Group consisting of eleven infantry battalions, two armoured regiments, one artillery regiment and two companies of engineers. Fighter aircraft support was on call.

The area to be attacked was roughly rectangular in shape and bounded by roads. Two of these roads were mined or closed by obstacles so the infantry moved into position on foot.

The operation commenced at dawn and while the infantry entered the rice fields, the engineers opened up one of the roads for traffic. A bulldozer being crippled by a mine delayed the

A VISIT TO INDO-CHINA

opening of the other road for 24 hours. The infantry were halted by enemy artillery which Napalm bombs failed to dislodge.

The Viet held the infantry off until darkness and then escaped into the rice fields leaving 250 dead and 80 prisoners. Holding grimly on to their positions by day was a normal tactic for them because going into open rice fields in daylight was clearly courting disaster.

The operation was considered rather unsuccessful, and after mopping up and destroying the vacated Viet defences, the Group moved on to a similar operation codenamed "*Antelope*".

CONCLUSION

I FOUND the tour very instructive and worthwhile. The French engineers had an extremely important part to play in the operations in Indo-China and although handicapped by a shortage of men and equipment, they successfully remedied this by sheer hard work and very clever improvization.



"General Views of my Visit"

Bridge Building (and Demolition) Across the Great Lakes

MAJOR R K TOMLINSON MBE MSc BSc



Rob Tomlinson was commissioned into the Royal Engineers in 1986. He gained experience of close, general and air support engineering and commanded 65 Field Park Squadron on operations in Bosnia and Kosovo. He passed the Defence Logistics Management MSc in 2000 before spending two years on the staff as SO2 Engineer Logistic Operations at HQRE Theatre Troops LAND; towards the end of this job he was offered the temporary escape chit to East Africa that spawned the following article. He recently took over as Chief of Staff in the Engineer Systems Support Integrated Project Team.

As every Regimental 2IC knows, the Engineer staff at HQ Theatre Troops push out countless short notice trawls for manpower to fill obscure but apparently essential posts around the world. One such trawl caught the eye of our SO3 Operations - Captain Richard Brown - in February this year. It called for a major, of any cap badge, to head up the Ugandan / Rwandan Joint Verification and Investigation (V&I) Committee. This major was needed to deploy immediately, for about three months, no special skills were called for. Clearly eager to spare our hard pressed Regiments from yet another ridiculously short notice request for manpower, and no doubt conscious of my ability to meet this last job specification, Richard thought of me. Flattered though I was by his suggestion, I said no. Our office was already over-stretched and was about to have to stand the gap of another officer. I knew that my absence would leave the remaining team too hard pressed. Oh, and I also had two skiing trips booked. Nothing Richard said would persuade me to go. Nothing, that is, except his final throw-away phrase "Local Lieutenant Colonel rank with substitution pay goes with the job".

I landed at Entebbe airport ten days later. High on larium and virtually clueless about what may lie ahead (so what's new) I was met by the British Defence Adviser (DA) – a charming Army Air Corps Lieutenant Colonel called Chris Wilton – and a British Military Intelligence Liaison Officer (MILO). MILO had helped set up the V&I mission three months previously but was now needed elsewhere in Africa; he was heartily relieved that I was to replace him. The two men briefed me during the 40 minute drive into Kampala. A few snippets from that initial chat stuck in my mind:

- In the last 10 years five million people have died as a direct result of armed conflict in the Great Lakes Region (half of those have been killed within the Democratic Republic of Congo [DRC] since 1997).
- One in seven Rwandans were slaughtered in a 100 day killing spree in 1994.
- 20 per cent of Ugandan children die from malaria before the age of five.
- Britain is the biggest donor of development aid to both Uganda and Rwanda.
- Uganda has the lowest incidence of HIV/AIDS in the region with only eight per cent of the population infected (in the military infection rates are twice as high and in one large government agency 70 per cent of the members are infected).
- Kampala is a *relatively* safe city. (In the next three months I was to hear more gunfire than I had during my last two Balkans tours).



Africa's Great Lakes Region.

THE JOINT VERIFICATION AND INVESTIGATION COMMITTEE

THE Joint Verification and Investigation (V&I) Committee was the brain-child of British Ministers Clare Short and Jack Straw. They had visited the region in 2001 in an attempt to reduce tensions between Uganda and Rwanda and to prevent another outbreak of violence between the Ugandan Peoples Defence Forces (UPDF) and the Rwandan Peoples Army (RPA). In the previous two years three major battles had taken place between these former allies as a result of their occupation of large tracts of neighbouring DRC. These battles were ignited by squabbles over mineral exploitation in and around the small DRC town of Kisangani (see map). Hundreds died on both sides but the UPDF was soundly beaten on each occasion. In mid-2001 relations were spiralling out of control once again and the prospect of further violence seemed high. At the heart of the conflict were allegations by both sides that each was harbouring or actively training dissidents bent on over-throwing the other regime. The V&I process was established in order to investigate allegations of dissident training and re-organization. Both Uganda's President Museveni and Rwanda's President Kagame, with pressure from Short and Straw, signed up to the process which guaranteed "free and unfettered access" to the V&I Committee. No doubt Clare Short's threats to review the level of British aid contributed to this unprecedented level of Presidential agreement.

The UPDF and RPA established inspection teams in Kigali and Kampala respectively and each side was encouraged to call very short-notice inspections of any sites they believed would reveal evidence of dissident activity. UK's Third Party, initially the MILO and then me, accompanied the inspection teams as an honest broker to ensure fair play.

Just before MILO departed for his other African hotspots I asked him what would happen if either side did actually discover evidence of dissident activity. His response was a terse: "If they do it means that you've screwed up!". My real role in the process now clear, I prepared tion

spection.

THE FIRST INSPECTION – RWANDA

RWANDA. Land of a Thousand Hills and the location of the world's most recent true genocide. During a three month long orgy of violence in 1994 over one million of the country's minority Tutsis and moderate Hutus were slaughtered. This shocking episode was co-ordinated by the Hutu dominated government and executed by the military (the FAR), Interahamwe death squads and most disturbing of all, by tens of thousands of common Hutus. It was not the tribal squabble that many western governments tried to describe it as at the time - it was a pre-planned, systematic and horrifyingly effective genocide. The killing triggered a devastating reprisal from the Rwandan Peoples' Force (RPF), the Uganda-backed Tutsi rebel army based in the hills and villages along the Rwandan northern border. The RPF struck deep into Rwanda, destroying the cohesion of the



Genocide site - Kigali, May 2002

FAR and chasing them and their Interahamwe militia into neighbouring DRC and Tanzania. As the last of the killers fled into refugee camps the international community finally took action: and with remarkable irony found themselves feeding and protecting the perpetrators of the genocide. The surviving Interahamwe regrouped and with support from the DRC government (and other international friends) began mounting terrorist strikes into Rwanda. In 1996 the RPF (by then renamed the RPA) responded by invading DRC, they toppled the government and annexed a large swath of eastern DRC to form a buffer zone with Rwanda. As a profitable side-line they also began to do what every other occupying military force does in DRC – ripping off diamonds, gold, $\cot an^1$ and anything else of value.

Rwanda was let down badly by the international community in 1994 and lost all faith in the UN, USA and France. Britain's role in playing down the extent of the genocide at the UN, though passive, was also quite shameful. Rwanda's only real ally during the genocide and for the following few years was Uganda. All the more tragic, therefore that these two countries have come to blows recently.

This recent and devastatingly violent history has done two things: it has left the surviving Rwandan population traumatized and burning with a collective desire for self preservation, justice and revenge; it has also forged the RPA into the most effective fighting force in the region.

I was met on the pan at Kigali² International airport by the British Ambassador, facilitated through customs with great pomp and driven to the Embassy in the official Range Rover – flags an' all. None of which was lost on the highly effective Rwandan security services. The message was clear: Britain is very serious about the V&I process, we've sent in a new military expert and if you don't co-operate with him we'll send Clare Short back. I liked it all a lot – except perhaps the word "expert".

My first inspection, after all that, went smoothly and the Committee "found no evidence of dissident training or re-organization". Other inspections followed, both in Rwanda and Uganda (and one inside DRC that, due to some unfathomable political reasoning, I was not permitted to take part in). All went the same way with no damning evidence discovered by either side. The Third Party was doing OK.

UGANDAN INSPECTION – TEAM DYNAMICS

In early May the Rwandan team leader called a routine inspection in Uganda. This time to the South West border region of Ishasha (home of the tree climbing lions) and the wonderfully named Bwindi Impenetrable Forest (home of the mountain gorillas). From the start it was apparent that the Rwandans were working to a new agenda. More purposeful and less friendly than usual, they had received what they believed to be reliable intelligence pointing to dissident activity in those areas. Unusually they called the visit over a weekend. The Rwandans interrogated every soldier, policeman and civilian they could find at and close to the border. To a man, these interviewees responded that there had been no dissident activity in that area. This clearly failed to convince the Rwandans who began to use more menacing questioning techniques. The Ugandan team protested vehemently, our UPDF security detachment tensed up and the Third Party had to step in to wave the red card. The Ugandans and Rwandans were furious with each other and I started to feel distinctly conscious that I was the only unarmed member of the Team and probably the only one yet to prove his manhood by killing another human being. Fortunately both Parties resorted to a prolonged bout of sulking rather than to actual violence.

This incident highlighted many of the differences between the two teams. Both were led by high quality Presidentially appointed trustees: Uganda's Deputy Chief of Military Intelligence on one side and President Kagame's personal military adviser on the other. The RPA field team also comprised high quality professional soldiers. These men were battle hardened and did not mess about. They were also acutely aware of the bigger political and intelligence picture and never missed an opportunity to outfox and embarrass the Ugandans. The Ugandan team was far less impressive and manned by a poorly selected bunch of military lawyers and administrators. They had very little operational experience and seemed to select inspection sites using the blindfold, road map and pin method. They employed crude interview techniques that gleaned nothing of any intelligence value. The

¹ Cotan is a scarce and valuable mineral used in the

manufacture of mobile phones and other IT products. 2 Pronounced Chigarlee.



Like Brothers – UPDF & RPA at Rwandan Army Barracks, April 2002

Rwandans ran rings around them. It is hardly surprising that the RPA beat the UPDF so resoundingly during the Kisangani battles I, II and III. In the course of my time in the region I came across many high quality Ugandan officers, and some more than adequate units, but collectively they were no match for the Rwandans. The heady days of Museveni's National Resistance Movement – forged on the apparently unstoppable peoples' bush army which overthrew Idi Amin and then kicked out the occupying Tanzanian Army – are, sadly, long gone.

CONFIDENCE BUILDING MEASURES

THE V&I process was established as a shortterm stopgap – initially for three months then extended for six – to improve transparency and trust between Uganda and Rwanda. But to be of any long-term benefit the V&I process had to evolve. To that end we (the Third Party) suggested and then wrote up a number of military Confidence Building Measures (CBMs). These CBMs formed the basis of a bilateral Memorandum of Understanding (MOU). They included:

- The exchange of Liaison Officers between units operating close to the border.
- A mechanism for facilitating cross border movement of off duty soldiers (ethnicity and national origin is complex in that region and many soldiers have families in the neighbouring countries).
- An SOP for the exchange of information on border patrol activity.
- A suggested process for requesting cross border hot pursuit rights when chasing rebels or poachers.
- The mutual exchange of Defence Attachés.

After considerable drafting and redrafting, and some acrimonious debate over whether to include Ugandan and Rwandan controlled areas of the DRC in the MOU^3 , all Parties came to an agreement. The documents were presented to Defence Ministers for ratification.

In addition to these military CBMs we pressed both sides to adopt a series of protocols on the thorny issue of access to asylum seekers and prisoners. Each claimed that the other was protecting dissidents behind refugee status and training them in prisons and refugee camps. With wise input from a remarkably capable UNHCR officer and guidance from a more stand-

offish Amnesty International, we gained agreement on the asylum seeker issue but not, at time of writing, on prisoners access. We were, however, successful in arranging and then supervising an exchange of prisoners, an event that was to make both countries aware of the need for a formal consular agreement on prisoner access. This put Amnesty International's nose out of joint because, having lost faith in their usefulness previously we had not involved them in this latter process.

WIDER RESPONSIBILITIES

In addition to my role on the V&I Commission I was also given a watching brief over other military developments in Uganda. Though past its prime, the UPDF is still a busy little army. In addition to its routine contribution to electoral rigging, voter intimidation, mineral exploitation in the DRC and the occasional dalliance with organized crime they mounted two new major operations in March and April. They launched a highly ambitious operation to destroy the Lord's Resistance Army (LRA) in southern Sudan, and began the forcible disarmament of Karamajon warriors on the eastern border. At time of writing this latter operation, which should have concentrated on winning hearts and minds, had deteriorated into a series of running battles that resulted in dozens of fatalities on both sides. Heavy artillery was used to subdue a particularly troublesome village.

³ The Sun City Inter-Congolese Dialogue was at a tricky stage so the Foreign Office was loath to get involved in DRC issues at that time.

The LRA operation was more interesting. Hailed as Uganda's contribution to the war against terrorism, Operation IRON FIST was launched in March, the routes of advance in Sudan and modus operandi of the UPDF having been reported in great detail in the Kampala media for weeks beforehand. The LRA - led by a charismatic and truly evil killer called Joseph Kony - has been terrorising southern Sudan and northern Uganda for over a decade. Bent on removing President Museveni he had been supported, until very recently by the Khartoum regime. He has been responsible for the abduction of around 10000 Ugandan children who have been either worked to death, sold into sex slavery or, most commonly, forced into battle. The bodies of armed children as young as nine have been found on numerous battlefields in the north. Some girls, impregnated by their captives, have been forced to go into battle with their babies strapped to their backs. The terror had to end and, catalysed by the September 11 tragedy, the international community applauded the Ugandan decision to move against Kony – despite some misgivings about their ability to win the day and release the abductees. Sudan, with pressure from the USA, agreed to stop backing Kony and allowed the UPDF to operate across their southern border.

Six weeks into the operation I attended a briefing by the UPDF Army commander. He was adamant that Kony was a spent force and would

be dead within days. That evening the LRA attacked a funeral cortege in a Sudanese village. They made the 60 grieving relatives cook and then eat the deceased before slaughtering the lot. Over the next fortnight at least 400 civilians were massacred by the LRA. So much for them being a spent force.

On writing, fewer than a dozen abductees had been recovered alive by the UPDF.

KAMPALA

THE Great Lakes region is stunningly beautiful and the people, despite their appalling poverty, greet visitors with genuine warmth and hospitality. Scratch the surface though, and brutality, disease, ignorance, corruption and ineptitude combine to hold the region on a social and economic knife edge. For example, the DA's driver died of AIDS in February and in March the High Commission's popular estate manager was dragged from his car and executed. It's worth recounting another brief episode that perhaps sums up the often hilarious mix of sudden violence, incompetence and plain stupidly that, for me at least, over-shadowed much of the natural beauty of the region.

Picture me, Sunday night, feet up in my apartment, sharing a beer and pizza with my neighbour – a civilian management consultant working for a major aid agency. Bemoaning the fact that whilst he had spent a pleasant day by the pool I'd been in a Landrover for the last 25 hours looking for nonexistent Rwandan dissidents on the DRC border. (He also gets paid four times what I do so one of us was in the wrong job). In my kitchen I keep a radio tuned to the High Commission's emergency channel. My ears prick up when I hear:

"Man down at New Site (a mile from me), gunshot wounds, send ambulance now over!"

Sounds interesting but these things are best left to the High Commission security officer and his guards. The response from Zero went something like this:

"Hello, what is ambulante, why is mandown, who are you anyway, get off the net..."

Thinking that a little trained military intervention might be prudent, if the poor bleeding victim was to live, I grabbed a medical pack and sped off to New Site.



Nile River Recce (R&R).

New Site is old, derelict and very dark. The African security guards are young, very excited, also very dark and very heavily armed. They had shot someone, their blood was up and to say that further gunrelated accidents were possible is an understatement. I approached the blacked-out building cautiously. I'd forgotten my torch. The screams lead me to the casualty, a half naked man writhing in agony on a bare concrete floor; scene lit by a single flickering candle. On top of the casualty sat four flack-jacketed, shotgun wielding, grinning, High Commission security guards. He was badly hurt but not bleeding - which is quite unusual with gunshot victims. Perplexed, I asked what had happened. The first answer was that the injured party was a thief. He had been skulking in the roof, had crashed down through the ceiling close to the

patrolling security section – they apprehended him efficiently and with minimum force but unfortunately a shotgun had been accidentally – but thankfully harmlessly – discharged.

Me to guards: "But he's badly hurt why are you sitting on him?" Response: "We don't have any handcuffs, sah!"

I left the scene, un-bloodied, relieved but still perplexed. The following day the security officer - a Brit – was sticking to the negligent discharge story but somehow the "thief" had turned into one of his own High Commission guards. It took me a few more days to get to the truth. Our guards had heard a noise in the roof. Suspecting a thief, two men had searched the ground floor rooms (remember it was pitch black in there) and another had decided to search the attic (blacker still). Attic man stepped where he shouldn't have and came crashing thorough the ceiling onto his two colleagues below. They, forgetting that their mate had been in the attic, and finding an injured man writhing at their feet, did the only sensible thing a pair of well trained security guards should do – they blasted him in the back at point blank range with their pump action shotguns! His flack-jacket saved his life – just.

THE FINAL VISIT

AWAY from these sad but fascinating events in Kampala the V&I visits continued to go well; "the Committee found no evidence of dissident training in the areas visited". Then it went ever so slightly wrong. The Department for



The DA and a UPDF Team Member. Ishasha May 2002.

International Development (DfID) had agreed to fund the V&I process, and my deployment, until mid-May. Beyond that time it had been agreed that both teams would be self funding. Unbeknown to us at the time neither side had any intention of paying their own way and it seemed likely that the inspection programme would grind to a halt. This was fine as we expected to divert our attention to making the CBMs work. Not surprisingly both sides called simultaneous inspections on 12 May to make the most of the last remaining funds. I went to Rwanda with the Ugandans and the DA was called in to accompany the Rwandan team back into the Bwindi Impenetrable Forest. Perhaps by luck but more likely through good intelligence the Rwandan team struck gold. Clear and irrefutable evidence of recent Interahamwe activity was found in the forest. In fact, several villagers had been killed by rebels in recent weeks. This was a major embarrassment for the Ugandans and the Third Party was obliged to confirm the findings in our formal Inspection Report. Not surprisingly this sensitive and confidential report was promptly leaked to the national press in both countries and the story ran for several weeks. Britain's contribution to conflict prevention in East Africa was looking distinctly shaky and the Foreign Office had to review its travel advice to British tourists - noting that there are gorillas and guerrillas in the Impenetrable Forest.

Clearly it was time for me to leave.

Have Mossie Net and Spare Tyres – Will Travel



I SUPPOSE it is not surprising that when one is associated with mines and demining for any length of time the odd alarming incident comes ones way. However, two fairly hairy events in my mildly checkered existence had nothing to do with mines but with the means of getting to the mined areas. Both events were concerned with air travel. Having served five tours in airborne forces and flown thousands of miles in RAF and civil transport aircraft travelling to, from and within overseas tours I consider myself an expert in air travel and able to give an informed opinion on dry, curly-edged sandwiches, contorted sleeping positions, several touch-downs for every landing and jet lag. I had not experienced the joys of flying Mozambique Airlines nor Dalla Airlines but, all in a good cause, I was to experience the latter airlines' deep consideration for the safety, general welfare and comfort of their passengers.

I needed to get to Tet Province in Northern Mozambique from the capital Maputo to have a look at the demining operations in the Cabarro Basso dam area. The way to get there was clearly courtesy of Mozambique Airlines. The international airport in Maputo is not exactly at the top end of the range of airport buildings in fact it may well have slipped off the bottom end of the list and there is no need to ask the way to the loos. Their location (unless you happen to have the most

BRIGADIER J H HOOPER OBE SBSTJ DL FCMI

John Hooper was commissioned into the Corps in 1951 and served a good deal of his early career in Airborne Forces, including service in the Canal Zone. He later commanded 25 Fd Sqn, was GSO 2 in HQRE 1(BR) Corps and then commanded 36 Engr Regt. He wrote the draw-down plan for the withdrawal of British forces from Singapore before becoming successively CRE 1st Armd Div and Col GS, 38 Gp RAF. He was then appointed Dep Comd, HQ Wales, but managed to extricate himself to command the British Military Mission to Saudia Arabia. After retirement, he was advisor to HRH Crown Prince Abdullah of Saudi and Chief Executive of an aviation company in the Isle of Man. He was then involved in demining in Cambodia, Mozambique and Somaliland for over ten years He has also been Chairman of Gwent Appeal of the ABF, President of Monmouthshire St John Ambulance, Vice President of Gwent Scouts, President of Monmouth Branch REA and SW Branch, Airborne Engineers Association and Deputy Lieutenant of Gwent.

> appalling head cold and even then I believe one would get some indication) is immediately made known, on getting out of the taxi (a euphemism for a just-mobile scrap heap) at the airport, despite a noticeable lack of signs. Things do not improve as one gets into this experience. "Manana" and "Bukra, Inshallah" may be Spanish and Arabic respectively but the concept was born in Mozambique. The concept of time tables still has not reached there however and any idea of keeping to a schedule would, in any case, be a source of huge amusement for the local punters nominally in charge of matters aerial.

> The means of transport for the Maputo – Tet trip is a twin engined high wing monoplane not too unlike the Twin Pioneers I experienced in Oman in 1958 (maybe it was one of the originals!) and it comes fully laden with passengers. Despite every seat being taken, there is cargo to load and takeoff is delayed as negotiations concerning the cargo are conducted by the driver and driver's mate through the open window of the cockpit in between taking deep drags on their cigarettes. Eventually we get airborne with the cargo not too firmly secured in the passenger compartment. We head for Beira where we land and the cargo conveniently moves itself forward for unloading. Newton had it right and this cargo was in uniform motion whatever the plane was now doing. Some

passengers disembark and their seats are immediately filled again by the first few at the head of a very long queue of potential and mainly soon-tobe-disappointed passengers.

Now, if Maputo airport was not too salubrious, Beira's airport buildings were nothing to complain about. They did not exist. As far as I could see the airport was piles of cargo and lots of people littered about the place, oh, and a runway of sorts. The driver and his mate, still with the cigarettes going strong as they had been throughout the flight, were engaged in further noisy discussion about yet more cargo. Apparently, the pilot supplements his irregular and almost non-existent pay by a little private enterprise cargo flying so there is a huge amount of cargo on every flight including, in this case, some very large lumps of raw beef. One remained aware of them even when they disappeared beneath yet more cargo This flight was no exception as far as cargo went and as I sat in my seat I was gradually barricaded in with boxes, parcels and canvas wrapped bundles of every kind. Would that they had wrapped the meat in smell-proof polythene bags.

When we were ready for take-off I had a look to see where the emergency exit was as the main doorway was now completely sealed off with cargo. So was the emergency exit. As the engines had both been emitting considerable amounts of smoke from time to time during the Maputo-Beira flight, the lack of a clear escape route was a matter of some concern to me. The engines were started with the usual cloud of smoke. It must have been the vibration, for it was then that a lining panel of some eight feet by four fell on me exposing the ribs and the outer cladding of the fuselage. Even the odd shaft of sun-light through holes in the latter did nothing to improve my morale. Neither did the driver's mate who, complete with fag came to render assistance and succeeded in lifting the panel off me. He was not able to secure it and a further delay ensued while the driver abandoned the cockpit and idling engines to lend a hand . The solution eventually decided upon was to pile luggage and cargo against the panel and tie some string across the top. This worked and we made Tet in due course.

You will not be surprised to learn that I declined a further flight, from Tet to Harare in Zimbabwe some days later, courtesy of Mozambique Airlines but elected to go by Landrover. Well, I wanted to see the scenery didn't I?

The actual flight to Hargesha in Somaliland

some months later started well thanks to Swissair even if my trip at one stage appeared to be doomed before starting thanks to the lady operating the check in desk in Heathrow who wanted to see my visa for Somaliland. It was no good explaining that neither Somaliland nor Somalia had a government and therefore visas were a luxury only to be gained by crossing several palms with US dollars on arrival in Hargesha. Eventually, the lady salved her conscience by agreeing that as I was only going to Dubai by Swiss air I did not need a visa for the part of the journey for which she considered herself responsible. The rest of the journey was my problem. I could pass. Apart from forgetting that Geneva was an hour different from UK and nearly missing the connection, the flight to Dubai was extremely comfortable and uneventful. Dubai was different. The last time I had been in Dubai (forty years previously) it consisted of two mud huts and a shop on the creek but it still did not offer enough seats at its vast modern international airport and I sat on the floor for six hours waiting for my Dalla Airlines flight to Djibouti. Eventually my flight was called and I walked out to the huge Illuyshin delta winged aircraft crewed by Russians.

The plane was shabby. Given a Thesaurus I could probably find a word to describe the degree of shabbiness which was extreme. The internal paint work had been rubbed off by countless passengers so that the highly burnished aluminium gleamed in the, apparently, no more than five watt, lighting. The "No Smoking" and "Fasten Seat Belts" signs did not work which was just as well as fifty percent of the passengers were smoking and I could not find a safety belt. Eventually, after take-off, I found the belt trapped under my seat, covered in dust and dirt. I did actually put it on but in its severely frayed state (caused no doubt by countless feet scuffling on it) I doubt if it would have been of much use. There was no preflight safety briefing and no checks of passengers. Well, there wasn't much point was there. It was dark when we boarded and took off which was just as well. It was daylight when we landed at Djibouti and I was horrified to see that not only was there no tread on any of the wheels of the forward undercarriage but the canvas showed through on more than one of them. I did not look at the main under carriage wheels. Enough was enough and why spoil my day.

In Djibouti we changed to a four engined propeller driven aircraft, again of Russian make and Russian crewed. There were very few passengers and it was not hard to see why. The smoke from the engines had created a very attractive black and iridescent (oil I suppose) pattern on the wings. The cabin staff consisted of one huge bleached blonde Russian lady whom one could easily imagine in charge of the ladies' section of a Siberian penal settlement. I believe even the most sex-starved of the brutal and licentious soldiery I have met over the years would have sworn to celibacy after one look at her. She marched down the aisle with a plastic bottle of water in one hand and a stack of plastic cups running up her other arm. We were invited to take a cup which she filled with water and that was the in-flight refreshment problem disposed of. No expense spared. There was an overhead shelf, no lockers for hand luggage. As we took off all the baggage on the shelf slithered rearwards. (Newton at it again) I had previously spotted this possibility and had chosen a seat safe from flying brief cases which was just as well as fly they did. We landed at Hargesha and after enough money had changed hands I got a visa and was allowed out of the airport building at Hargesha International Airport.

I knew it was the international airport as it was written up in both English and Arabic despite the passenger lounge being a couple of tables under the trees. The trees were quite clearly popular with the local bird life. There were two MiG's parked at the end of the runway. Neither was serviceable but neither appeared to be vandalized which surprised me until I learned the reason. Apparently, two of the local voters had decided to investigate these planes as they had been stationary for several weeks and there were clearly good pickings to be had. Half of this pair of buffoons had climbed in and was playing at being the hero fighter pilot when the second spotted a red handle. This he pulled which was the last thing he ever did. His mate, the make-believe hero fighter pilot, was ejected and took the venturesome handle-puller's head off in the process. Despite the efficacy of the ejection system the man, having not belted himself in, went into free flight and moments later into free fall. Newton's observations were further justified, his Laws kicked in again and our hero died with his sandals on. There was a huge loss of interest in the planes.

I found my way to the only hotel in Hargesha which I rated as minus three star for both accommodation and culinary delights. (Egon Ronay should visit. Their camel and goat dishes are something else again) I was luckier than a colleague who had also been sufficiently misguided as to stay there. He spent his single night trying to sleep in a chair. I asked him why he had not used the bed and he explained that it was already occupied by a fleet of ferociously hungry bed-bugs. Needless to say this vital information was not vouchsafed until my return. Possibly my experience of Egyptian bed bugs some forty five years before had rendered me immune to their Southern cousins but this lot did not bother me. I also only spent one night there as I was able to scrounge a bed from the Danish demining team for the rest of my stay. There, again, I was lucky to have brought my own mosquito net as the one supplied had a huge hole in it. The net would have admitted a vampire bat and several hundred mossies advancing in review order. After a very interesting stay in Somaliland where I managed to communicate by using Arabic (they are all Muslims) and obtained sufficient material for an article entitled "Have Square Backside - Will Travel" it was time to leave. There was only one way to go.

Dalla Airlines again. Prop aircraft to Djibouti again but this time it was full, or rather over full. Every seat was taken and the cabin crew, three this time, had to stand for take-off. The crew jump seats were taken by fare payers. Least I assume they had paid although none of them looked to have the price of a donkey ride let alone an air flight. I don't think there is an Arabic phrase for "Health and Safety at Work" and I would bet good money there is not one in Russian either. Very few passengers were smoking but those that were carried on happily for take-off. Nearly every passenger clutched a large bundle of leafy twigs. The leaves were stripped off and chewed and the twigs thrown on the floor. It was ghat of course and most of the passengers were away with the birds. By no means the ideal flying companions. The flight was uneventful and I eventually left the plane having waded through ankle deep ghat twigs to see the dreaded Illuyshin standing on the runway at Djibouti.

I steeled myself to examine the nose undercarriage and, sure enough, the tyres were treadless and the canvas was showing through on them. I had a look at the main undercarriage which seemed to have about twenty wheels on it and, again, no tread but Praise Be there was no canvas showing – well, not that I could see anyway and the phrase "Thankful for small mercies" sprang to mind. After a couple of beers in the airport lounge at three pounds for a half pint (well if you will drink alcohol in a Muslim country what do you expect but I needed them), I was invited to board the treadless-tired Illuyshin along with a pretty motley crowd of all nationalities. It was as shabby as I remembered it but this time it was daylight and I can assure you the brighter light did nothing to increase one's confidence in reaching Dubai without incident We did however reach Dubai without incident even if I did hold my breath when we touched down. No explosion when the main undercarriage hit the runway, a quick breath and then the nose wheels hit the runway and still no burst tyre. I could not believe my luck. Another four hours or so of sitting on the floor in Dubai International was almost welcome. I did, eventually, get back to Heathrow and even my luggage arrived a week later.

So, the real risks in demining in Africa are in the approach. A mosquito net and a set of Illuyshin tyres should always be carried.

Sapper Caught on CCTV!

STAFF SERGEANT A D PEEL IENG MIIE

SSgt Peel commenced his career in the Royal Engineers at the Army Apprentices College Chepstow in 1984. Following postings with 36 and 39 Engr Regts as a Fitter RE, Section Commander and Training Wing Instructor he attended No 48 Clerk of Works (Mechanical) Course at the RSME. On completion of the course he served as Clk Wks (M) with 527 STRE (Wks) at Chilwell prior to assuming his current post in 25 Engr Regt as Professional Technical Officer Closed Circuit Television (PTO CCTV) within HQ 8 Inf Bde. SSgt Peel has completed previous operational tours in Northern Ireland, the Gulf and the Balkans.

INTRODUCTION

THIS paper describes the planning, design, installation and operation of Closed Circuit Television (CCTV) systems in Northern Ireland.

CCTV seems to be a technology seldom out of the news these days and with the Government committing hundreds of millions of pounds to it over the last few years, its use in the private sector has never been greater. The military have been making use of CCTV for a number of years particularly in Northern Ireland. What is less well known is that the Corps has had a SSgt/WO2 post within the NI CCTV Cell since its formation in 1990.

The cell was formed as part of the WSM for NI with responsibilities for the design, installation and maintenance of CCTV at all SF base¹ and OGD² locations in the Province for GDA³ protection requirements and is currently responsible for around 700 cameras across the province. It also provides CCTV support to force troops outside of SF base locations. In addition, the cell has responsibility for all Intruder Detection Systems (IDS), Access Control, Intercom and Mortar Attack Alarm Systems within the Province. However CCTV provides by far largest proportion of the work.

Prior to Project VARAN⁴ the cell consisted of five MOD Civil Servants and a military Clerk of Works (Mechanical) based at HQNI. The imple-

mentation of Project VARAN saw the cell split, with a representative based in each Bde HQ and RAF Aldergrove under direct control of the commander in each area. The cell continues to be headed by a Higher Professional Technical Officer Closed Circuit Television (HPTO CCTV) who is based with 3 Inf Bde at Portadown. The Clk Wks (M) post was established to provide continuity of service should the troubles escalate to a point such that RE personnel would replace MOD Civil Service technical staff and civilian contractors. The history as to why it is a mechanical rather than the more obvious electrical post seems to be lost in time. Technical training for the post is provided externally by residential courses at EDICTS and PSDB⁵ and TAVCOM Training Ltd⁶.

CCTV

As the name implies CCTV is a system in which all the elements are directly connected in a closed loop, unlike broadcast television where the signal from the transmitter is available to any receiver tuned to the correct frequency. A basic system comprises a camera and lens with a power source and lighting, a means of picture transmission to a monitor and a means of recording the pictures. The lens is an optical device selected to focus the desired scene on to the pho-

¹ The CCTV Cell was responsible for the CCTV on certain joint Army/RUC bases as well as all Army, RAF and RN bases.

² Up until 1995 the CCTV Cell was responsible for the CCTV on OGD sites such as HM Customs and Excise, Coast Guard, Inland Revenue and NIO sites including Hillsborough Castle.

³ Ground Defence Area. The area adjacent to the perimeter of a base in which a terrorist must operate to reconnoitre and mount an attack.

⁴ Project VARAN. Dispersal of centralized design teams from HQNI to the Bde HQs and RAF Aldergrove.

⁵ Evaluation and Development In Counter Terrorism and Sabotage (EDICTS) and Police Scientific and Development Branch (PSDB).

⁶ TAVCOM Training Ltd. Residential CCTV and IDS training to MOD, Police, Public Sector and private installers based in Droxford Hants.



Typical Pole Mounted Overt Pan Tilt and Zoom CCTV Camera.

toelectric sensor of the camera. The camera scans the sensor and converts the optical image into an electrical signal. The signal is then transmitted to the monitor. With very few exceptions the pictures are transmitted as a composite video signal of 1 volt peak to peak at 75 ohms impedance, giving 25 picture frames per second (real time). In the majority of cases the signal is carried to a monitor where it is amplified to produce the display and relayed to a video recorder.

More complex systems include telemetry control for remote operation of pan, tilt and zoom (PTZ) cameras and additional functions such as lighting, wipers, low light intensification, digital picture enhancement, iris and focus control. Systems can incorporate video motion detection (VMD) for automatic triggering of cameras or recorders on movement sensing. Multiple camera systems have multi-screen displays via video switching, split screen displays via quads or splitters and multiplexing for recording of multiple cameras by one recorder. Other features include preset camera position or roaming routes for PTZ cameras and electronic privacy blanking to prevent operators viewing certain areas.

Systems are generally mains powered, however low voltage AC and DC is used for increased safety on metal structures, vehicle or remote deployment and for more flexible pan and tilt motor operation.

THE PLANNING PROCESS

An new installation generally begins with a request from a unit security officer, intelligence, or from G3 (Surv) or G4 (Est) staff officers for advice on a potential requirement. This is followed by an initial site recce and meeting with the user to determine their exact operational requirement (OR), this being the corner stone of the design process.

The important issues determined on the initial recce include the following:

- The activity that poses the threat and the type and speed of response.
- The objects or targets to be observed, whether they are static or moving and at what speed and direction.
- The purpose of the surveillance (i.e. monitoring, detection, recognition or identification) and Where and by who the system to is be monitored.
- Whether recording is required, for what purpose, who needs access to recorded data and where it is to be viewed.
- The users performance specification at the monitoring location (i.e. what is the required recording frame rate and quality. Is video motion detection, alarm inputs to recorders, preset or roaming cameras required).
- Conjunction with any other systems (i.e. intruder detection and access control etc) or requirement for uninterruptible power supply or generator back up.
- The level of security of the video transmission (i.e. is there a threat of tapping or interception).
- The likelihood of vandalism (Protective mesh and bulletproof glass has had to be used in certain locations).
- The availability of any site drawings or maps.
- The proposed completion date, duration of the operation and budget.

Compliance with legislation such as the Restriction of Investigatory Powers and Data Protection Acts has to be considered at the planning stage as this may impact on the design process, equipment selection and camera positioning. All CCTV installation works undertaken by the cell comply with Health and Safety Regulations, Institution of Electrical Engineers (IEE) Regulations for Electrical Installations CDM Regulations and Defence Estates Safety Rules and Procedures. The installation standards adopted by the cell are based on the National Approval Council For Security Systems (NACOSS) Code Of Practice for Planning Installation and Maintenance of CCTV Systems (NACP 20),

A detailed second recce is carried out to gain the necessary technical data once the users OR is confirmed. This is often carried out at night for both security and data gathering reasons. Information obtained on the confirmatory recce includes the following:

- The exact field of view (i.e. the object or area size to be viewed and the distance to it) and whether there is an existing camera that could be modified, redirected or repositioned to achieve the required surveillance.
- Whether a single camera, a number of cameras, static, PTZ or a combination of both would be best suited to achieve the required coverage.
- Availability of existing, or the installation of new mountings is investigated. At this stage potential maintenance problems such as height and accessibility are balanced against the protection of the camera and designed out where possible using tilt over or telescopic poles.
- Availability of reliable power supplies is checked along with the proximity of other existing services (i.e. HV, ECM, microwave, radio etc).
- Possible cable routes or line of sight for cable free transmission are also checked.

Perhaps the most critical data to obtain, as most CCTV is required for day and night use are the illumination levels. The lowest lux levels at the camera position, half way across the field of view and at full distance are measured with a light meter. Any existing lighting that may assist or adversely affect the camera has to be considered along with direct and reflected sunlight.

Meetings with other agencies such as BT for video transmission; NI Electricity Board for power supply or site owners via the Civil Secretariat for positioning of cameras and cables outside of SF bases often have to be arranged. Licenses can be required to import or use certain image intensifying or transmitting equipment, this and lead times on equipment delivery must also be taken in to account.

CCTV System Design

USING the data from the recces and meetings the design and costing process is then possible.

Correct design is critical to avoid the kind of poor CCTV recordings often seen on TV. With a seemingly endless array of equipment on the market costing many thousands of pounds, a great deal of money can be wasted if the performance is not adequate or indeed if equipment is over specified. Time taken to obtain evaluation results or to temporarily install and evaluate components to ensure suitability and compatibility has been invaluable on large or unusual projects. Using in house evaluation, product demonstrations and information from agencies such as PSDB the CCTV Cell has attempted to standardise some the equipment used across the Province aiding design and maintenance.

DESIGN PROCEDURE

The design procedure can be complex, and generally begins with lens and camera selection. Two principle types of lens are used for new installations. Varifocal, used for static cameras, where the focal length can be adjusted manually across a limited range (i.e. 2 - 12mm) and zoom lenses used for PTZ cameras where the focal length can be adjusted remotely via an electric motor in the lens across a larger range (i.e. 25 – 350mm). Lens selection is vital in determining the quality of the final image, most important is the focal length, light resistance factor and "f" number. Lens focal length sizes are determined using a lens calculator or optical view finder to ensure the correct size of image at a certain distance from the camera position. Image sizes can be crucial if the recordings are to be used as evidence. For example, to obtain a positive identification of a person in court, their image must occupy at least 120 per cent of the screen vertically (i.e. just above the knee to the top of the head must fill the monitor screen). A car number plate must occupy at least 33 per cent of the screen horizontally. Smaller image sizes can be used purely for recognition, monitoring or for triggering of VMD or alarms.

Adequate light is a key requirement for the success of all CCTV systems. The light reaching the camera sensor during the darkest operating conditions must equal or exceed the minimum lux rating of the camera in order to obtain a usable video signal. The light level is calculated using a formula involving the light reflected from the scene (a product of the incidental light measured during the recce and the reflectance factor of the scene), the "f" number of the lens (a ratio of the lens focal length and effective diameter) and light resistance factor of the lens (a factor of the quality of glass and amount of refraction within the lens). Due to the rural nature of the Province and size of zoom lenses often needed, additional lighting can be required. This is achieved using infra red (IR) lamps that are useful to a range of around 250 m and are invisible to the naked eye. Over this range more sensitive cameras are required.

The cameras used can be broken down in to

three main types, tube, thermal imaging and charge coupled device (CCD). Due to their versatility, durability and relative low cost CCD cameras are the most widely used. The camera selection depends on the OR, the most important features are sensitivity, resolution and response to available light. Tube cameras still provide the best resolution however unless intensified (which is expensive) they are not good in low light. CCD cameras are available for many applications from tiny pin hole cameras to larger highly sensitive low light cameras, operating in

colour or black and white or a combination for day and night use. With intensifiers fitted CCD cameras are capable of viewing in light levels as low as 0.005 Lux (star light is around 0.01 Lux). The thermal imaging cameras used will detect a person at around 500m in complete darkness however they cost in the region of 20 times as much as a good quality CCD camera and only provide a relatively low resolution black and white picture.

The camera support bracket design is based on the weight (some cameras weigh over 40 kg), physical compatibility with the equipment to be mounted and the mounting surface. The wind and snow loading of the assembly also has to be considered. Only proprietary or purpose made CCTV brackets, masts and poles are used as other types allow too much movement when large lenses are zoomed in.

There are many methods used to transmit the video signals from the camera to the monitoring location. These include fixed links such as coaxial, twisted pair, fibre optic and telephone type cables. Wireless links such as infra red, microwave and radio frequency. Remote links such as telephone lines and Ether net are also used. The type of transmission selected depends on the following factors:

- The system OR.
- Distance, ease of cable runs, relative proximity of cameras and number of connections.
- Existing infrastructure.
- Line of site and possible interference.



- Capital cost and maintenance of each method.
- Possible future expansion to the system.

· I ossible future expansion to the system.

CCTV Console for approximately 20 Cameras.

All transmission methods suffer from signal attenuation generally quoted as dB/100m run. The most commonly used method here is coaxial cable up to around 800m, fibre optic over 800m and microwave where installation of cables is difficult.

Telemetry control systems are used to operate camera functions remotely from the operations room. Most control systems consist of a keyboard with joystick controller that is used to control any camera selected via a matrix transmitter. Each camera has a telemetry receiver installed close to it to receive the data from the controller and convert this to a voltage to operate the motors within the lens, pan and tilt motors or the required camera and lighting functions. The telemetry data can be transmitted over the same medium as the video signal if conditions allow, however a separate twisted pair cable is often used. Additional considerations for the camera telemetry control system are the number of cameras to be controlled, distances and relative proximity of cameras. The type and size of cables must be compatible with the data to be transferred and any anticipated voltage drop, signal attenuation and interference.

Most CCTV systems installed here are monitored from operations rooms, guardrooms or surveillance suites where a console is usually required to protectively house all equipment



whilst allowing easy maintenance access. A local carpenter usually constructs the consoles to our design. The control room design depends on the OR ie type of display, number of monitors, recording method and the available space. In practice a keyboard controller mounted in front of the main monitor has been found to be the most ergonomic design. The main monitor displays any camera selected by the operator, with all other cameras displayed on split, sequence or dedicated monitors adjacent to the main monitor.

Control equipment is installed within easy reach of the operators and the recommended monitor viewing distances. Consideration has to be given to control room lighting and windows to avoid reflection on the monitors.

Recording is an important feature of most systems installed. When designing the recording system a maximum of eight cameras per multiplexer and VCR is normally used. This gives a recording rate of around 0.4 fields/sec per camera on 24 hour time lapse recording (i.e. one three hour tape used to record eight cameras for 24 hours via a multiplexer). Tape storage for 15-30 days per VCR is generally allowed. Digital recording systems are now being installed to replace the analogue VCRs, giving a recording rate of at least one frame (two fields)/sec per camera with a minimum of 15 days storage capacity. The digital systems as well as removing the onus on the operator to check and change tapes also provide a more controllable and auditable trail of video recordings for data protection and evidential purposes. In most locations a real time event or incident recorder is installed, it remains in an alarm mode set at three hour recording until the operator presses an activation button. This VCR then records the camera being operated in real time as well as all cameras being recorded in time lapse.

Monitoring rooms invariably also contain radio, battery charging, intercom, computer and other equipment. This generates a great deal of heat and ventilation or air conditioning is often a design requirement, providing an opportunity for some more traditional Clk Wks (M) work.

Once the design process is complete a further meeting is arranged to allow the user to approve the system and make any changes necessary to meet the available budget. The starting point is always the system design that best meets the OR. Adjustment and redesign is often required to meet the budget, equipment availability or required installation date. High performance sys-



Typical Fibre Optic Receiving and Digital Recording Racks.

tems required quickly are expensive. To reduce the cost either or both the performance and the installation time have to be compromised.

INSTALLATION

INSTALLATION begins once HQNI or Bde approves funding. This is generally carried out by a civilian contractor under the supervision of the PTO CCTV. A Measured Term Contract (MTC) for the installation and maintenance of CCTV, intercom, IDS and attack alarm systems is let for each Bde area. The MTC is usually on a two year term with an optional 3rd year and covers all maintenance of existing systems and new installation works up to £40K. New works over £40K may be put out to tender depending on the security nature of the task and the urgency of the requirement.

The installation is planned as with any project using a cascade diagram, giving time scales and priorities to each part of the installation and linking activities that impinge on others. Pre-assembly and testing of cameras and lenses is carried



The author inspecting camera installations.

out using lens filters to mimic night or infra red lamp conditions prior to deployment, with only fine tuning adjustments being required on site. Back focusing (also termed rack focusing or zoom tracking) of a camera and lens is required to ensure correct focus over the complete focal length of the zoom lens. This saves time and money particularly when the site is remote or access time is restricted and potential problems can be prevented. Cable connections can also be made prior to deployment, this is costly in cable use but saves time on rapidly deployed systems. In practise it has been found best to pre-assemble and test as much equipment as is practicable

Additional factors considered in the installation planning include the following:

- Available manpower and overtime.
- Planned use of specialized plant, tools and meters.
- The environment and possible co-ordination with a guard force or search team.
- Additional works such as power supplies, buried ducts, ventilation or air conditioning.

The weather always has some effect on installation methods and times particularly here in NI and a factor is always included for unforeseen occurrences that may effect the installation such as OR changes, changes in work priorities or increased terrorist activity.

The main practical issues during installation are ensuring that equipment and cables are installed in accordance with the manufacturer's recommendations, particularly at bends and joints to achieve the design transmission distances. Separation of services are observed since coaxial and twisted pair cables will have a mains hum induced on to them if they are not part of an adequately screened composite cable or installed in separate metal conduit when run adjacent to mains cables. Devices requiring line of sight such as microwave, infra red and radio frequency equipment must be securely mounted and appropriately positioned and future tree growth and reduction of performance with time and weather have to be considered. All equipment and cables must be clearly labelled to aid maintenance. Careful co-ordination of civil and military agencies is often required during installation work to ensure the system operation date is met. On large works payments are made to the contractor during the installation at the discretion of the PTO CCTV depending on progress achieved.

COMMISSIONING

SYSTEM commissioning is supervised by the PTO CCTV once installation is complete to ensure compliance with the standards laid down by NACOSS. This includes checking that all wiring is correctly terminated and the supply voltage correct to all parts of the system; that the camera and lens fitted are as specified and correctly set up for interference free camera operation under all light conditions and that the pan and tilt limits are correctly set. Cameras and lenses should be fine tuned using an oscilloscope to obtain the correct 1v peak to peak composite video signal at any point on the system from camera to control room. Alignment of wireless links is checked using the appropriate meter. Monitors are commissioned using a test pattern generator set to the applicable test card. Times, dates and camera numbers displayed and recorded must be accurate and the recording quality and rates correct for each camera. A test of any UPS or standby power supply is also carried out. If practical (rarely on the streets of NI) or applicable, a Rotakin (man shaped target rotating at walking speed) test for each camera is completed and a video of the test produced to aid future inspections of the system.

HANDOVER

ON completion of the commissioning and with the system fully operational a Board Of Officers is convened to hand the system over to the user. The handover to the user requires a complete demonstration of the system by the PTO CCTV and subsequent acceptance of the system by the user. This ensures compliance with the OR and adequate training of the users. Handover documentation is produced that includes the following:

- Operating, fault finding and repair call out instructions.
- Manufacturers literature for all equipment installed.
- Drawings showing all equipment types, locations and routes of all cables. The drawings also indicate the coverage footprint of all cameras and details of power supplies. Completion certificates for all commissioning checks.
- Details of possible sources of interference within the system and of equipment with which the system itself could interfere.

OPERATION

The systems are generally in continual use around the clock and require prompt repair. This incurs a considerable revenue cost. The PTO CCTV manages a contract for preventative and breakdown maintenance in each area. This allows two hrs for the call out engineer to respond and then 24 hrs in which to repair the fault if possible and if spares are available. Vital components are held within the Bde store to reduce repair times however if access to the camera is difficult and when a guard force or search have to be organized repairs may take longer.

A planned preventative maintenance (PPM) logbook is produced for each installation. This contains a system description, detailed site plans and schematic layouts of the system showing connection details. The log book also details the maintenance tasks required and contains the maintenance sheets, defect reports, initial test data and certificates for each installation. PPM is carried out monthly in accordance with the manufacturers recommendations and the mandatory maintenance described in Defence Estates (Works) Specification 005 Issue 003. Follow up repair works as a result of the monthly PPM inspections are subsequently planned and managed. The PTO CCTV is also responsible for long term planning and costing of system upgrades as technology advances and existing equipment becomes obsolete. An upside of this is an opportunity to attend one or two security seminars or exhibitions each year.

PTO CCTV APPOINTMENT

THIS post provides expertise in an interesting new field of engineering and responsibility for the security systems at SF bases covering more than half the Province. I would recommend it to any Clk Wks (M). Despite the initial steep learning curve, the personnel so far employed in this job have served the post and the credibility of the Corps very well. Previous incumbents have subsequently been employed in the security industry and during my tour I have been detached to provide CCTV advice and assistance to the mainland police on OP *PEGASUS*⁷ and requested to write the CCTV section of a Security Engineering Guide for the Corps.

With management of around £1M per year on new CCTV works and maintenance across the 8 Inf Bde TAOR, the post is very busy. Having sole responsibility for the design of systems and equipment specification this job provides a degree of independence not always available in other posts. I have so far designed and supervised the installation, upgrade or redeployment of approximately 115 cameras, nine attack alarm systems and over 20 intruder detection systems. Both the nature of the work and the constraints of armed, alone operation in some pretty inaccessible and inhospitable locations adds to the challenges of this unique post. The reward of being able to promote yet another field of the Corps expertise to the rest of the army, OGDs and civilian industry and to aid in the interdiction of terrorism here in NI continues to provide a real sense of job satisfaction.

⁷ Operation *PEGASUS*. Security for the Conservative Party Conference 2000.

The Army Postal Services 1939-45 Display in the Royal Engineers Museum

CAPTAIN S C FENWICK MSc MBA

Captain Simon Fenwick was educated at St Peter's School, York. He was commissioned into the Corps in 1978 and served with the Postal & Courier Services in Mill Hill, Germany, Northern Ireland and MoD London. He left the Army in 1986 and has since worked as an Operations Director in several express distribution companies in the UK, Canada and Europe. He currently lectures in IT and management, and is the Chairman of the PCS sub-committee of the Friends of the Royal Engineers Museum (FoREM)

INTRODUCTION

SIR Iain Vallance, the President Emeritus of British Telecom and President of the Confederation of British Industry (CBI) opened the Royal Engineers Museum's Army Postal Services (APS) 1939-45 display on Friday 10 May 2002. His late father, Col ET Vallance (late RE) served as Second-in-Command of the Home Postal Centre, Royal Engineers (HPC RE) in Nottingham during the Second World War.

The display tells the story of the APS, which was staffed by men of the Royal Engineers (Postal Section)¹ (RE PS), who were mainly recruited from the General Post Office (GPO), and women of the Auxiliary Territorial Service (ATS). It was researched and sponsored by the PCS Sub-committee of the Friends of the Royal Engineers Museum (FoREM) and contains narratives, photographs and artefacts from the PCS archive². Monies from the FoREM Disbanded Units (25, 38 and 76 Fd Sqns RE) fund were used to assist in the purchase of the display cabinets.

AIM

THE aim of this paper is to give a brief account, with reference to the display and archive, of the activities and achievements of the APS during the Second World War.

POSTAL DIRECTORATE

At the beginning of the war the War Office Postal Directorate was established at the GPO HQ in London.

HOME POSTAL DEPOT/CENTRE RE

THE centre of the worldwide APS operation (see Map 1) was the Home Postal Depot (HPD) RE, first established in London in the late summer of 1939, but was moved to GPO Reading shortly after the outbreak of war. It was then relocated to GPO premises in Bournemouth to be nearer to the Continent and to provide a more efficient service to the troops of the British Expeditionary Force (BEF) serving in France and Belgium.

Correspondence addressed to Army and RAF units serving overseas ³ tended at the GPO was circulated to the HPD RE. The Depot, whose primary responsibility was to collect, sort and despatch military mail to its final destination, also acted as a recruitment, training and reinforcement depot, as well as a Records Office for the RE (PS) and a supply centre for postal units world-wide.

In May 1941 the Depot was redesignated the Home Postal Centre RE and relocated to Nottingham, where the organization requisitioned, for operational and billeting purposes, a hundred and

¹ They were members of the Supplementary Reserve, Royal Engineers.

² The Postal & Courier Services (PCS) archive was given over to the Museum, due to the efforts of FoREM, by the Home Postal Depot RLC in 1999. It contains photographs, documents and artefacts appertaining to the 49/24 Middlesex Rifles Volunteers, Army Post Office Corps, the RE (PS), (PCC) and (PCS) and the 8th Post Office Rifles) Bn, City of London Regiment.

³ The Royal Navy (RN) had their own postal organisation, it did not become an RE responsibility until 1962. The RAF set up their own postal service in the UK.



over 1.2 million items of mail a day. (See Table 1).

These figures show both the Army⁴ and RAF mails, but do not include those mails sorted and despatched to home-based units using the "APO England" address nor do they account for telegrams and return correspondence handled by the HPC. The staffing numbers for such an operation are given in Table 2.

GPO trains and road service schedules as well as specially dedicated trains were used to convey mail between the HPC, the GPO, the Army Postal Distribution Centres

Map 1 - Map showing the global dispositions of the Army Postal Services 1939-45.

forty of the city's buildings, including the Vyvella factory premises, the Hickings buildings, the GPO's Queen Street offices and Trent Bridge cricket ground. It remained in Nottingham until 1947.

ORGANIZATION OF HOME POSTAL CENTRE

THE HPC RE was organized into several departments and branches, each responsible for their own part of the postal operation. They included; the Letter and Parcel Sorting Offices, an Inquiry Branch, Returned Letter Branch, Locations Branch, POW Mail Section, as well as, the Telegram, Airgraph, Administration and Motor Transport Departments, which were staffed by a mixture of RE (PS), ATS and civilian personnel. Heavy manual tasks, such as carrying parcel bags, were often undertaken by Conscientious Objectors assigned to the HPC RE.

MAIL PROCESSING

THE postal workforce was organized into eight hour shifts that operated around the clock seven days a week. By 1944 the HPC RE was handling (APDC), the embarkation ports of Liverpool, Bristol and Glasgow, the airfields in the Midlands (see Map 2) and the seaplane port of Poole.

TRACING UNDELIVERABLE MAIL

IT is a sad fact that battlefield casualties invariably produce large quantities of undeliverable mail. In the field, such mail that comes to hand in

Type of Mail	No of Items (millions)	% of total volume
Ordinary Letters	179	38%
6d Air Letters	158	33%
Newspapers & packets	95	20%
Airgraphs	28	6%
Parcels	12.5	3%
1/3/ oz Air Letters	1.3	0.01%
Total	473.8	

Table 1 – Mails despatched overseas from HPC ~ 1944.

⁴ The strength of the British Army in 1944 was approximately 2.75 million. Mail for 40,000 different commands, formations and units was sorted each day.


Map 2 – Map showing the dispositions of the Home Postal Centre and the Army Postal Distribution Centres 1941-45.

the units was checked against unit records and disposed of appropriately. Unit mail that was indisposable was returned to the Army Post Office⁵ (APO) or Field Post Office⁶ (FPO), and forwarded to postal detachments located at the formation's Second Echelon. These detachments checked the mail against the Field Records. Mail that could not be dealt with was returned the Return Letter Branch (RLB) at HPC RE for further searching and consultation with the Records Office of the appropriate arm. If that proved unsuccessful the letter was eventually returned to the sender.

In the cases where the addressee had been "killed in action" or was reported "missing" extreme care was taken to ensure that returned mail did not arrive at the sender's address before the official notification had been issued.

BRITISH EXPEDITIONARY FORCE (BEF) 1939-40

IMMEDIATELY on the outbreak of war members of the RE (PS) were mobilized and advance parties of the Postal units, under the command of Col W Roberts⁷ the Assistant Director Army Postal Services (ADAPS) BEF, were sent to France with their formations.

By mid September 1939 a Base Army Post Office⁸ (Base APO) was established at Cherbourg and a Regulating Section was set up at the BEF Assembly Area in Le Mans. APOs were deployed along the lines of communications and FPOs with their formations.

The APS provided mail collection and distribution facilities, sold stamps, postal orders and postal stationery, as well as

	Officers	Other Ranks	Total
RE (PS)	56	1571	1627
ATS	2	1482	1484
Totals	58	3053	3111

Table 2 - HPC Staffing Levels ~ 1944

⁵ APO – Army Post Office. A static Post Office run by the RE (PS) usually located on a line of communication or in a rear area.

⁶ FPO – Field Post Office. A mobile Post Office run by the RE (PS) usually located in the forward administration area of a division or brigade.

⁷ Col W Roberts, a Surveyor in the GPO was an active member of the RE PS (Supplementary Reserve) in the inter-war years. On the outbreak of war, despite being 51 years old, he joined-up immediately. Throughout the war he served in all the major European theatres; first as ADAPS to the BEF (1939-40), then ADAPS to the MEF (1940-43) and CMF (1943) before returning to the UK and subsequently returning to Normandy as ADAPS to 21 Army (1944-45). After the war he resumed his career with the GPO.

⁸ Base APO – was usually established at the main supply port of the theatre of operations. It was the largest APO deployed and acted as the exchange office between the HPC, APO/FPOs and the local civilian Post Office. It usually held the main postal account for the theatre. Base Censors were usually co-located with it.

providing a Telegram service. The transit time for mail between the UK and BEF was 3-4 days. During the "Phoney War" period a "cross post" operation was laid for intra-formation mail, the service also carried most of the Royal Signals Despatch Rider Letter Service (DRLS) material. The APS handled an average of 9,000 mailbags a day.

As part of the "Plan D"⁹ the Base APO was moved to Le Havre and a Regulating Post Office was established at Bolougne to receive mails from Folkestone. This improved the transit time to 2-3 days.

Postal personnel and their mails were evacuated from Dunkirk during 23 May - 6 June 1940. The evacuated included Col Roberts and his Postal Directorate, who on arrival in Dover were immediately ordered back to Cherbourg to organize the evacuation of the rear area Postal units and any outstanding mails.

The entries for 9-10 June 1940 in a private diary of Capt (later Lt Col) E G Hucker, (OC 2nd Line of Communications Postal Unit RE), contained in the archive, gives some insight into the confusion that reigned immediately after the fall of Dunkirk. He recorded:

Sunday 9 June1940:

...Trucks of inward (UK) mails (285 bags) received at station [Lisieux] and dealt with. HQ Rouen Sub area, Signals and other small units obtained mail but in general unit mail remained on hand as unit locations were not available. Moreover "G" staff (Capt Harper) informed me that the Postal Unit must be kept mobile ready to make another move at short notice. ADST seen and a lorry requisitioned for transport of mail. "G" staff and "Q" staff (Major Jackson Darling) instructed me to hold all mail for 51 Div as it was impossible to reach them across [the] Seine...

Beauman Div called and collected mail, A Div did not call.

Mails for 51 Div returned to Mézidon by road for re-consigning to Base [Cherbourg].

Party left at Mezidon on Col Roberts' instructions for requisition trucks. Mails from [APO] S6 returned there except those for 51 Div.

Monday 10 June1940:

Col Roberts left for Mézidon and Le Mans – taking two bags of unsorted English mail for Base APO 1 [Cherbourg]. Acting on instructions party left for Pont L'Evêque in an effort to locate [APO] S9 staff. I saw Col [John] Evans [DADAPS BEF] there who stated he had no knowledge of [APO] S9 staff and that if they had not already been evacuated to a place south of the river [Seine] they would go to England directly from Le Harve. Telephonic communication with Le Havre not possible after 12 noon.

Railway communication between Lisieux & Base APO [Cherbourg] interrupted by enemy's successful bombing of line at Serquigny.

Mails for 1 AD collected by $\hat{L}t$ Cashin¹⁰ on way to Le Mans.

Information received that Beauman Div already moved to Le Mans area at about 9.0pm 9/6/40.

2 L of C Postal Unit now in forward positions...

The entries after this date become more sparse as the situation became more desperate, however, the unit was eventually evacuated intact from St Malo.

HOME FORCES POSTAL ORGANIZATION 1940-44

In the period following the fall of France and the débâcle in Norway, Britain started to build defences in preparation for an invasion by Nazi Germany. The APS formed a nationwide postal service for military units. This service played a part in maintaining a cohesive defence system. It was based upon the HPC RE and the establishment of six APDC at London, Bristol, Leeds, Crewe, Belfast and Edinburgh. The APDCs received their mail direct from the GPO or the HPC RE. Units were responsible for collecting from, and delivering their mail to their allocated APDC, this system remained in place until the end of the war. Their war diaries are contained in the archive.

MIDDLE EAST FORCE (MEF) 1940-45

AT the time that war was declared, peace-time garrison troops stationed in North Africa and the Middle East were using the civilian postal ser-

⁹ Plan D – A line of defensive positions following the Dyle river between Antwerp, in the north, and Namur, in the south, which were held against the advance of the German forces between 15-17 May 1940.
¹⁰ Lt Coshie (Joten Lt Col) remained in the army often the war and masternin ded the actual lightness of the Forces.

¹⁰ Lt Cashin (later Lt Col) remained in the army after the war and masterminded the establishment of the Forces Courier Service in 1958 for which he was awarded an OBE.



Map 3 – Map showing the mail routes to the Middle East and Far East theatres 1940-43.

vices, as they had done since 1882, but by July 1940, under a special arrangement with the Egyptian government, a Base APO was established in Cairo and the British APS were allowed to run their own post offices and collect the resulting revenue.

Throughout North Africa and the Middle East, Postal units were deployed with their formations. Some of the RE (PS) personnel, along with their formations, were captured at Crete and Tobruk and spent the rest of the war as PsOW.

Surface mail routes through the Mediterranean became extremely vulnerable once Italy entered the war in June 1940 and by mid-1941, after Germany had conquered the Balkan regions, the direct air service to Cairo was cut. This meant that new routes for mail had to be found. Surface mail was sent via the Cape of Good Hope and an air route was forged across the southern edge of the Sahara desert from Takoradi, West Africa to Sudan (see Map 3).

These new routes were slower than the old ones and in a very short time this began to have an adverse effect on the morale of both the troops and their families. The situation was aggravated by the

uncertainty and casualties caused by the German bombing of the major cities of Britain and the enemy U-boat action against the convoy ships carrying mails and supplies. The mail, if it got through, could take 1-6 months. To improve the service it was necessary to find a way to lighten the mail so that more of it could be carried by air. The solution, initiated by the APS and the GPO, was the introduction of the "air letter form" and the "airgraph".

AIR LETTER

LT Col R E Evans, ADAPS MEF, proposed that a lightweight self-sealing letter card that weighed only 1/10 oz be adopted by the British Army for air mail purposes. He recommended its use to Sir

Anthony Eden, the Secretary of State for War during his visit to the Middle East in late 1940. By January the following year, General Wavell, the Commander-in-Chief, MEF was told by Eden that "Your Assistant Director Army Postal Services may forthwith introduce an Air Mail Letter Card Service for the Middle East. Use British stamps from all countries, including Egypt." On 1 March 1941, the service between the Middle East and the UK was started, using a combination of Imperial Airways seaplanes and military transport.

The postage on each air letter was three pence (3d) and, due to limited air capacity, they were initially rationed to one per man per month but towards the end of the war, as more capacity became available, the ration was lifted. The private nature of the air letter ensured its popularity among its users and that popularity with its lightness brought about its continued use as today's civilian air letter (aerogrammes) and the military "bluey".

AIRGRAPH

THE airgraph was invented in the 1930's by the Eastman Kodak Company in conjuction with Imperial Airways (now British Airways) and

¹¹ An airgraph form approximated the size of an A4 sheet of paper. The photographic process reduced its size.

Pan-American Airways as a means of reducing the weight and bulk of mail carried by air. The airgraph forms¹¹, upon which the letter was written, were photographed and then sent as negatives on rolls of microfilm. A GPO poster of the time claimed that 1,600 letters on film weighed just 5oz, while 1,600 ordinary letters weighed 50lbs. At their destination the negatives were printed on photographic paper and delivered as airgraph letters through the normal APS or GPO systems. (There are examples of the airgraph form and airgraph letters in the display).

In 1940 the Minister of Transport, Lt Col Moore-Brabazon ¹², put forward the idea that airgraphs be used to reduce both the bulk and weight of mail travelling between the MEF and the UK. The matter was referred to the APS and the GPO, who jointly investigated the possibility of using airgraphs. This eventually lead to a service being instituted between England and Egypt in 1941¹³ when 70,000 airgraphs were sent in the first batch and took three weeks to reach their destination.

Kodak had offices in Cairo that were capable of processing airgraph negatives, but it was not until the appropriate equipment arrived from America that their Cairo office enabled the APS to provide a return service to the UK.

In the theatres of war the whole airgraph operation was co-ordinated by the APS. Completed airgraph forms were collected by the A/FPOs and forwarded to the Kodak processing plants, which were co-located with the Base APOs.

The use of the airgraph was not rationed and its postage was also set at three pence (3d). Although it proved to be immediately popular, its use was limited because of its size (approx; 11cm x 14cm) and lack of privacy, so when sufficient aircraft capacity became available its use declined in favour of the air letter.

We can better appreciate the positive effects on morale of these innovations from remarks made in an air letter (also in the display) written by a Gunner serving in the Middle East who wrote: Dear Peggy,

I was extremely bucked to receive your airgraph dated 23rd July. It may be difficult for you to realise how much mail means to us very often it's the difference between a happy day and a miserable one. Probably more so in my case because all the incoming mail passes through my hands and you can imagine how I feel if I sort a couple of hundred letters and there is not one for me! Your letter saved the day and cheered me up immensely....

BRITISH NORTH AFRICA FORCE (BNAF) 1942-43

THE APS was not involved in the initial planning of Operation *Torch*, the 1942 Anglo-American invasion of North Africa. Consequently a Base APO was not established in Algiers until a month after the invasion and through no fault of the APS the mail services to the BNAF were very poor in the initial stages. This was worsened by the fact that a convoy carrying the Christmas mails was sunk.

After consultation between the military authorities and the APS, air links¹⁴ with the UK were established and both air letter and airgraph services were made available. Kodak established an airgraph processing station in Algiers, which was later to process the airgraphs sent by troops engaged in the Italian Campaign.

In theatre the mails were carried along the North African coast to the front lines by sea, rail and vehicles. The road service that operated over 500 miles from Algiers to the front was described as having the "the regularity of a town collection in peacetime Britain". A staff officer with the 6th Armoured Division commented that "As soon as the tanks pulled out of battle, there was the mail wanting for them – incredible".

Central Mediterranean Force (CMF) – Italy 1943-45

¹² Lt Col Moore-Brabazon RFC was also a Director of Kodak. During the First World War as a pilot in the Royal Flying Corps, he had pioneered the techniques of aerial photography.

¹³ The airgraph service was then later extended to: Canada (1941), East Africa (1941), Burma (1942), India (1942), South Africa (1942), Australia (1943), New Zealand (1943) Ceylon (1944) and Italy (1944).

¹⁴ Seaplanes flew the mail between Poole and Algiers staging at Lisbon and Gibraltar.

¹⁵ The invasion of Sicily – code named "Husky" – was launched on the night of 10 July 1943 and involved half a million men deployed in eight divisions.

THE Postal units of the MEF and BNAF, which made up the CMF, accompanied their respective formations on the invasion of Sicily¹⁵ and subsequent landings on mainland Italy¹⁶. These invasions were the first major amphibious operations of the war. A datestamp taken by a Postal unit from the Syracuse Post Office dated 10 July 1943, the day of the invasion is an exhibit in the display.

FPOs were established on the beachheads during the landings at Salerno and Anzio. On two occasions mails leaving the Anzio beaches onboard an LST¹⁷ were lost to enemy action.

After the 8th Army secured itself on mainland Italy, Base APOs were established at Bari on the heel of Italy, and at Naples (the main Base APO) to handle the army's mail.

Mails were distributed within the VIII Army operational areas by truck that were augmented by rail and air, which were developed to provide an internal mail service to troops as they moved north. Surface mails entered and exited via Naples, Bari, and Taranto. Until the liberation of Paris on 25 August 1945 airmail was staged through Gibraltar on its way between the UK and Naples, but after that date a more direct air route over France was established, which reduced the transit time for airmails to the Italian and Far East theatres. The air and surface transit times between HPC and Base APO Naples are shown in graphs 1 and 2 respectively.

The only outlet for telegrams accepted at A/FPOs in Sicily was by air from Catania via Castel Benito to Cairo where they were passed to Marconi for electronic transmission to their destination. Once the Base APO was established in Naples the telegrams were flown direct to Cairo.

As in the other theatres special military currency was issued to the troops and was used to purchase items at the A/FPOs, NAAFIs and local shops. Examples of this currency, a gift from a RE (PS) WW2 veteran, can be seen in the display.

INDIA AND FAR EAST 1942-45

THE mail services for troops serving in the Far East was administered and provided by three agencies; the RE (PS), the Welfare Department



Graph 1 – Graph showing the transit times of airmails between HPC and Base APO Naples 1943-45.



Graph 2 – Graph showing the transit times of surface mails between HPC and Base APO Naples 1943-45.

of the Adjutant-General's Branch of the Indian Army (GHQ, India) and the Indian Army Postal Service (IAPS), an arrangement that was fraught with political tensions and proved to be an uneasy working relationship.

The outbound surface mail travelled by sea from Liverpool to Durban, South Africa, where an APS Postal Regulating Office was established, after which it crossed the Indian Ocean to the IAPS Postal Clearing Section at Bombay and from there it was forwarded to the battle fronts in the Far East. There was a limited airmail service in operation between India and Britain that followed the Empire Air service routes across the Middle East (See Map 3). The transit times are given in Table 3.

After the fall of Singapore and the retreat from Burma in 1942 the military postal services in India came to a virtual standstill because a serious backlog of undeliverable

¹⁶ The Allied campaign in Italy began on 3 September 1943 with a three-pronged invasion of the southern peninsula and ended on 2 May 1945.

¹⁷ Landing Ship: Tank (LST) – built to land tanks, troops and supplies onto beaches and used by Allied troops fighting in Europe and the Pacific theatres.

	Surface mail	Air mail (via Takoradi)	Airgraphs (via Cairo)	
UK to India (1942)	3-4 months (via Cape of Good Hope)	2-3 months	3-4 weeks	
UK to India (1943 onwards)	2-3 months (via Mediterranean Sea/Suez Canal)	10 days	11 days	

Table 3 – Mail transit times between the UK and India.

mail had built at the IAPS Postal Clearing Section, Bombay – a situation that prompted complaints to be heard in the Houses of Parliament. The Director Army Postal Services (DAPS), Brig F Lane, who worked from the GPO HQ, London was instructed to resolve the problem. He sent a member of his staff, Lt Col EG Hucker to India to investigate the apparent shortcomings of the service. Hucker concluded that the IAPS should be reorganized along British lines and the adoption of this recommendation coincided with the establishment of the HQ Allied Land Forces, South East Asia (HQ ALFSEA) in 1943. Fragments of his report are in the archive.

A Base APO was established at Calcutta by the RE (PS) and mail for the British and African troops engaged in the recapture of Burma was forward from there to postal units at the forward supply depots and hence to the front line FPOs.

Postal units, officered¹⁸ by RE (PS) were formed for the 81 (West African) and 11 (East African) Divisions. The 81 (WA) Division Postal Unit RE under the command of Lt AE Tee RE become the pioneers of "air dropping" mails to forward FPOs and troops. Special air despatch postal units were located at the main airfields and were responsible for packing and loading mails onto the correct aircraft. Dedicated mail sorties were flown in Dakotas from the main supply depots at Imphal and later Chittagong. Lt Tee was subsequently promoted and posted to the Chindits to oversee their mail services. L.5 casualty evacuation aircraft were also utilised to carry mail between the front line FPOs and the APOs at the rear area airfields. On the ground close cooperation existed between the British and Indian APSs and the two services' lines of communication were dovetailed to make efficient use of the resources.

On the fall of Singapore

to the Japanese on 15 February 1942, the entire staff of 18 Division Postal Unit RE were interned. During their internment they took responsibility, as far as their captors allowed, for the organization of the mail service within the Changi Gaol and the "death" railway work camps in Thailand, for which the OC of the unit, Maj WA Border RE, was later awarded the MBE. In 1946 he wrote of this episode: "After over twelve months the first mail arrived from home, These letters were quite twelve months old, and contrary to the usual Japanese practice the men of the Postal Unit got the work of distribution." Of the 27 members of the unit, 17 (63 per cent) of them survived to be repatriated back to the UK at the end of the war. A transcript of Border's diary and report of his experiences in captivity is contained in the archive.

OPERATION OVERLORD 1944-45

THE APS played a significant part in Operation Overlord¹⁹ not only as a morale boaster, for General Montgomery and his staff considered that a regular mail service was "the greatest morale factor in an army", but probably more importantly, as a means of maintaining the elaborate deception plan that was essential to retain the element of surprise required to ensure the success of the operation.

APO ENGLAND

AFTER the ADPCs had been established in late1940 UK stationed units were served by them using a "closed address" (i.e. No, Rank, Name, Unit, c/o APO England), the style of which was already in use for overseas theatres (e.g c/o BEF, MEF, SEAC, BLA etc.). This

¹⁸ Both RE (PS) officers and NCOs managed these Postal units. The staff were raised from ordinary African soldiers, usually those who had worked for their local colonial postal administrations.

¹⁹ Operation Overlord – the code name for the Allied cross-Channel amphibious and airborne invasion of northern France on 6 June 1944 onwards.

was a radical departure from the past for until then UK based units used their normal civilian GPO address and service. The importance of this address style was that it meant letters so addressed were circulated under APS control thus providing a simple but effective weapon in the Staff's deception arsenal. The GPO circulated "APO England" mail to the HPC RE, where it was sorted and forwarded under military control to the correct destination thereby providing the necessary security to mask troop movements and locations. During the build up to the invasion planners ordered that all units to adopt this address style. Such an instruction had obvious implications on the staffing of the HPC, which was reluctantly allowed to

increase it establishment to accommodate the extra work. The "closed address" concept remains a part of today's BFPO address system²⁰.

MARSHALLING AREAS

In the prelude to the invasion, troops were sealed in their marshalling areas and their only official contact with the outside world was through the camps' FPOs set up by the APS. To maintain secrecy all private mail posted at these FPOs was impounded and stored at the APDCs until the news of the landings had been made public knowledge by the news agencies. During this time special trains running out of Nottingham were set up to carry mails to the marshalling areas and embarkation ports (see Map 4).

PRE-LOCATION SCHEME

THE APS planners were among the very few staffs that were entrusted with knowledge of the full battle plan, with such information. The ADAPS Second Army, Lt Col CR Smith, conceived a pre-location scheme that enabled mail to be delivered to the various "serials" of each unit as they landed in Normandy. The scheme



Map 4 – Map showing the mail routes to the Operation Overlord Marshalling areas 1944.

worked on a system of "phantom FPOs" whereby units were allocated FPOs from which they would be served. In reality they were served by the FPO closest to them, which may not have been their allocated FPO, but was regarded by the APS for location purposes as their "phantom FPO".

NORMANDY BEACHES

FPOs attached to the breach parties and special forces were established on the beaches on D-Day. Although it was planned that mail be delivered to units on D+1, mail was delivered the following day (D+2) because of confusion caused by the day's delay to the invasion.

To ensure the safe recovery of mail from ships arriving from Southampton, a Postal officer was given the task of patrolling the choppy anchorages in an amphibious Jeep bawling through a megaphone at each ship "Are you carrying mail?". This system remained in place until the Mulberry Harbours at Arromanches were established to allow mails to be docked more formally.

The 6 Airborne Division Postal Unit RE and the Beach Group APO S698 made the first despatch from Normandy on D+2.

²⁰ The BFPO numbering address system (e.g. BFPO 1, 2, 23 etc.) was actually introduced immediately after the war to enable non-English reading sorters in Germany to sort military mail on behalf of the APS. The BFPO address only required the "Number Rank Name, Unit, BFPO…" which meant that it retained the masking element of the "closed address".

BASE APO 8

THE main Base APO (No 8) arrived in theatre on D+10 and established itself in a barn at Crepon. The barn had to be cleared of 20ft accumulated manure and straw by bulldozers of a RE Road Construction Company before the Base APO could become operational. The Base APO was later moved to Brussels, where it remained to until the end of the war.

AIRLIFTS AND ROAD SERVICE SCHEDULES

ON 6 July 1944 a two-way airlift system was established between the UK and airstrips in Normandy for the exclusive transportation of letters and newspapers. As the British Army advanced along the north coast of France into Belgium and finally into Germany, these airlifts continued and were augmented by an elaborate system of road service schedules that linked the airstrips with the Base APO and A/FPOs. It was said that ones' watch could be set by the arrival of these vehicles, such was their punctuality.

END OF HOSTILITIES IN EUROPE

THE display contains an apt illustration of the end of hostilities in an exhibit of an original signal received by Capt (later Lt Col) John Turver²¹ RE, OC Guards Armoured Division Postal Unit RE on 5 May 1945 at Stade (between Hamburg and Cuxhaven), which simply reads:

GERMANS surrendered unconditionally at 0820B hours 4 May 45. Hostilities on all Second Army fronts ceased at 0800B hours today 5 May 45. NO repeat NO adv[ance] beyond present front line without orders from this HQ.

(You can still see John Turver's pencilled initials to the right of the text, initialled to acknowledge receipt of the signal.

Auxiliary Territorial Service (ATS) – Postal

THE first ATS to join the RE (PS), at the beginning of the war, were members of the Berkshire Company ATS, a cadre of administrators and cooks for HPD RE in Reading. They move with the HPD to Bournemouth and then to Nottingham. It was at Bournemouth that they first became involved in the postal aspect of the work at the Depot.

By the end of the war the ATS women made up 49 per cent of the total strength of the HPC RE, employed in both postal and administrative duties. After 1944 some were deployed to the Base APOs in Belgium and Italy.

On joining the HPC they received 5-6 weeks postal training before being posted to their companies. They became the major letter sorting force of the HPC and were each expected to sort 1,000 letters per hour during an 8-hour shift.

An ex-ATS Private (Mrs Barbara Danter), who served at the HPC during the war, kindly donated her ATS tunic to the Museum and it is now an exhibit in the display²².

DOMINION AND FOREIGN ARMY POSTAL SERVICES

THE Canadians established a Base APO in Manchester and where possible their service ran in parallel with the British APS. The HPC RE also provided them with postal stationery and equipment.

In the Middle East, Far East and Italian Campaigns; Australian, Indian, New Zealand and South African APS used the British APS' lines of communication to carry their mails between the front and rear areas.

After the fall of Europe, small components of the Allies armies, such as the Free French, the Poles and Czechs escaped to Britain and were re-formed. They raised their own Postal units, which were trained by the RE (PS). In the field

²¹ Capt J Turver began his service in 1939 as a Sapper with the 42nd Divisional Postal Unit RE and was evacuated off the Dunkirk beaches aboard HMS Wolsley on 30 May 1940. He was later commissioned and served as OC Guards Armoured Division Postal Unit RE. During Operation Market Garden he was personally ordered forward to deliver mail to the beleaguered airborne units in Arnhem (21-3 September 1944) to counter German propaganda that the troops were cut off – the assumption was that they could not have been cut off if they received their mail. The airborne units on this occasion did not deploy with their own postal units, which had remained with the rear parties in the UK.

²² The tunic is resplendent with the original RE Bomb worn on the left breast of tunic an as indication that the wearer served with a RE Postal unit. This practise continued until women of the WRAC, who were trained as Postal & Courier operators, were finally cap-badged as RE in 1992. Many of the ex-ATS women who served at the HPC still feel a very strong affiliation with the Corps.

their postal services were dovetailed into the British APS, and the HPC RE provided much of their postal stationery and equipment.

The American forces had their own APS based upon a Base APO in Sutton Coldfield, their service ran separate from the British service, although there was much liaison between to the two services.

CONCLUSION

THIS paper only scratches at the surface of the history of the APS and only briefly hints at the complexities of providing an extensive postal service to troops in wartime, a task made more difficult by enemy action and meagre resources.

In his address to those who attended the opening of the display, Sir Iain observed that the period of the Second World War "could be seen as the service's 'finest hour' for, against the odds, the APS succeeded in establishing and maintaining a thoroughly professional service that came to be relied upon by the troops and their families back home". A great deal is owed to the 7,000 men and women of the APS, who worked so tirelessly and selflessly to provide such a vital service. There is no doubt that they made a major contribution to maintaining the morale of the nation and its fighting forces during the war.

If you have not seen this display, or indeed any of the others, do go to the Museum, it is well worth a visit.

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Sappers Should Know These Things

MAJOR K J GRANT TD CENG FICE FCIOB

THIS is not a story of Military Engineering. There is however a more or less tenuous Sapper connection; certainly Sapper training and experience played a part.

During my "day job" as an Engineer Agent, (rather than in my TA role), working for the organization which at the time was the world's largest construction company, I was required to handle any enquiry which came my way, from client's conception to contract completion. I then subsequently drafted the final account.

One of my contracts at the time of this tale was situated in a large steel works on a hill top in South Wales, where one of my gangs was engaged in digging deep to provide foundations for a new ingot processing plant. With my head well below ground, endeavouring to give advice on how to stem the water which was penetrating the excavations at pit bottom, I was approached by my client's representative who said "Ken, you're a Sapper, you must know all about mines and demolitions". This was true to a point - I'd done my time at No. 1 TBRE and I was presently entrusted with commanding a Sapper Squadron. My recent civilian experience was also related in that my team had just moved up the valley in which we had been erasing a Victorian school from an historic site, whilst simultaneously mining a decayed tunnel to restore it to life. "Oh Yes?" I tentatively replied, wondering what was coming next. "I would like you to demolish the chimney stack on the other side of the works", said my client. " No problem" I replied, having in mind a recent exercise carried out by my TA squadron, in which we demolished a chimney stack, some 20m high, in a colliery not far away from the location in question. I had also, some weeks prior to this exercise, demolished a steel stack in West Wales.With these jobs fresh in my mind I was not a bit concerned to commit my (civilian) company to a similar, smaller task, with a quick and easy return on capital to supplement the income we were earning the hard way below ground. I went off with my client to inspect the scene in a happy and relaxed state of mind. Furthermore, was I not becoming an expert in stack demolition? At the time it was not always

easy for me to change "hats". If I was not careful I could easily confuse my civil engineering jobs with military engineering tasks. This was particularly so at week-ends since my site office sometimes became my Squadron HQ, in which "O" Groups were held prior to night marches over the Brecon Beacons or rafting on a mountain top pond. However that, as they say, is another story. The two jobs were also fairly similar in method, resources and procurement. but the over-riding civil aim was, of course, to make a profit, whereas the TA priority was quality of training.

THE FIRST STACK DEMOLITION

I HAD been requested to demolish a chimney in a steelworks in West Wales. On that occasion the stack was of modest height, and made of steel. To take it down, the hook of a crane was attached to the top and burning gear was applied to the circumference of the base until it became detached from the main tower. Unfortunately the crane's hook had not been exactly centered at the stack top and a scary moment occurred when the base was eventually burnt through. The stack became out of plumb very quickly and swung towards the crane and for a moment or two I had visions of also being in the crane demolition business. Whoever heard of tension? However the swing was slight and the stack was laid to rest.

THE SECOND JOB

THE second job, by my TA unit, was also successful. In that situation, Sappers supervised by my PSI, with myself making frequent reference to RESPB No4 (1946) "Demolitions", drilled the requisite number of holes in the base of the brick stack, set up a simplified circuit linked to a double initiating set, inserted some "808", retired to a safe distance, attached an Exploder, Mk 7, depressed the handle and watched the stack give a little shrug and then sink gracefully into itself.

Two Down And One To Go

WITH two down and one to go, I felt confident until I arrived at the site of the tall chimney. "There you are, Boyo" said my client, "piece of cake, we've already cleared the site for you". And, so they had, a neat empty level space had been created to one side of the 20m high stack. However, to the rear and to one side was a terraced row of occupied Victorian workers cottages, albeit behind a wall, but in the line of fire if the stack fell off course. This was not at all like the colliery site where there was ample room for error. Even if the stack did fall within itself a minor shrapnel burst would not be helpful to the cottages. "Ah well!" said I, scratching my head. "This is not quite what I imagined, explosives are out of the question". While my mind was pondering the possibility of sub-letting this risk, my client chipped in with, "Remember you're a Sapper, surely all you've got to do is to treat it like a tree". He'd obviously read the book. "Cut part way through one side, cut through a little bit more on the side on the line where we want the stack to fall and hey presto, down she comes" "Well ye-es", I replied and, "of course, it will have to have temporary supports which we will burn out". I too had read the book; however, it's never quite like that in practice. Horrible thoughts started to go through my head. What if the burning was uneven and the stack twisted and fell off line? The answer to that was easy - it would demolish the cottages!

THE WORK STARTS

I MOBILIZED a gang and instructed them to carefully cut through the 450mm thickness of brick wall, to a height of 600mm, from two corners of the stack on the side facing the area in which the stack would fall. This was done, one corner at a time, with myself like an anxious parent watching his child take the first few faltering steps, observing the removal of each and every single brick. Each corner was supported with timber props immediately there was sufficient space into which they could be positioned. Once the props were secured in place with folding wedges, removal of brickwork between the now propped corners was undertaken. It was removed from two sides of the stack for a length marginally over the half way point between the propped corners and the remaining insitu corners. Piece of cake! Now it was just a matter of burning out the props!

Horrible thoughts returned. How could I ensure that the opposing props burnt evenly? Say the fire went out on one side? What if the there was an unseen flaw in one prop? The concept seemed unscientific. A more positive way and higher tech method of prop removal had to be devised. An unfamiliar noise was heard. At that moment a puff of steam appeared over the horizon and into view came a steam crane. Surely nothing is more reliable than steam. Why not harness it?

The safety area was established and "sentries" were posted. The steamer was positioned well away from the area in which it was planned to fell the stack and SWR was attached to the crane, lead back and fastened to the props. A crowd mysteriously started to gather, obviously the works jungle telegraph had hastened into action and all the other boyos had come with one mind, as crowds are wont to when there is a potential drama in the offing, lest things go awry. Not to be daunted I nearly said "Carry on Sergeant Major!" However, there was no escape that way to-day and remembering my (hard) "hat" I believe I said "Take up the slack!" Slack was duly taken up. My tension built up. "Go!" said I. The crane chuffed and slowly but surely, started to winch in the hawser. The line became taught. The props squeaked and simultaneously fell away. "Champion!" said I. But the stack stayed upright. Silence descended upon the onlookers. Would it fall? and if it did, would it fall in the pre-determined direction or would it topple towards the cottages? My client looked accusingly at me. "Did you cut out sufficient brickwork?" said he. Time as well as the stack stood still. Perilous thoughts raced through my head. The ganger looked at the general foreman, the GF looked at me. Would I have to risk my gang's lives in an attempt to cut out more brickwork to encourage the wretched obelisk to fulfil the objective? My client looked at me again. "Well Boyo" said he "what are you going to do about it, you can't leave it hanging by there look you!" "No indeed" I replied, still debating in my mind as to the next possible course of action. Had this been a military situation, I would have known the IA to take, and the drill to resolve the problem, eg gun fires; gun misfires; crawl up side of gun etc. - but of course there was no DS or book solution to this one. How I wished we could get behind it and push.

SUCCESS!

AFTER what seemed an eternity, the stack creaked and slowly started to lean towards the required line. The creaks got louder and some splinters of brickwork fell away. Then more fell, quickly now, finally hitting the ground with a loud crump. The ground under our feet trembled. Dust everywhere, of course, but no diversion from the intended line. Hawsers were removed, a traxcavator drove into the rubble and loaded trucks with the remains. Job done.

WHY THE DELAY IN FALLING?

APART from submitting the account there remained one question to answer. Why did the stack stand for an unseeming length of time before crashing to ground? Perhaps insufficient brickwork had been removed from the sides of the stack? Calculations were re-examined. The theory was correct. One factor remained. Pressure on the side of the stack. Ground level was about 160 metres above sea level and a breeze was blowing towards the stack which added another 20 metres; anyone who has climbed a tower of similar height will be aware of how different conditions are at even an apparently small increase in height. Finally it struck home. The wind, which was gusting at the time, had given a blast just at the moment the props were removed. Fortunately the gust was short lived and when the wind "took in another breath", the stack finally and irrevocably fell on line.

Sappers should know these things!



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The Supply of Mines and Explosives to Royal Engineers in the Close Battle – A Solution

MAJOR A J A MACLACHLAN



Major Andrew MacLachlan joined the Corps in 1987 as one of a dwindling number of non-graduates. After two tours as a Troop Commander in Germany and Hong Kong he was posted first as Second in Command of 69 Gurkha Field Squadron and then as an instructor at RMAS. Following a brief civilian spell as a Game Reserve manager in South Africa and a Sports and Event Manager in Huntingdon he rejoined the Army and was immediately sent to Bosnia to Command the UN Mine Action Centre in Mostar. On his return he continued as Operations Officer at 22 Engineer Regiment before taking command of 69 Gurkha Field Squadron and deploying immediately to Kosovo as part of 5 Airborne Brigade's entry operations. He is currently serving at HQRE 1 (UK) Armoured Division as SO2 G1/G4 whilst also attending the Executive Masters in Defence Administration at Cranfield, Shrivenham.

I WOULD first like to state for the record that I am not a logistician. I know this because I'm still wearing the same mess kit that I was when I left RMAS. That I am in this appointment may seem to be at odds with this bold assertion but it wasn't my idea. This article is an adaptation of a paper written not only in order to speed the arrival of mines and explosives to hard driving combat engineers under pressure to deliver but also to save at least two hours of pontification by "logisticians" during DEG Study Days.

Since the responsibility for the supply of mines and explosives (M&E) was handed to The Royal Logistic Corps its efficient delivery to engineers in the close battle has been a matter of fierce and prolonged debate. The current system for the demand of M&E in the two Divisions is shown in Figure 1.

This paper recognizes observations during exercises with 1 (UK) Armoured Division (Ex SAIF SAREA II and Ex IRON RATION 00) and lessons learnt during 3 (UK) Division's Engineer Group exercise (Ex IRON HOLDFAST 01). It also makes use of work from 3 (UK) Division¹, developing a solution presented as a result of that work. The research phase involved several key contributors who deserve mention:

- SO2 J4 Ops Sp 2, PJHQ In relation to the development of Start States.
- SO1 and SO2 Engr Log Ops HQRE Th Tps.
- Log Sp HQ 1 (UK) Armd Div.
- SI Engr, Engineer Resources Division (Trade Wing), RLC School of Logistics.

No article of this type would be the same without some principles. Those below are taken from the Joint Logistics Manual² which are abridged and adapted below:

Foresight. Assessment of the probable course of future operations and forecasting of the likely requirement for personnel, material and equipment, and their movement.

Economy. Effective, efficient and economic use of resources.

Co-operation. Between combat and logistic units, and throughout the theatre of operations at every level.

Simplicity. An easy to implement and simple to follow plan.

Flexibility. The ability to adapt the plan as the situation develops.

¹ HQRE 3 (UK) Div HQRE/23511 dated 13 Oct 00.

² Joint Warfare Publication 4-00. Joint Logistics



Figure 1 – Current M&E supply system.

OUTLINE

HAVING covered some key assumptions and constraints it is my intent to deal with some concerns that are central to the whole debate. I will then discuss two possible systems for M&E supply before choosing the best course of action and outlining the test results to date.

KEY ASSUMPTIONS CONSTRAINTS

Definitions. During the research phase it rapidly became apparent that there were differing interpretations placed upon terminology by the contributors. In order that parity is ensured certain terms are clarified as endnotes.

Maintenance of the Status Quo. In considera-

tion of the problem it soon became apparent that maintenance of the status quo was not a viable option and it was discarded. The Royal Engineers Lessons Learned Database coupled to the experience of both headquarters were the main sources of information for this decision^{3 4 5}. The three references deliver damning indictments on the status quo from separate exercises and were therefore considered enough to discard the option. The Scope of the Challenge. There is no doubt that this problem is a significant challenge to both RE and RLC. The RLC are used to forecasting combat supplies through the "Daily Ammunition Expenditure Rates" (DAER) system, wherein predicted consumption rates are the key to their adherence to the principles of logistics. The speed of logistical reaction demanded between completion of the engineer recce and stores being required on site is per-

haps the quickest required on the battlefield today. Add to this the array of stores required, the bulk nature of M&E stores, the lack of predictability, and the lack of training communication between the two Corps and we begin to see the hurdle. A point in our favour, and one that is not fully recognized, is that the current stock array of M&E items is actually quite low, a fact that assists in the development of the solution and which should be borne in mind throughout by the reader. The stock array is shown at Figure 2 and has been split into two sections, the reasons for which will become apparent later. EOD items have been omitted as much of their specialist stores are carried at first line, but the principles

³ HQRE Th Tps Lessons Learned Database, Serial 20. 13 Nov 01.

⁴ HQRE Th Tps Lessons Learned Database, Serial 34. 12 Nov 00.

⁵ HQRE Th Tps Lessons Learned Database, Serial 33.09 Oct 01.

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Ser	Description				
1. 2. 3. 4. 5. 6. 7. 8. 9. 10 11. 12. 13. 14. 15. 16. 17. 18.	SMALL STORES Safety Fuze Detonating Cord Electric Detonator Non Electric Detonator ISFE Grip Switch Matches Fuzee Fixing kit Steel Studs Fixing Kit Steel Nails Fixing Kit Concrete Studs Fixing Kit Concrete studs Fixing Kit Concrete nails Cart Fixing (Red) Fixing Kit Hard Concrete Fixing Kit B/Wood Fixing Kit B/Wood Fixing Kit Supplementary Fixing Kit Concrete Flash Initiators Coupler kit Demolition				
19 Ser	Cart Pressure Electric Description				
1. 2. 3. 4. 5. 6. 7. 8. 9. 10 11. 12. 13. 14. 15. 16.	BULK STORES PE4 Cartridge CD 14 PE4 Slab Charge Demolition Conical Charge Demolition Underbridge Charge Demolition Overbridge Bangalore Torpedo VLSMS Mk 7 Mine (Local Defence) Barmine SI Barmine DI Fuze L9 Barmine FWAM E Fuze L90A Barmine FWAM M Fuze L90A Barmine ADDI Fuze L90A Giant Python Rapid Cratering Kit				

Figure 2 – Current M&E stock array.

remain the same for any of 33 Engineer Regiment with time to read this *Journal*.

Establishment Changes. It is assumed throughout this paper that no further equipment, manpower, or finance is available to us in finding a solution. Ongoing efforts to define the role and structure of RE HQ Squadrons may assist us however they are also proceeding under the same constraints.

The Checking of Stores. It is the desire of all commanders that they be able to check their stores as close as possible to the task site whilst at the same time in a position to correct an error. As this task is most often carried out by a Troop Commander or Recce Sergeant it must be within reasonable range of these CVR(T) borne individuals. For the purpose of this paper it is considered that 10 km (20 km round trip) is a viable maximum. Work by SI Engr, Engineer Resources Division (Trade Wing), RLC School of Logistics confirms that the majority of error in the supply of M&E occurs within the stock group designated Small Stores at Figure 2.

CENTRAL CONCERNS AND SOLUTIONS

THERE are several concerns that are central to the topic which need to be developed and discussed prior to coming to a final solution.

OPERATIONAL START STATES OF MINES AND Explosives

Current Situation. Preliminary investigation into the M&E problem revealed the need to define the size of the challenge by investigating the amount of stocks carried at 1st⁶, 2nd⁷, and 3rd⁸ Line. This total amount would then be used to make reasonable assumptions on the size of problems such as reconfiguration of pallets or loads. The decision on deployed stocks of common items is currently based upon the RLC held A6606. These are SECRET and are more normally used to calculate DOS with regards to combat supplies. The only truism that can be relied upon when utilizing these systems for M&E is that we will not get everything that we want, as it probably does not exist in the required quantity at 4th Line⁹. During research for this paper it proved impossible to define the exact process by which operational stock levels of M&E are calculated, or indeed who is responsible.

Proposed Solution. It appears that there is an urgent requirement for focus in this critical area.

⁶ 1st Line, in RE terms, includes all RE units and their HQ Sqns, most of which will be located within the various BSAs.

 $^{^{7}}$ 2nd Line, for the purposes of this paper, includes all RLC stocks within the Div area

⁸ 3rd Line, in RLC parlance, includes all stocks held behind the Divisional area.

⁹ 4th Line is defined as being UK located, depot based stocks.

General consensus seems to point to the ideal location for such a decision being HQRE Theatre Troops in conjunction with the formation headquarters of the deployed force, they being ideally positioned to investigate the suggested factors as set out below:

- **Mission.** Whether Peace Support Operations or Combat, the mission will be decided by LAND, they having been given a requirement by PJHQ.
- Force Structure. The force structure is normally a matter for negotiation between PJHQ, LAND, and the deployed force with exact numbers not being agreed until the last minute. In general the basic structure is agreed upon rapidly enough to enable the Operational M&E Start State Decision (both 1st Line and stocks) to be made.
- Enemy Capability. An enemy capable of rapid, armoured warfare over considerable distance will require our forces to deploy with very different M&E to one that operates on foot from deep cave complexes.
- Theatre Specific Geographical Intelligence. The balance of M&E required for combat in the desert, with the wide Manoeuvre Corridors requiring large and complex minefields, will be very different from that demanded by other regions where, for example, bridge and route denials are of greater importance.
- Current 4th Line Stocks and Required Reserves. In this regard input will be required from those who have visibility of total held stocks, required 4th Line reserves and regeneration times as required. It is anticipated that this responsibility will lie with DLO.

REALISTIC EXERCISE START STATES

Current Situation. Both Divisions currently employ 1st Line and Divisional Support Area (DSA) generic exercise tables. These are based upon Cold War deployment plans, with some amendment over the years, represent large stocks, and are articulated within the Divisions' Engineer Group Standard Operating Procedures. It is a common misconception that the 4th Line stocks of M&E are near limitless and that a deployed formation of whatever size will get that which it asks for. As a result lip service is paid to the complex decision needed to judge the correct levels of deployed stocks, units are used to receiving that which they bid for, and HQRE is not overly taxed in the delicate matter of prioritization.

Proposed Solution. Although conceivably the most accurate means of creating tailored Start States for each individual exercise, employment

of the officer nominated at LAND to form Operational Start States is probably unrealistic. The current generic exercise start states would benefit from the input of the DLO to check availability and should then be adapted by formations to form the basis of exercises in different environments.

THE FIELD SUPPORT SQUADRON'S ROLE Current Situation - Vehicle Lift Capability. During divisional level operations the two Field Support Squadrons are based in the DSA and either the Port Of Disembarkation (POD) or Forward Supply Group (FSG) depending on distance. Under current arrangements it is assumed that the squadron within the DSA is able to carry extra M&E and coordinate the supply of further stocks from either the FRV or POD (See Figure 1). Recent exercising has proved that this is not possible. They are simply not manned or equipped to the level required to carry quantities of M&E, nor to reconfigure loads. Once again the Royal Engineers Lessons Learned Database¹⁰ is the most recent evidence that a Field Support Squadron, in addition to its own combat supplies, is expected to take possession of an array of extra equipment. Although the manpower to deal with this is a concern the critical asset is the DROPS, of which they do not have enough. Field Support Squadron commanders who participated in the preliminary investigations for this paper all concurred that, even at War Fighting Establishment, they were unable to lift any extra ammunition. In a situation requiring the provision of more than one unit simultaneously the Field Support Squadrons are unable to match demand and are more often out of range of the sub units and troops coming back to check stores, more of which later.

Current Situation – Command Post Capability. Figure 1 details the "2nd line Fd Sp Sqn" to "decide on the best source of M&E in consultation with the Div Engr Log Cell". It suggests that the possible sources are FRV, MRV, and RLC. It then further suggests that the squadron authorizes release of M&E stocks and organizes transport for them. All of the above iz somehow to be achieved with a shift strength in the command post of a single officer and a radio fit of 1 x PTARMIGAN, 1 x HF 351 and 1 x

¹⁰ HQRE Th Tps Lessons Learned Database, Serial 29. 27 Nov 01.





Figure 3 - Proposed/Current Demand Chain.

353(Z). The squadron must continue to communicate with its parent unit and must continue to process all other engineer resources.

Proposed Solution. The key issue here is reliability. The Royal Engineers continue to hold large stocks of M&E on "capbadge" vehicles because we do not trust the delivery of the stores via the RLC system, a fear which leads to the problems outlined above. This article is dedicated to getting over the reliability problem and it is therefore proposed that the Field Support Squadron should be taken from the demand and supply chain of M&E completely. Before Field Support Squadron Commanders Corps wide launch at me I should explain. The proposed alternatives are dealt with below:

• **Demand System.** A proposed demand system is represented diagrammatically by the solid arrows at Figure 3. Compare this to the current situation represented by the broken arrows. The restructuring cuts the confusion from the system by ensuring that there

is always a single point of focus for demands. By ensuring that the M&E demand does not enter the RLC system prior to divisional level we retain clarity, allow HQRE to ratify demands against allocation, and are therefore able to redistribute stocks as available.

• Supply Chains. It is not practical to suggest that the Field Support Squadron has the staff or communications capability to carry out tasks currently allocated to it with regards M&E. It is proposed that the sub unit be cut from the supply chain insofar as bulk movement of M&E is concerned. During discussion of the solutions to the main problems a possible role in the supply of small demolition stores will be discussed.

Course of Action 1 – Standard Loads

GENERAL IDEA

Standard Stores Lists. The Royal Engineers currently operate a recce procedure that often results in the production of a Standard Stores List for a particular type of task. Whilst the equipment requirements for each task are broadly similar the quantities are prone to change depending on the size of the target. The standard load proposition is based upon the theory that

loads can be configured to match target, and therefore Standard Stores List, type. Two options within this area are considered.

UNITS OF LOAD – THE FLAT RACK

General Idea. Current thinking bases the unit of load around the DROPS flat rack. The belief here is that the flat rack is a convenient size and forms a good basis for the creation of loads based around the Standard Stores List. This method has been discussed to death at many a study day.

ADVANTAGES/DISADVANTAGES.

Advantages.

- RE units are completely disengaged from M&E supply during the contact battle and the speed of reaction is increased.
- Loads are pre-configured to standard tasks to save time and can be augmented by RLC or RE at any stage.

Disadvantages.

• Flexibility. As previously stated the amount of stores required can change from task to task. In this case the

RLC find themselves unable to identify the exact store required to make up the load, and very often the quantities requested are not delivered accurately. In order to overcome this knowledge gap it has been proposed that an RE expert is embedded within the RLC system to provide the expertise. Given that the mobility of the battlefield today forces the RLC to position stores in various different locations the exact location of this RE singleton becomes difficult. As yet there are no identifiable RE posts within the Division that could be utilized in this manner. The training gap within RLC units would have to be addressed in order to solve the problem by this means.

- **Sustainability**. The RLC would encounter great difficulty whilst reconfiguring further flat racks during prolonged operations. The low level of manpower available to them would undoubtedly cause them to request further support, which is difficult to identify. The need to adapt certain of the pre-configured racks to cope with adjustments as a result of recce adds to the confusion. Once again, further training could do much to overcome these problems.
- Small Stores. The smaller stores (detonators, safety fuses, match fuzee, etc. See Figure 2) are the greatest cause of error within the process. The RLC lack the expertise in depth to identify the items and their packing quantities and the small number required for each task makes it necessary to break pallets. Their explosive nature makes their packaging critical if they are to be contained within the mixed load that the standard rack system represents.
- Summary. It is considered that the lack of flexibility of the flat rack theory, coupled to the confusion entailed with regard to possible requirements to amend the load, make this system unattractive. The embedding of RE expertise at various levels within the RLC system cannot be achieved without additions to the establishment. If it is to succeed we will need to concentrate on the inter Corps training programme, a time consuming and costly solution. The addition of the smaller stores further complicates the matter.

UNITS OF LOAD – TARGET REQUIREMENTS S BY PALLET

General Idea. In this proposed method the emphasis of the recce report is altered so that the Standard Stores List can be used to calculate the numbers of types of pallet required to complete the task. For the majority of cases this entails little readjustment; a minefield recce will result in numbers of pallets of barmines of differing types as well as other stores, a bridge demolition will require varying amounts of PE4 or purpose built demolition charges. There is scope for inefficiency as tasks are seldom likely to incorporate a round number of pallets. This inefficiency could be kept to a minimum by sensible adjustments to unit first line holdings. In this option there is a need for a small stores pallet or pallets (Augmentation Pallet) which contain the necessary minor items to enable a task to be carried out.

ADVANTAGES/DISADVANTAGES.

Advantages.

- RE units are completely disengaged from M&E supply during the contact battle.
- RLC commonly identify loads by pallet type, these can be easily identified and require no specialist knowledge to make up into task bundles.

Disadvantages.

- Stores Mix/Sustainability. The Augmentation Pallet would need to contain items of an explosive nature (detonators etc) along with those of a non explosive nature (green string, black mine tape, and 14 gauge wire etc). In order for this to happen the non explosive stores have to be married to the explosive stores before and during the conflict. The lack of expertise and manpower within the RLC to continue this task has already been covered.
- **Flexibility.** Whilst the flexibility in this option is markedly more than for the flat rack option there is still scope for error, particular in the area of small stores.
- **Inefficiency.** The main efficiency concern in this option stems from the likelihood that entire pallets may be delivered from which only part may be used by the tasked troops. In order to reduce this effect the 1st Line holdings of the RE units will have to be utilized and may need to be altered to take account of any required adjustments.
- Expansion. As the pallets are stripped the volume of stores required to be lifted expands.

Summary. This option is more attractive to the RLC in that it requires less by way of expertise or manpower to make up the loads. The make up of the Augmentation Pallet is still a cause for concern as it not only requires expertise, but also lacks flexibility. The problem of mixed natures within a load in storage also remains. The efficiency of this system can be improved by the intelligent use of RE 1st Line holdings.

COURSE OF ACTION 2 – FIRST LINE AUGMENTATION

General. This option is one in which the modification of RE 1st Line holdings is further investigated. It has been proved by research that the small stores as designated at Figure 2 are the main concern throughout the system. In this option these are retained in sensible numbers at 1st Line by the TQMS and within RE sub units and moved forward by the unit itself in response



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Figure 4 - Proposed supply chain for M&E

to demand from tasked troops. The bulk items, moved by RLC transport as far forward as necessary, would meet these small stores at an "M&E Exchange Point", a term spookily like that used by the Royal Artillery and happily familiar to the RLC. Critically it is possible to locate this M&E Exchange point in range of a Recce Sergeant returning to check his stores.

Demand and Supply. The flow-chart at Figure 4 shows the supply chain in this respect. Sub Units/Units demand bulk M&E by whole pallet as per Figure 3, first deleting small stores known to be available at 1st Line, either with the TQMS or tasked troops. The TQMS will maintain control over his stock levels, effectively holding an

"M&E Stores Section Vehicle" containing the array of items required. As these and sub unit 1st Line stocks run low they can be restocked in slower time through the RLC supply system, with pallets delivered entire to the TQMS and broken down as required amongst the sub units. 1st Line Holdings. A considered first effort at possible 1st Line holdings is shown at Figure 5. Any spotter will tell you that the numbers of items held here is in fact vast. For example 0.05 of a pallet of detonators equates to 1000 individual items. The current proposed total number of M&E pallets held at first line by sub units is also shown. Any of the small stores required in greater quantities for particular tasks (e.g. Detonating Cord) can be demanded from the RLC as required. The Headquarter Squadron holdings would be contained on a DROPS vehicle within NATO post pallets for ease of containment. The DROPS could be configured to hold 10 such pallets, the additional pallets containing other items important to demolitions tasks such as tape, string, wire etc. All other first line holdings of M&E would be removed from the HQ Sqn.

I now expect the COs to be throwing themselves at me in

horror, but once again may I request a stay of execution. At present the HQ Sqn carries a large and disparate array of M&E which may or may not be relevant to the next mission. Instead of this it is proposed that the CO consider his mission and order up the type of stores required. If not used these can be returned to the DSA at the end of the phase, normally during rehabilitation. This system has been practised on Ex *RHINO CHARGE* and *RHINO SPEAR* and found not only to be workable but to allow the carriage of larger quantities of more relevant stores. On average a HQ Sqn finds that by employing this method it has four free DROPS to carry out this task.

SMALL STORES							
Ser	Item	Quantity (CS HQ Sqn)	Quantity (AES)	Quantity (GS HQ Sqn)	Quantity (Fd Sqn)	Quantity (Amph Sqn)	Quantity (Fd Sp Sqn)
A100	Safety Fuze Metric	0.5	0.25	0.5	0.25	0.13	0.13
A101	Cord Det	0.5	0.25	1	1	0.25	0.25
A102	Det Dem Elect	0.05	0.01	0.05	0.01	0.01	0.01
A103	Det Non Elect	0.05	0.01	0.05	0.01	0.01	0.01
A104	Ign Safety Fuze Elec	0.02	0.01	0.02	0.01	0.01	0.01
A105	Grip Switch Fir Dev	0.25	0.02	0.25	0.03	0.02	0.02
A106	Matches Fuze E Box	0.34	0.17	0.5	0.5	0.17	0.17
A107	Fixing Kit Steel Studs	0.14	0.03	0.14	0.03	0	0
A108	Fixing Kit Steel Nails	0.14	0.03	0.14	0.03	0	0
A109	Fixing Kit Concrete Studs	0.14	0.03	0.14	0.03	0	0
A110	Fixing Kit Concrete Nails	0.14	0.03	0.14	0.03	0	0
A111	Cart Fixing (Red)	0.03	0.03	0.14	0.03	0	0
A112	Fixing Kit Hard Concrete	0.14	0.03	0.14	0.03	0	0
A113	Fixing Kit B/Wood L36	0.14	0.03	0.14	0.03	0	0
A114	Fixing Kit Supp	0.14	0.03	0.14	0.03	0	0
A115	Fixing Kit Conc	0.14	0.03	0.14	0.03	0	0
A116	Flash Initiators	0	0	0	0	0	0
A117	Coupler Kit Dem	600 items	150 items	600 items	300 items	0	0
A118	Cart Pres Elect	1000 items	220 items	1000 items	0	0	0
	Total pallets	2.86	0.99	3.63	2.08	0.6	0.6
	Round Up	4	1	5	3	1	1

Figure 5 - Proposed 1st Line holdings of M&E

ADVANTAGES/DISADVANTAGES.

Advantages.

- In this option the complication of split pallets and stock identification are removed from the RLC, thus negating the need for an RE representative and cutting out the margin for error.
- The RE remain removed from the bulk of the problem of M&E supply during the contact battle, only having to re-demand small stores in slower time.
- Flexibility is at a maximum, the small stores being held within range of sub units returning to check task stores before guiding them forward. There are varied options for their final delivery forward and these can be adapted to reflect the situation.
- There is no requirement to tie up RE effort assisting the RLC to reconfigure stores.

Disadvantages.

- Units will be required to keep closer accounts of 1st Line holdings, with the additional challenge of doing so with regard to the M&E stores held by the TQMS.
- Work is required by the unit command post to separate the small stores from the bulk items as the demand is sent. Adaptation of the demand system should reduce this effort considerably.

Field Support Squadron Involvement. A proposal to hold the small stores at the Field Support Squadron was considered. It is believed that doing this would hinder the ability of the tasked troops to return to check stores at a location where errors could be recovered and over

centralises the supply. Over centralization becomes a concern when more than one unit is involved in tasks requiring M&E as the Field Support Squadron lacks the ability to set up more than one RE M&E Exchange Point. Figure 6 demonstrates this point. There is however some merit in the Fd Sp Sqn handling the slower time resupply of 1st Line M&E in order to further reduce the confusion caused by the supply of split pallets amongst engineer units.

Summary. This option effectively removes the difficulties from the RLC by identifying that the major problem lies with small stores and creating a system to allow those to be delivered to units in slower time and in whole pallet loads. The creation of an "M&E Exchange Point" close to the tasked troops allows them to return to check stores before taking them forward to the task site. The fact that the unit holds an M&E small stores stock means that the opportunity exists to recover the situation in the event of a stores bid/delivery error.

SELECTION OF BEST COURSE OF ACTION AND TEST PROGRAMME

Best Course of Action/Test Programme. It is considered that Course of Action 2 – First Line Augmentation offers the best balance of advantages of the two considered. The system has been/will be tested within 1 (UK) Armoured Division as follows:



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Figure 6 – Overtasking of Fd Sp Sqns in delivery of small stores.

- Consideration on Ex RHINO HOLDFAST 18 20 Jun 02. Ex RHINO HOLDFAST is the annual DEG Study Period within 1 (UK) Armoured Division and offered an excellent opportunity to introduce the requirements of the new system. The RLC was represented during the discussion by SO2 Combat. The general view, albeit close to the end of the exercise and after an excellent supper, was that it provided a workable solution.
- System Run Out on Ex RHINO CHARGE 05 12 Jul 02. Ex RHINO CHARGE is controlled by the Division and was used to test the system, utilizing the LOCONS (units) to test Division at the same time as using the opportunity to develop their own stock controlling/demanding systems. After a difficult first 24 hrs, as units became used to ordering bespoke 1st Line holdings, the solution proved effi-

cient in a CAST environment. This is if course no substitution for the real thing.

- System Test on Ex RHINO SPEAR 15 23 Jul 02. Once again, in much the same way as RHINO CHARGE, but under the ARRC spotlight, the system proved flexible and workable. The same caveat about CAST remains.
- Practical Test on Ex ULAN KESTREL 11 20 Sep 02. Ex ULAN KESTREL was to provide the opportunity for the RLC and the RE unit involved (28 Engineer Regiment) to practice the system using SIMMO and training stores to represent 1st Line and Bulk stores. In the event it was a much modified RLC, RE and Divisional headquarters that deployed. It is clear from the exercise that there is still much work to be done in educating and training the RLC in M&E matters. That said, RE understanding of the requirements cannot be

said to have been 100 per cent. Further training events and discussion groups are being planned, particularly with RLC and RE HQ Squadron involvement.

GENERAL CONCLUSION

It is believed that by practised use of this system the current difficulties surrounding the efficient delivery of task orientated stores to RE units in the close battle can be dramatically reduced. The results of testing during the remainder of the exercise season will be promulgated in due course for further consideration and possible inclusion within RE/RLC doctrine. It is believed that the only real test of a system such as this is during an exercise similar to *IRON HOLDFAST* and it is hoped that such an opportunity might present itself in 2003.

Rocket Propelled Grenade Protection: Some Observations

MAJOR A H HAY BSC(H) CENG EURING MICE



Maj Alec Hay was commissioned into the Corps in 1989. Following a few years at 35 Engineer Regiment, which included deployments to Northern Ireland and Bosnia-Herzegovina, he completed Professional Engineer training in 1995 and has been fortunate to serve variously in the Balkans, Canada, South America, the High Arctic and the Middle East among others. He has worked on Security Engineering and Counter-Terrorist projects over the last 5 years and currently commands DCRE (Wks) NI.

INTRODUCTION

ROCKET Propelled Grenades (RPG) have recently excited the imagination of journalists and the wider population since the attack in September 2000 on the Secret Intelligence Service building at Vauxhall Cross. For soldiers, they have been an exceedingly versatile reality of warfare, from "spectacular" terrorist attacks to bunker busting to tank action. The study of RPG effects upon targets is a huge subject in itself and perhaps unsurprisingly, is sometimes misunderstood. Table 1 shows the comparative thickness of common materials to prevent RPG7 explosive perforation.

Various composites perform better and are more widely used for long campaign and permanent

infrastructure. However, received wisdom and early proven protection measures have rarely been updated and remain current military engineer thinking. During the validation of the existing protection measures against the latest RPG variants, it became apparent that the current protection design concept needs development.

This article considers only the most recent of the RPG 7 series, RPG 22 and RBR M-80. (Refer to Table 2 – Weapon Characteristics.) It does not discuss the detailed science of RPG design or behaviour. Instead, after reviewing a few basic principles, some of the RPG and target effects are described, based upon observations during a series of trials conducted over the

Material	In Contact	0.5m Stand-Off	3m Stand-Off
	(mm)	(mm)	(mm)
Mild Steel	300	295	120
Brickwork	900	880	400
High Density Blockwork	750	720	310
Reinforced Concrete	650	630	250

Table 1 - Comparison of Material Thickness to Resist RPG7 Explosive Perforation.

Weapon	Missile Weight (kg)	Charge Weight (kg)	Warhead Calibre (mm)
RPG7VM	1.58	0.32 : A-IX-1	89
RPG22	1.48	0.34 : OKFOL-3.5	73
RBR M-80	1.58	0.5 : HMX	64

Table 2 - Comparison of Weapon Characteristics.

last 18 months. These observations are compared to other findings and reports with the ultimate aim of providing the military engineer with a better ability to apply proprietary and improvised protection on expeditionary deployments in the future.

DEVELOPMENTS

THERE were a series of RPG protection trials conducted at Chertsey in the early 1970s¹ when it became evident that the RPG7 had become the PIRA-preferred weapon of choice for spectacular attacks. The early variants of RPG7 were highly robust and generally reliable, having changed little from the original Soviet post-WW2 design. This early research looked specifically at the disruption of the fuse and the shaped charge effects under primarily static firing. Effective protection was soon developed and the research focus was redirected². There has been a proliferation of the newer RPG variants over the last few years. The RPG7VM has appeared in various theatres and still uses the original RPG launcher – a potent terrorist status symbol. The RPG22 has also appeared and has the added attraction of being a disposable, though robust weapon. This is the weapon that was fired at Vauxhall Cross and has been found in Northern Ireland. The RBR M-80 has also appeared. It bears an uncanny likeness to the US M72 Light Anti-tank Weapon. All three have different calibre warheads, fusing arrangements and trajectories. Upon inspection, it became apparent that two of these three warheads were a smaller calibre than the existing RPG mesh and so there was an increased, though relatively small, geometric potential of "pass-through".

THE BASICS

THREE aspects of RPG performance are considered for this article: shaped charge, rocket propulsion and initiation.

Shaped Charge. The shaped charge action of an RPG is the primary warhead effect. The explosive charge that forms and accelerates the shaped charge also causes significant local fragmentation. Upon detonation, the explosive packing around the copper (or aluminium) cone reaches up to 4000°C and a pressure of $3x10^4$ MPa. This heat and pressure almost vaporize the cone and concentrate it towards its centre of axis, as well as propelling it forwards. The partially vaporized cone forms a jet that travels at up to 10,000m/s and a slug that follows behind at a more stately 300 m/s. The jet is highly penetrative, though the slug can be stopped more easily.

Rocket Propulsion. The rocket is electrically initiated by the firer and burns extremely quickly, effectively accelerating the warhead over its full battle range. This helps with the accuracy of the warhead, typically achieving a 30mm displacement from boresighting over 50m with an incident velocity of typically 100m/s, though up to 200m/s³. The maximum realistic battle range of these weapons is 200m. After this range, the burn of the rocket can become unreliable causing deflection in addition to normal gravitational fall. However, the rocket still has very high kinetic energy at 200m and is capable of punching through a 1m earth filled gabion. If the rocket motor does penetrate the target, there is also the possibility of a further combustion and fragmentation hazard. Generally, modern RPGs have far more powerful rocket motors than earlier variants. Initiation. Though the RPG is a reasonably accurate

weapon, it is not easy to fire accurately under high stress conditions. Also, the action of pulling the trigger or depressing the button may impart a deflecting movement in the launcher at the point of initiation, which further reduces accuracy. This can only be

¹ JPS Downey 1974 – report is classified.

² It is highly improbable that dynamic testing would have been missed – there are anecdotal suggestions of dynamic tests and other trials, though no reports have been found following a search of TICRE, DERA and HQNI.

³ Depends upon the weapon origin/country of manufacture.

overcome through field experience. The warhead generally has a 6-second time delay fuse, which will have been initiated upon firing - in the interests of reducing battlefield ordnance disposal, in the event of a miss. It is also fused to cause a separate initiation sequence when it hits the target. This initiation can simply be inertial, where a sliding pin hits a detonator cap under its own momentum, as the warhead/missile hits the target. This method is usually found on improvised RPGs. The RPGs under consideration in this article have piezoelectric fuses on the nose with the signal wire either along the nose cone or through the centre, with or without a collapsing circuit. The weld mesh screens seen in various theatres were designed to dud these relatively simple fuses. The modern fuses are more sensitive and significantly more reliable.

OBSERVATIONS

THE following observations were made during the Project *Underworld* series of trials 8 & 9 and associated testing. It is worth noting that the earlier research appears to be largely based upon static firings of RPG warheads against targets and so the dynamics of the pre-detonation collision were not analysed. It is now thought that this collision mechanism directly influences the behind armour affect.

- Following each RPG detonation, there were concentric rings of fragmentation damage. The first ring appeared to be thrown slightly forward of the warhead with a second clearly defined ring being almost perpendicular to the warhead flight. There also appears to be a transitional spread of fragmentation between the rings, though of less predictable concentration. This was particularly well demonstrated when dynamically fired against high-density blockwork walls, where the first ring is clearly scored into the face. The second ring of fragmentation scored heavily into the concrete floor. Larger fragments from the aluminium body were found up to 30m away with smaller fragments beyond that.
- When the warhead strikes a steel target, there is a ring scab produced in addition to the usual shaped charge effects. It was originally suggested that this could be due to the rocket motor striking the target while the steel was stressed/plastic immediately following the detonation. However, after studying the ring scabs in

more detail, with different catch media behind, it appears that the shaped charge strikes the target on the point of detonation. That is, the shaped charge has struck the target in the time between fuse initiation and detonation. This results in a slight splaying of the shaped charge so that on detonation there are the usual shaped charge effects accompanied by an annular Mizny-Schardin effect. In the traditional steel-concretesteel structure of a sangar wall, this effect is not immediately apparent and why behind armour effects have not been a practical infrastructure concern in counterterrorist operations⁴. This effect is not seen under static firings. When the warhead detonates against a sangar, the jet will perforate the wall generally followed by the slug. If the interstitial medium is changed to a low-density aggregate, there is increased disruption of the jet and slug, though the scabs become more penetrative⁵. Therefore, one must either continue to use concrete as both catching and penetrative medium or use catch plates for the scabs. The different RPGs performed differently against these targets with the RBR M-80 being the most penetrative of homogenous and quasihomogenous materials, though also the most easily disrupted by changes of media through the target fabric.

- The difference between static and dynamic firing has been referred to earlier in this article. Dynamic firing not only affects the immediate warhead/target incidence; it also subsequently strikes the target with the rocket motor. Dynamic firings against blockwork walls, earth gabions and bastions and conventional glass panes all result in the rocket motor continuing through the hole and generally emerging the other side. Parallel research recorded RGP22 perforation of 1m earth filled bastions with the rocket motor continuing for approximately 20m further on⁶. When considering building protection, this is of immediate concern as the rocket will still be burning and may cause fires. However, in striking such a barrier at the outset, all warhead fragmentation effects are isolated to the incident side and the jet/slug penetration is purely linear. If the target material is a single sheet of steel, unlaminated glass or similar, the scabbing will generally remain the greater concern.
- RPGs are far more likely to detonate than to dud when disrupted or otherwise interfered with. It was previously thought that between 54 per cent and 80 per cent of RPGs striking a weld mesh screen would dud with the remainder detonating⁷. Over 80 per cent detonated in tests and it is believed that even

⁴ The scabbing of the incident steel rear face is in fact noticeable if the hole is carefully sectioned. The scabs are caught by the concrete filler.

⁵ The jet and slug are more penetrative in low-density aggregate than in concrete, though tend to "splatter" more and so become easier to stop. In this case, the low-density aggregate is best considered as an alternative to a free-air stand-off.

⁶ JF MacKenzie 2000 to 2001 – reports are classified.

⁷ The relative percentages depend upon the screen geometry.



Elevated sangar with RPG screens.

this observed percentage is low due to the firing practices conducted. This means that the stand-off between screen and target must allow for detonation. Depending on the target this can be reduced to 1m, though the shaped charge slug begins to dissociate between 2.5m and 3m and this is most appropriate as a guide dimension. The jet also loses some of its penetrative effect with stand-off and only perforated a sangar wall in less than five per cent of attacks under a 3m stand-off detonating screen.

PROTECTION

THE trials primarily considered weld mesh screens for stand-off RPG protection. This research led to the development of design criteria that balance Reliability, Flexibility, Risk, Splash and Visibility. The reliability refers to the screens reliability in

consistently causing the warhead to dud or detonate rather than pass-through (when the mesh is geometrically larger than the warhead) and is expressed as a percentage. Flexibility is a consideration when the screens must withstand other forms of attack that might damage them or throw hazards through them. For example, petrol bombs thrown at a mesh can ignite and cast their contents near horizontally over 4m if the mesh is too inflexible. Risk refers to the risk that the user is prepared to accept. For example, reducing the chances of perforation to less than 5 per cent and only a linear jet intrusion may be acceptable. In other cases, removing all fragmentation and rocket motor follow through behind the target may suffice. Splash refers to the ability to fire reliably through the mesh without round deflection and visibility refers to the ability to see through the mesh over given periods of time and under different light conditions. The specifics of the RPG Mesh Design Criteria and current mesh specifications are still classified, though can be made available upon request (see below).

There is a variety of other protection/mitigation methods that depend solely upon the desired effect. The most common is cover from view. This is effective only where the RPG is used as a direct fire weapon aimed at a specific target. By denying line of sight, target acquisition becomes virtually impossible. Thereafter, the most common approach is to cause det-

onation at a distance and so reduce the weight of target protection. Where stand-off screens are not possible, consider using the outer offices of a building as the stand-off. It has been demonstrated that Government Standard glazing will cause detonation and keep the fragmentation outside the building. This means that the jet and slug will penetrate the building, though over the typical 7m office they will reduce in effectiveness and vital assets can be relatively lightly protected in the centre/core. Water has been experimentally used⁸ and shown to reduce the slug velocity sufficiently that it only continued for 5m beyond the screen. In the test, a shaped charge was fired from 1m through a screen made of shopping bags filled



Multi-storey ground mounted RPG screens, Crossmaglen.

⁸ Professor Salter, Edinburgh University.

with water. There are proprietary systems available on the market similar to those used in Explosive Ordnance Disposal. Where the threat of RPG attack is indiscriminate or there is a hazard associated with the protected asset being detonated, it is imperative that the rocket motor is also considered. There has been a tendency for the rocket motor to be deflected over the target when prevented from penetrating.

COMMENT

HOPEFULLY this article has raised some awareness of the developments in the ongoing study into RPG behaviour and protection. It is a brief overview of a paper that is being co-authored with Mr F

Hulton of QinetiQ for presentation to the ISIEMS⁹. The practical application of RPG Protection and the design standards used remain classified. However, research continues for the foreseeable future with the aim of developing methods of protection that are compatible with conventional construction. Significant progress has been made with overall structural thickness of cost-effective wall panels down to less than



Architectural adaptations at Old Park.

900mm. This supports the overall aim of reducing the physical and psychological profile of protection for Operations Other Than War. DCRE (Wks) in Northern Ireland is leading on much of this research and development and can provide advice and guidance if required.

⁹ International Symposium for the Interaction and Effects of Munitions on Structures.

"Le Génie Francais" The French Engineer Corps – Today

LIEUTENANT COLONEL P E CROOK DIPMGT



Lt Col Philip Crook is the current British Liaison officer to the French Engineer Corps based in Angers in the Loire Valley, a post he has served since 2000. He joined the Army in 1974 and his career has taken him to Northern Ireland (1976), Australia (1977), the Falklands (1982 and 1984), the Gulf War when he commanded 15 Field Support Squadron in 1991 and to Bosnia in 1996. In addition to his "sapeurs" duties he is accredited to a French divisional level headquarters in a general capacity managing to visit them in Bosnia during their overseas tour in 2001. One of his main task during his current tour has been to develop the twinning activities between UK and French units in order to enhance our own operational knowledge and effectiveness. In 2001 he oversaw the Twinning of the RSME and the French Engineer School, a first between UK and French military schools.

THE FRENCH ARMY AND HER CORPS OF Engineers

SINCE 1996 the French Army has being undergoing a major change with a reduction of some 105,000 personnel from a strength of 240,000 to 135,000. National Service was ended with the last conscript leaving in November 2001 and since 1996 the Armed Forces have undergone a complete reorganization. The new structure of the Army is based on eight manoeuvre brigades, the Franco-German Brigade and seven specialist brigades (engineer, signals, reconnaissance, helicopter, artillery and two logistics brigades) all coming under direct command of French Land Command (CoFAT -Commandant de Force l'Armée de Terre). In addition there are four small divisional size headquarters (Etat-major de force - EMF) that do not command units in peacetime but regularly conduct command post exercises in a wide variety of scenarios. These HQ also regularly deploy to the Balkans to provide the French led Multi – National South East HQ. To date the change is just about complete though with any large reorganization there is still much tinkering left to be completed.

The French Corps of Engineers has reduced from some 23 regiments to 12 combat and special to role regiments and its strength is 9,500 combat, 7,000 Paris Fire Brigade (Sapeur Pompier), 2,000 Civil Defence and an Infrastructure Branch of some 1,400 military and 1,600 civilians, a total of 19,900 military and 1,600 directly employed civilians. Of the 12 regiments two are Foreign Legion (supporting the mountain brigade and a light mechanized brigade), one parachute regiment, an air support regiment and a regiment rolled to support the amphibious brigade; the remaining regiments support the four armoured and mechanized brigades. The Engineer Brigade has the obstacle/ bridging regiment, an infrastructure regiment, and a heavy plant/railway regiment. Also within the brigade is the Nuclear, Biological and Chemical Warfare (NBC) Group with two specialist NBC companies who are integrated within the NBC School. Survey is not a direct remit of the Corps but engineer officers and NCOs serve within the Geographical Group, which is artillery heavy but comes under the command of the Engineer Brigade. Officer and SNCO special to arm and continuation training, and artisan trade training is conducted at the Ecole Supérieure et D'Application du Génie, ESAG at Angers in the Loire valley with the commandant of the School as the defacto Engineer - in - Chief.

HISTORY

HISTORY testifies to the influence of Engineers and this is very much the case with the French Corps of Engineers whose works have helped shape the national territory. The Marquis de Vauban, known as the founder of the Engineer Corps is a symbolic figure, an engineer, strategist, and a reformer who personified the versatility of the Arm. As with the Royal Engineers the French Engineer Corps played its part in aeronautics, telegraphy and fixed communications. With the creation of the Corps came the first engineer school which was established at Mézières in 1748, the first in Europe. The international impact of the Corps is exemplified in the USA. The American Engineers are the offspring of the French Engineer Corps and its motto is French: "Essayon" ("We Try"). West Point and the planning of Washington owes much to the French Engineers. The Corps colours are red and black representing fire and gunpowder, and the engineer uniform of the 17th Century.

MISSION AND ROLES

THE Mission of the French Corps of Engineers is a familiar one: To provide mobility, countermobility support and protection to the Army and Airforce but to a much lesser degree to the Navy. This is achieved by three branches: Combat, Infrastructure and Security.

Combat. This is in effect the "teeth arm" of the French Engineer Corps and provides the close



The cap badge is based on the breastplate and helmet which was developed by Vauban as a first form of body armour.



The VAB – Section Vehicle.

support and general support to the combat forces of the Army. Each brigade has its dedicated sapper regiment and regiments are between 800 -1,000 strong. The regiments are organized on similar lines with a headquarters company, 3 - 4 combat companies, a support company, a training company and finally a reservist company (TA). A combat company can either be mechanised or armoured depending upon the brigade it supports and regiments often have a mix.

 A mechanised company is commanded by a Captain (age 26-30) and there are four platoons, three combat and one support with a Company HQ. The principle section vehicle is the VAB (Vehicule de l'avant blindé – four wheeled APC) which is commanded by a sergeant and a section of seven combat engineers. Companies have their own integral plant



The EBG is based on the AMX30 chassis and its digging capability is 120m3 per hour in good conditions. It is multipurpose with a 20 ton winch, a 5 ton grab with a borer adapter (220mm diameter), a medium demolition gun (5 rounds), four mine launchers (two salvoes of 20 mines), and a 7.62mm MG. It has a three man crew. Its successor, the Engin Principal du Génie based on the Leclerc tank, comes into service in 2004.



Mechanised Engineer Company.

and are equipped with Medium Wheeled Tractors (MPG – Moyen polyvalent du génie). The company has the usual range of combat engineer skills and sections are equipped with basic hand and power tools and mine clearing equipment.

 An armoured engineer company is organized on similar lines but with two platoons equipped with the Combat Engineer Tractors (EBG Engin blindé du Génie). There are two EBGs per platoon with one combat engineer section mounted in VAB; the third platoon is a combat engineer one with VAB. There are no armoured engineer assets such as AVLB or AVRE to provide close support to the armoured assets of a brigade.

To support the combat companies each regiment has a support company, which contains the usual array of specialist. There are six EFA (Engin de franchissement de l'avant – "M3"), which gives an excellent wide wet gap crossing capability. Each regiment has its own diving team commanded by an officer/Warrant officer and 8-10 divers who are full-time as diving is a "trade" in the French sappers. The divers are more combat orientated and are equipped with canoes, small arms with "silencers" and their main role is beach and river reconnaissance, support to crossing operations and more recently urban operations (sewers!). They do not carry out the same level of trade-related task as Royal Engineer divers do and have a limited capacity in this area but are well trained and practice their skills regularly. Within our own Corps we have relied on "triple hatting" and our diving team is spread across a Regiment with the running of the diving store a QMs' headache. Maybe its time we re-visit diving and take a lesson from the French?

Each regiment has an EOD team or rather a NEDEX team (Neutralisation, enlèvement, destruction d'engins explosifs) and consists of one officers and a team of 8-12 SNCOs and junior ranks. Their prime mission is to support operational deployments and their peacetime role is to deal with improvised/unexploded ordnance found within the military estate. On occasions they have assisted local authorities in support of the police. They are well equipped with wheelbarrow, EOD suits etc. The French are more active when it comes to clearance operations and will defuse rather than destroy mines, which is doctrinally different from our own approach. The other specialist group is the regimental recce platoon, which consist of six VAB's equipped with secure communications.



EFA (Engine de franchissement de l'avant – "MF3"). Within the regiment there are six EFA, which gives an excellent wide wet gap crossing capability in either a bridge or ferry format. In the ferry mode the EFA can ferry some 20-24 tanks per hour over a 100-metre gap and each regiment has the capacity to produce three ferries – therefore a mechanised brigade could be ferried within 6 - 8 hours in ideal conditions.

Finally the Training Company which trains all new recruits to the Regiment (See Training) and the Reserve Company which is part of a regiment's order of battle but in most cases their task is to remain behind to secure the barracks if the regiment is deployed. The recruiting of former officers and SNCOs is good but soldier recruiting is a problem and most companies are found to be undermanned.

In addition there is a whole host of other assets available within the regiment from waterpurification pumps, entrenching machines, minelayers, mine clearers etc which makes a French engineer regiment a very capable organisation.

Within the Combat arm of the Engineer Corps there are the specialist regiments of parachutist, air-



The Pont Flottant Motorisé (PFM – Ribbon bridge) provides the large wet gap crossing capability and the 1st Régiment du Génie has two companies with the capacity to produce 380mm of bridge.

field support and with the Engineer brigade based in Strasbourg there is a gap crossing regiment equipped with PFM (Pont flottant motorisé – ribbon bridge), mine clearance tanks (AMX30), Aardvarks and heavy plant. Also part of the brigade is the 5th Regiment of Engineers which has a railway company, heavy plant and a mine clearance capacity (Armoured D6) whilst the 2nd Regiment is the infrastructure regiment with specialist in watersupply, electrical power and artisan tradesmen.

Infrastructure. The primary role of the Infrastructure Branch (Service du Génie) is to look after the military estate from the maintenance of existing facilities to overseeing the construction of new barracks - the role of the old PSA. However each Service retains its own engineering branches whilst the Army has by far the largest is also responsible for the Gendarmerie (national Police) estate a force of some 100,000 plus personnel. The Branch is controlled by the Direction Centrale du Génie (DCG) based in Versailles and is commanded by a Major General with six regional headquarters (Direction du Génie - DG) each commanded by a Brigadier/Colonel and these in turn command the 10 Works establishments within France and the seven in the overseas territories. An Etablissement du Génie is commanded by a Lieutenant Colonel and has a military/civilian staff of some 40-50 with a 25/75 military-civil split. To support overseas operational deployments individuals are drafted in from the various establishments to provide the necessary specialist engineering support when needed. The Branch is supported by the Service Techniques des Bâtiments Fortifications et Travaux (STBFT) which is attached to the DCG and is charged with carrying out studies and research. This includes ensuring that the Branch is kept upto-date with the latest techniques from industry but the STBFT also carries out its own research into topics such as the hardening of buildings. There is also a reserve element to the Infrastructure Branch which regularly conducts training in metropolitan France and with our own STREs (V).

Security (Safety). This Branch is divided into two groups, first the Paris Fire Brigade (Brigade de Sapeurs- Pompier de Paris – BSPP) and secondly the Civil Safety/Rescue units based in NW and Southern France (La Securité Civile).

- The BSPP. A brigade of some 7,000 personnel and is responsible for the Paris region for all aspects of fire safety. Paris is divided into three battalion (Groupement Incendie) areas, which in turn are divided into company and then platoon level districts to provide the necessary cover to Paris. This also includes dealing with chemical and toxic waste incidents with specially trained teams. The Brigade is responsible for its own training but the BSPP is part of the Engineer Corps and its officers and men are organised on military lines and conduct continuation trained at the Engineer School. For example the company commander course run at the Engineer School often includes several officers from the BSPP as they may well find themselves being posted back to field force units but many remain as firemen. The French Engineer Corps link to fire fighting in Paris is historical as is the same for the city of Marseilles which is looked after by the French Navy! We only have to look at our own history to draw parallels!
- Sécurité Civile. The security or rather safety units of the French Engineer Corps provide a rescue/safety service at home and abroad. Under the direct control of the French MOD the unit has its own headquarters with a Colonel as commander and three battalion size units who are located in the north and south of France with the third based in Corsica. Each battalion is commanded by a Lieutenant Colonel and has 32 officers and 600 other ranks. Their tasks has been varied from forest fires - an annual summer hazard in southern France, pollution - oil slicks with the more recent spillage off the Brittany coast in 2000, chemical and radiological hazards - France depends on nuclear power, flooding - France has some of the longest rivers in Europe. And, finally search and rescue during earthquakes, cyclones etc on a world-wide basis. All are sappers and their continuation training is conducted with a view of a full military career.



Supporting the civilian population through search and rescue, disaster relief is an important role played by the French Corps of Engineers through their Sécurité Civile units.

TRAINING

- Soldier Training. With the end of conscription in November 2001 the French Army is now entirely professional with all the issues of recruiting, training and retention. There is a national recruiting office network and the Army needs some 10,000 recruits per year and there are some 400 trades available across the Army. All recruits receive their basic (phase 1) training within their chosen regiment with local ties playing an important part. After about 10 weeks the recruit then receives his special to arm training (phase2) and again this is conducted within the unit. For engineers the training consist of minewarfare, demolitions, basic skills, bridging, watersupply and he or she (there are some 250 female soldiers in the Corps) is then trained in his or her selected specialisation such as in watersupply, bridging, minewarfare etc within their regiment. Each regiment has a Training Company dedicated to this role. Once they obtain NCO rank they then attend further career development within their trade at the Engineer School. Their contracts are 3 or 5 years extendable to 11 years or 15 to 22 years. They can be promoted to Corporal and those selected can go onto SNCO training.
- SNCO Training. Initial training is conducted at Saint - Maixent, "Ecole Nationale des Sous -Officiers d'Active during a seven month course. This is followed by a technical course in their specialist skills, which last 4 - 8 months run by the specialist schools and establishments. Engineer SNCOs attend a specialist course at ESAG in minewarfare (leading into EOD), or obstacle crossing, watersupply, electrical power, diving etc. This will be his technical career path and his subsequent postings as a junior SNCO will be within these fields. After an initial 5 - year contract the NCO, and after passing more exams will be allowed to extend his career to the rank of Warrant Class 2. During this period he or she has to obtain a General Military qualification (similar to our Education for Promotion - EFP) and by obtaining a technical certificate within his own arm. SNCOs will be able to serve on until age 56 and a number can obtain commissioning via Saint -Cyr if under the age of 30 or on reaching the rank of Warrant Officer Class 2 (via more exams) but they normally top out at the rank of Captain.
- Officer Training. There are three types of entry:
- Ecole Spéciale Militaire de Saint Cyr (ESM the French Sandhurst). Before Saint – Cyr which is located in Brittany about 40 km South West from Rennes, armed with the Baccalauréat diploma ("A" Level) and having attended a preparatory school for two years, aged under 22 having passed a competitive entrance exam (No RCB) the potential officer will spend three years at Saint-Cyr and on graduation the young officer will obtain a degree in a science, arts or language subject.
- Ecole Militaire Inter-Armes (EMIA). Open to serving personnel (NCO and reservist) and armed with the

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Baccalauréat diploma, having passed a competitive exam, and aged over 22 but under 30 the potential officer will spend two years at Saint – Cyr.

• Finally, Ecole Militaire du Corps Technique et Administratif (EMCTA). Aged under 30, having passed the entrance exam and holding an appropriate degree for entry into the Army's technical and administrative branches such as the medical services, their training last only one year.

Officer selection to Arm is based on the end of training "Classement". On completing their three years - for the Saint Cyrians, or two years for the EMIA cadets, the choice of to which Arm they join is made based on the cumulative mark they have achieved during their training. The top achievers have a choice, the bottom take the slots left. The top consistently select the Gendarme, Armoured Corps and Infantry, followed by Army Aviation, Engineers, Signals and EME, then the Artillery and Logistics in that order. The Artillery is a low choice because it is not seen to be of use other than in high intensity operations! Success in a diversity of exams is not necessarily an indication of their prowess as a leader and commander, but is perhaps collectively indicative of their potential. English is no longer viewed as a foreign language; it is the operational language of coalition or international co-operation. Every officer has to acquire a basic competence in using tactical and operational terminology, and apart from about 20 per cent of each intake and the Engineering stream, all cadets have to learn a second foreign language, be it European, Russian or Arabic. This is something we are not very good at and over the last few years the French Army have made great strides to develop English as their principle operational language and the vast majority of the younger officers speak it well.

For the Sapper officer Saint-Cyr is followed by 11 months at the Engineer School based in Angers in the Loire valley. Some six months of the course is spent on combat engineering, infrastructure and leadership training with the balance spent on preparing the officer for his posting. Those going to the Sapeur Pompier will undergo their fireman's training in Paris and parachutist to the parachute school at Pau in southwest France. Also during this period some students will visit the UK, Germany and US forces in Germany to help develop their international understanding and their English. What is of interest is that the length of "Young Officer" training is the same for all arms – 11 months as the school training cycle is fixed to the academic year and Saint Cyr. The training cycle is very much geared to that of a university campus with long holidays and the young officer treated as a student at a school of learning. Students whilst undergoing their special to arm training will also conduct "aguerrir" training - toughening up by jumping off dams, rock climbing etc, all designed to make the officer a more robust leader. Systems Approach to Training enthusiasts would certainly have a challenge on their hands, as there is a degree of overlap with St Cyr and the Arms Schools! Aged between 23-26 the young officer then takes up his first troop command appointment and again selection is based on order of merit with the Legion and parachute regiments taking the pick. The first tour is normally 2-3 years in command of a troop, which is followed in most cases as company second-in-command before attending the four month Captains course (Squadron commander).

As for the British Army the young officer has to attend a whole series of promotional and staff training courses from the Ecole d'Etat-Major (Junior Staff college), Cours Supérieure d'Etat-Major (Staff College), Higher technical training courses and the College Interamée de Défense (Joint Staff College) and so on. Greater emphasis is placed on exam results and academia rather than performance and promotion to Major is a greater hurdle than promotion to Lieutenant Colonel. Command of a regiment is normally Colonel though regiments do tend to be larger than their UK counterparts.

Collective Training. Collective and Combined arms training in its modern format is being developed and with any modern army there are difficulties with space, over-commitment and budgets. Combined-armed tactical training systems such as JANUS using the latest technology exist in every Training School with the emphasis on the school's specialty i.e. the training of engineers within a combined arms battle. At Mailly le Camp East of Paris is the equivalent of CAST (Combined Arms Staff Trainer) where brigades and the divisional level HQs (EMFs) are put through their paces. Also at Mailly young officers are introduced to combined arms with joint training with the other Schools with field force units providing the equipment and manpower – a form of DRAKES DRUM (UK young officer final exercise).

EQUIPMENT

By looking at the roles rather than list equipment may be a better way of illustrating the French Engineer Corps capabilities.

- Close Support. The VAB (Section vehicle), EBG (CET), MPG (MWT), EFA (M3) are all robust, simple to operate and capable vehicles which provide effective support, and bearing in mind the specialisation of the soldiers and NCOs are well served. The capability weakness is in close support bridging, as the French do not possess armoured bridgelayers to provide the intimate crossing support to their armoured manoeuvre forces equipped with the Leclerc tank. This issue has been addressed and an option being considered is an all-in-one wheeled close support system. With the days of the tank numbered and the development of the medium force concept, a concept the French have had for a number of years with the VAB, AMX10 (wheeled 120mm tank) etc then the need for a tank based close support vehicle may well be redundant - food for thought? The Medium Light Float Bridge (MLFB) provides a Class 16 bridge and ferry capability and is held in each regiment. The AMX30 tank fitted with a mine plough and sensor equipment provides the close support mine breaching capability and these tanks are held by 1st Régiment du Génie based near Strasbourg who are the specialist gap crossing/ breaching unit. Aardvarks (MADEZ) are also held as is the South African made Souvim vehicle for route clearance. For minelaying there is the Matenin anti -tank minelaying vehicle and the Minautor scatterable mine system.
- General Support. As with British sappers the variety of vehicles and equipment available to the French sappers is vast and the capability in some fields is superior to our own current equipment such as in watersupply and field lighting systems. The Aquamobile AM36 water treatment plant (trailer mounted all in one unit) has a capacity to produce 1,500 liters per hours of drinking water and some 36 systems exist and held at regimental level. The French field lighting equipment and generators are easy to assemble and maintain and a 5 KVA set can provide the normal power requirements for a 1,000 man camp.

Access trackway is provided by a specialist mat laying vehicle system (MATS – matérial d'aide à la traficabilité des sols). A host of construction plant, including rock crushers are held by the air support regiment, light and medium wheeled tractors and heavy construction plant are available – and most are French built! However, fixed logistical bridging is still based on Bailey though Mabey Johnson is being introduced in 2003.

OPERATIONS

THE French have a similar view to our own ranging from deploying a NATO class theatre HQ with the capability of deploying a multinational force of 30,000 soldiers overseas for a year whilst maintaining an ability to project a French only force of 5,000, to be relieved every four months. Or committing a force of 50,000 in a one off operation within a multi-national framework. The French Corps of Engineers is widely committed and is involved in nearly every operation to all corners of the World. From sustaining its garrisons in Djibouti to Guyana on a regular roulement basis to supporting current operations in the Balkans and Afghanistan, "les sapeurs" are to be seen. They train hard for these deployments and besides training within the unit refresher courses for tradesmen are run at ESAG and company plus deployments tend to be modularised to meet the needs of the theatre of operation. In Bosnia the French Engineer battalion or BATGEN is made up of an RHQ with one or two of its integral companies plus specialist such as water supply, electricians etc from other units - notably the 2nd Régiment du Génie based in Metz, which is the infrastructure regiment. A more modular approach is taken to deployments, which has however put a strain on certain specialist trades. Within France the Corps of Engineers has been involved in disaster relief such as the great storm of 2000 as well as supporting the Police in counter - terrorist patrols within urban France. All these commitments, fun to undertake by the soldiers but add to the program with the follow on effect of reducing time for training and other activities. A familiar story!

A great deal of emphasis is placed on "peace support operations" with aid to the civil community a high priority especially with mine clearance in which the French take a major lead in with several teams deployed around the world involved in demining operations. At ESAG the French have established an international demining centre which has been based on the mine training department training Non-Government Organisations and engineers from other countries. Their doctrine is to disarm the mine in place rather than destroy it, which is very different from the way we operate as we place individual safety first. Why disarm when you can blow? The argument is to first reduce simultaneous detonation and therefore enable safer subsequent clearance and secondly to recover the mine intact for intelligence purposes. An issue for further debate.

CONDITIONS OF SERVICE AND THE QUALITY OF LIFE

THE quality of life for the French officers, SNCOs and soldiers has many positive aspects with good pay and excellent pension rights. Officers receive about 2/3 of their salary as a

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France plays a major part in international demining with an International Demining Centre based on the Engineer School at Angers.

pension with overseas service counting towards the final pension salary, so those months spent in Djibouti and Chad were not wasted? Leave and travel is also good with SNCOs receiving 45 days annual leave with extra leave for operational deployments. Reductions in train fares are high with up to 75 per cent reduction, with SNCF (French Rail) staff ensuring you get the best deal when you buy a ticket rather than you having to inquire. Accommodation for the soldiers is variable with new builds and refurbishment programmes ongoing to meet the demands of the young generation but the legacy of conscription is still present with some unit lines no better than those experienced at training camps. There are no married quarters provided and many single soldiers choose to live out. Throughout France officer's messes are available not only for those on duty but for leave periods and family rooms are provided at very competitive rates and some are sited in top tourist spots such as St Tropez with marvellous views of the Mediterranean! For those living-in barracks the standard of catering can vary with often only one choice on the menu though the cost is low with beer or wine available with lunch and dinner, something we have a cultural problem with? The French Army has recognized the challenges and active plans are being implemented to meet the expectations of recruits as well as the need to train and retain highly skilled personnel.

CHALLENGERS

AFTER several years of downsizing and reorganizing the French Army now needs a period of stability in order to develop its doctrine, deal with the issues of an all professional army such as recruiting and pay & conditions, however with the relentless pressure of operations there will be little respite. The Corps of Engineers is experiencing an increasing level of challenges in both support to operations abroad as well as at home. The system of command and control is very centralised as the French constitution demands it to be so and routine matters can only be authorised at a senior level such as Colonel which creates delays and denies working experience to younger officers. With the nature of modern operations junior commanders need to act swiftly and decisively and this is an issue which needs to be addressed through changes in training and doctrine. With the downsizing and the end of conscription the mind set of having "all military post" still exist in that "khaki" is still employed in sedentary employments such as post rooms, secretarial jobs especially in static organisations. With pressure on budgets, recruiting issues there is still room to "redress the balance" of manning with greater civilianisation thus releasing soldiers to more active and undermanned post within the field army. Issues such as pay and conditions, recruiting the "millenium kid", overstretch are all raising their heads as the realities of running a fully professional army come home. Issues such as Whole Fleet Management and Public Private Partnership are still some way off and alien to the current way of thinking but will need to be addressed if budgets are to be more effectively used in the future.

"ENFIN"

TREMENDOUS change has taken place within the French Army and her Engineer Corps in a very short space of time and there is still much to be done to reach the end state. It is well equipped and organised and with its doctrine being developed, the increasing realization of the importance of working on the international front particularly for its young commanders will place the French Army and Engineer Corps amongst equals.

The Combined Arms Tactical Trainer



MAJOR M O TRESIDDER MA

Matthew Tresidder was commissioned into the Royal Engineers in 1986. After starting as a troop commander at 32 Armd Engr Regt he moved on to OC of the Corps Lighting Troop – from the sublime to the ridiculous. After leading that particular charge of the light brigade, tours as a FIBUA instructor, Adjt in NI and SO3 G3 Ops/Plans at 1 Mech Bde followed. He commanded 6 HQ Sqn which he deployed on various exercises to Kenya, Canada, France and most of Southern England. This was followed by the Dagger Course at RMCS and a very grown up job at DLO Andover working on future equipment procurement. He is now SO2 Engr at the Combined Arms Tactical Trainer at Warminster. This article aims to explain what this new system is and what it can offer to the Corps.

INTRODUCTION

THERE can be no argument that the field army must train for war and, to paraphrase Rommel, to fight easy we must train hard. However, we are all aware of the increasing pressures that limit our ability to conduct full collective training. The Corps is busier now than it ever has been; in addition to close support tasks, all sub-units are also heavily involved in infrastructure support tasks overseas while the frailty of our heavy 'A' vehicle fleet adds to the soldiers' burden. This, together with the overall costs of field training and the environmental pressures limiting the army's field training exercises, have made it ever more difficult to train effectively. In short, our ability to provide close engineering support to battlegroups in the field is under pressure.

SIMULATION IN TRAINING

THERE is no easy answer to this problem. However it has been recognized that simulation may go some way to improving it. The case for the role of simulation in training is well known. The increased range, lethality and expense of modern weapon systems make any field training an expensive undertaking. The pressures on the environment further limit our activities. The huge overhead to provide Observer Controllers, Excon staff, OPFOR and general exercise support can impose further limitations or add to overstretch. In order to address these problems, the Army has been investing heavily in simulation over the last few years. Simulation can not only help to reduce these issues, it also allows repetition and, because of the reduced overhead, allow greater throughput. There is no suggestion that simulation can replace field training but it can enhance the preparedness of troops significantly allowing it to begin on a higher plane.

Simulation is something we have all been involved with in some way or other – TEWTS and battlegroup Command and Staff Trainers are all forms of simulation. In the last 10 years more simulator systems have come into service – Tactical Engagement System (TES), the ABA-CUS Higher Command and Staff Trainer and the Small Arms Trainer (SAT). The latest, and by far the biggest addition to the fold is the Combined Arms Tactical Trainer (CATT). CATT is a simulation system specifically designed to train armoured, armoured infantry or formation recce battlegroups in high intensity operations.

CATT

THERE are two CATT systems, one at Warminster and the other at Sennelager. Each consists of a number of computers and vehicle simulators linked together to provide real-time
interactive training against a computer generated, intelligent enemy over a virtual reality manoeuvre area (110 x 100 km²) centered on the Salisbury area for UK or Sennelager area for Germany. The CATT system provides realistic combined arms training and practice for armoured and armoured infantry battle groups. It will also be able to provide RE special to arm training for armoured engineer squadrons and troops. Exercising troops will be able to use the facility with the exercise packages tailored to meet the user's requirements. The aim of this article is to highlight CATT's capabilities and explain how it can be used to improve RE combined arms operations in support of armoured battlegroups.

THE MISSION

CATT's mission is: "To provide standard and pre-deployment Combined Arms training in a realistic, simulated combat environment for specific vehicle crews, formed sub-units and battlegroups in order to prepare them for operations"

THE FACILITY

CATT provides the following training facilities, all connected to a LAN (see Figure 1):

- Battlegroup Headquarters Set Up. Similar to CAST, facilities are provided for BG HQ Main A, Main B and A1/A2 Echelons. Computer workstations are provided for the tasking and control of CSS, medical and ES assets.
- Manoeuvre Sub-Units. Vehicle Specific Simulators (VSS) are provided for 29 x CR2 (2 x Sqn + CO's tank), 29 x WR (2 x Coy + CO's tank) a well as 8 x Scimitar, 3 x WR OPV and 1 x WR BCV. VSS are detailed immersive simulators designed to replicate



Figure 1 - The CATT LAN



Figure 2 – VSS Station Commanders.

the interior and crew stations of the designated vehicle (see Figure 2). Crews must carry out all tasks and functions pertinent to their roles.

- **Combined Arms Integration**. 16 reconfigurable Generic Vehicle Simulators (see Figure 3) are provided which can provide the functionality of 15 different vehicles. These are based around computer workstations and, while not directly practising crew drills, do require the crews to fully integrate with and practise their role within the BG. The equipments that can be represented are:
- Engr Eqpts. AVRE, AVLB, CET, VLSMS, Engr Recce Spartan, 432 + Barminelayer.
- Recce Eqpts. CVR(T) Scimitar. CVR(T) Striker. MFC Spartan.
- Avn Eqpts. AH-64, Lynx.
- ES Eqpts. CRARV, WR Rec, WR Rep.
- **Dismounted Stations (DS).** 12 computer workstations that provide the input to the BG of deploying infantry sections, platoons, Milan and GPMG SF, FOO and MFC OPs and Engr Fd Sects.
- Computer Generated Forces (CGF). It is possible



Figure 3 - GVS Commander's Workstation

to create forces, both OPFOR and BLUEFOR that are controlled by the computer. These CGF OPFOR are controlled from Excon and act as the opposing forces for troops in training. The CGF BLUEFOR can, when controlled by a suitable role-player, be used to augment the battlegroup, add elements that are unable to deploy on training and provide flank play or formations outside of the battlegroup. These are controlled by LOCON role-players operating at designated computer workstations.

- EXCON. There are six stations in Exercise Control from which CATT staff observe exercise play. Each has the ability to view any part of the battlefield from any angle or height and to move around unseen by the exercise participants. Additionally, there is a Plan View Display (PVD), which uses a map display to show all vehicle locations, their orientation and movement in real time.
- **HICON.** HICON facilities are provided for key Bde Staff for BG exercises. These consist of workstations which allow the control of flanking and formation assets allowing the BG to simulate operating within a formation environment.
- AAR Theatres. Four AAR theatres allow simultaneous debriefing of the BG by sub-unit and Combat Support Arms grouping. Portions of the battle can be replayed in the theatres allowing troops to view both a 3D image and a moving map. Radio communications can also be played back.
- Linkage between CATT (UK) and CATT (GE). It is possible to link the two sites over a WAN. This allows Bde (-) operations to be conducted as well as allowing a BG to operate with sub-units deployed in both countries. This will be of particular relevance for 3 (UK) Div formations with committed armd units currently based in Germany.

EXERCISE FORMAT

GIVEN the above facilities, a typical battlegroup exercise would be:

- **Day 1-3.** Deploy to CATT, initial briefings, simulator training, FAMEX and sub-unit special to arm training.
- Day 4-5. Combined Arms training at sub-unit level.
- Day 6-9. BG level training.
- Day 10. Force on Force exercise (sub-unit vs subunit) and depart.

The end of each day would conclude with an AAR allowing lessons learnt to be identified and carried forward to the next day. Should these reveal any particular weaknesses, the programme can be adapted to allow further training on problem areas to be adapted.

Duration. The ideal training period is seen as 10 working days (two weeks). However shorter exercises can be provided based upon five exercising days. These will obviously suffer from

lack of continuity and the need to train up new personnel on day one of the second week, however they will be possible. Longer exercises can also be considered. Units should note that CATT is supported by Contractor Staff and is thus only able to operate weekdays within extended working hours. Experience has also shown that time in simulators should not exceed six hours per day due to the excessive eye strain and fatigue that is a characteristic of such simulation systems.

Unit Orbats. CATT provides the flexibility for units to exercise in all armd BG configurations based around a four sub-unit orbat. However a 3:1 or 1:3 does have limitations as it requires crews to work in unfamiliar vehicles which have been adapted to appear differently (ie CR2 can be adapted to replicate WR to allow a 1:3 orbat). The ability to use CGF friendly forces allows smaller BGs to exercise at full strength as well as allowing them to exercise with full Combat Support Arms support. The only requirement is to provide a suitably experienced individual to operate the CGF forces. For example, should manned RE support not be available, a full CGF engineer squadron can be provided to support a BG requiring only one RE officer to act as the role-player. Experience has shown that the use of such troops, including CGF manoeuvre units, is indistinguishable to other elements of the BG.

INTEGRATION WITH OTHER TRAINING

It is currently envisioned that CATT will sit inbetween CAST and TESEX/BATUS training (see Figure 4). In due course, once sufficient experience has been gathered, CATT may be able to replace elements of both or reduce the time spent in CAST and conducting special to arm training



Figure 4 – The Place of CATT within the Collective Training System.

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in the field. CATT will allow drills and procedures to be thoroughly practiced which will allow field training to start at a much higher intensity.

The potential for CATT and CAST to be run simultaneously is being examined. However this will require some compromise, either in the provision of LOCONs to BG HQ in CAST, or in sub-unit level training, perhaps being run by 2ICs rather than OCs.

CATT will also allow units returning from TESEX/BATUS to maintain their level of training by conducting further exercises at minimal training impact. In the case of BGs with sub-units deployed in Germany, exercises can be run over the WAN allowing seamless integration.

RE SPECIAL TO ARM TRAINING

IN addition to armd BGs, CATT provides significant potential for special to arm training for RE Armoured Squadrons and Troops. This can take the form of:

- **TEWTS.** The excellent AAR theatres offer considerable potential for study days and TEWTS at command team level without troops being required to man the simulators. This potential may be of particular use for study days etc.
- **Troop Training.** CATT offers excellent potential for an armoured troop, both in support of a BG and also to conduct its own training. Although individual



Figure 5 – Troop Training

crew skills will not be practiced, procedures, drills, command and control and reports and returns can be examined in detail (see Figure 5).

• Squadron Training. The number of Generic Vehicle Simulators available limits the potential for full sub-unit RE training. However, by flexible use of other simulators (OC in WR for example) and the use of CGF for Fd Troops and Sp Troops, a squadron ORBAT can be configured (see Figure 6).

Typical RE training activities that can be undertaken in CATT are:

 Recce Concentrations. Including practicing the use of tactical movement, comms, gunnery, reports and



Figure 6 – This is an example only. Based on a limit of 16 GVSs, any ORBAT can be considered.



Figure 7 - Simulated Obstacle Crossing

returns, route recces, obstacle recces etc.

- **Troop Training.** Practicing the use of tactical movement, communications and troop drills for hides, ERVs, road moves etc.
- **Obstacle Crossing Drills.** Including the use of AVLB, Python, mineplough, fascine and trackway to practice armoured engineer troops and squadrons in drills for crossing common battlefield obstacles (see Figure 7).
- **Obstacle "Gallops".** To practice troops and squadrons in the above while also concentrating on the regeneration of assets during an advance to contact.
- Squadron/Regimental CPX. Using CGF elements, CPXs can be conducted to practice C3I and R2 at unit and sub-unit level. This can include the planning and placing of obstacles and then testing them against OPFOR using live engineers.
- **Support to BG Operations.** A "simulated" battlegroup can be created using CGF forces that will allow troops and squadrons to conduct mobility operations within a combined arms environment. The tasks of RE elements within a BG level crossing operation can be fully rehearsed using simulated BG troops to allow this critical and complicated operation to be fully practiced before carrying it out with a "live" battlegroup.

COUNTER MOBILITY

Currently the facilities to practice RE troops in counter mobility operations are limited. This is a natural limitation of simulation – the nature of counter mobility tasks are time intensive and there is little or no training value to be gained in carrying these out in a simulated environment. These are much better conducted on various backdoor training areas and demolition bridges. The only exceptions to this are the use of VLSMS which is extremely well simulated, and the laying of light and medium tactical minefields. However, the use of the latter requires some adaptation of drills as the full range of necessary lane markers etc are not yet modelled in CATT. The ability to link exercises between Germany and UK may also provide benefits while the lack of barrack space in UK keeps UK assigned armoured regiments in Germany. It will be possible for a UK armoured engineer squadron to support a Germany based armoured regiment training in CATT without having to fly out to Germany. A video conference facility allows face to face discussions and the giving of orders. While face to face contact is preferred, it may help to reduce overstretch and nights out of bed.

CONCLUSION

CATT provides a highly flexible, capable training system with a minimal training support bill. It allows drills and procedures to be practiced which will benefit all members of the BG, from vehicle crews to BG HQ staff, while its AAR provides excellent facilities for the conduct of the battle to be examined. There is also huge potential for special to arm RE training by units, subunits and troops concentrating, initially, on mobility support to armoured battlegroup operations. Its consideration by units is strongly recommended. Although the Corps is busier than ever, the relatively low training overhead, the structured training environment and the ability to concentrate on key tasks will allow us to improve our performance while reducing the burden on our soldiers.

Inquiries for CATT (UK) should be directed to Major Matthew Tresidder on Warminster (94381) 5606. For CATT(Germany) inquiries should be directed to Major Andy Bellingall on Sennelager 94879 2368

Learning to Love BOWMAN and Digitization

MAJOR G E L BUCKINGHAM BA BAI MSC



Major George Buckingham was commissioned into the Corps in 1984. He is enjoying his current post as SO2(W) CIS at HQ EinC(A) where he is responsible for CIS, Digitization, Recce, Command Support and diving. He considers this fair compensation for his previous tours in Northern Ireland (twice), America, the ARRC, Monmouth and Tidworth. Having sworn he would never write for the RE Journal he felt compelled (by his boss) to do so. This article is the result.

INTRODUCTION

No Apologies. I make no apology for foisting on you what many may regard as yet another article on BOWMAN. In around a year (or less, if you have only just found this copy of the RE Journal at the bottom of your in-tray where you had dropped it on the way to the Regimental Christmas party) 26 Engineer Regiment will start BOWMAN conversion. The next unit will convert only three months later and there will be little respite until all have been through the conversion mill. From an Army perspective BOWMAN conversion is being viewed as a medium scale commitment from late 2003 until 2008. Most of you will be affected by its introduction, some of you might like to know a little more about what those impacts are likely to be.

What's the Point of Digitization? Let's get the obligatory digitization quotes out of the way early. The purpose of digitization is to:

"exploit the information opportunities offered by

digital technology in order to optimise the Army's capability within all spheres of activity¹." It remains CGS's top equipment priority².

So, this effort is being undertaken to improve military effectiveness. Key to that is the use of technology to speed up decision making.

Aim. The aim of this article is to update readers on BOWMAN and Digitization and make them aware of the likely impact on the Royal Engineers. It is intended for the general reader rather than the proud owner of bound copies of *"Computing Weekly"*.

HEADLINE BENEFITS

What will Digitization Do for Me? In simple terms BOWMAN radios will give the Army secure communications down to section level, it will provide positional and navigation information³ and it will allow data messages to be transmitted. Just those benefits alone will, I believe, represent a step change in the way we do business. However, there's more! The asso-

¹ BOWMAN Technical Description v3 Feb 02.

² Army Digitization Management Plan May 02.

³ The Navigation Aid provided by the BOWMAN Automatic Position Location Navigation and Reporting System assists the user in moving between specified points on the ground with a high degree of accuracy and determining bearing and distance from specified locations or other Users.



Figure 1 – Example of Vehicle-borne UDT.

ciated, small, vehicle-borne and manpackable computers (called User Data Terminals (UDT) – see example at Figure 1), along with the software applications delivered as part of the parallel Digitization Stage 2 (DS2) programme, will allow us to manipulate data to prepare orders, to assist planning, to automate reports and returns and so on. The key all arms software application will be the Common Battlefield Application Toolset (ComBAT) which will enhance situational awareness and aid the planning for and control of operations (See example screenshot at Figure 2).

What It Won't Do. BOWMAN has limited bandwidth so do not expect live video feed from a UAV into the Squadron CV. Neither will late night stags be enlivened by the ability to browse the internet.

EQUIPMENT AND TECHNOLOGY

How Much Kit? The scale of the BOWMAN programme is impressive. It is planned to fit BOWMAN equipment to 20,000 military vehicles, 156 ships and 276 aircraft. Around 70,000 trained service personnel will use it and more than 46,500 radios and 26,000 computers will be procured⁴. The majority of vehicles will be converted at two central locations (Ashchurch in UK and Dülmen in Germany) less certain exceptions such as Challenger and M3 Rigs which will be converted in unit lines.

Platform Presentation State (PPS). If you want to appear to know what you are talking about when next speaking to someone at the DLO ask them how the PPS work is coming along. This effort is



Figure 2 - Screenshot "COMBAT".

being managed by them and HQ LAND and is one of the major tasks already underway ensuring that all variants of a vehicle type are brought up to a common modification state which correlates to the contractor's BOWMAN design fit for that vehicle. The aim is to ensure that all vehicles in a particular fleet are appropriately configured in time for a unit's thirteen-week conversion period.

BOWMAN Installation Requirements Database (BIRD). Sooner or later in any conversation about BOWMAN someone will mention the BIRD. This mighty attempt to identify the BOWMAN requirements for every vehicle and unit in the Army has, like the Dodo, been somewhat overtaken by the pace of change. The initial plan was to replace Clansman with BOW-MAN equipment on a like for like basis, ie, in simple terms if a vehicle had a VHF Clansman radio then it would get a BOWMAN radio. That simple mapping has been continually amended as a better understanding of BOWMAN has developed, however there are still undoubtedly gaps in the BIRD that will not become clear until the equipment is issued. In an attempt to give the contractor a stable set of requirements the BIRD has had to be frozen (insert your own witty pun here!) until after the first units convert. The important message for sappers is that if the scaling of BOWMAN does not meet our requirements we must let the chain of command know so that the BIRD can be adjusted in due course.

AVLB/AVRE. One of the main sapper concerns is that neither AVLB nor AVRE will be fitted with BOWMAN. This is because they will be replaced by TITAN and TROJAN (ISD 2006) respectively, during the BOWMAN conversion period. That does mean that the first

⁴ BOWMAN and Land Digitization (BLD) IPT figures.



Figure 3 - MAKEFAST Capability.

close support regiments to convert will have to go through their training year and enter their high readiness year with AVLB and AVRE fitted with CLANSMAN. The best technical solution to give them connectivity with the rest of their 'BOWMANised brigade' is being investigated but no doubt some procedural innovation will be required.

MAKEFAST. MAKEFAST is the Engineer Battlefield Information Systems Application (BISA) which will be a set of software tools hosted on the BOWMAN infrastructure - in other words it is the engineer element of digitization. As Figure 3 shows it will assist engineers in the planning, recce, design and command and control of mobility, counter mobility, survivability and sustainability tasks in order to support joint and combined operations. It is funded and ISD is planned for early in 2006. A Technology Demonstrator, which shows some of the functionality that we might expect to see on MAKEFAST, has been developed and demonstrated fairly widely within the Corps. The comparison to make is with bridging. In fifty years we have moved from Bailey to ABLE reducing the time to span a 30m gap at MLC 70 from eleven hours⁵ to thirty minutes. However, our planning, recce, design and command and control processes would be immediately recognisable to a WWII sapper - MAKEFAST offers us the opportunity to speed them up to a similar dramatic extent.

CONCEPTS AND DOCTRINE

A LOT of work has been done on the development of concepts and doctrine for the use of BOWMAN and DS2. The lead agency has been the Command Development Centre (CDC) which has run a series of Digitization "MAPEXs" called Ex *BRILLIANT THUNDER*, the output of which has been used to inform doctrine development. HQ EinC(A) have been closely involved in that developmental work ensuring that sapper needs and capabilities are considered.

A series of Concepts of Use papers have also been written exploring how we expect to use specific applications. More detailed work, such as the draft Communications Procedures Pamphlet, is also now being produced. The engineer-specific concept of use work that has been done will be updated and expanded upon as lessons fall out of the conversion process. An example of that work showing how digitization could affect engineer procedures is shown in Table 1.

Much of the concepts and doctrine work that has been done was based on our requirements and expectations rather than on what the equipment will actually deliver. As the fielding of BOWMAN and DS2 draws closer more work will be required to ensure that doctrine reflects the capability of the equipment.

PEOPLE

PEOPLE still Matter! It will not surprise you to find that the BOWMAN programme will have a great impact on the People area. The increasing use of advanced technology, greater job opportunities and the higher profile that will be associated with BOWMAN represent an opportunity for sapper signallers.

Manning of Converting Units. It is obviously important that converting units are fully manned with C3S personnel if possible. It is probable that the first converting unit will be fully manned with signallers so that lessons for subsequent units are captured during what will essentially be a trials period. Subsequent converting units will go through the process at best manning effort since the Corps is currently undermanned for Command, Control and Communications Systems soldiers (C3S).

⁵ 90 ft at MLC 80 in daylight using a field squadron. ME Vol 3 Bridging, EWBB Normal Uses, 1955. If you disagree then speak to WO2 Holmes in the Battlefield Engineer Wing, not me!

ROYAL ENGINEERS JOURNAL

Ser	Generic Stage	Mobility Example - Bridging
(a)	(b)	(c)
-1a	Defining. Initiation. Engineer unit tasked.	Brigade Operations Order (provided on ComBAT) directs (after input engineer Commanding Officer) Close Support Engineer Regiment to provide suitable route for advance of Battle Group. Commanding Officer believes (having viewed map on ComBAT) that suitable route exists requiring the pro- vision of two crossings over a river. Regimental Warning Order is passed (probably on ComBAT) tasking Armoured Engineer Squadron with task.
1b	Initial Reconnaissance. Initial recce conducted often using maps, standard design proformae, historical data	Squadron's Armoured Troop is warned off for the task – for example by sending a message such as a GAPRECCEORD from AEngrP-2(A). Troop Recce Sergeant tasked to recce possible crossing sites. Preliminary map recce conducted using mapping on ComBAT to identify possible sites. Some of those sites have already been identified by the Regiment's Recce Troop working with the Formation Recce Regt and recorded on ComBAT/MAKE- FAST. Each possible site then recce'd in detail.
1c	Selection of Options. Recce will often generate a number of options. The most appropriate solution in the circumstances is then chosen.	Recce Sergeant will use pamphlets (such as Pamphlet 7 – Gap Crossing in the Combat Zone), Army Form W 4012A – Gap Crossing Recce Report, Tactical Aide memoire Parts 1 and 2, Standing Operating Procedures (all available as encyclopaedic data on MAKEFAST) training and experience to select the best crossing options. Factors considered include: tactical situa- tion, technical aspects such as time available, approach, ground, cross fall, gap width, water flow etc. He decides that the most appropriate solution is one close support bridge (carried on Armoured Vehicle Launching Bridge) at each of two sites. The Recce Sergeant will pass the initial results of his recce back to Troop and/or Squadron Command Vehicle.
2a	Planning. Detailed Reconnaissance. There may be a requirement to conduct a more detailed recce after the initial recce to confirm final details or to ensure the situation has not changed.	No need for more detailed recce.
2b	Design.	Recce Sergeant has based his design on standard designs given in Military Engineering Volumes (encyclopaedic data). No further design work needed.
2c	Resources Identification. Resources (equipment, vehicles, manpower, materiel) are essential to engineer tasks. They are often bulky and may be held ground-dumped in the rear so early warning is essential to get them brought forward in time for the required task.	Squadron Second-in-Command knows that he has sufficient armoured bridges for one crossing but not for two (details of Squadron equipment holdings available on MAKEFAST). Since both bridges need to be in place simultaneously he asks Regimental Command Vehicle for additional assets for the second crossing (voice because of urgency). Regimental Command Vehicle checks (engineer assets visible on MAKEFAST) to see if the requested assets are available (probably from another Armoured Engineer Squadron, though they may have to go to the Headquarters & Support Squadron or even to the Divisional Field Support Squadron for some assets).
3	Mounting . The mounting stage requires access to information including recce reports, reference data, superior HQ's orders and other information.	Regimental Command Vehicle then make arrangements to transfer assets over for the duration of the task. Squadron Command Vehicle orders its echelon to move forward additional bridges on Tank Bridge Transporters to a hide location as back up (message with sketch map sent via ComBAT). The troop(s) conducting the task will receive their orders (for example an AEngrP-2(A) GAPORD), probably by radio (message with sketch maps and map overlays), including detailed location, timings, routes, signals information. Recce Sergeant will have marked the site to assist the task of laying the bridge.
4	Execution During the execution stage the progress of the task is monitored and the plan adjusted if necessary	Squadron Second-in-Command is provided with regular reports (ENG- TASKREP on MAKEFAST) on the progress of the tasks. He passes this information onto his affiliated Battle Group so that they are ready to move as soon as the bridge is complete and to the Regimental Headquarters. Maps are updated with crossing site location (overlay sent to Battle Group/Brigade units).
5	Recovery Once the task is complete the equipment will be recovered and returned to appropriate location. As built diagrams will be produced.	Once the Battle Group has passed over the crossings the bridges are recovered. The attached assets return to parent sub-unit (MAKEFAST engineer asset list amended).

Table 1 – Example of impact of digitization on Engineer task.

LEARNING TO LOVE BOWMAN AND DIGITIZATION

BOWMAN Job Role	Present ME C3S Role	Remarks
BOWMAN Basic Signaller will have completed the BOWMAN Basic Signaller course. He will be able operate BOWMAN subsystems that exist at sub unit and unit level	ME C3S Class 3/2	
BOWMAN Advanced Signaller is a skilled and experienced vocational signaller who has completed a BOWMAN Advanced Signallers course.	ME C3S Class 1	
BOWMAN Advanced Signaller (Systems) is a very experienced BOWMAN vocational signaller who will be capable of operating all BOWMAN equipment	ME C3S Cpl or Sgt	
BOWMAN System Manager is the most senior role in the BOWMAN vocational signaller hierarchy. Units will require two BOWMAN System Managers (Unit) ((BSM(U)) to provide 24 hour working	RE Signals Warrant Officer Plus Selected RE Signals Sergeant (Adv Sig (SyS) (one SNCO from either of Regt CV1 or CV2)	Not clear yet whether BOWMAN System Managers (Formation) will be needed in Div GS Engr Regts
Applications Operator	Selected ME C3S Class 1 (ie, BOWMAN Adv Sig)	Developing job role, day to day admin of BOWMAN/DS2 applications
Applications Administrator	Selected ME C3S Cpl or Sgt (ie, BOWMAN Adv Sig (Sys)	Developing job role. Management of BOWMAN/DS2 applications.
RSO	RSO	Course still being developed for what will be a key job in the future.

Table 2 - Mapping current ME C3S jobs to Bowman jobs.

Nevertheless direction has been given to maximise the recruiting and retention of signallers in order to ease the shortfall for those units. In addition REMCM will ensure that, where possible, stability is maintained over and beyond the conversion period in certain key posts such as RSO, RSWO, certain Signals SNCOs and JNCOs so that hard-won expertise is not lost to the unit on posting. I believe that the increased career opportunities and high value training that signallers will receive in the future will make that an increasingly attractive career option.

Changes to Vocational Signallers' Job Roles. A lot of work has been done on identifying which existing vocational signallers will take on which new BOWMAN/DS2 job roles. Table 2 makes clear that signallers – currently focussed on communications tasks – will also have to undertake information management roles in the future. These roles are still developing but current planning is shown.⁶

I believe that these changes represent an opportunity for our signallers giving them additional IT-related training and employment. HQ AG is doing work on developing a career structure for these Information and Communications Systems (ICS) specialists. One of the areas they are examining is the possibility of additional pay to retain such highly skilled people who no doubt will be very attractive to civilian employers.

Military Survey. Obviously the provision of up to date, suitably formatted digital mapping is critically important for any digitized system. The first converting brigade (and possibly subsequent

⁶Extract from BOWMAN / Digitization Stage 2 (DS2) Fielding instruction.

ones) is likely to receive an additional survey NCO to help ensure this aspect goes smoothly.

STRUCTURES

THE mapping of BOWMAN and DS2 job roles outlined above means that based on our current understanding we will be able to convert to BOWMAN with no increase in establishment liability. That is a stroke of luck because it coincides with the direction that Arms and Services were given! That is not to say that establishments will remain unchanged in the future. Clearly as we start to use this equipment we will find that some of our structures may need to change in line with changing processes.

SUSTAINABILITY

THE sustainability policy for BOWMAN is still developing. The addition of BOWMAN (and other elements of digitization) into already crowded and complicated vehicles will clearly add an additional layer of complexity. BOW-MAN radios, the Commander's Crew Station and other computers within vehicles will start to become interdependent. It will be important, therefore, to have electronic technicians who understand this interlinked system. It is expected that user maintenance will probably be limited to "re-booting" and using the Built-In Test Equipment (BITE). Level 2 maintenance will be the domain of vocational signallers and some specially trained users. More advanced maintenance and repair will be taken on by REME or Royal Signals personnel with probably less repair and more replacement than is the case today. Software support will also be centralised allowing little scope for the enthusiastic "Hacking Monthly" subscriber to modify code for his or her own purposes.

TRAINING

TRAINING Needs Analysis (TNA). The TNA for BOWMAN has been produced and A&SDs are using that to inform their own plans for BOW-MAN and DS2 training.

What's the Plan? Delivering BOWMAN will require an enormous associated training effort. In broad terms:

· The contractor will deliver individual BOWMAN con-

version training during a unit's 13 week conversion period. In some areas they will provide mobile classrooms, in others they will use garrison facilities. In general, training will be delivered using simulations rather than real equipment.

- No specialist pre-training will be required though converts will have to hold the equivalent Clansman qualification before they are nominated to the required BOWMAN course.
- Some nominated individuals will receive pre-conversion training so that they can then act as unit Subject Matter Experts and provide support to the conversion package by training non-vocational signallers.
- It is planned to test-run some of the individual training courses early in 2003 in order to ensure that the courses eventually delivered to converting units are as polished and complete as possible.
- The contractor-delivered individual training will not address the total requirement. Additional team, collective and some DS2 training will remain the responsibility of the chain of command. A number of BOWMAN Training and Advisory Teams (BOWTATs) are being formed (two initially with the possibility of a further five) to assist in delivering that training. There is likely to be a sapper on each team, probably - but not necessarily essentially – a C3S SNCO.

Vocational Signaller Training. The RSME Communications Training Wing (CTW) will convert in Summer 05 after around 1/3 of the Corps has converted. Thereafter they will only generate BOWMAN-trained signallers. Limited regimental in-house training will therefore be required as some BOWMAN-trained signallers may be posted to CLANSMAN units and vice versa. Having said that, some in-house training on the 'other' system will be required regardless of what an individual used in his/her training at CTW since converted CS Regts may have to operate BOWMAN and CLANSMAN in parallel until AVRE and AVLB are replaced⁷. Only a relatively small percentage of C3S training is equipment specific so the Regiment should be able to manage that training burden from within its own resources.

Training for Non-Vocational Signallers. Non-vocational signallers, staff users and other non-C3S personnel will also receive BOW-MAN/DS2 training to enable them to conduct their roles. For example the adjutant will probably require training on the G1 functionality provided by DS2, while the Ops Offr will need

⁷ As discussed earlier, this depends on the technical solution for AVRE/AVLB connectivity to the remainder of the BOWMANised unit.

to be an expert in the use of the G3 functionality - probably mainly provided by ComBAT.

SUMMARY

Responsibilities. As the practicalities of implementing the BOWMAN programme are addressed so the balance of responsibility will shift between HQ EinC(A) to HQRE Theatre Troops. At present the Concepts and Doctrine and Structures lines of development remain the responsibility of HQ EinC(A) while both it and the HQREs have input to the other four lines. The conversion programme itself is owned by HQ LAND with engineer input from HQRE Theatre Troops.

Advanced classes. Since I started with a standard BOWMAN quote I feel compelled to end with a standard BOWMAN disclaimer, which is that the programme is moving so fast that some of the information given above may already be out of date by the time you read it. If that is the case I apologise. Those of you who feel the need for clarification or more information should get in touch with the author at HQ EinC(A) on Hawley Mil (94261) 3550 or on CASH as EINC-SO2CIS. For those who are really interested and - more importantly - for those of you who <u>should</u> be really interested, there will be a BOWMAN/DS2 briefing day at the end of the Signals Convention in Gibraltar Barracks in March 2003.

Afternote. I am grateful for the assistance and information I received from BLD IPT, HQRE Th Tps and the RSME as well as from staff within HQ EinC(A). The opinions expressed are my own.



Supporting the STTT's – Op Silkman





Lieutenant Richard Millbank was educated at Richard Lander School before going to Welbeck College in Nottinghamshire. In 1998 he was commissioned into the Corps of Royal Engineers, going on to complete 123 RE Troop Commander's Course. On joining 5 Field Squadron he deployed on Operations Palatine and Silkman. He is now reading an in-service degree in Information Systems and Management at the Defence Academy at Shrivenham.

THE British Governments' support to the Government of Sierra Leone (GoSL) has now exceeded 2 years. Throughout the mission, named Op *Silkman*, a force of around 600 British soldiers has been involved in the reequipping and training of the Sierra Leonean Army (SLA). The BRITFOR effort revolves around the "Short Term Training Teams" (STTTs), conducted by a British infantry battalion, whose main effort is to improve the SLA's basic soldiering in preparation for taking the fight to the RUF.

INTRODUCTION

IN April 2001, 5 Fd Sqn prepared and mounted the RE detachment for Sierra Leone. The planned RE manning levels had been for an 11man team at 1+10, to support all the BRITFOR locations throughout theatre. With seven different locations to contend with, and all becoming increasingly nervous about the approach of the wet season, the detachment was surged at 10 days notice to a trade, rather than troop based, task organisation of 1+26. The priority 1 task was to prepare Benguema Training Camp (BTC), the centre of gravity for the training effort, for the expected winter weather. Unlike a British winter the West African version brings 5000mm of rain in three months and continues to be in the high 20 degrees centigrade. Harsh and testing conditions through which the STTTs had to conduct their training.

FORMATION READINESS CYCLE (FRC)

As part of the FRC, 22 Engr Regt moved into a High Readiness year in January. It had to continue its training to meet the Engineer Training Standards (ETS) as laid down by HQ LAND. These generic objectives revolve around engineer activity in a Western European climate. 22 Regt's mission statement is "...to deploy worldwide ... " and so our objective at squadron level, as part of our confirmatory High Readiness training, had been to cover different climates and types of warfare. The High Readiness training standards, very much similar to those of the training year, were rigid and so when our deployment came we were ill prepared for a jungle environment. We had no intention of going to an operational theatre during a precarious lull in the fighting with a real time threat to contend with. Fortunately 9 Para Sqn were able to help with a morning's worth of "jungle awareness" carried out at the realistic training area of Wyke Regis!

READINESS

5 SQN had been nominated as the lead mechanised squadron for the year and as a result were now held at two levels of readiness. A troop and recce party were held at R2 (5 days NTM) with the remainder at R3 (6-10 days NTM). The regiment remained at R6 (60 days NTM) and thus independently the squadron introduced new working practices in order to meet this requirement. The R2 troop had to be held as a composite of formed sections as the normal requirement of career courses and central employment took their toll on the field troops. A call-out procedure was introduced and G1 factors such as documentation and reporting had to be tightened. Bergans were kept

packed along with G1098s ready. A validation exercise was conducted in December to test our procedures and confirm our planning times. The result was impressive. In three days the complete squadron was packed and ready to deploy as if called out on operations. Though clearly not as impressive as the old "Active Edge" timings, it was successful considering that the men scatter to the four winds at every opportunity and the "A" fleet is increasingly aged. As a mechanised squadron we could, in theory, deploy to an operational theatre with the minimum of fuss at only three days notice. The benefit of these preparations to our deployment was obvious. In terms of pre-deployment planning we were able to concentrate on the finer detail rather than starting from the beginning. This eased the pressure and in turn our preparations were more thorough and complete.

NO MORE MEN

By the middle of this year the squadron had undertaken 17 deployments to eight different countries at troop level or below and finding manpower was becoming increasingly difficult for the 2IC. Soldiers were experiencing redeployments as little as one week after returning home from tours and OTX's. A positive side effect of this was that experience within the squadron was increasing at a rate of knots. To our benefit we had deployed an artisan section at seven working days notice, to establish the Role 3 Field Hospital at the port in Freetown. They had come home with useful advice and experience, which considerably



This was standard "accomodation" for the SLA soldiers. The weather conditions destroyed equipment at frightening speeds.

helped our deployment. Knowing the small detail gave the commanders and soldiers alike more confidence.

LOGISTICS

In order to support a larger team the obvious logistics of vehicles and equipment had to be considered with only a minimal list of "proposed tasks" to work from. Each detachment had previously deployed with its small G1098 and relied on the goodwill of the previous Sapper unit for the use of vehicles, until the arrival of their own. Our vehicles were due to arrive five weeks into our tour so local "white fleet" was arranged for through the small National Support Element (NSE). Each tradesman required a toolbox, not something that is catered for in a normal troop G1098, to enable us to be flexible once the tasks started to be confirmed. Deploying with a complete troop's G1098 maintained our flexibility and ability to work self sufficiently from other units. Although all our equipment had to move by airfreight this was advantageous, as it would arrive with us, unlike the sea tail. On arrival, as ever, we realised that we had far too much equipment. This however enabled us to operate a contingency plan which will be mentioned later

PRE-DEPLOYMENT TRAINING

TRAINING which we achieved at WRTA had mainly focused around water supply. The detachment held WPU (NBC), WPU (NBC Saline) and WPU (S) sets. Refresher training was undertaken and lessons on the Saline set-up were conducted in order that all contingencies could be covered. With BRITFOR limited to drinking bottled water, the need to produce potable water was reduced leaving these sets to be held as an operational reserve. Other training focused around what we were aware of having to deal with in terms of combat engineering and trade related tasks. The political background and recent history of Sierra Leone was outlined to the men so that they would appreciate that there was still a real enemy to contend with.



An overview of Benguema Camp. The ablution facility is in the foreground.

OPTAG

WARMINSTER provided the OPTAG training as per other deployments. The one day package covered generic factors such as mines awareness, language training and scenarios. Although adapted from a Balkans style program the training helped to focus the mind on the forthcoming events, and for many it gave the first realistic impression of the country. The training gave the troop a chance to gel together for the first time as they went through the "what-if?" scenarios. Once the OPTAG training was completed the men got a short leave prior to returning to Perham Down in preparation for departure.

ARRIVAL IN THEATRE

AFTER an overnight stop in Senegal the trooping flight finally made it into Lunghi airport. The initial heat, in the 'relatively low 30 degrees C, was a severe difference to that which we had left behind at Perham Down two days earlier. Geographically, the airport is situated across the bay from Freetown, which meant an hour-long ferry ride by an RLC operated Mexefloat. Freetown even looked quite appealing from 5km away until its true state became apparent. We were met at the RFA Sir Percival, the FRV for theatre, by the outgoing detachment from 31 AES and we were taken in-country to BTC. The Theatre Reception Centre (TRC) was conducted in the cookhouse at Benguema. We had expected to be received and kitted out as soon as we arrived at the FRV. This was not the case and we were finally issued ammunition and other theatre issue items that evening. Meanwhile our handover began in earnest as the presence of the 31 AES detachment had been extended in theatre by three weeks already and were more than eager to get home.

BENGUEMA TRAINING CAMP

LOCATED about 30 km in-country at Benguema is the former training depot of the SLA. Situated here was a tented camp, about the size of six Rugby pitches, and had been constructed using the remaining buildings where possible. The RUF had ransacked BTC and thus the site was in quite a poor state. BRITFOR and the SLA soldiers live in close proximity which helps the training party considerably. The camp had been initially constructed for 150 men for a duration of six weeks. By our arrival it held 400 men, crammed and fitted in wherever the Battalion QM could manage. Due to the uncertainty of the life span of the mission, the camp had evolved rather than grown by design. Without an overarching development plan to speak of, each detachment had made its mark and made adjustments where fitting. By our arrival all basic facilities were up and running despite a serious manpower bill required to maintain them. In reality, the detachment had held a maintenance only capacity while we, with the extra manpower, had the ability to improve and develop the camp into a more hospitable place to live

EHT MATTERS

THE most surprising issue was the fact that all ablution facilities were either tented or simply constructed from CGI. The only CORIMEC units were 2 Field Sanitation Units (FSUs) that

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The heaviest piece of plant which we had was a Light Wheeled Tractor (LWT). This proved a highly reliable and robust piece of equipment. Here we are trying to rectify the drainage on the SLA "North" Camp.

had arrived from the UK without the necessary electrical stores and so were unusable. The Camp had survived on Deep Trench Latrines (DTLs) from the outset. After 12 months of use, real estate had become an issue and trying to locate new sites for further latrine's required tact and diplomacy at the highest level. Informing a CO that a Latrine needed to go in next to his tent was a tricky task indeed.

Another aspect of used DTLs was the problem of vermin. Rats were starting to become a serious environmental health issue and the DTLs were mainly to blame. Rumours spread quickly about hearing the rats in the DTLs and as a consequence, a whole refurbishment was undertaken. Collapsing and burning the latrines out did not go down too well with the locals, who

failed to understand our wanton destruction of what to them was perfectly good timber. Due to the high risk of disease from the malaria-infected SLA soldiers the troop was granted "Pay for Work of an Objectionable Nature" (PwoN) which, at nearly £5 a day, helped to appease tension.

PROJECTS

THE Infantry QM soon realised that he had an opportunity not to be wasted. All kinds of requests were fired into the detachment ranging from the mundane to the amusing. Once we had established

what was likely to be funded, the sensible requests came in thick and fast. The main tasks undertaken were constructing walkways, waterproofing buildings and stores, and preparing the drainage as best as possible. An ammunition field storage compound was constructed from written-off ISO containers. This replaced the two 18 by 24 tents, which had held the complete theatre operational stocks for over 12 months. To construct a small project out of materials, which would not be stolen, was a feat in itself. Palm fronds became order of the day as even green string and rusty nails were "attractive" items that would

disappear overnight. A 300m Gallery range was refurbished again with no more than the bare minimum. The SLA skill-at-arms was dire to say the least, with only the 50m firing point ever getting a look in. The use of the detachment as the MCF, with its surged capacity was an option which the STRE used when required to guarantee something happening and being safe once finished. four men were placed TACOM to 519 STRE for the tour to provide them with their own reliable work force.

RESOURCING TASKS

To rely on material coming from the UK was unrealistic and. With a six-week lead-time at best the only clear solution was local purchase. Once the SOR paperwork had worked its way through



This is an example of the sort of task which we undertook. It involved all of the Primary Trades.

the six different signatories at NSE we could purchase any materials that we needed. Actually getting into Freetown to locate items became my most time-consuming weekly task. Fortunately for my sanity, the remaining British Ex-Pats were more than willing to make their fortune from the British Army and were able to provide what we needed. If they did not already hold it, they would "acquire" it and deliver it out to BTC. Having a Class 1 Resources Specialist with the detachment was a real benefit as his knowledge and experience in the "black art" of G4 saved considerable time and sweat. To have learned the myriad of documentation would have created further stress when things were hectic enough. It also allowed the detachment sergeant to concentrate on running the in-camp issues whilst I was occupied with the C2 issues around the country.

CONTINGENCY PLANNING

At the time things were increasingly volatile with the RUF. Although they were reported to be hundreds of miles away losing a war against the Guineans, the Int Cell was predicting a possible move towards Freetown. If this had taken place the only obstacle in their way would be the camp at BTC. CO 1 LI had plans drawn up for several contingencies for which important input was needed from an engineer perspective. Shaping the battalion plans for a withdrawal, and storage of munitions and Conplan Alpha (the total destruction of BTC) was quite a responsibility. To destroy a whole camp and ammunition compound was a task that I was not keen to shoulder unless an AFW1198 was produced as the authority if needed. Fortunately for the RUF, they had decided to follow a diplomatic approach after Operation BARRAS. They were beginning to surrender to the DDR process at a rate of thousands per day which no doubt will become the next chapter in the saga of Sierra Leone.

CONCLUSION

THE deployment to Sierra Leone was an excellent opportunity for all members of the team. It provided a plethora of different challenges and problems in what was an arduous environment. The chance that all ranks had to practice trade and combat engineering skills was one that will not be repeated for sometime.

To deploy on an operation during its relatively early stages added an extra dimension, which few of the team had experienced before. It was essential that all personnel took responsibility for their own area of expertise and this proved to be the ultimate challenge.

Journal Awards

The Budget, Investments, Membership, Scholarship, Memorial and Publications Committee announces the following awards for articles of special merit published in the August 2002 issue:

Timewatch: The Mystery of a Television Programme LT B J W Day – $\pounds 100$

THE SHACKLETON PATROL Capt T P Clarke – £75

THE BERLIN SPY TUNNEL – A MEMOIR Brig R M Merrell MBE – £50

PORTRAIT OF A REGIMENT Maj Gen E Fursdon CB MBE – £50

German Military Geologists and Terrain Analysis for Operation *Sealion*: The Invasion of England Scheduled for September 1940

COLONEL E P F ROSE TD MA DPHIL MCIWEM CGEOL FGS OBERSTLEUTNANT D R GEOLOR DR RER NAT DIPL GEOL D WILLIG

IN a recent RE Journal article, the two authors contrasted the large numbers of military geologists deployed by the German army in France in 1940 with the single military geologist deployed with the British Expeditionary Force that opposed it. Here they demonstrate that the senior German geologists included men of considerable experience and future distinction. With the end of the Battle of France, their expertise was soon focused on terrain analysis to aid the invasion of England.

FEW people realize that geologists contributed to preparations for Unternehmen Seelöwe (Operation Sealion), the Second World War German invasion of England scheduled for September 1940. Widely-read accounts of Sealion by authors both British (e.g. Fleming, 1957, 1975; Wheatley, 1958) and German (Klee, 1958, 1959; Schenk, 1990a,b; Kieser, 1997, 1999) make no mention of the role of geology or of geologists in operational planning. Yet the German armies which occupied northern France from May 1940 were aided by considerable geological expertise. As recently described in the RE Journal (Rose & Willig, 2002), five military geology groups (Wehrgeologengruppen) were deployed in their support. We here document the calibre and role of senior geologists from two of the groups, those based at Lille and Brussels, to generate maps which would guide the invasion.

SEALION PREPARATION

GERMAN forces invaded westwards from 10 May 1940, through Holland, Luxembourg, Belgium, and then France. They advanced with such speed that the British Expeditionary Force was compelled to evacuate via Dunkirk between 26 May and 3 June, Paris was captured unopposed on 14 June, and an armistice was imposed on the French on 22 June. Yet to the *Führer* Adolph Hitler's surprise, the British were unwilling to sue for a speedy peace. Accordingly, on 16 July 1940, he issued Directive No. 16 "On the preparation of a landing operation against England" (Kieser, 1999, p. 274-6).

For the operation to be successful, a pre-requisite was that the Royal Air Force be eliminated to the point that it would not have the strength necessary to mount a significant attack on a German attempt to convey troops across the Channel. Hitler's Directive No. 17 of 1 August 1940 "On the conduct of the air and sea war against England" gave instructions "to beat down the English air force with all available forces as quickly as possible" (Kieser, 1999, pp. 277-8). The aerial Battle of Britain, which had effectively begun in mid-June, was intensified. The main Luftwaffe assault took place on 13 August (Eagle Day: Adlertag) and bombing was focused on Royal Air Force airfields until early/mid September. However, from 7 September daylight attacks on London began in earnest, and the daylight Battle of Britain merged with the first phase of "the Blitz": a series of night attacks against British cities sustained from August 1940 to mid-May 1941.

September 1940 was the month chosen for the landings. In conference with the commander-inchief of the German armed forces (the Wehrmacht) on 21 July, Hitler had remarked: "If it is not certain that preparations can be completed by the beginning of September, other plans must be considered" (Flower & Reeves, 1960, p. 157). Among those other plans was an attack upon the Soviet Union. However, advised on 31 July by Admiral [of the Fleet] Erich Raeder, commander-in-chief of the German navy, that the navy's preparations for a landing could not be concluded before 15 September, Hitler decided that all preparations should take that date as a deadline, with the proviso that his final decision would depend on victory in the Battle of Britain. Eight, or at most fourteen, days after the start of the intensified air campaign against Britain initially scheduled to begin on or soon after 5 August, he intended to decide whether Sealion could take place in 1940.



Figure 1 – Operation 'Sealion': map of southern England and northwestern France showing deployment of German troops planned for September 1940. (After Rose *et al.*, 2002, by permission of the Geologists' Association; redrawn after Wheatley, 1958; Maier, 1995, by permission of Oxford University Press.)

The invasion was to be carried out by divisions drawn from Army Group A's 9th and 16th Armies (Figure 1). Preparations included the recording of all available sea and river craft in Germany and the countries already occupied by German forces; embarkation and disembarkation exercises; and the formation of occupation authorities which planned, among other tasks, the arrest of certain prominent British citizens. By mid-September, the plan was to land ten divisions (seven infantry, two mountain, and one airborne) in the first wave of the attack, in total about 138 000 men in two days, followed by more divisions in the second and third waves to build up a total of some 248,000 to 300,000 troops within two weeks.

On 14 September Hitler informed his commander-in-chief that the navy had completed preparations for *Sealion*, but in spite of the (supposed) enormous successes of the *Luftwaffe* the preconditions for the operation did not yet exist. Domination of the air had not been achieved. Hitler therefore deferred the invasion date to 27 September, with 17 September as the date for its confirmation – or otherwise.

On 19 September the *Wehrmacht* high command confirmed a decision to postpone the invasion by ordering a dispersal of the *Sealion* transport fleet and a halt to further concentration of transport ships so as to avoid continuing losses from British air attacks. It had become clear that the landings were unlikely to take place. On 2 October Hitler ordered that all measures taken in conjunction with *Sealion* were to be largely dismantled. In his Directive No. 18 of 21 November he stated that changes in the general situation might make it possible, or necessary, to revert to the plan in the spring of 1941, but on 5 December Admiral Raeder came to note after further discussion: "Sealion can be left out of account" (Maier, 1995, p. 989). On 18 December Hitler issued Directive No. 21 in which he ordered the Wehrmacht to prepare to crush Soviet Russia in a rapid campaign (Op Barbarossa), so developing the Eastern rather than the Western Front. The planned invasion of southeast England thus never materialized – but some two months had been spent preparing for it.

DEPLOYMENT OF GERMAN MILITARY GEOLOGISTS

A MILITARY geology group based at Lille (Wehrgeologengruppe Lille) was tasked to support 16th Army Command (Armeeoberkommando 16) (Rose & Willig, 2002). It thus supported one of the two German armies assigned to Op Sealion, and at least two of its geologists became involved in preparations for the invasion of England: Ferdinand Trusheim and Otto Burre. Their signaauthorized explanatory tures leaflets (Erläuterungen) written to accompany water-supply maps (Wasserversorgungskarten) of southeast England and other documents generated by the group, and did so specifically in the post of military geologist (Wehrgeologe) (Rose et al., 2002). (The leaflets are preserved in Germany, in the archives of the Amt für Wehrgeophysik at Traben-Trarbach). By establishing a base at Lille these military geologists followed a precedent set by a German military geology group in the First World War, to gain access to the extensive geological library and other resources captured with its museum and university (King, 1919; Rose, 1978; Willig, 1997).

British military geological expertise deployed during 1940 for the Battle of France comprised a single university professor, over 50 years in age (Local Major W B R King OBE RE, born 12 November 1889; Figure 2) (Rose & Hughes, 1993a; Rose & Rosenbaum, 1993a,b; Rose & Willig, 2002; Rose, 2004). Did the German army also seek to promote victory at this time by deployment of elderly academic geologists in uniform on the battlefield? Comparison of biographical data for Trusheim and Burre presented here with data for senior British military geologists already published in the *RE Journal* (Rose & Hughes, 1993a,b,c) indicate that, to some extent, they did.

A CORPS GEOLOGIST OF THE 16TH ARMY FERDINAND Trusheim (Figure 3) was by the sum-



Figure 2 – Local Major W B R King OBE MC RE, military geologist with the British Expeditionary Force in France from 1939 until the Dunkirk evacuation of 26 May – 3 June 1940; until September 1940 the only geologist then serving as such with the British army. (From Rose & Rosenbaum, 1993b, courtesy of Professor C A M King and the Geologists' Association.)

mer of 1940 already an experienced military geologist, although only 34 years of age. Born on 24 April 1906, he had graduated as a geologist from the University of Würzburg in 1929, and been appointed to its staff in 1930. Following research initially on Cretaceous rocks of southern Germany, later more specifically the geology and palaeontology of Franconia, he was successively promoted, being accorded the title of Professor of Geology and Palaeontology in 1942.

His obituary by Plein (1997) tactfully glosses over his wartime career in two brief sentences: "In the Second World War he was with the military geology service for a long time. Within the scope of this duty he had to be active in various European countries" (translated from Plein, 1997, p. 45).

However, aspects of his geological service in the Second World War have been conveniently summarized by Professor Hermann Häusler (1995b, pp. 52, 86) of the University of Vienna. It apparently began a month after France and the U K declared war. In October 1939 he was appointed to the military geology group deployed in support of the German 16th Army



Figure 3 – Ferdinand Trusheim in the uniform of a *Technischer Kriegsverwaltungsrat*, the status assigned to military geologists given commissioned rank to serve as such with the German army in the Second World War. (Photograph taken at Berlin-Wannsee in 1942, reproduced courtesy of Drs Ursula and Hans Trusheim; from Rose & Willig, 2002.)

Command (AOK 16). This was soon to be poised for action behind the line of fortifications which marked Germany's western border, facing France - the West Wall. In January 1940 he was attached to the 12th Army, to the military geology group which supported its chief engineer, serving in a military geology unit based at Bitburg in the Eifel region of Germany, near Luxembourg - and from 30 January to 6 February he was one of the 19 military geologists who participated in a military geology course given at Giessen (Häusler, 1995a, p. 68). During the Battle of France, from May to June 1940, he served as the "Corps geologist" with the German 7th Corps, part of the 16th Army. In July of that year he published a paper on aerial bombing and geology, illustrated largely from cratering observed during the Polish campaign of September 1939 (Trusheim, 1940). By October 1940 he was back in support of AOK 16, on the strength of Wehrgeologengruppe Lille (cf. Rose & Willig, 2002, Figures 1, 2). At Lille he prepared a paper on army geological experience in the construction of field positions, presented at the December 1940 military geology conference in Heidelberg (Trusheim, 1941). He also prepared an appraisal of potential water supplies in the region from northwest London to Watford (Rose et al., 2002).

Later, following reorganization of the five military geology groups into a larger number of smaller centres or teams (Wehrgeologenstellen) (Häusler, 2000; Häusler & Willig, 2000; Rose et al., 2000), from April 1941 to March 1942 Trusheim became leader of Wehrgeologenstelle 11, deployed still in support of AOK 16 – but on the Eastern Front. Then from July 1942 until the autumn of 1943 he was posted to serve on the military staff established at Wannsee in Berlin, in a leading position from at least August to September 1943 (Häusler, 1995a, pp. 71, 141). This unit, responsible through the "General Army Office" to the Army High Command (Oberkommando des Heeres), had oversight of the military geology teams within the German army as a whole: 25 teams in April 1941, progressively expanded to 40 by November 1943 (Häusler & Willig, 2000; Rose et al., 2000). It developed departments with regional expertise, one for each of the campaign areas, together with specialist divisions to promote the disciplines of engineering geology, hydrogeology, and geophysics (Häusler & Willig, 2000, Fig. 6.5). Between 9th and 11th January 1943 it was Trusheim who gave a presentation on the aims, objectives, and aspirations of the Wannsee staff to a military geological conference convened at the Geological Institute of the University of Bonn (Häusler, 1995a, p. 71).

The man who in 1940 served in the field with 7th Corps and then appraised potential water supplies in the London to Watford region for Op *Sealion* was thus destined to rise high in the hierarchy of German military geology during the war. His service earned him, from 1945, five years as a prisoner-of-war in the Soviet Union.

After his return to Germany in 1950, Trusheim became a petroleum geologist, distinguished for research on the sedimentary basins of northern Germany and especially on salt tectonics (Plein, 1997). Many geologists credit him as the effective founder of this latter discipline: as the "father of halokinesis". His petroleum career, largely based on Hannover, ended partly with his retirement in 1970, and finally with his death (at the age of 91) on 28 June 1997.

THE SENIOR GEOLOGIST OF THE 16TH ARMY OTTO Burre (Figure 4), was in 1940 a geologist of even greater experience. Wilhelm Otto Johannes Burre, born on 15 June 1887, had studied mathematics and natural science for a year at



Figure 4 – Otto Burre, a postwar photograph of the wartime leader of *Wehrgeologengruppe Lille*, which generated the most detailed geotechnical maps prepared to facilitate the invasion of England. (From Nöring, 1975, courtesy of the *Hessisches Landesamt für Bodensforschung*).

the University of Heidelberg before transferring to the University of Berlin, to study geology and natural sciences. He completed his Dr. phil. thesis in 1910, and worked for two years on the staff of the mineralogy-geology institute at Charlottenburg in Berlin before a year's military service in an artillery regiment. Subsequently, during the First World War, he achieved the rank of second lieutenant (*Leutnant*); award of the Iron Cross (2nd class in 1915, 1st class in 1917); and, in 1918, placement as a military geologist (Nöring, 1975).

After that war he joined the Prussian Geological Survey. (In Germany then, as partly now, geological survey was a regional rather than a national responsibility.) Successively promoted, he was given the title of district geologist in 1927, and additionally that of professor in 1933. In a very full obituary, Nöring (1975) has given details of his publications and other achievements within the Prussian Survey between the two wars.

Shortly before the Second World War he contributed the section on construction/raw materials to the authoritative textbook on military geology by von Bülow, Kranz & Sonne (1938). Not surprisingly in view of this, in 1939 he was appointed (in a civilian capacity) geological adviser to the construction staff of the Luftwaffe's western aerial defence zone (Luftverteidigungszone West), to guide the provision of raw materials necessary for construction of airfields and development of associated potable water supplies (Häusler, 1995a, pp. 50-51). Nöring (1975) records that he renewed his service in a military geology group as such from 21 October 1939 to 23 November 1940, to the summer of 1940 with the status of Technischer Kriegsverwaltungsrat (War[time] Technical Administrator: cf. Rose, 1980; Rose & Willig, 2002). Häusler (1995b, pp. 13, 62) notes that in 1940, following the Battle of France, he was appointed head of Wehrgeologengruppe Lille. His work was apparently deemed to be of value: he was decorated with the war service cross (Kriegsverdienstkreuz) 2nd class in 1941 (Nöring, 1975).

Following reorganization of the Lille and other military geology groups early in 1941, and presumably because of his age (54) and long-standing geological survey experience, Burre returned to a survey role. He became a senior government geologist in 1941, leading a works office based initially in Saarbrücken and later in Metz, with responsibilities for the Rheinpfalz, Saarland, Lothringen, and Luxembourg area (Nöring, 1975; Häusler, 1995b), his duties changing with the progress of the war. For at least part of this time he had responsibility for geological investigations to facilitate the re-location of German industry in the Saargebeit and Rheinpfalz regions into underground sites, safe from Allied bombing. His wartime career came to an end in March 1945, with capture by American troops.

However, he was soon appointed to head a new geological survey in the German Federal Republic's province of Hessen. He remained in a senior position through subsequent reorganizations of the Hessen survey until 1948, and was active in geology for some years after that. He died in Hessen, at Darmstadt, on 7 March 1975, at the age of 87

SEALION GEOLOGISTS OF THE 9TH ARMY

THE 9th Army was also supported by geologists who generated specialist maps similar to those prepared for the 16th Army. The style, however, was different. For example, water-supply maps for the 9th Army had all the information deemed necessary printed on the map itself, whereas for the 16th Army each map had to be used in association with a separate explanatory leaflet. Each leaflet was signed by the authorizing geologist, but maps were unsigned. In consequence, the names of the senior 16th Army geologists can be ascertained from leaflets, those for the 9th Army can not.

However, the specialist maps generated for the 9th Army were prepared by a military geology unit/section (Wehrgeologentrupp) whose work was continued by a military geology centre/team (Wehrgeologenstelle 13). This particular team was derived from the military geology group based at Brussels rather than that at Lille (Häusler, 1995a, p. 79), a group that had initially been deployed westwards in support of the 4th Army (Rose & Willig, 2002, Figure 1). The group was led by Fr. Schuh, supported at this time by a younger geologist as his adjutant (Wilhelm Pickel), and geologists as specialists for water supply (Th. Oehler), mining (Günter Schulz), roadworks (Hans Frebold), and geophysics (Johann Kliemstein), together with specialists for electrical engineering (Lange) and blasting (Stemick), and other geologists deployed to the group's reconnaissance units (Häusler, 1995a, pp. 74-5).

It is known that Carl Hahne became leader of Wehrgeologenstelle 13 in April 1941 when the former military geology groups were restructured into a larger number of smaller, independent centres/teams, and that WG13 (as such teams were usually abbreviated) went with the 9th Army to serve on the Eastern Front – eventually to generate numerous geological appraisals, of which about a hundred are still known (Häusler, 1995b, p. 125). Prior to that Hahne served in the military geology group based on Brussels, initially in its Versaille reconnaissance unit and by October 1940 in the out-station at Rouen (Häusler, 1995b, pp. 19-20) (cf. Rose & Willig, 2002, Figures 1, 2). In preparation for Op Sealion, by early August 1940 potential invasion forces drawn from the 9th Army were all based near Rouen: the 8th Division close to the city, 28th Division to the northwest, 30th Division to the southwest, and 9th Army headquarters at Limésy close by to the north (Wheatley, 1958, map 1). Even the revised plan of September 1940 had the 8th and 28th Divisions still in essentially the same areas, with

elements of the 6th Mountain Division to the west of Rouen (Wheatley, 1958, map 3). Hahne (born 7 January 1904 so 36 years of age) was by this time a specialist in coal-field geology. He had studied at the universities of Tübingen, Munich, and Göttingen before appointment to the staff of the "polytechnic" at Aachen. In 1939 he was promoted as a professor in its faculty of mining, chemistry and mineralogy, before war service as a military geologist interrupted his studies on palaeontology, tectonics, sedimentology, and petrography. It seems likely that he may have been leading the 9th Army geologists from a base in Rouen during August/September 1940, but if so, details of this role against the United Kingdom have been tactfully omitted by his biographers (Metz, 1984; Fiebig, 1995).

GERMAN TERRAIN ANALYSIS OF SOUTHEAST ENGLAND

THE geologists of both 16th and 9th Armies compiled four types of specialist maps in preparation for Op *Sealion*. Topographical base maps were derived by the German army's "Mapping and Survey Department" from Ordnance Survey maps of the most similar scale. These were annotated by the geologists to show features of specific military interest.

Examples of each type now form part of the "Heringen Collection", an archive of German military geological and geographical documents temporarily stored for safety deep underground in the Wintershall salt-mine at Heringen (Werra), in the Hessen province of Germany. When captured by American troops at the end of the war this was found to comprise three libraries: those of the German Patent Office, the National Geological Service (Reichsamt für Bodenforschung), and the Military Geology Staff (Wehrgeologenstab) of the Army High Command (Oberkommando des Heeres). Parts were transferred to the United States, geological documents first to the Military Geology Unit (subsequently re-named the Military Geology Branch) of the U S Geological Survey, later to the Federal Records Center, and finally to the National Archives and Records Administration at College Park, Maryland. There the maps are catalogued as part of Record Group 57, line sequences 72 and 73, "Mil Geol Branch: German geologic maps of Europe 1917-45".

• Coastal geomorphology. To indicate optimum



metal and similar resources, quarry sites were plotted on 1:100 000-scale topographical or engineering-terrain Figure 5 - Map of East Kent, showing the seven water-supply regions depicted on German 1:50 000base maps so as to scale water-supply map sheet 117 prepared for the 16th Army. Ornament and symbols as on the origigenerate construcnal map. As with other such maps prepared for the 16th Army, all springs were plotted, categorized into tion whether they were already tapped or not, whether outflow was strong or not, and whether contaminamaps for the whole tion was likely or unlikely. Any spring lines (zones with numerous springs at similar height) were plotted as such. Engineered works plotted comprised water works as such, pumping stations, wind pumps, area east from reservoirs, water towers, and hydraulic rams. Regions defined on the map comprised those: (1) where Brighton and south siting of shallow wells was possible almost everywhere; (2) where siting was possible in places, espefrom cially in low ground; and (3) where siting of shallow wells was generally impossible. The map also London. Colourshows areas (1) where there was risk of contamination both of springs and wells; and (2) where, near coding the sea, there was the risk of encountering brackish groundwater due to saline intrusion. (From Rose et guished sources of al., 2002, courtesy of the Geologists' Association.) An explanatory leaflet accompanied the original hard sandstone, map to give hydrogeological characteristics for each of the numbered regions. limestone,

landing areas for amphibious assault, four coastal geomorphology maps were prepared at 1:50 000 scale, together interpreting the terrain eastwards from Selsey Bill on the south coast to Margate in northeast Kent. These categorized coastal regions on the basis of cliff topography and beach granulometry, and illustrated the geological features of major cliff profiles.

• Water supply. The military geology group deployed to support the German 16th Army generated ten 1:50 000scale water-supply maps plus accompanying explanatory texts to cover southeastern England. Two additional military geology units generated at least nine water maps for the adjacent south-central areas assigned to the 9th Army, maps different in their presentational style and in adopting 1:100 000 and 1:250 000 as well as 1:50 000 scales. Initially, water was to be obtained by both armies from untapped springs and drive wells: partly-perforated steel tubes hammered <7 m into suitdolomite, sand and gravel, fine sand, clay, and gypsum, and a more detailed 1:50 000-scale series of such maps was in preparation when the invasion was cancelled.

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(Figure 5).

provide

Abyssinian campaign of 1868: the "Norton tube well".) Geologist annotation defined positions of springs of different types, key engineering

the

· Cross-country trafficability. To guide selection of vehicular routes cross-country, a start was made on the preparation of cross-country trafficability maps for the southernmost areas at 1:100 000 scale.

BRITISH AND GERMAN MILITARY GEOLOGIST **USE: A COMPARISON**

FROM the data presented here and in recent articles on Op Overlord, the Allied invasion of Normandy on 6 June 1944 (Rose & Pareyn, 1995, 1996a,b, 1998; Pareyn & Rose, 2000), there are some evident similarities between British and German use of military geologists during the Second World War:-

· Manpower. Both sides initially recruited their military

geologists from staff of the universities and the national geological survey. British geologists W B R King (in 1939) came from the University of London, F W Shotton (in 1940) from the University of Cambridge, J V Stephens (in 1943) from the British Geological Survey (Rose & Rosenbaum, 1993b). As already described in the *RE Journal* (Rose & Hughes, 1993a,b,c; Rose & Pareyn, 1996a), a similar pattern was maintained later in the war and in the reserve forces postwar. Biographies of the senior German geologists given here show that they too were drawn from the staffs of universities (Trusheim, Hahne) or the national geological service (Burre).

- Calibre. Both sides chose geologists of evident scientific ability. In Britain, post-1940 Bill King became Woodwardian Professor of Geology at the University of Cambridge, Fred Shotton became Professor of Geology at the University of Birmingham – both prestigious academic appointments. Both King and Shotton were elected to fellowship of the Royal Society – the highest U K scientific accolade. Steve Stephens returned to a British Geological Survey role. In Germany both Trusheim and Hahne achieved distinction as geologists postwar, and Burre returned to a senior geological survey role.
- Quantity. Both sides made use of significant numbers of geologists when these were deployed for an offensive rather than defensive role. Thus the small number of British geologists militarily deployed up to 1943 was increased from three to about a dozen during 1943/4, largely to prepare for the landings in Normandy of 6 June 1944. Burre, Trusheim and Hahne were supported by assistants, so a similar number of military geologists was assigned by the German army when it too was preparing for a cross-Channel invasion, in the late summer of 1940.
- **Roles**. For invasion purposes, both sides used military geologists to generate specialist maps to identify potential landing beaches, water supply for invading troops concentrated for further attack, location of quarries to provide sources of road metal to maintain supply routes as well as finer aggregates for concrete and cement for construction works, and selection of routes for off-road vehicular movement.

That the Germans were able effect geological preparations in two months rather the twelve available to the British is partly a reflection of the size and early development of the German military geological service as such. However, it also reflects the high quality both of Ordnance Survey maps and of geological maps and memoirs published in and for the U K for many generations previously.

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WE thank copyright owners as acknowledged in captions for permission to reproduce figures;

staff at the *Bundesarchiv-Militärarchiv* in Freiburg-im-Breisgau and at the *Amt für Wehrgeophysik*, Traben-Trarbach, Germany, and especially the U S National Archives and Records Administration at College Park, Maryland, for access to the archive documents which stimulated this research; and Graham McKenna (Chief Librarian and Archivist) for access to wartime documents in the archives of the British Geological Survey.

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Memoirs

WARRANT OFFICER CLASS 1 P SLEEP MBE MSM

Born 11 August 1925, died 15 April 2002, aged 76



WO1 Phil Sleep proudly wore the Royal Engineers' cap badge for over 44 years, for many years as Band Sergeant Major and the leader of the orchestra. His speciality solo "Gypsy Carnival" always guaranteed effusive applause and appreciation from his audiences. He was also an outstanding tubist.

Phil Sleep's father was headmaster of the local school and music formed an important part in the life of the Sleep family. Young Sleep started to play the violin at the age of seven, encouraged particularly by his mother, who was a very accomplished pianist. At the age of fourteen he won a silver medal in the London examinations of the Trinity College of Music.

In 1940 Sleep was auditioned as a violinist for the RE Band but, because of delays caused by the war, he was unable to enlist until July 1941. In 1941 the RE Band, which was about 60 strong under the Director of Music, Captain D W Jones, was based with the School of Military Engineering (SME) at Ripon. In those days the band was primarily an orchestra, with the military band role being secondary. Many of its members had served in the 1914-18 War and no lance corporal had fewer than five good-conduct stripes.

On enlistment, Sleep took up the cornet as his military band instrument and subsequently played in the Corps Dance Band. When he had completed boy service, he was sent to No 1 Training Battalion RE at Clitheroe, Lancs, where he completed his Sapper training course, including an extra course on demolitions. At that time the battalion had its own brass band, with Mr Holyoake of the Royal Scots Fusiliers as Bandmaster.

In 1943 the RE Band set off for the Middle East, complete with Tango Orchestra, a Palais Dance Band, and a 16-strong Swing Band, based on the Glenn Miller line up. They roamed about the Middle East in two coaches and four three tonners, as a part of ENSA, playing to Army and RAF units all over Egypt, Palestine, Syria, Lebanon and Jordan. During one of these visits young Sleep met up with his brother, an officer cadet who later became a lieutenant colonel in the Corps.

In early 1944 the band returned to Ripon and remained there until it moved to Chatham, with the SME, in 1946. During this year Sleep went with the band on its first visit to BAOR, a visit repeated innumerable times thereafter. He also took part in all the Band's major tours, including a second tour of the Middle East, Cyprus and Malta in 1952, and the bicentenary celebrations of Gibraltar. He played at a number of great state occasions, including the Second World War Victory Parade, the funeral of King George VI, and the Coronation of Queen Elizabeth. In addition, he played at numerous garden parties, investitures and presentations at Buckingham Palace, and many times at major sporting events at Wembley and Twickenham.

At the end of the war, Phil Sleep had intended to become a bandmaster. However, most of the old and bold retired immediately after the war, and he was prevailed upon to stay with the RE Band, for a couple of years, to help maintain standards through a difficult period. The "couple of years" stretched to 35 and, although some other band undoubtedly missed out on getting an outstanding bandmaster, the Corps benefited greatly by his loyalty in staying.

Promotion had for years been terribly slow in the RE Band, but this soon changed. Mr Sleep rose from lance corporal in 1948 to warrant officer class l in November 1955. He was awarded the Long Service and Good Conduct Medal in 1959, with bar in 1977; the MSM in 1969; and the MBE in 1974. In the many band performances in which he had taken part, there were a number of lighter moments and his "disappearing" act whilst playing on Eastbourne bandstand in the summer of 1978 was one of them. Mr Sleep's chair collapsed, and he vanished from sight behind the rear staging, his tuba on top of him. The band saw the amusing side of the incident and laughed so much that they had to stop playing. Fortunately he was unhurt, and came up smiling, making a bow to a delighted audience.

Following 38 years of continuous service with the RE Band, Phil left in early 1980, but not to retire from the Army. He moved to Germany to join 28 Amphibious Engineer Regiment in Hameln, where he was tasked by the Engineer in Chief to form a volunteer band to provide military music for those serving in BAOR. This presented a very real challenge, and it is to his credit that the band, comprising 14 members, became a thriving and flourishing concern, which undertook about 100 engagements a year.

Phil finally retired from the Corps in January 1984, settling in Surrey, but eventually moving to Cartagena, Spain. He had been suffering from serious problems with his lungs for some time but, true to form, he fought with determination to overcome these setbacks. He died at home in Spain.

Phil Sleep gave great enjoyment through his music to hundreds of thousands of listeners. His devotion to duty, and his setting and maintenance of high standards, both musical and military, reflected great credit upon himself, the RE Band, the Corps of Royal Engineers and the Army. His humour, presence and outstanding talents won him many friends both Corps and Army wide.

His wife, Marilyn, and two sons survive him.

Contributed by past and present members of the RE Band and Corps of Army Music. COLONEL K BARKER TD Born 21 November 1938, died 25 May 2002, aged 63



KEN Barker was the last in a line of distinguished Royal Mail Post Office directors to command the Royal Engineers Postal and Courier Services TA Group. However, his tour was far from the norm as he headed the Group in both the Corps of Royal Engineers and the Royal Logistic Corps whilst also serving as the Director and General Manager Royal Mail South Wales and South West (SWSW). Responsible for one ninth of Royal Mail operations nationwide, he had the added difficulty of dealing with severe industrial relations issues in a couple of his areas.

The task of taking the Group, part of a large TA organisation, away from the comfort and support of Mill Hill and its empathy with the forces postal services as well as severing the link with the Royal Engineers and the confidence this engendered, to completely new pastures in Grantham was not one which Ken shied away from. At the same time, he had to downsize the Group, from four to three regiments and reduce manning from 75 officers and 750 soldiers to 55 and around 550, and also improve military skills! The change of Corps to the RLC and reducing its size were not exactly popular with anyone in the Group. The fact that the Group

became well established and respected at Grantham was due entirely to Ken's supportive leadership, his planning, inspiration, professionalism, determination, tact and diplomacy.

In his early days in the TA, Ken was definitely a "Folkestone Fusilier", spending most of his annual camps there. He was always the centre of any fun, good times and general good humour. He never missed a morning parade and developed a strong desire to make the TA a place where soldiers learned, became better people, improved their personal skills and had such a good time that they wanted to come back for more the next year. His command of 61 PC Squadron RE (V) and 5 PC Regiment RE (V) saw him make a sound start to these changes. His tour as commander consolidated such changes and spread the ethos throughout 1 PC Group.

Ken was a member of the small Royal Mail group that travelled to America and Japan to study how they had managed to automate the processing of huge volumes of mail. He was soon recognised in Royal Mail as an expert in the field of automating the processing of the post. The MOD was indeed fortunate to have had the advice and guidance from such an expert in postal technology and mechanisation. He gave freely of his time and expertise to plan the changes needed to bring the Mill Hill Depot and BFPO mail into the world of postal automation. Thanks to his standing at Royal Mail, most of the bar coding of the BFPO mail was done by the civilian mail centres as the letters entered the system, meaning quicker and cheaper processing.

A Lancastrian, born in Wigan, Ken joined Royal Mail after leaving grammar school, and his career progressed through postal operations grades before he became Manchester's youngest ever Assistant Head Postmaster in 1973 at the age of 34. After two stints as an Operations Controller, in Eastern Postal Region and later with North East Postal Board, split by a spell as Head Postmaster Sheffield, Ken returned to Manchester as the District Head Postmaster (one of the UK's big five offices). With the 1992 reorganisation of Royal Mail, he was promoted to Director and General Manager SWSW and moved to Gloucester. He returned to Manchester for his final appointment as Director and General Manager Royal Mail North Wales and North West, responsible for the postal service to some 3.4 million addresses between the Brecon Beacons and Carlisle, and delivering a daily post of some 9 million items – helped by his staff numbering just over 20,000.

Ken retired from the TA in November 1993 having thoroughly enjoyed the experience and definitely having given more than he had received, and finally retired from The Post Office in 1998.

He was a man who had two hugely successful careers both of which involved things of importance to him : people and the post. People sought out and valued his company. They benefited from it by enjoying themselves, having a good time, or learning and being better fitted for their jobs. Many developed their leadership skills and went on to much higher levels of responsibility. He was a huge character who easily filled a room – and often filled a bar! He was a terrific entertainer with his tales and his singing of anything from light opera to naughty ditties, but without any rude words. "Having a bit tonight" meant "roly poly", which was whatever you wanted it to be! He could entertain endlessly but never boringly. Yet he was a most supportive boss and leader. He would tenaciously pursue a correct and just cause with all his guile and energy. In the toughest days, Ken was a man to be working for as he never let his team down, nor would he accept a less than satisfactory solution. He was a distinguished leader and a person who held the highest standards in business ethics. He was also immensely loyal to The Post Office.

A keen follower of rugby, especially of his local club, Rochdale, Ken, in his day, had been a powerful rugby forward. He loved to sail, especially on holiday with Liz and their boys and also enjoyed playing golf.

He is survived by his wife, Liz, and their three sons.

DS

LIEUTENANT COLONEL S C S KING QVOMS&M AND RE Born 25 August 1924, died 15 July 2002, aged 77



LIEUTENANT Colonel Simon King was a sapper officer who served in the post Second World War end of Empire trouble spots of India, Malaya and Cyprus.

Simon Charles Stuart King was born on 25 August 1924, the second son of Lieutenant General Sir Charles King, KBE CB MICE, who was the first Engineer-in-Chief at the War Office from 1942 to 1944 and later a Colonel Commandant, Corps of Royal Engineers.

King was educated at Felsted School, where he won the school mathematics prize for two years running. From there he was directed by the Ministry of Labour under the then governing war-time regulations to join the state bursarship scheme in which students attended a crash university course followed by practical experience in industry. Under this scheme he gained a degree in engineering at King's College, Cambridge; then with a modicum of paternal string pulling he was able to forgo the experience in industry and join the army.

Following completion of his OCTU course, King was granted an emergency commission in the Royal Engineers in August 1945 and posted to India where he joined the Queen Victoria's Own Madras Sappers and Miners based in Bangalore. After two years in QVOMS&M field companies in India and Burma, he was certain that a career in the East was what he wanted. Returning to England he took his "demob" and then answered an advertisement for civilian garrison engineers in Malaya. He was accepted. The plan was that he would fulfil his contract and then seek his fortune elsewhere.

Based in Kuala Lumpur he was involved in the construction of new barracks for the British and Malayan garrisons and the Kinrara military hospital, but this comparatively peaceful existence was not to last for long as the fight against communist terrorists in the Malay Peninsula was then reaching its climax. The states to the west of the central mountain range were now clear and military effort was to be directed to the states of Pahang, Trengganu and Kelantan to the east. A Gurkha infantry brigade was moved up to Pahang, establishing its HQ at Temerloh and its infantry battalions spread around in the jungle in Pahang and southern Trengganu. The commanding brigadier demanded a sapper officer on his staff and got King, a civilian - eyebrows were raised!

The tasks were to establish a sapper depot of useful equipment including earth moving plant, inland water transport and road building material together with the men to operate them, to defuse mines and explosive charges laid by the terrorists and to construct light aircraft (Auster) landing strips in the jungle, one to each battalion. Auster strips were a vital feature in brigade operations and consequently were top of the priority list. Travel by air avoided the tedium and danger of using roads and tracks and enabled the commander and other officers to move around the brigade area to more effectively control operations. Under King's direction airstrips were quickly established at Temerloh for Brigade HQ, Mentakab for 1st/10th Gurkha Rifles, Kemayan for 1st Malay Regiment, Qua Musang in Trengganu in anticipation of future use and Jeramtut for 2nd/7th Gurkha Rifles. Owing to terrain difficulties the strip at Jeramtut was barely up to the minimum standards required and was not popular with the pilots.

The jungle track to Kemayan was the scene of what might have been a disaster. A reconnaissance party comprising King, a wireless officer, a pilot and an armed guard set off early one morning along a jungle track 30 miles long and just wide enough to take jeeps and ferret scout cars. There were five vehicles all manned by armed infantry. The party arrived safely and quickly confirmed that an airstrip was feasible.

After a pleasant jungle lunch (curry and gin and tonic) the party set out on their return journey. About halfway, where the track widened to about 20 yards, the convoy came under rapid fire; they were running the gauntlet of a classical bandit ambush. There were four fatalities, including King's driver, and two seriously wounded. Arriving back at Temerloh the wounded were loaded into two Austers and flown to the Kinrara military hospital, where happily they survived their ordeal.

The bandits were well supplied with explosives left over from the war, but their detonating devices were Heath-Robinson and often failed to go off. On one occasion a train carrying the Scots Guards out of the area was sabotaged, the locomotive being derailed, but clearly an inspection of the whole length of the train was essential because it was unlikely that the bandits would rely on only one explosive charge. Luckily a railway jeep was kept available for such an emergency and King arrived at the rear end of the train in twenty minutes. Two charges of plastic explosives were found; they were defused and removed.

At this time King was under considerable pressure from family and friends to rejoin the army. In 1950 he returned to England, gained his regular commission and rejoined the Royal Engineers in the rank of Captain. His first appointment was as an instructor at the School of Military Engineering in Chatham, Kent. There followed a period as Adjutant of 37 Corps Engineer Regiment in BAOR and then in Cyprus (37 Field Engineer Regiment), during the troubles with the EOKA terrorists. After a year at the army Staff College Camberley in 1958, he was posted to the War Office as a member of the CIGS's planning and exercise staff where his ability was recognized. He then returned to Germany to command a field squadron. His last appointment in the army was Chief Instructor at the Army Apprentices College Chepstow, in the rank of Lieutenant Colonel.

King was also a keen glider pilot and an instructor in the Corps gliding club, teaching a number of his brother officers to glide at Detling airfield in Kent, where much fun and a few hair-raising moments were enjoyed by all.

After leaving the army in 1968, King became a schoolmaster for many years, teaching mathematics, history, geography and carpentry at Morton Hall Preparatory School in Bury St. Edmunds, Suffolk. Later he undertook part-time teaching appointments for RAF servicemen at Honington and was also a visiting lecturer for some of the American universities running courses for USAF personnel at their East Anglian airbases of Bentwaters, Lakenheath and Alconbury.

King was a somewhat austere man with a dry wit, but always helpful and was well liked by his many friends and acquaintances. He was also an accomplished amateur artist. In 1962 he married Priscilla Coppinger, daughter of Lieutenant Commmander Brendan Coppinger RN, who had died in 1940. She was given away in marriage by her first cousin, the late Major David Jamieson VC. She pre-deceased her husband. King died on 15 July 2002 aged 77, and is survived by a son and a daughter.

Memoirs in Brief

LIEUTENANT COLONEL J W PIKE OBE

Born 13 July 1911, died 7 June 2002, aged 90

JIM Pike joined the Royal Engineers as a Boy Soldier in 1926 aged 14, following in his father's footsteps. He became a Boy Sergeant Major at the Apprentice School at Beachley and the gates he made for the church when qualifying as a blacksmith still stand there.

In 1935 Jim was posted to a searchlight unit at Dover where he met and married his wife, Dot. At the outbreak of World War Two, searchlights were transferred to the Royal Artillery but he elected to remain with the Royal Engineers and, joining 291 Company RE, embarked with them for France in March 1940. Following the German attack in May, the Company was involved in demolition tasks and Jim, later Mentioned in Despatches for his actions at this time, found his way back to England via Cherbourg.

Having risen to the rank of RSM by 1942, Jim was then commissioned into the Royal Engineers and posted to the Middle East, serving in Persia and

Iraq. After the war, and having gained a regular commission in 1951, he served for many years in 36 Engineer Regiment in Ripon and BAOR. His final posting in 1962 was as Quartermaster in 17 Port Regiment RE at Marchwood. Promoted to Lieutenant Colonel in 1963, he remained with the regiment on its transfer to the RCT in 1965 and on his retirement from the Army in 1966, he took up an appointment as an RO with the headquarters at Marchwood where his integrity, long experience and sound advice were invaluable.

He was given the honour of taking the salute at the Queen's Birthday Parade in 1966 and was appointed OBE in the same year.

Jim was a life-long supporter of the Royal Engineers Association and the Beachley Old Boys Association and both were represented, with standards, at his funeral.

He is survived by his wife, Dot, and his daughter.

RM

COLONEL S H CLARK OBE JP DL

Born 16 June 1922, died 22 June 2002, aged 80

STEPHEN Clark joined the Corps at the beginning of the Second World War and was commissioned in 1941. Posted to the Bombay Sappers and Miners in 26 Indian Division, he spent the war years serving in the Arakan, Burma, Malaya, Thailand and Sumatra.

In 1947 he was appointed an instructor at the School of Combined Operations and held various staff appointments before graduating from the Staff College, Camberley. He went on to command squadrons in Germany, Malaya and Christmas Island before taking command of a TA engineer regiment in Northern Ireland in 1964. He always maintained that the latter, which involved the conversion of a Gunner TA regiment into Sappers, was his hardest task.

Following a three-year tour as Chief Logistics Officer to the United Nations Force in Cyprus, Clark was promoted to Colonel in 1970 and joined HQ Midlands District as Colonel AQ. On retirement from the Army in 1972, he was appointed Secretary to the East Midlands TAVR Association in Nottingham, finally retiring in 1987. He was a magistrate from 1976 to 1992, appointed a Deputy Lieutenant for Nottinghamshire in 1981 and also served as the Honorary Colonel for the East Midlands UOTC.

He is survived by his wife, Sheila, and two children.

WJH

Correspondence

'C' VEHICLE FLEET MANAGEMENT STUDY COMPLETED

From: Lieutenant Colonel IS Cobley

Sir, – The C Vehicle Fleet Management Study, part of the Assessment Phase for the 'C' Vehicle Capability Project, a potential Private Finance Initiative (PFI) was completed earlier this year. This was a joint venture between the DPA and the DLO as a risk reduction measure and was started in Mar 01.

The 'C' Vehicle Capability (PFI) Project has proposed a number of innovative proposals. These include the provision of the fleet and maintenance support by a commercial service provider, where units would operate routinely on reduced holdings and bid on the provider for further equipment when it was actually required. The study was designed to test the feasibility and gain confidence in some of the detail of this innovation.

The concept was based on setting up a practical study that involved three RE units: 36 Engr Regt (Maidstone, Kent), 39 Engr Regt (Waterbeach, Cambs) and 71 Engr Regt (V) (RAF Leuchars, Fife). Each units' holding of 'C' Vehicles were transferred as Government Furnished Equipment (GFE) to HE Group Ltd, a commercial plant hire/plant service provider that had been selected by competitive tender. An agreed minimum quantity of equipment [the Optimum Unit Holding (OUH)] was then provided back to the unit by HE Group in order to satisfy domestic use and individual training in barracks. While the unit retained primary responsibility for the maintenance of their OUH, HE Group cared for the remainder of the assets, provided support to the OUH when asked and supplied additional capability on demand, whether it was military equipment from the GFE fleet or items of commercial hire. HE Group specified all scheduled maintenance activity and organized levels two and three unscheduled maintenance. The whole process was managed in real time using an IT based Management Information System (MIS).

The study was a complete success gathering vital evidence and lessons learned that will be used by the team assessing the proposed PFI deal. The study also permitted a few units to experience what the future may hold and give them confidence to embrace the change process.

Progress on the main PFI project is on time. The assessment of the competitive bids from the two bidders was completed in July and the way ahead will be announced in Oct 02. If PFI is the selected route, then contract award is expected in the second quarter of 2003. Thereafter full service provision will take a year to implement.

More detail about the PFI project and a list of FAQs can be found in recent copies of the *Sapper Telegraph*. Yours sincerely – Ian Cobley

WARTIME COMMUNICATIONS

From: Captain (retd) J A Muirhead

Sir, – Referring to my friend Geoff Webb's letter in the August *Journal*, in my limited experience as a sapper platoon commander with the 23rd Indian Division, communication was by field telephone.

Miles and miles of telephone wires were left behind around the countryside. On one occasion I used many strands of this wire bound together to form a rope which we stretched across a fast flowing stream to improve the safety of the troops we were supporting, who had to wade across it. Yours sincerely, Alan Muirhead.

WATER DIVINING (DOWSING)

From: John Baker, Chairman, London and Thameside Dowsers

Sir, – A member of our group is ex-Army and he told us of his use of dowsing to get out of serious difficulty on exercise in Norway.

The thought crossed my mind "why doesn't the Army make more use of this natural ability that many of you have?"

The RE *Journals* in the Library at Chatham contain several articles on the subject, but I notice that the last one appeared in 1957. Presumably the march of technology has made dowsing redundant. But, just a minute, the finest computer and electronics system known to man is between our ears, so why not use it.

Divining is not just linked to finding water, but if you can find water, why not other things, pipes, cables, voids etc. Someone walking around a field with a forked stick or metal dowsing rods does not look like they are tapping into the cutting edge of technology, yet in truth, these people are streets ahead of modern machinery and electronics.

To learn to dowse is probably the start of the most fascinating and exciting journey anyone can have, and no Army should be without these gifted individuals.

Finally, if any of you have served in Möenchen Gladbach, you will be interested to know that the water source used there was found by a diviner – namely Col H Grattan. Yours sincerely – John Baker

WATER DIVINING

From: Brigadier (retd) A C S Ross

Sir, – I was interested to read John Baker's letter in the October Supplement about Water Divining. When I was an exchange instructor at the French SME in the 1960s, dowsing was treated as a minor but serious subject on their YO courses. All regular young officers were tested for natural ability in dowsing and their proficiency recorded. I was pretty mediocre, but for those with the gift or the confidence, it was a useful attribute for service in French North Africa or with the Legion. I think the subject was called *Radiesthésie* (although I doubt it was spelt like that!)(*Yes it was! – Ed*).

In Andalucia, where many detached properties in the hills have their private wells, dowsing is widely used. Our present hillside property has a fall of some forty metres and I expected my diviner to say that the best hopes were in the valley rather than the hilltops. We covered the whole area and on the climb back to the top, he suddenly stopped, his pair of bent welding rods twitching and he said "Estupendo! Very strong. Much water, strong current!". He was partly right. We noticed we were under the overhead power lines – strong current indeed!

Eventually we concluded that the best chance was close to our highest point – but a long way below the thousand metre Sierras nearby. My borehole is about seventy metres deep and produces about a litre per second from water normally thirty or forty metres down. We drink it untreated.

My posting on leaving France was to command 23 Amph Engr Sqn where, instead of looking for water, my concern was to keep the rest of the Army out of it. But I agree with John Baker that water divining is no "black art" and that the Corps should test and record the dowsing abilities of YOs and perhaps MPFs and Recce Sergeants. Yours sincerely – Alan Ross.

DIVINING

From: Brigadier (retd) JA Thorp CBE

Sir, – John Baker's letter in the October *Supplement* on the military potential of divining reminds me that on 39 YO course, we were all tested for divining potential; some bright spark in M&E Wing thought that it might be a way of detecting mines. Those with the gift were then enlisted in a trial and spent some happy hours wandering round various fields divining for mines. If I remember aright, the trial concluded that divining rods did indeed twitch in the vicinity of a mine, but only when the holder was actually standing on one! Yours sincerely – Austin Thorp.

LAD'S ARMY

From: Major (retd) KJ Grant

Sir, - Have you watched any of the Lads Army programmes on television? Generally the scenes depicted do not match my experience of the six weeks I was at PTC. It infuriated me and those of my contemporaries to whom I have spoken on the subject. I wonder how much it was exaggerated and dramatized to boost ratings. If any of my NCOs had behaved like those on TV I would have drummed them out! No 1 TBRE at Clitheroe was tough but fair and without the senseless bullying shown in the programme. Only on one occasion did I witness an unfortunate sapper doing drill at the double with FSMO. As a matter of interest, the SDI at No 1 in my day was posted into R Mon RE at the time I was a squadron commander.We had a very interesting re-union! Yours sincerely - Ken Grant.

LAD'S ARMY

From: Major (retd) A G Marsden

Sir, – Since I did not watch the Lad's Army TV series, I did not propose to comment on Major Grant's letter in the August Supplement. However, as nobody else has done so, let me rush in. I missed the first episode, but when I heard about the grass cutting with scissors, I decided that if it was that sort of series, I would not bother. It was all very likely exaggerated. During the twenty plus years that conscription was in force, from the first Militiamen of 1939 to the last of the National Servicemen in the early sixties, millions of men must have passed through the system. The Corps alone had up to eight Training Battalions/Regiments. Among the NCOs there must have been a certain number of bullies, small minded men who had to show who was boss, and the just plain stupid.

There were no human rights do-gooders, but plenty of mums to write to the tabloids saying, "Look what they are doing to my poor boy". TV researchers trawling through the papers would no doubt find enough such incidents to provide one for each episode.

Major Grant may rest assured that they were not typical. The Oct/Nov issue of the RBL magazine *Legion* describes the series as "controversial" but all the same is hoping that it will boost membership and show that a lot of people are missing out on disability pensions. Yours sincerely, A G Marsden.

CORRESPONDENCE – JOURNAL OR SUPPLEMENT?

From: Lieutenant (retd) G P Webb

Sir, – Thank you for your note on the policy change on correspondence, however I believe the *Supplement* does not have the status and prestige of the *Journal*, which therefore, letters do or do not, acquire.

I note that in Jennifer Brennan's "Curries and Bugles", she uses the term "old Ko Hais" – perhaps an ultimate spelling of the traditional expression.

One was happy to see James Morris in "Pax Britannica" wrote "the Himalaya" in place of the uninitiate's "Himalayas" – a mistake comparable to the faux pas of writing RE's for RE! Ghastly!

It is especially important for the Royal Engineers to celebrate the year of the mountain. Since their establishment, Royal Engineers have been climbing mountains.

The silent mountain demands respect. It welcomes men to its slopes.

It invites them to attempt a climb to the summit. From the summit, the whole world is laid out before them.

There is no need to speak – just to gaze and view the wonder!

For any man who is dis-spirited, the advice is "climb a mountain!".

In 1942, I trekked in Kashmir to the Kolahoi Glacier. En-route I stopped overnight at Atak Bungalows. I was woken up by intense itching, to find myself being bitten by bed bugs living in the joints of the charpoy. I spent the rest of the night on the floor.

In the morning I took the charpoy outside into the sunlight and bounced it up and down, causing dozens of bed bugs to fall on the ground.

Reminds me of the Sherpa hill-men who wore clothes that they never removed during a life time! It was very necessary to keep upwind of them when using them as porters if you wished to retain your appetite! Yours sincerely, Geoff Webb.

Reviews

THE IMPERIAL WAR MUSEUM BOOK OF MODERN WARFARE BRITISH AND COMMONWEALTH FORCES AT WAR 1945-2000

EDITED BY MAJOR GENERAL JULIAN THOMPSON

Published by Sidgwick & Jackson in association with The Imperial War Museum Pan Macmillan, 20 New Wharf Road, London N1 9RR. Price £30.00 ISBN: 0 283 06364 5

THIS book claims to be the first to cover the whole of the 1945-2000 period in British and Commonwealth Military History. As is well known, British forces have been in action somewhere around the world in every year of this half century. Modern Warfare devotes a chapter to each of the fifteen significant campaigns which have taken place. Each is written by a different author, mostly senior officers who participated in the campaign, but in a few cases by journalists or acknowledged experts. Oddly, with the sole exception of that on the Korean War, each chapter is of the same length, despite the widely varying duration and intensity of the campaigns; thus the chapter on the SAS action in the Jebel Akhdar apparently merits the same acreage as that on the Falklands conflict.

The book starts with a lengthy introduction by Major General Thompson, who pulls no punches in his views on the probable ineffectiveness of the Euro Rapid Reaction Corps, the politicisation of the Chiefs of Staff, and the debilitating effect on our forces of the worst excesses of political correctness.

The most interesting chapters are those dealing with some of the less well-known campaigns, such as the highly unwelcome 1945 operation in the Netherlands East Indies, the Canal Zone and Suez débâcle, and General Sir John Akehurst's chapter on Dhofar. Having served as a very junior officer in Borneo during Confrontation, your reviewer was disappointed by the particularly egocentric chapter on this campaign by General Sir Walter Walker, which did little to improve his understanding of the wider operation. There are clear and succinct summaries of the Korean, Northern Ireland and Falklands conflicts respectively by General Sir Anthony Farrar-Hockley, Colonel Michael Dewar and Major General Thompson. As befits a book by the Imperial War Museum accuracy is good, marred only by a transposition of the roles of Saracen and Saladin AFVs, and a reference to the East Anglian Regiment. There are clear maps and a good selection of photographs, some from the authors' personal collections. Sappers get few specific mentions in the book, although the incident in which Captain Brian Coombe won his MC in Cyprus is covered in some detail.

CPRB

BIOGRAPHICAL DICTIONARY OF CIVIL ENGINEERS VOLUME 1 – 1500 TO 1830

EDITED BY PROFESSOR SIR ALEC SKEMPTON

Published by Thomas Telford Publishing on behalf of The Institution of Civil Engineers, Thomas Telford Ltd, 1 Heron Quay, London E14 4JD. URL: http://www.thomastelford.com Price £95. ISBN 0 7277 2939 X

THIS is a detailed and well-presented biographical reference volume on the life and works of Britain's distinguished civil engineers whose careers began before 1830. Until the mid-seventeenth century, the term 'engineer' applied to military engineering and it was not until 1763 that the term 'civil engineer' became widely used to distinguish between the two professions.

It should come as no surprise that of the 430 or so engineers mentioned in this biographical dictionary, about 60 were military engineers, many of whom are best known for their civil engineering works but others such as General Napier, General Pasley and Lieutenant Colonel By, are equally well known as military engineers.

One of the more intriguing soldiers listed, though not a Royal Engineer, is Field Marshal George Wade (1673-1748). He was born in Ireland and joined the Earl of Bath's Regiment (10th Foot) as an ensign. He seems to have followed in later life, parallel careers in both politics and the army, the latter with singular success. He was also a great promoter and facilitator of the construction of military roads, bridges and barracks, predominantly in Scotland.

Quite apart from the biographies themselves,
the short introduction covering the practice of civil engineering from 1500 to 1830 together with the appendices, give some interesting snippets of information.

A copy of this volume of the *Biographical Dictionary of Civil Engineers* has been kindly presented to the Corps by the Institution of Civil Engineers and will be held in the reference section of the Corps Library at Chatham.

MRC

THE MYTH OF THE GREAT WAR John Mosier

Published by Profile Books Price £9.99 (soft back) ISBN 18697395 0

JOHN Mosier is a Professor of English at Loyola University, New Orleans. He has researched World War 1 since 1976 and the "Myth" in the title is that the Anglo-French alliance won the war. The corollary, of course, is that the Americans won it. His multinational sources are impeccable. But, being an apple-pie American, there is obvious chauvinism in Mosier's statement. So does what he has to say hold water and is his book, which has a controversial label, worth a read?

The US came late to the Great War, President Wilson declaring war on 6 April 1917, and the mobilization of an expeditionary army from a six division 127,000 man regular army took a considerable time. The British were desperate to get American manpower into their own national formations, which were seriously depleted from the 1917 offensives, rather than let the US deploy a national capability, and for this ulterior motive, the British agreed to provide much of the shipping to get the Doughboys to Europe. However, Pershing, the Commanding General of the American Expeditionary Force (AEF), who had Wilson's total support, was determined that the AEF would fight as a national army. Perhaps surprisingly, this was supported by France. Advance parties of 1st US Division did not start to arrive in France until June 1917 and the Division's infantry occupied front line trenches on 21 October 1917. F Company of 16th Infantry Regiment sustained 3 KIAs, the first of some 122,500 US fatalities, on 2 November 1917. Eventually, the US sector between Soissions and Verdun contained two US armies with some 29 Divisions seeing combat.

So what of this myth? That the majority of the Anglo-French formation commanders were incompetent has been well debated - profligate with lives, largely ignorant of the theory of war and generally devoid of any battlefield initiative. However, Mosier takes this a stage further in his brief analysis of every major action in which the Allies engaged the highly professional German Army, reasoning that the Allies were out-fought, outmanoeuvred and out-weaponed in every encounter. The Germans are stated to have had a far better grasp of the all-arms battle, their tactics and junior leadership were far more flexible and effective and they pioneered and then embraced a variety of weapons within the infantry, rather than the traditional rifle, bayonet and machine gun on which the Allies relied. In addition, and this is probably key in the scheme of Great War tactics, they always inflicted greater casualties on the Allies, whether in attack or defence, mainly by the use of well controlled and coordinated close support artillery.

Is Mosier correct? There is no doubt that by mid-1918, the Allied armies were creaking. The British had lost thousands at 3rd Ypres, Cambrai turned into a disaster and the Kaiserschlacht offensive in March 1918 broke the British 5th Army with Paris almost lost. Indeed in 1917 the British and Empire had 226,000 killed, double the German losses. The French were mutinous after the failed Nivelle offensive in Champagne and were being nannied by Petain. The deployment of two US armies, totalling some 1.7 million men in divisions which were double in size to those of the depleted Anglo-French armies and taking over 157 kilometres of front from the French, allowed the French armies to concentrate their diminished combat power. Haig did not have that luxury, he had to fight the campaigns of 1918 within the manpower constraints that the British cabinet allowed as well as on his unchanged 148 kilometre front. That said, the Allies now had some 6 million men against the German's 3.5 million, the entire Western Front was shrinking in length as the Allies started to roll eastwards and the number of field armies had increased by 20 per cent, possibly 40 per cent in numerical terms given the size of US formations. With a reasonable level of military competence, the endstate was probably a forgone conclusion once the US had finally deployed its full military capability from mid 1918.

Did the AEF "win" the Great War? Certainly they were probably the straw that broke the

Germans' back. If their considerable combat power had not been deployed, the Anglo-French would probably not have been in a position to counter-attack in 1918 and the last 100 days might have been a different story. The decisive victory and Armistice would not have happened and the combatants would have been forced to stagger on to final exhaustion. Thank you Uncle Sam! However, Wilson's 14 Points, the terms of the Treaty of Versailles and its cause and effect on the Germans and the origin of 2nd World War are another matter.

Read it? Mosier's analysis of German superiority is good but his snapshot of the major actions has to be superficial in a 350 page book and there is little detail about US operations in the Great War to justify the "Myth". However, the points that he makes are valid and have to be taken in context.

MDC

ALAMEIN

BY JON LATIMER

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"Not another book about that battle?" asks the author, before answering the question himself, with the justification that it was uniquely decisive in its result, and established the reputation of the Army Commander, Bernard Montgomery. He considers that Monty's meticulous preparations, sound administrative stance and tactical brilliance at Alamein certainly justified this high reputation, but also points out those petty faults of character which detracted from his fame, leaving the conclusion that the hero was a great general, but not perhaps superlative.

The author emphasizes how many other individuals, and factors outside the Army Commander's control, provided great advantages for Monty at Alamein. Primarily, Churchill did not interfere, as he had done with Wavell and Auchinleck. By Monty's day, the armour in the Eighth Army included a high proportion of reliable American tanks, and when the battle opened in October 1942 the Allied manpower was almost double that of the Axis. The author also robustly defends the Italian soldier's honour, which the Anglo-Saxons have tended to discredit; he upholds it, saying that it was the officers who let them down. The book makes clear what wonderful strategic support was provided by the Royal and Merchant Navies for the whole three years of the Desert Campaigns, and reminds us that the great increase in the Allied air forces did not take place until the Alamein phase. It rightly draws attention to the high quality of the Commonwealth troops, to their bravery and all ranks' individuality, but admits to the feeling amongst them that their senior officers were superior to some of the British. It was at Alamein that Colonel Clifton, the impressive CRE of the NZ Division, made the first of his celebrated escapes from German captivity, and later went on to command a brigade.

The lavish use of contemporary quotations is a graphic way of expressing the atmosphere of the battle, including the horrors, of which there was no shortage. We are reminded of other features, too, less dangerous but never forgotten, like the all-pervading smell of "un-expired portions of the day's rations" being gorged by swarms of the noisy flies, which harassed us all and caused Army HQ to enjoin all ranks to kill 50 each a day. For old "Desert Warriors" the place names recall the excitement of that terrain, where even the slightest feature had a name, either in Anglicised Arabic or in soldiers' English.

This book may leave Sappers with a feeling that the contribution to the Alamein victory by members of the Corps is not fully appreciated by the author, although he has mentioned minefields in many places and includes quotations from Sappers on the eve of the battle. He has misinterpreted the failure of 23rd Armoured Brigade at Ruweisat on 21st July (page 70), when Major Peter Moore's 3rd Field Squadron had made safe gaps in the minefield for the tanks to support the New Zealand infantry. Being inexperienced, the Armour's navigation was faulty, and they arrived late, taking no notice of the extensive signs marking the minefield and the gaps in it. As they drove straight at the mines, each losing a track, or worse, a lone German anti-tank gun (overlooked in the dark by the NZ Infantry) slaughtered our tanks, one by one, and Peter bravely ran under fire to the Brigadier's tank to "explain" about minefields to him.

There are some irritating inaccuracies, such as the usual precedence given in the Allied Order of Battle; the use of the word "petrol" when such a significant amount of the automotive fuel used by the Axis Forces was the much safer "diesel"; the majority of the terrain over which the battle was fought was not of "sand", but of clay and rock; and why use foreign spelling for the widely used "jebel"? Included also is the assertion (page 21) that the Arabic "bir" means borehole, whereas it is a cistern carved into the rock to gather rainfall, and its position is marked on all the maps and used for navigation. Similarly, it is a matter of fact that "Eisa" (page 65) is the Arabic for Jesus. I am also surprised by the disparaging comment on the Italian motor transport (page 15), when we were delighted to capture their 10-ton diesel lorries, because they were both reliable and "desert-worthy".

One has to take much of the author's history on trust but the inaccuracies and mis-judgements tend to lessen one's confidence in it. Not perfect, but worth reading.

JC

THE BOER WAR Denis Judd and Keith Surridge

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MILITARY readers usually prefer the origins of this war simply unveiled, full chronological development of the campaign and battle narratives, and a short and clear summary of the key judgements and historical themes. There are enough earlier books such as "Goodbye Dolly Gray", and Thomas Pakenham's "The Boer War", that successfully provide this treatment. This book is more adventurous.

Jan Christiaan Smuts described the Boer War as: ".....other than most wars. It was a vast tragedy in the life of a people, whose human interest far surpassed its military value: an epic struggle between the smallest and greatest of peoples. Wars pass, but the human soul endures; the interest not so much in the war as in the human experience behind it."

Professor Denis Judd and Dr Keith Surridge are esteemed published historians, and this focused and intriguing account penetrates deeper and probes more contentious issues than many others attempt. They combine their writings well, but not always seamlessly in style or structure, and the flow is occasionally uneven with some chapters being noticeably less excellent than others. Descriptions of battles are honed down to austere minimalism, and the results can be somewhat obscure. For example, that of Magersfontein inadvertently creates an impression that only the Highland Brigade attacked, making no reference to the 9th and Guards' Brigades. Sharp eyes will spot errors. Thus we have "General" Thorneycroft at Spioen Kop, and the Marquess of Winchester (killed commanding 2 Coy 2nd Bn Coldstream Guards, in 1st Guards Brigade at Magersfontein) being referred to as "Britain's premier Marquess". He was England's, Scotland has its own premier Marquess (or Marquis, to some traditionalists). There are other minor lapses, and at times the impression is created that these details are somehow not important enough to be got right. Even a few extra sentences would greatly improve descriptions of the early set piece battles. Also, the fairly convoluted fighting in the Ladysmith area, in crossing the Thukela, to seize Bloemfontein and Pretoria would benefit from a few more maps and diagrams. Towards its end, though continuing to hold the reader's interest, the book structure sadly wobbles and fragments a bit, and there are depressing similarities in style with some of the output of the Humboldt University in the 1980s!

These quibbles set aside, this is an interesting and stimulating book. The suppression of superfluous detail enables fuller analysis of some of the key developments and events. The Boer War was a war in two grand stages. A year of fighting and counter manoeuvre between organized field forces led up to the Boer armies effectively being defeated and dispersed, and the formal annexure of the Transvaal. Then, almost a year and a half of increasingly bitter and divisive guerrilla war followed. Most ordinary histories tend to falter after the relatively easily covered first 18 months. This book, however, re-animates itself with zest, and moves vigorously on to what are generally its best chapters. Those dealing with the role of Kitchener in command, and in the negotiations leading up to the 31 May 1902 Peace of Vereeniging, are simply fascinating, handling the story better than many Kitchener biographers. The book is also illustrated with subtly chosen unusual photographs, and draws skilfully on well-targeted contemporary sources, providing an evocative backdrop to the narrative. This enjoyable book would strongly reinforce any collection of the more general histories of the war still in print - making many features of them much easier to evaluate.

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Explanation of Abbreviations Used in This Journal

IMATT . . . International Military Advisory Training Team ISAF International Security Assistance Force LAFB Light Assault Floating Bridge LASS Lead Air Support Squadron LELate Entry LOCON Lower Control MEC³S . .Military Engineer Command Control and **Communications Specialist** MELFMiddle East Land Forces MEXEMilitary Experimental Engineering Establishment MFCMortar Fire Controller MILOMilitary Intelligence Liaison Officer MND(SW) . .Multi-National Division (South West) NRPSNon Regular Permanent Staff NTMNotice to Move ORBATOrder of Battle OTX Operational Training Exercise PJHQPermanent Joint Headquarters PSI Permanent Staff Instructor PTZPan, Tilt, Zoom (CCTV Cameras) QDG1st The Queen's Dragoon Guards REPSRE Postal Section RESPBRE Supplementary Pocket Book RETDURE Training Development Unit RFARoyal Fleet Auxiliary RLCRoyal Logistic Corps RMAS Royal Military Academy Sandhurst RPFRwandan People's Force RPGRocket Propelled Grenade RRT Regimental Recruiting Team RSORegimental Signals Officer SATSmall Arms Trainer SLASierra Leone Army STRESpecialist Team RE STTT Short Term Training Team TACOMTactical Command TESTactical Engagement System Th Tps Theatre Troops TRC Theatre Reception Centre UNFICYP United Nations Forces In Cyprus UPDFUgandan People's Defence Force VSLMS Vehicle Launched Scatterable Mine System VSSVehicle Specific Simulators WRTAWyke Regis Training Area

AARAfter Action Review APCArmoured Personnel Carrier APDCArmy Postal Distribution Centre APS Army Postal Services AQ/T Al Qaida/Taliban ATRA Army Training and Recruitment Agency ATRArmy Training Regiment ATS Auxiliary Territorial Service AVLBArmoured Vehicle Launched Bridge AVREArmoured Vehicle Royal Engineers BASE APOBase Army Post Office BDABritish Defence Adviser BEF British Expeditionary Force BGBattle Group BNAFBritish North Africa Force BRITFORBritish Forces CATT Combined Arms Tactical Trainer CBI Confederation of British Industry CCTVClosed Circuit Television CGFComputer Generated Forces CGICorrugated Iron CGS Chief of the General Staff CIS Command and Information Systems CPXCommand Post Exercise CRARV . . Challenger Armoured Recovery Vehicle CTW Communications Training Wing CVCommand Vehicle CVR(T) .Combat Vehicle Reconnaisance (Tracked) DRC Democratic Republic of Congo DROPS Demountable Rack Offloading and Pickup System DTL Deep Trench Latrine EOD Explosive Ordnance Disposal ETS Engineer Training Standards EXCONExercise Control FARELFFar East Land Forces FIBUAFighting in Built Up Areas FoREM Friends of the RE Museum FOOForward Observation Officer FRVForward Rendezvous GEGarrison Engineer GEGermany GPMG (SF) General Purpose Machine Gun (Sustained Fire) GoSL Government of Sierra Leone GPOGeneral Post Office HICONHigher Control HQNIHeadquarters Northern Ireland HPC Home Postal Centre HPDHome Postal Depot

Please note: the above abbreviations are those which appear within articles published in this edition of the

Journal only, and are printed for the benefit of our many foreign and non-military readers.

Appointment abbreviations (which appear on the first page) can generally be found in the back of The Royal Engineers List.