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An Update on Institution Matters

THIS edition of the *Journal* marks the end of its second year in the new format and apart from one or two comments about A4 size being incompatible with domestic bookcases, the change seems to have found favour with all sections of the readership. I am delighted to that we continue to receive high quality articles on a range of subjects from both the serving and retired Corps. Correspondence has taken off this year, although we know that trying to promote a debate when there are four months between issues is difficult.

With regard to content, it should be remembered that amongst other things, the *Journal* is an intrinsic part of Corps History. The official volumes are only published every twenty years or so and in any case can never go into the detail that personal accounts can offer. Volume 12 of Corps History is currently in production and should be in print at the end of 2006. To complement this in the middle of next year we will be publishing a revised Short History of the Corps covering most subjects up to the present day. Whilst on the subject of history, our Heritage Book, *Follow The Sapper*, was published in October and has turned out to be the triumph it well deserves to be, following four years of dedicated work by Colonel Gerald Napier and the Institution team. You will find a review of it by General Sir George Cooper in this issue, and if you have not yet ordered your copy, hopefully his words will move you to action – Christmas is coming and it will make a fine gift, personal or corporate.

The digitization project is still ongoing and shortly all volumes of Corps History to date, and *Journals* from 1904 will be available on DVD/CD. More information will be published in the *Supplement* and *Sapper* as these items become available.

On the professional Development front, we are continuing along the direction set by Council with the aim of becoming a Licensed Institution and awarding body. This should be in place by the end of next year.

This has been a very busy year for all members of the Institution Staff and I am delighted in what we have been able to achieve to take the Institution forward.

Have a safe and peaceful 2006.

David Hamilton

Guidelines for Authors

The Editor is always pleased to consider articles for publication in the *Journal*.

Subject. Articles should have some military engineering connection but this can be fairly tenuous, especially if an article is well written and interesting.

Length. Articles of any length are considered but should normally be between 1500 to 5000 words. About 1200 words covers one page less photographs.

Copy. One copy of the text should be submitted, together with a head and shoulders photograph of the author plus a short pen picture and any other illustrations.

Clearance. Articles must be cleared by an author's CO where applicable.

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Copyright and Release Branch, Defence Geographic Centre, MacLeod Building, Elmwood Avenue, Feltham, Middlesex. TW13 7AH. Tel: 020 8818 3104.

Photographs should, if possible, be of good quality with sharp definition, and have appropriate captions. Files from digital cameras can be used providing they are taken with a camera capable of producing high quality images. The files should not be altered in any way prior to submission and they MUST NOT be embedded in the document. Digital images can be sent via email to assist.sec@inst-royal-engrs.co.uk or on a CD.

Rewards can be generous. The publications committee has about £350 in prize money for each issue plus valuable annual prizes. All authors receive £20 to help cover costs.

Pseudonyms will not be revealed by the Editor under any circumstances.

Contributions should reach the Editor by:

10 February for the April 2006 issue.
9 June for the August 2006 issue.

Submissions before the deadline are particularly welcome.

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Introduction

ROYAL Engineer effort remains dominated by ongoing operations, for which we continue to deliver outstanding support recognized by commanders at all levels. Operation *Telic* remains our main commitment but we also have soldiers on operations in Afghanistan, the Balkans, Sierra Leone, Cyprus, Northern Ireland and on the UK mainland.

Behind this operational success lies significant change in organization, training and equipment. Future Army Structures (FAS) will result in some significant structural changes for the Corps, reflecting the need for a more expeditionary Army. Both regular and reserve elements of the Corps will increase in size at a time when many other parts of the Army are reducing.

We have fought off a significant threat to our training regime, but this has resulted in changes to RSME basic trade courses. I remain concerned about undermanning regiments. That said, recruiting has improved, helping to set the conditions for manning increases over the next five years. A Continuous Personal Development Strategy is being introduced into the Corps to bring greater recognition for the work and abilities of our officers and soldiers; coupled with training changes it should also aid retention.

C Vehicle Private Finance Initiative (PFI) is now upon the Corps, improving availability but requiring greater unit planning, as will whole fleet management in the future. TITAN and TROJAN will arrive in unit lines in 2007 with TERRIER following two years later. MAKEFAST, the RE application to sit on BOWMAN, has been developed rapidly and should also be with units in 2007.

My report reviews 2005 but also looks forward to impending change over forthcoming years.

Operations

Overview. Operationally the year has once again been dominated by the situation in Iraq. Elsewhere, there has been a drawdown in the number and scale of standing commitments and a shift towards surging capability for directed tasks, specifically in the Balkans and Afghanistan. The result has been an overall improvement in tour interval for units, reflected in the Land Commitments Tour Interval Plot, which shows an average of 25 months between operational tours. This does however, mask the significant pressure that has remained on 170 (Infra Sp) Engr Gp and 33 Engr Regt (EOD).

JRRF Roster. The Corps has continued to provide combat engineer, EOD and infrastructure support to both the Spearhead Land Element (SLE) and Airborne Task Force whilst 12 (Air Sp) Engr Gp has provided the Lead Air Support Squadron in support of the RAF.

Great Britain. The Corps provided EOD support to the G8 Summit at Gleneagles in July 2005. A team from 42 Engr Regt (Geo) provided mapping and terrain analysis to the Police, helping to prepare police units who are not routinely used to operating outside of their normal areas of operation. Specialist mapping was produced at the Defence Geographic Centre and the Joint Air Reconnaissance Intelligence Centre that proved to be of significant value during the planning and execution of this high profile event. This Summit also saw the first deployment of 25 Engr Regt assets outside Northern Ireland; the Regt provided a Public Order Troop to protect the perimeter fences of HMNB Faslane and Clyde. In addition to the G8 Summit, 33 Engr Regt (EOD) has once again been involved in a range of MACA tasks including providing troops to support the Metropolitan Police following the 7 July 2005 London Bombings, and searches in support of the York Races, Trafalgar 2000 and the G8 Home Affairs Conference.

Northern Ireland. The recent decommissioning announcement by the IRA and the signing of the Joint Declaration for Normalisation has increased the focus and pace of reducing military assets in Northern Ireland. Whilst the Roulement Engineer Squadron commitment ceased in September, additional support was immediately required from 20 Fd Sqn to enable 25 Engr Regt meet base closure deadlines.

Iraq. The Corps' commitment to Security Support and Nation Building operations in Iraq has remained at Medium Scale Plus with Sappers continuing to deliver a broad range of military engineer support across Multi-National Division (SE), including life support, force protection, riverine operations, Iraqi national infrastructure development, diving, EOD and Search. At the tactical level the Close Support Engineer Regiment is fully engaged, offering technical and project management advice to the Public Utilities Director Generals as well as providing a number of support teams to facilitate repairs to the Iraqi essential service network. As part of the UK effort to reform the security sector within Iraq, Regiments have run search courses for the Iraq Police Service, Iraqi Army and Training Support Unit personnel. The Regiment has also provided specialist training to the Iraqi Government's Department of Border Enforcement and conducted joint anti-smuggling operations. The following units have been committed to Iraq:

- Operation *Telic 5* (Nov 04 to Apr 05): 21 Engr Regt, 63 Wks Gp (-), 65 Fd Sp Sqn, Tp from 49 Fd Sqn (EOD) and a Tp(-) from 42 Engr Regt (Geo).
- Operation *Telic 6* (Apr 05 to Nov 05): 26 Engr Regt, 64 Wks Gp (-), 70 Gurkha Fd Sp Sqn, a Tp from 49 Fd Sqn (EOD) and a Tp(-) from 42 Engr Regt (Geo).
- Operation *Telic 7* (from Nov 05) 32 Engr Regt, 64 Wks Gp (-), 15 Fd Sp Sqn, a Tp from 21 Fd Sqn (EOD) and a Tp(-) from 42 Engr Regt (Geo). Elements of 516 STRE (BP) deployed to repair and enhance the Tactical Bulk Fuel Installation at Basra International Airport.

In addition to its standing commitments to 12 Mech Bde, 26 Engr Regt Gp was also involved in the construction of a passenger and cargo terminal at Basra Air Station, the con-

struction of a Tier 1 (500 man) Camp in Al Muthanna to accommodate the Australian Contingent, force protection works at Basra Palace to allow the Romanian Contingent to move in and provide security to the UN, a temporary camp in Talil for the Iraqi Security Forces, the dismantling and removal of the Mabey and Johnson Logistic Support Bridge at Rumaylah, and major force protection works for the 1 STAFFORDS Battlegroup in Maysan Province.

The Geographic Troop produced a range of situation awareness, engineer intelligence and transitional intelligence support products. In the summer the troop was augmented from UK and by US soldiers from the 30th Engr Bn from Fort Bragg to assist in the successful implementation of the Iraqi Geospatial Reference System, an Iraq wide geospatial network that will aid future large scale construction work in Iraq and local mapping.

Afghanistan. The UK has a strategic aim to create a stable and secure Afghanistan. The 2005 focus was in the North, with the standing RE commitment limited to three clerks of works: one with the Afghan Roulement Infantry Battalion in Kabul; one with the Provincial Reconstruction Team in Mazar-e-Sharif; and one on other tasks. There have also been a number of additional deployments:

- 34 Fd Sqn and 529 STRE deployed to Kandahar Airforce Base (KAF) to upgrade the infrastructure of the HARRIER GR7 Deployed Operating Base.
- 33 Engr Regt (EOD) provided an SO2 to support a multinational exercise and continue to provide a high readiness rear-based EOD capability.
- 170 (Infra Sp) Engr Gp deployed an SO2 Infrastructure to Kabul to support HQ COMBRITFOR.
- 13 Geo Sqn deployed a section to support an RAF Tactical Imagery Wing task.

During the autumn the Corps, and in particular 8 Force Engr Bde, has been focusing on the major 2006 commitment in Afghanistan. It is pleasing to report that 170 (Infra Sp) Engr Gp was included on the PJHQ Joint reconnaissance.

Bosnia. The situation in Bosnia remains stable with the pan-Balkan STRE commitment being a Chartered Engineer Project Manager and a clerk of works supporting Multi-National Task Force (NW). Despite recent drawdown, limited military engineer tasking has continued with 33 Engr Regt (EOD) providing advance search support to a number of anti-smuggling tasks and to Spearhead Lead Element (SLE) Battalion deployment in March 2005. In Sarajevo, UK geographic staff, working primarily in support of intelligence-led operations, have filled two HQ European Force posts.

Kosovo. In Pristina, 42 Engr Regt (Geo) continued to support the Intelligence, Surveillance and Reconnaissance organizations to help counter organised crime and terrorism.

Cyprus. The small RE maintenance team continues to provide support to the UN Force in Cyprus (UNFICYP) on Operation *Tosca*. Following the unsuccessful referendum on the Annan Plan and Cyprus' EU accession the UN commissioned a review on UNFICYP. This resulted in a reduced commitment and a reduction in the RE detachment to five posts in April.

Falklands Islands. The requirement to provide the Falkland Islands RE Maintenance Team continued throughout the year. The scale and nature of the capability was reviewed by 12 (Air Sp) Engr Gp in May 05, which led to a reduction in the team to 11 tradesmen. 39 Engr Regt has taken on the responsibility for the provision of the core of the team.

Sierra Leone. The UK led IMATT continues with seven Royal Engineers involved in the provision of training to the Royal Sierra Leone Armed Forces.

Reserves. The tempo of TA mobilizations has decreased in 2005. Up to 40 personnel have continued to be deployed in support of operations in Iraq, Afghanistan and the Balkans. Officers and soldiers who deployed on Operations *Telic 1-3* will come back "on-line" for deployments in 2006 under RFA 96 rules although the Army policy restricting mobilization to 12 months in five years will be followed. The Engineer and Logistic Staff Corps provided operational support to the Royal Signals in UK and to the Corps in Iraq, as well as a wide range of support to training and policy.

Future Army Structures

Future Army Structures (FAS) work continues to dominate organizational change, although other pressures seek to impose further liability savings as the Army reduces to 101,800 by 2008. The Army aims to achieve all FAS changes by 2012. In HQ EinC(A) the focus has changed from justification to refinement of the RE FAS establishment tables for implementation. Every RE establishment in the Field Army has been reviewed in light of the FAS measures agreed in 2004, including significant unit consultation. I am confident that the Corps will have a structure that is capable of delivering on the most demanding of warfighting operations and the most likely enduring operations. Under FAS, 874 posts will be re-invested into our Field Army units to provide a truly balanced and integrated military engineer capability at all levels. This enhancement is counter-balanced by two non FAS changes; the loss of liability for the Northern Ireland roled regiment under Normalisation and of posts at RSME under the Public-Private-Partnership. We have now drawn a line under the FAS structures and future change proposals will be considered as post-FAS work although could be implemented ahead of some FAS changes.

Close Support Regiments. The headline changes to the Corps remain those reported last year although implementation timings have been refined. 38 Engr Regt is already changing to the light role, less 11 Fd Sqn, which remains in the mechanized role until 2007. 23 Engr Regt (Air Asslt), which receives a command and control uplift and sees complete parity between 9 and 51 Para Sqns, changes in 2006 when it also relocates to Woodbridge. The creation of 24 Cdo Engr Regt will be spread across the FAS implementation period: in 2006 an additional troop will be added to 59 Indep

Cdo Sqn, the Regimental implementation team in 2008 and the remainder of the posts in 2010. The medium and heavy close support regiments move to a common structure of three armoured squadrons, each with one armoured, one field and one support troop. 21, 32 and 35 Engr Regts adopt the revised structures in 2006. 22 and 26 Engr Regts gain an extra squadron each through a mixture of reorganization and addition of posts. Some initial changes this year have seen a rebalancing of the field and armoured troops mix in the Regiments. The two HQ&Sp Sqns will adopt their FAS ORBATs in 2006 and 27 and 52 armoured squadrons should be added to 26 Engr Regt in late 2007 and 22 Engr Regt in 2008. These latter timings are dependent on delivery of Project *Allenby/Connaught*.

General and Force Support Units. General support regiment reconnaissance troops will be disestablished in 2006 and the capability transferred to RAC formation reconnaissance regiments with RE NCOs in each reconnaissance squadron. The Resources Specialist trade continues to prove its worth on expeditionary operations and Future Army Structures has recognized this, particularly in the de-cadreisation of resources troops in all field support squadrons, mainly in 2006 although growing additional the necessary numbers of ME (Res Spec) to fill these posts will take time. 33 Engr Regt (EOD) will reorganize and gain 17 Fd Sqn (EOD) into the Regiment in 2006/7. On completion of Northern Ireland Normalisation 25 Engr Regt will re-role to provide an additional air support RHQ, including 43 HQ&Sp Sqn, but 33 Fd Sqn will be drawn down. 170 (Infra Sp) Engr Gp will have a small increase of 15 posts in early 2006 and 535 STRE (Wks) will transfer into the Group during Normalisation. 42 Engr Regt (Geo) will gain 28 posts in 2006 and 34 posts in 2008 as a mixture of both FAS and non-FAS enhancements.

Establishment Tables. FAS establishment tables for the majority of RE units are being scrutinised by HQ LAND and MOD through this winter for promulgation in early 2006. TA establishments will follow the same process and will probably not be published until early Summer 2006.

TA FAS. FAS will see the RE TA more closely integrated with the regular units of the Corps, with stronger affiliations and special to arm direction than is currently the case. The whole TA's role will change to the provision of augmentation to Regular RE units deploying on large-scale operations and the provision of formed sub-units for discrete tasks at large and medium scales of operation. The posts requiring augmentation are those that lend endurance and robustness to unit establishments and these reflect the skills that can most readily be provided by the RE TA. Whilst the Army is undermanned and at high operational tempo, formed TA sub-units and individual augmentees will continue to be mobilized to support regular units. These changes reinforce my belief that the TA is very much a "TA for use".

RE TA FAS Structure. The RE TA is to increase in size by 47 per cent to 4638, against an unchanged Army TA total of 42,000, through the addition of one regiment and six new squadrons. Providing the implementation plan is endorsed by ECAB and Ministers, due in December this year, it is intended that the future RE TA will comprise: R Mon RE(M), 71 Engr Regt (Air Sp), a new regiment in NE England, 73 Engr Regt (Air Sp), 75 Engr Regt (V), 101 Engr Regt (EOD) (V), 131 Indep Cdo Sqn RE (V), 135 Indep Geo Sqn RE (V), a new independent field squadron in Northern Ireland, 65 Works Gp (V), 412 Amph Engr Tp (V) – and TA personnel in HQ 170 (Infra Sp Gp) and 62, 63 and 64 Works Gps. Jt CIMIC Gp remains a tri-service organization with a majority reserve cadre and TA will remain in HQs EinC(A), 12 (Air Sp) Engr Gp and 29 (Land Sp) Engr Gp. Our militia and volunteer regiments will no longer have headquarters squadrons nor RLC stores sections but each will have a RHQ troop and LAD. A regiment will normally have three large squadrons of about 150 TA personnel each occupying a main TA Centre with a troop in a detachment location. Independent squadrons will be larger still and have more detachments. Six new squadrons will be formed, one will disband, several other moves will take place and three squadrons will be resubordinated between 2006 and 2008. The Corps should also gain a TA Band and a troop in Orkney.

Other Organizational Changes

8 Force Engr Bde. The reformation of 8 Force Engineer Brigade took place on 1 April this year. It is formed from the former RE Theatre Troops, with some of its policy functions being subsumed into HQ EinC(A). Commander 8 Force Engr Bde is also the Joint Force Engineer and has coordinating authority over 1 and 3 Division Engineer Groups. The selection of the brigade title reflects the contribution of the Corps to 8th Army during the Italian campaign from 1943 to 1945. In tandem, the three groups within 8 Force Engineer Brigade have been retitled 12 (Air Sp) Engr Gp, 29 (Land Sp) Engr Gp and 170 (Infra Sp) Engr Gp (formally Military Works Force). Comd 29 (Land Sp) Engr Gp has also taken command of 11 EOD Regt RLC.

HQ EinC(A). HQ EinC(A) has continued to develop. In February it took the Corps' lead for the RE TA and Reserves from Commander 29 (Land Sp) Engr Gp, with some staff being resubordinated into HQ EinC(A). Further changes in early 2006 will see HQ EinC(A)'s EOD responsibilities and staff reducing as the Joint EOD Staff Branch establishes in Wilton. This is a major step forward bringing together EOD staff from the Royal Navy, Army and RAF into a joint branch reporting to the Central Staff. The Corps has also established a full-time Corps RSM from those selected for commission in early 2005. WO1 (RSM) Garcia took up the appointment in the summer having served as RSM in 36 Engr Regt and will obtain a deferred commission in 2007.

Equipment Support. The Headquarters has finalized an agreement with DEME(A) to improve equipment support to the Corps. RE equipments, less infrastructure, are now managed, inspected and maintained by the equipment support chain rather than the Corps. 28 ME (Fitter) posts have been transferred to work in LADs and Workshops as part of this agreement. This is

not connected with the rebalancing of equipment support from first to second line, which is stretching close support engineer regiments, and also sees the removal of RLC stores sections from Close Support Engineer Regiments during 2006/07.

Individual Training

Phase 2 Outputs. The output of RE soldiers from Phase 2 basic training (including Gurkha) for 2004/05 was 1086. This high level exceeded the planned Statement of Training Requirement (of 1054) and was achieved partly through additional courses run by RSME, with assistance of Field Army instructors to reduce the number of Soldiers Awaiting Trade Training (SATT) within the training pipeline. SATT numbers have now reduced to acceptable levels. Forecast of Phase 2 output for 2005/06 (as at September 2005) is 837 (against SOTR of 1045). This shortfall reflects inadequate recruit inflow in some Career Employment Qualifications during 2003/04. The most significant shortfalls are forecast in design trades, fitter trades, ME(POM), ME(C3S) and ME(Geo). In future resource specialists will be recruited directly into the Corps. Process based training for the trade will start at the Defence School of Logistics in 2006.

Short term Plan 2005 Individual Training Measures. A year ago my predecessor reported that the need for multi-skilled soldiers was widely endorsed by operational commanders. This continues to be the case, but the duration and cost of RE training, particularly at Phase 2, continues to be a target for those seeking budget savings within ATRA. In the past year we have had to defend the need to retain trade training within Phase 2. In order to achieve this we have reviewed the content of our Phase 2 courses and offered savings through reductions in course lengths in areas where this can be made without significant impact on operational capabilities. The changes are summarized below:

RSME is now redesigning the Class 2 courses affected, with the revised courses being introduced this winter. Development of Class 1 courses and Specialist Qualifications will follow. These changes have not reduced the NVQs available to our soldiers although some elements will now be covered on the Class 1 rather than Class 2 courses.

Training Studies. The difficulties in balancing constantly increasing training requirements with limited funding has prompted the Army Policy and Resources Committee to endorse a number of reviews and studies to be conducted by the Directorate of Individual Training (Army) to improve the definition and delivery of Army training requirements. Key studies will:

- Review individual training governance in the light of proposed reorganization of HQ Land Command and HQ Adjutant General into a single HQ.
- Identify ways of streamlining Training Support (Systems Approach to Training) processes to allow for more responsive adjustments and decision-making.
- Review soldier career training & education to examine all arms requirements for individual and career training and education and recommend the most efficient and cost effective means of

Serial	Trade (CEQ)	Old Course Duration (weeks)	ITM Reduction (weeks)	New Course Duration (weeks)	Remarks (SQ = Specialist Qualification) (TO = Training Objective)
1	ME(B&C)	36.6	8	28.6	Selected TOs to Cl 1 course.
2	ME(B&SF)	29.2	6	23.2	Selected TOs to new Spray Paint/Signmaker SQ.
3	ME(Cbt)	10	2	8	Content subject to RETDT EXVAL.
4	ME(C3S)	8	1	7	Achieved by extending working day.
5	ME(C&J)	30.6	10	20.6	Selected TOs to Cl 1 course.
6	ME(CMT)	21	2	19	Selected TOs to Cl 1 course.
7	ME(Elec)	36.4	7	29.4	Selected TOs to Cl 1 & new SQ
8	ME(FtrACR)	44	6	38	Delete selected TOs
9	ME(FtrGen)	33.9	2	31.9	Delete and transfer selected to Cl 1.
10	ME(Fab)	37	8	29	Reduce training time in selected TOs and transfer requirements to Class 1 course
11	ME(H&P)	32	4	28	Reduce training time in selected TOs.
12	ME(POM)	20	4	16	Transfer Frame Steer Dump Truck & Medium Wheeled Excavator training to new SQs.
13	ME(SvyEngr)	31.8	4	27.8	Reduce training time in selected TOs and transfer TOs to Cl 1 course.

meeting them. It will provide an opportunity for the Corps to examine whether current career structures and training, which arose from the RE Employment and Structures Review conducted in the mid 1990s, remains the most efficient and cost effective means of meeting the Corps requirements.

Geographic Training. On the academic front the Royal School of Military Survey (RSMS) has continued to make real strides. The first cohort of twenty-six ME (Geo) technicians successfully graduated from Sheffield Hallam University with their Foundation Degree in Applied Computing (Defence Geographic Information). Looking wider, to meet changes to the Army individual training system, RSMS has developed a new Mandatory Annual Training Test in Navigation from scratch for delivery in the first half of 2006.

TA Training. The identification of the TA as the reserve of first choice under FAS has lead a wide range TA training initiatives including reviews of:

- TA Officer training to bring it into line with the regular officer Review of Officer Career Courses (ROCC(V))
- Command Leadership and Management training for the TA (CLM(V)).
- TA Phase 1 training.
- TA Fitness Policy to engender a fitness culture within the TA and link standards required to readiness.

With the slight reduction in operational tempo, RE TA units have returned their attention to restoring an individual and collective training cycle that will ensure sufficient trained personnel are available when required. The focus is on Phase 1 and 2 individual training and collective training to Collective Training Level 2. This requires individuals to commit to at least 12 weekends and a 15 day concentration per year. TA concentrations have been both at home and abroad and included Military Aid to the Civil Community tasks. Some 300 soldiers also attended a centrally run Courses Camp at Wyke Regis in September.

RSME PPP. The RSME PPP project continues to move forward. The intent remains for ATRA to submit a Main Gate Business Case to the Investment Approvals Board, now expected in early 2006. If this gains Ministerial approval, final contract negotiation should be completed by the end of 2006. Success of this programme remains a high priority and would secure the delivery of RE training for the 30-year contract period.

Collective Training

HQ LAND continues to develop the Formation Operational Readiness Mechanism (FORM), which replaces the Formation Readiness Cycle. The FORM envisages a 2.5 year cycle during which units will pass through a 5 phase cycle: recuperation, collective training at Levels 1-2 (sub unit individual and team training), collective training Levels 3-5 (unit, all arms and formation training), high readiness and finally deployment on an enduring operation. Implementation of FORM is currently constrained by operational commitments and the introduction of new equipment, especially Bowman.

HQ EinC(A) retains high level responsibility for collective training policy and Engineer Training Standards but is supported by HQ 8 Force Engr Bde. The LAND Field Army Training Manual, which includes Special to Arm direction, is being revised and will provide direction on application of the FORM. LAND is also developing, under Project BLENHEIM, a resourcing tool to capture directed training resource requirements.

Collective Training Strategy. HQ 8 Force Engr Bde is leading the development of a Corps Collective Training Strategy. Its aim is to provide commanders sufficient guidance to undertake progressive and relevant training to deliver the combat and force support engineer capabilities required for expeditionary operations. The Corps does not currently have such a strategy, two consequences of which are a deficit in force support engineer training and the cancellation of some RE Special to Arm Overseas Training Exercises in recent years. Part of the developing model for RE training sees these exercises being re-packaged as Joint Force Enabling Exercises with potential projects also being identified by Defence Estates Overseas Division.

Manning

FAS will increase the Corps by 874 posts, although this uplift to the field army will be offset by reductions in Northern Ireland and at RSME when Public-Private Partnership is implemented, giving a net uplift to the Corps of around 350 posts. Manning will therefore remain a significant challenge for the Corps over the next five years, placing greater emphasis on both recruiting and retention and, by extension, career management. The current strength for RE officers lies at 1167 against the 2010 liability of 1220. Soldier strength is 7662 against a 2011 liability of around 8350. The last two years has seen very limited growth (0.5 per cent) in soldier strength after two years of excellent expansion, mainly attributable to enforced recruiting pauses and increased voluntary outflow. RE TA manning continues to grow steadily, increasing by 12.3 per cent over the last two years although it shares recruiting and retention difficulties with the wider TA. A number of initiatives, including "centralising" regular and TA recruiting efforts, have been launched to combat this.

Misemployed Personnel. The number of personnel misemployed in the interests of the Corps is just under 100, below the Army average but higher than last year. They mainly support the introduction of new equipment and bolster the recruiting and training organisations to help them grow the Corps.

Recruiting

Recruiting pauses and overly restrictive processes resulted in the Corps only recruiting 86 per cent of its 2004/05 target, comprising 84 per cent of the Soldier Entrant Military Engineer target, 90 per cent of the Junior Entrant Military Engineer target and 72 per cent of the Apprentice Military Engineer target.

2005/06 is proving far more successful with the Corps achieving 75 per cent of its 1,348 target at the mid-year point

(August 2005). Some trades are still difficult to recruit, particularly within the technical areas of geographic, fitter and plant operators. Several initiatives are targeting these areas, such as the RE annual briefing to all Army recruiters and the establishment of unit Recruiting Officers. A new RE Regional Recruiting Team was established in Scotland and a Geographic Engineer Group recruiting team formed. The longer term recruiting market will be more demanding, with an unfavourable demographic trend and increasing numbers undertaking higher education.

Officer recruitment remains buoyant and we remain the first choice of arm for cadets at RMAS, attracting three applicants to every vacancy. As a result the Corps takes from the top third at Sandhurst; over 90 per cent of our new officers are graduates with some 40 per cent holding an engineering based degree. The Corps was well represented at the Sovereign's Parade in August 2005, most notably by 2Lt Rob Hoey who was awarded the Sword of Honour; the first RE officer to receive the awarded since 1992.

Career Management

Officer Career Stage 1. Quotas from Sandhurst and on the Beige List have been increased as the Corps prepares for FAS. Whilst there has been frustration with the mechanics of the Military Knowledge (MK) 1 and MK2 courses, I am pleased that junior officers realize their importance and are qualifying in time for promotion; this momentum must be maintained. I am also delighted to see nine officers starting the Professional Engineer Training courses at Chatham in 2006 and 6 officers embarking on the Geographic MSc. It is crucial that the specialist areas of the Corps continue to recruit and allow a greater flexibility with attendance on the Intermediate Command and Staff Course (Land) (ICSC(L)) which is now mandatory for all.

Officer Career Stage 2. The current strength of the Direct Entry majors community is 297, with a Corps liability of 267 majors' posts (Regimental Duty and Grade 2 staff). Some 22 of the former Black Bag jobs were released to ICSC(L) 2 this year as initial SO2 appointments and the remainder are likely to be classed as subsequent grade 2 posts. Our officers took 15 per cent of the E2 Defence Policy and E2 Technical SO2 posts following ICSC(L) 2, showing that we can still compete for the top jobs. The key to this success is preparing the ground in senior captain annual reports in order to ensure that our most able officers get the most demanding initial SO2 appointments. Likewise we must recommend officers for German and US staff colleges which have now been aligned with ICSC(L). FAS will provide more sub-unit command opportunities with the new first squadron on line in 2006. With the demise of the old Advanced Command and Staff Course (ACSC) the opportunity will exist for about three or four majors each year to attend one of the transition ACSC courses and Overseas Staff Colleges. This is a good opportunity for some of those who missed out first time around or those who have specific language and international skills. The current difficulties associated with all majors moving in August should be alleviated by the split in ICSC(L) 3 courses. This will increase flexibility and provide a smoother transition from May to October each year.

Officer Career Stage 3 – The Corps liability for lieutenant colonels remains at around 170 posts (Mainstream Direct Entry and Late Entry, Chartered Engineer and Geographic). In the Mainstream Direct Entry roster there remains a healthy balance between E1 and E2 opportunities, with similar numbers filling staff appointments in each domain. Sixteen officers were promoted off the Pink List 05 and my intention is for the Pink List quota to rise in line with Future Army Structures.

Group B Rules. In addition to the welcome increase in the uptake in professional training starting in 2006, it remains my overall intent to give RE Specialist Officers wider employability. Group B rules for promotion to lieutenant colonel have been amended to allow a more realistic window of opportunity for promotion under Group A rules. Immediately we have seen one Chartered Engineer officer promoted under Group A rules and one make the Reserve List this year. These rules also embrace the possibility of some specialist officers undertaking mainstream staff or command appointments, albeit subject to the Corps continuing to man its liability of specialist posts.

Late Entry Officers. The October 2005 Arms Selection Board had 44 applications for commissioning and the Corps looks to continue to commission around 30 WO1s each year. The present Late Entry strength stands at 299. Against this the 2005/6 authorised liability for Late Entry officers has risen to 310, representing an increase of 21.

Soldier Promotion and Soldier Career Management. The Corps is now close to achieving full SDR manning in ranks above corporal. The total promotion figures this year are 163 per cent higher than in pre-SDR years and this combined with increased employment opportunities is good news for the Corps. The new FAS establishment will clearly offer greater opportunity for all. Of continuing concern is the increasing number of our soldiers that are being medically downgraded. 15.6 per cent of our soldiers are now low medical category, an increase of over 1.5 per cent on last year.

JNCO Manning. The lance-corporal population is showing signs of stabilising and the balance between trades continues to improve. There are still too many ME (POM) lance-corporals but the surplus of ME (Dvr) lance-corporals is much improved on last year. The deficit of ME (Ftr Gen) lance-corporals in the Corps remains a concern, although numbers have remained steady. In the last year the number of ME (Ftr Gen) sappers has improved but the trade still remains significantly undermanned.

Manning Restrictions. Directorate of Manning (Army) (DM(A)) has transferred authority for granting continuance beyond 22 years service to Colonel RE Manning and Career Management (MCM) Division. Limited continuance for up to two years can be granted for pension (Warrant Officer Class 1 only), manning purposes or when the residual service rule has

been waived by DMS. Career continuance can be granted for substantive corporals upwards for up to two years. Individuals will be invited to apply for continuance by RE MCM Div. Applications will also be considered from soldiers who have not been invited where applications are supported by the chain of command.

Rejoins and Transfers. The restriction on rejoins back into the Army has been lifted. Acceptance is predominantly dependent on filling shortfalls in established posts. Priority is given to operational pinch point (OPP) trades. There has been an increase in the number of applications to transfer from other Arms and Services into the Corps. We must encourage and welcome voluntary transfers to assist us in manning the Corps.

Harmonised Soldier Year. The Army will adopt a single harmonised reporting and promotion year for soldiers from 2006. The promotion year for warrant officers and staff sergeants will be 1 April to 31 March and for sergeants and corporals from 1 October – 30 September. The Corps will continue to run two lance-corporal boards, with seniority dates of 1 April and 1 September. There will be some compression in the reporting period in the conversion to Harmonisation.

Manning Policy. With current undermanning, the Corps Manning Policy continues to provide direction on manning priorities. Overall the policy spreads undermanning across the Corps in preference to following readiness cycles or the commitments plot, which would lead to reduced stability for soldiers. Within that I have set a number of priorities, including the posting of officers and soldiers of the right quality to the training engine. Instructors should be properly trained prior to assuming responsibility for trainees. Therefore three weeks overlap will be programmed to allow pre-employment training and a handover/takeover.

Retention

Officers. Historically the Corps' officer voluntary outflow rate has fluctuated between 2.25 per cent and 4.5 per cent and has typically been well below the Army's average. This year has seen our officer voluntary outflow rate deteriorate and move towards one of its rare peaks. The areas that appear to have contributed to this unwelcome rise are chartered engineer majors, direct entry captains and garrison engineers. It is yet unclear whether this is another historical spike or a more damaging trend and thus all officers leaving the Corps will now be interviewed by a Sapper brigadier to better define the reasons for leaving.

Soldiers. Over the last nine years RE soldier voluntary outflow has steadily reduced from nearly 9 per cent to 6 per cent before increasing suddenly to 8 per cent in 2005. Whilst this follows an Army upturn, the Corps' rate is now 2 per cent above that of the Army, double the historical difference. Artisan and fitter trades are hardest hit. We are working with DM(A) to identify how retention can be improved, particularly at the 4-year point. We all have an important role in retaining our soldiers, especially given the predicted, harder, recruiting climate ahead.

Continuous Personal Development (CPD)

Government initiatives over the last few years have promoted Lifelong Learning. The Army has adopted this and is encouraging a culture change to make it part of our routine business. CPD aims to develop individuals to their full potential by encouraging them to learn throughout their working lives, not to assume or accept that what they learn at school and college is sufficient for life. Most RE soldiers have not had the benefit of either further or higher education and indeed some joined the Army to make up that gap. We are fortunate that most of the trades and skills that we require to fulfil our role as military engineers on operations are directly transferable to civilian life, but some are not. RE CPD will provide a mechanism that enables officers and soldiers to get credit for the training, knowledge and experience that they gain in the RE. At the same time it should aid retention and contribute to increased operational capability. My intention is to deliver CPD to the Corps by September 2006 once the resources are in place.

Combat Capability Development

Future Manoeuvre Development Cell (FMDC). Support to FMDC continued throughout the year, involving a minimum of one seminar per month. As part of the FMDC process, the Manoeuvre Support Sub-Concept has been further developed and staffed to the Army Doctrine Committee. It supports the higher level Future Land Operational Concept (FLOC) paper and provides a coherent linkage to FAS, new equipment capabilities such as Future Rapid Effects System (FRES) and identifies a number of key areas for experimentation and analysis.

Army 2020. FLOC points the way towards the future Army and both Parts 1 and 2 of this study have now been endorsed by the Executive Committee of the Army Board, establishing a pan-Army view. Work on Part 3 will continue in the coming year to establish a detailed plan, setting out the developmental work required to achieve this view across all lines of development.

NATO Engineer Doctrine. Development of tactical level NATO combat engineer doctrine has continued with the completion of the re-write of Allied Tactical Publication 52A by the UK as sponsor nation for this key NATO engineer publication.

FRES. FRES will replace the Army's obsolescent Saxon, AFV 430 series and CVR(T) vehicles from around 2012 in order to form the backbone of our future medium force. Work continues to ensure that FRES will contain appropriate levels of engineer support based on a range of FRES complex variants consistent with the platforms used by the supported force. Current work is considering a number of fleet options to determine the optimum platform type and mix. Critically, Sappers must be provided with the equivalent levels of protection and mobility of those whom they support in order to provide truly coherent all-arms capability.

Mobility Support. The TROJAN and TITAN prototypes are continuing to demonstrate the impressive capabilities of these vehicles. Delivery of the production vehicles into the acceptance system has already started. In-Service-Date is now

planned for October 2006 with the aim of deploying the vehicles to BATUS for the second half of 2007. The Breaching and Dozing Capability (BaDC) programme has already let the contract to modify the Universal Dozer Kit, and a new Magnetic Signature Projector for TROJAN is due delivery in late 2007. We have started to take delivery of 14 Full Width Mine Plough (Improved) (FWMP(I)), as an interim measure prior to the delivery of the BaDC FWMP. Further breaching capability has been developed through HYDRA, which will provide the ability to mount 2 Pythons on a modified AVRE trailer. The TERRIER prototype is also undergoing trials and promises to provide a step change in capability over Combat Engineer Tractor.

Counter Mine. We have had mixed success in the counter mine arena. The Dismounted Countermine Capability is progressing well and will deliver new metal detectors, training and personal protective equipment in 2008 and an explosive line charge, for rapid breaching, in 2011. The Mounted Countermine Capability has had its funding removed. A Concept Capability Demonstrator has however received funding and will undergo trials during 2006-7, with the aim of retaining the capability within the Equipment Programme.

Bridging. The Air Portable Ferry Bridge was brought into service this year providing an air portable/air droppable 14m bridge, an air transportable 28m bridge and a ferry, all at Military Load Classification 35. It is carried on DROPS, but the basic 14m bridge can be towed behind light vehicles on six special to role trailers. It has been designed for light forces, but will be available for any unit to use should they need the capability. The reduction in gap crossing capability and fatigue life of BR90, resulting from the increase in MLC of a range of vehicles, continues to cause concern. Work is ongoing to identify a solution.

Counter Mobility. Conceptual work on the Future Counter Mobility System has concluded that the system will need to consist of a range of lethal and non-lethal components that can be used across the operational spectrum. The requirement is tending towards the need for intelligent munitions and systems that include a man in the decision loop. There is little Defence appetite for bringing in new dumb mines systems to replace BARMINE's large patterned minefield capability. The aim is likely to switch to target, rather than terrain, orientated systems. Counter Mobility is an area of considerable current debate.

All Arms Equipment. This year saw the roll out of Light Machine Guns to formed sections across the Corps. The PANTHER Command and Liaison Vehicle will be brought into service in 2007 with a variety of RE crews including RSMs and SSMs. 33 Engr Regt (EOD) and 23 Amph Engr Sqn will also receive them for OCs and troop commanders.

The Engineer Battlefield Information Systems Application (BISA) – MAKEFAST. The MAKEFAST BISA is the engineer element in the Command and Battlespace Management (Land) digitisation programme. The application will provide tools to support the reconnaissance, planning, design, resourcing and command and control of engineer tasks. It will be used by RAC support troopers, Infantry assault pioneers and RLC pioneers as well as by Royal Engineers across the spectrum of conflict and in all phases of an operation. It is now proceeding through the Bowman integration process with a user field trial planned to take place from January 2007. It is anticipated that the application will be available for deployment from June 2007.

Geographic Support Capability Development

The Environmental Fusion Capability, drawing together Geographic, Hydrographic and Meteorological staff in order to produce the Recognised Environmental Picture, is pivotal to greater situational awareness within the Network Enabled Capability era. The concept was tested on Ex *Joint Venture 05* with an embryonic environmental cell embedded within the Joint Force Engineer staff.

Technical evolution continues to drive geographic engineer equipment developments with the Deployable Geographic System (Light) fleet being fully upgraded. The Geospatial Information Deployed Data Environment Programme, a major technology insertion programme, has been developed in three parts. Handheld data loggers will allow the capture of geospatially referenced data on the battlefield, assisting significantly with Engineer Intelligence and reconnaissance. Once captured, the data will be stored, managed and shared on new high-end Data Management systems. The third element of the programme is the introduction of a new Geospatial Information Dissemination (GID) notebook system.

Sustainability Capability Development

Engineer Logistics. In light of lessons identified on Operation *Telic*, work has progressed in moving Engineer logistic accounts on to electronic systems. We have seen a large increase in the use on operations of a laptop accounting system, the Deployable Multiple Accounts System, and work is progressing in upgrading the GLOBAL system to manage both loan and local purchase materiel. Engineer logistic units are now fully equipped with consignment tracking systems. The major challenges of closing the non-active Operation *Telic* accounts have been largely completed with only a relatively small write-off.

Defence Logistics Transformation Programme (DLTP). We have been fully engaged in the DLTP, which is already having its effect within the Corps with its mixture of opportunities and threats. Some major elements of the programme include Echelon Rebalancing, Rebalancing of the Royal Electrical and Mechanical Engineers with the removal of Royal Logistic Corps Stores Sections from our Close Support Regiments, and the development of Priming Equipment Packs including Engineer Materiel.

C Vehicle Private Finance Initiative (PFI). Amey Lex Consortium completed negotiations with the Ministry of Defence with the PFI contract being signed in June 2005. Implementation has begun with Amey Lex Consortium installing Management Information Systems, training units in the requirements of the contract and starting to takeover equipment. Full Service Commencement is scheduled for

May 2006 with the new Capability Management Cell in Engineer Systems Support Integrated Project Team becoming the interface between users and the service provider.

Deployable Engineer Workshop (DEW). Five DEWs will be bought and will be whole fleet managed. The intention is that one will be deployed on operations, two held at readiness for deployment and two held for training. The system will give Fd Sp Sqn workshops significant additional capability with each trade group having its own work space designed for engineering hygiene, environmental control and flexibility to cope with the widest possible range of tasks. A trial is planned for mid 2006.

Infrastructure Capability Development

Force Protection Engineering (FPE). FPE has been accepted at the highest level as an important Defence capability and staffing continues to re-establish longer term funding for explosive and ballistic trials. Under FAS it is intended that a FPE focus will be established in 8 Force Engr Bde. Doctrinal Note 05/6 "Protecting Expeditionary Camps from Indirect Fire" has been issued and Joint Warfare Publication (JWP) 3-64.1 Force Protection Engineering has been passed to the Joint Doctrine and Concepts Centre for publication. FPE is to be general skill within the Corps so a full Training needs Analysis has been completed and it is planned that training will be undertaken at all levels of the Corps. It will mainly be incorporated into existing courses, from JNCO to squadron commander, but additionally there will be an eight week Employment Training course for chartered engineers. International liaison with our allies continues, including HQ EinC(A)'s hosting of the International Defence FPE Conference in April 2005.

Water. Replacement of the water carriage packs, Water Purification Units and a new capability of third line water storage are now parcelled in to a single equipment programme called Combat Water Supply System.

Power. HQ EinC(A) is the Customer 2 Core Leader for General Purpose Power. Recent operations have made it very clear that power needs to be managed on deployed operations. As a result of HQ EinC(A)'s detailed paper on power a 2 star officer will now be responsible for all Defence field electrical power, whether General Purpose, platform mounted or portable. As procurement of new generators to fill capability gaps proceeds, this will reduce the proliferation of equipment types and the heavy dependeence placed on hire and special buys to meet particular operational requirements.

Expeditionary Campaign Infrastructure (ECI). Temporary Deployable Accommodation, which started life as an urgent operational procurement, has now been brought 'into service' so will now be maintained and replaced at the end of its service life. Work on achieving Full Operational Capability, for example to meet training requirements, continues. Other directorates lead on ECI for headquarters, workshops and hospitals but HQ EinC(A) will chair a working group to ensure that procurement is coherent.

Engineer Support to Stabilisation. Work on infrastructure and utilities, and reconstruction generally, are likely to be significant activities during Stabilisation operations so work is underway to review the Corps' contribution during this phase of operations.

JWP 4. JWP 4-01.1 Water was published in Mar 05 and JWP 4-01.2 Fuel is expected to be published by the end of 2005. Work on the JWP 4-05 Infrastructure Management on Joint Operations sub-sets has progressed slowly with 4.05.4 Property Management, 4.05.5 Works Contracts, 4-05.6 Finance and Accounting, and 4.5.7 Lands Procedures being passed to JDCC for publishing. A re-write of the parent document and parts 1 to 3 will follow. A JWP on Power is now being written.

RE GS Publications. The RE GS Publications Section continues to produce Military Engineering publications to support operations and training. During the past year, two CDs, six revised pamphlets, six amendments, a safety guide, the Operation *Telic 1* History and two editions of the Sapper Telegraph have been published. All the Military Engineering Volumes and some other publications and operational forms are available on CD and accessible through the MOD Intranet. Work continues to bring and maintain all the Military Engineering publications up to date.

Regimental Affairs

Corps Charities. The Corps charities face a rapid pace of legislative change through the introduction of the Government's Statement of Recommended Practice 2005 and the prospect of a new Charities Bill in early 2006. Both will place a greater burden of legal accountability on trustees.

The Army Common Investment Fund continues to grow. On the 3rd anniversary of the fund launch (01 Sep 05) the value of growth and income units had increased by 41 per cent & 31 per cent respectively. The cumulative dividend from Corps investments in 2005 is expected to be £275,000.

In the first half of 2005, Corps Funds distributed £134,210 to individuals, groups, teams and clubs embarking on a wide range of sport and adventure training activities.

The Institution. 2005 has seen many changes to the Institution and publications. The *Journal* has continued to lead the way with interesting articles on a variety of subjects. I am encouraged at the range of articles from junior serving members.

The Institution will shortly engage with the respective bodies to bring forward professional accreditation and awards for CPD, linking up with the overall Corps Strategy. In the first instance this will be through a Partner Institution and concentrate on Engineering Technician (EngTech) for artisan trades. This will lead to the Institution gaining its own independent ability to award new qualifications as a Military Engineer, potentially at EngTech, Incorporated Engineer and Chartered Engineer grades.

Corps History The short History of the Corps is currently being updated and should be available from spring next year. Volume 12 of the Corps History is currently under production and should be available at the end of 2006.

Follow The Sapper. This new book is available now from the Institution. It has over 200 pages and 300 illustrations depicting the Corps from early years to the present day.

Digitization Thanks to a grant from General Dynamics the Institution has started a programme of digitisation. In the near future it is intended that past volumes of Corps History and the Journal will be available on DVD in a searchable format.

RE Band. The Corps Band was again very busy and performed at over 250 engagements, mainly for Royal Engineer Units but also to the wider army, army charities and fee-paying functions. The Band is the only regular contributor to the Corps Treasury, paying a proportion of all income earned to Corps Funds. Visits abroad this year include Germany, Vienna and a return visit to Abu Dhabi. It is anticipated that the Corps will gain a Volunteer Band under TA FAS.

Royal Engineers Association

The REA continues to provide support to the serving sapper, his wife or widow and their dependant children who are experiencing hard times. Last year the number of cases the REA assisted was over 1000 at a total benevolence cost of over £400,000. 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 continues to grow in the support of those in need. The purchase of Electric Powered Vehicles, bath lifts and stair lifts continues to ease the suffering and discomfort of those elderly former-sappers and families who have served their Corps and Country and are now asking for help to ease the difficulties experienced with old age. Apart from benevolence the REA continues to have Veteran's Weekends and Family Events around the UK that 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 Airborne and Amphibious Engineer Branches. In addition 2005 has seen many branches commemorating the 60th Anniversaries of VE & VJ Days.

Sport

Notwithstanding operational commitments the Corps has kept a footprint in all Army and inter-Corps competitions. Over the year there were good performances in cricket, golf, rugby, canoeing, skiing, sailing, cycling, hockey and hang gliding/paragliding. With the introduction of a new all-weather astro-turf hockey pitch in the Stadium at Chatham, Corps hockey has moved their base to use this facility. Chatham is now the home of four major sports: Rugby, Football, Cricket and Hockey.

Rugby. We have four members in the Army squad and four in the "Development" squad with Cpl Hughes skippering the Army RU "10s" side in Hong Kong.

The annual Sapper v Gunner match at Larkhill was won by the hosts in a high scoring game. As a result we lost the Inter-Corps Merit League title that the Sappers had won for the first time in 2004.

Cricket. At Major unit level 1 RSME Regt won the Army Cup in a tight and thrilling final against the SAS in September. The day before, 42 Engr Regt (Geo) won the final at Minor-Units level and so, for the first time ever, the Corps are double Army Champions.

Hockey. 42 Engr Regt (Geo) again won the Army major units title, continuing a decade of hockey dominance. The side is also tri-service unit champions.

Skiing. A composite 28 Engr Regt & 35 Engr Regt team reached the final of the Alpine championships but were outside the first three. However, in the NORDIC event, 28 Engr Regt won both the 4 x 7.5km relay and the Patrol race. An increase in attendance at the Corps skiing camps run by 28 Engr Regt and a flourishing Corps women's team bodes well for the future. Finally, following a unit ski camp run by 28 Engr Regt, two novice sappers were selected for the GB development squad.

Sailing. The Lagos Trophy, the Inter Corps Team racing championship was held late July at Netley. Although it was a close fought contest, virtually finishing as a tie, we found ourselves Corps Champions on a count-back – a Trophy we have not won since 1998.

Canoeing. RE canoeists excelled again in the Devizes-Westminster race, being 1st Service Team and with four pairs in the top twelve.

Golf. Cpl Loome of 39 Engr Regt won the 2005 Army golf championship for the second time. In the Inter-Corps championships playing as 1st seed following our success in 2004 we lost the first match against the Gunners but then reasserted ourselves with the help of veteran Lt Col Allen, playing in his final Corps fixture before retirement. Reaching the final we defeated the Infantry to retain the trophy and the title as Army champions. Finally, in a successful year, Cpl Churchill, also of 39 Engr Regt, won the Dorset County strokeplay scratch. It is believed to be the first time that a sapper has won a County Open title.

Minor Sports. The minor sports continue to flourish with boxing, motor-biking, mountaineering, cycling and now athletics to the fore with the newly formed Corps Hang gliding and paragliding club winning the Army and Joint Service championship. Athletics has risen from the ashes and 59 Indep Cdo Sqn wrestled the minor-units title from the Army School of Physical Training who had retained the trophy from time immemorial. Spr Davies of 33 Engr Regt (EOD) won the Men's Sabre at the Army Fencing championships and Sgt Smith successfully competed in the World Cycling championships. In August he also won the Army road race championship and finished 5th in the UK "Tour of the South".

RE Mountaineering and Exploration Club. REMEC mounted an expedition to climb Satopanth in the Indian Garhwal Himalayan region through the autumn under expedition leader Maj Allewell. Taking many novices, the team

faced difficult weather and whilst not reaching the top of Satopanth, had a very successful expedition.

Veterans. Those who followed Corps football in the successful 80's and 90's will be familiar with the names of: Torrance, Hood, Reed, Tusz, Bicknell, Steadman and Richardson, to name but a few. The team survives to this day, playing the Gunner Veterans each year and touring either Hameln to play Alte Herren sides or Gibraltar. This year it was Hameln. They are worth a mention in this report because they fly the Corps flag in a Sapper garrison town in Germany and in Gibraltar and help maintain cordial relationships with the local population. They will continue to do so for a few more years, demonstrating how successful we were in Army and Corps football during that period. "Forever Young" is their motto! In May an RE Veterans team competed in the Scottish Highlands Peaks race, a combination of fell running up four peaks, and competitive sailing. The team finished 1st Service, won the Pathfinder trophy and were 3rd overall in the Open competition. The Corps has also formed a Veterans Cricket XI, under the Engineer-in-Chief, which in 2006 will take on the Gunners.

Corps Website

THE Corps website provides much up to date information on the Corps and individual units, as well as recruiting and regimental affairs. Visit www.royalengineers.com.

Military Secretary Appointments, Honours & Awards

During the past year, the Honours and Awards have been:

GCB:	1
KCB:	2
CMG:	1
CVO:	1
CBE:	1
OBE:	3
MBE:	13
OBE (Civil):	1
MBE (Civil):	2
QGM:	2
MID:	2
QCB:	2
QCVS:	3
Bronze Star Medal (USA):	1

Conclusion

THIS is a period of significant change and high operational tempo. It is my job to look beyond the "here and now" and steer the Corps to be able to deliver yet more effectively in the future.

The challenges must not be understated. Delivery of FAS is yet to be achieved and will take several years. We must put every effort into recruiting high-quality soldiers into the Corps, whether civilians or transferees from other parts of Defence, and then retaining individuals for longer. The ability of sappers to be soldiers, combat engineers and tradesmen is a cornerstone of military engineering and must be protected through forthcoming training reviews. We must ensure that the Corps is fully included in the FRES programme and that counter-mobility and Force Protection Engineering are all included in Defence thinking.

As the end of my first year as your Engineer-in-Chief I can report that the Royal Engineers remains highly regarded across Defence. I believe that this is simply down to the officers and soldiers of the Corps who continue to deliver admirably, whatever the challenge.

17 Years of Experience on Search Operations in Support of Counter Insurgency Campaigns

WARRANT OFFICER CLASS 2 M J BROWN

WO2 Michael Brown was employed as a search team commander in 33 Independent Field Squadron in 1988. He was then posted to the Counter Terrorist Search Wing as a corporal instructor in 1989, travelling to teach students all over the world until 1992. He returned to Northern Ireland in 1993 as a Royal Engineer Search Adviser, his time there spanning both pre and post cease-fire. He then became the intelligence staff sergeant for G3 Search Branch in Headquarters Northern Ireland until 1999, when he was posted to 33 Engineer Regiment (Explosive Ordnance Disposal) where he was variously employed as a Royal Engineer Search Adviser, a Bomb Disposal Officer and an Improvised Explosive Device Disposal Operator. During this tour he deployed to the Balkans three times and established the first search cell, coordinating multi national search operations. At the time of writing, WO2 Brown was the QMSI Search for 25 Engineer Regiment/Headquarters Northern Ireland and the resident Royal Engineer Search Co-ordinator for Northern Ireland, but has since assumed the appointment of SSM of 22 Headquarters and Support Squadron (Explosive Ordnance Disposal). WO2 Brown was awarded a Queen's Commendation for Valuable Service in September 2005 for his work in Northern Ireland.

Aim

THE aim of this article is to discuss how search contributes as an effective offensive capability on expeditionary operations world-wide.

Introduction

BASED around my operational search experiences I intend to demonstrate that search is moving forward and growing as a capability to meet the challenges of each new operation. I will focus on the contribution of search within the Northern Ireland campaign and wider issues. This I hope will underpin and add to the justification of Future Army Structures which endorsed the formation of a second search squadron, 17 Field Squadron (Explosive Ordnance Disposal) within 33 Engineer Regiment (Explosive Ordnance Disposal). Having worked along side many different Armies I can say that none have embraced search in the same way as the British Army. Without exception, they have been amazed to see what can be achieved by a well-trained, well-equipped (with simple un-classified equipment) and a very highly motivated search grouping.

Background

IT COULD be argued that Battle Group Engineers and Royal Engineer Search Advisers are similar, in that they are both representatives of the technical expertise of the Corps. Both are problem solvers with a remit to advise the chain of command. The only difference is that in the main, a battle group engineer deals with conventional engineer problems and a search adviser is tasked to non-conventional situations employing a different skill set. These usually correspond in some way with the objectives of search, that is denying the enemy its resources, gaining intelligence, gaining evidence and protecting potential targets. However, search advisers of recent times will tell you that nothing is ever as straightforward as that, especially with the current political climate in Northern Ireland.

Battle Group Engineer and Royal Engineer Search Adviser.

STATED SIMPLY, the role of search advisers and battle group engineers is to advise on the safest and most efficient course of action (best practice). If their advice is not accepted or acted upon, then neither can be held responsible. *"Do not tell them what to do, just ask them what effect is required!"* Search is not a black art as some would have you believe and when utilized correctly, can become a force multiplier. A well-planned and executed search task can be very successful. In 2004, out of one-hundred and one Northern Ireland advanced search tasks, thirty-six were productive, denying terrorists their resources each time. Some of these tasks had a strategic importance and the outcome could have changed the political end game. Equally, the remaining non-productive tasks still delivered an effect, albeit not so obvious. However, search advisers and associated advanced search teams had already been migrated to several other world-wide theatres, which had an immediate impact, delivering considerable effect to the all arms commanders who had invested in search as a capability. Between 2000 and 2003 a series of *Leatherman* operations in Kosovo and *Wolvereen* operations in Bosnia both delivered substantial quantities of enemy resources (upwards of one hundred tonnes of arms, munitions and explosives). Removing the tools of violence from such a fragile situation not only achieved all the search objectives, it has been argued that it considerably shortened the campaign. So why do some commanders choose not to invest search as a capability, when it has been proven that it is a highly effective and non-lethal offensive tool?

Royal Engineer Search Co-ordinator.

INDIVIDUALS differ greatly and we as a Corps do not preselect for the appointment of Royal Engineer Search Adviser; any officer or Senior Non Commissioned Officer should be able to learn the skills required at the National Search Centre. However, mature

Images of large weapons finds in Kosovo.

search capabilities (58 Field Squadron (Explosive Ordnance Disposal), 62 Cyprus Support Squadron and 25 Engineer Regiment) have discovered that the position of a Royal Engineer Search Co-ordinator has been both invaluable and critical when giving support to search advisers on large scale or high profile operations at the next level of tactical command. The appointment is usually filled by a more senior and more importantly, a more experienced personality (usually squadron commander, second in command, quartermaster or squadron sergeant major), but it is widely known that some young officers have had to take up the appointment because they were the only available officer who was search adviser trained.

By virtue of their rank and their Search Adviser qualification, commanders may automatically think they have the experience of a search co-ordinator, even though an individual might only recently have completed his or her search adviser's course. This could partly explain why a commander may have little confidence in the advice given by the search co-ordinator – the latter might not have had the time to gain the required confidence or credibility. The selection and appointment of Royal Engineer Search Co-ordinators is thus pivotal to the success of search as a capability.

Royal Engineer Search Adviser.

I believe that Royal Engineer Search Advisers in the Corps today have successfully developed as both the threat and commander's intent has evolved. This has been a challenging and difficult period. Search Advisers have to be problem solvers; they must be dynamic, persuasive, reasonable and diplomatic at every stage and most importantly, they have to be capable risk and threat practitioners. The basic skills required of them have changed little over the years and my Kosovo experience confirmed that these basic requirements can be migrated from Northern Ireland and deliver a similar effect. As a QMSI Search at 25 Engineer Regiment I used this mind map (Figure 1), to communicate what I believe are the responsibilities of Northern Ireland Royal Engineer Search Advisers.

National Search Centre.

The advanced search training provided by the National Search Centre is innovative, demanding and challenging. I also believe that it is rewarding and worthwhile. When there were students from 25 Engineer Regiment on the Search Adviser's course I regularly visited and witnessed this for myself. I strongly recommend that every officer and warrant

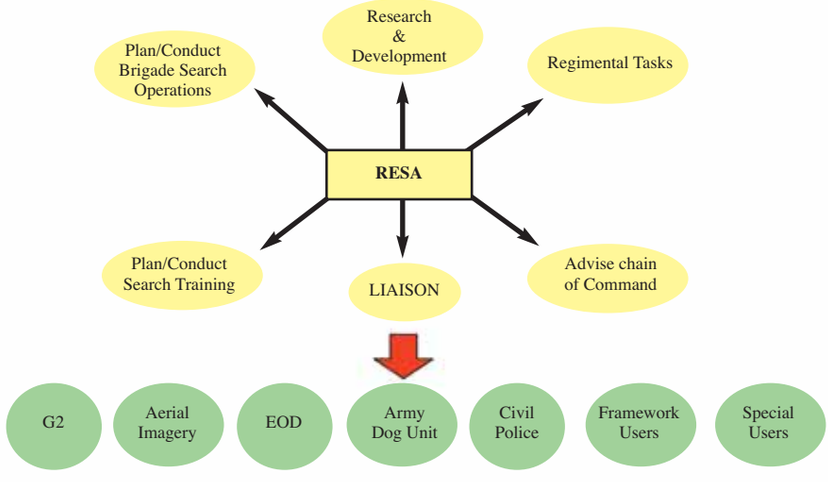


Figure 1 - Mind Map of Royal Engineer Search Advisers responsibilities.

officer takes the opportunity to visit students from their units whilst under training at the Centre as they have implemented an excellent senior officers debriefing day. These days have two objectives for visitors. Firstly, given that senior officers do visit, which should be encouraged, students actually get used to briefing brigade commanders, senior staff officers and commanding officers thus giving them the opportunity to get quality feedback from senior officers before deploying on operations and getting used to the pressure that this entails. Secondly, senior officers have the benefit of seeing the capabilities that the search adviser, with associated advanced search teams, can deliver to operational situations. Due to the recent increase in demand for search assets from the joint rapid reaction force, the National Search Centre has switched to a more generic training approach. This has had its teething problems, where specific requirements of some theatres such as Northern Ireland, could not be met. In this case Northern Ireland designed and implemented their own special to theatre training to cover these training gaps, such as; electronic counter measures, Northern Ireland legislation and its impact.

Equipment and the Golf Bag Approach.

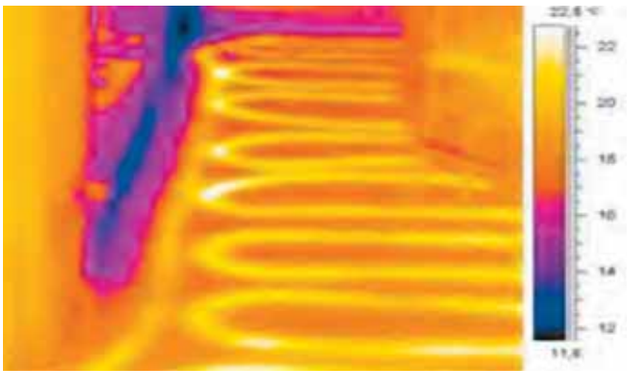
Search as a capability, is being encouraged to harness technology to enhance assurance and speed of task, thus reducing the threat to cordon troops. However, this technology has to be taught by someone and will inevitably increase the time that soldiers spend on courses (this training burden comes at a price), and this must be taken into account. The uphill struggle to train search advisers for many different theatres is being won by the tenacity of the instructors at the National Search Centre, which remains the envy of the international military community.

Where possible advanced search procedures attempt to remain non-invasive, as damage to any target is usually unacceptable. Therefore modern search techniques are very technologically orientated and possess a 'golf bag' approach to reducing the threat. A number of innovative technologies are being harnessed to give the Ministry of Defence an advantage. However, visual confirmation of the presence or absence of terrorist resources is ultimately sought. Whilst both human and technical resources attempt to exploit every opportunity, such as physical ground sign and/or technical data, time on target along with safety are the most important constraints. These must be balanced against the level of assurance being delivered. This is ultimately the commander's decision and Northern Ireland advanced search teams have recently been forced to search at night due to wider operational threats and considerations. This clearly demonstrates that advanced search is flexible and able to move with the ever changing operational demands that faces the all arms commander. This must however be carefully balanced against the safety of the soldiers undertaking the task.

The change in the global terrorist threat has accelerated the commercial development of search equipment beyond anyone's expectations. Recent direction by the chain of command in Northern Ireland is to develop new procedures using modern technologies and equipments to speed up what can be lengthy procedures. The collaboration of these innovative and technologically advanced systems will be key to the development of advanced search as a capability. The biggest problem for the user is that of cost and budgets! However, the procurement of hand held thermal imaging systems has been authorized, financed and will significantly enhance the current advanced search capability. This addition will complement existing detection equipment and should accelerate advanced search tasks by exploiting the thermal signature of terrorist devices.

Two coloured thermal images of building constructions to demonstrate its utility are shown below.

Stud partition wall thermal image.



Underfloor heating thermal image.

Explosive detection.

The field of explosive detection has always been available in laboratories. Recently (in the last fifteen years), chemical and biological techniques, which have been harnessed by the military, have significantly enhanced it. These have proved extremely successful in the fight against Irish terrorism and can hopefully be migrated to the wider Army. However, there are a number of sceptics out there who may not understand the intended concept of operations. To do this successfully you must first accept that explosives (commercial or home made) are a man made substance and do not appear without the assistance of someone or something. Search assets in Northern Ireland rely on equipment to indicate/recognize traces (that is minute particles not visible to the naked eye), of explosives. This information is critically important and should be treated as quality intelligence. Historically this type of intelligence has driven Northern Ireland G2 operations, this capability *must* be migrated.

Searching underwater.

Historically, searching under water (of any depth) or an agricultural slurry pit is a very time consuming business. It is accepted that the level of assurance delivered by either a conventional diving team or an advanced search team cannot meet that which is required by the chain of command in a timely fashion. If a high level of assurance were required during such a search, it would require the target area to be completely drained; this is not only tactically and financially unacceptable, it is unrealistic. Therefore, we are currently trying to exploit a number of technical options that are currently both available on the open market and have been rigorously trialled by the American military and civilian underwater recovery teams.

We as Sappers must never operate in isolation and must be prepared to collaborate with other interested parties, who have more experience with such maritime issues. This will be achieved through the Northern Ireland Search Working Group, which gathers every six months and serves to bring together many disparate agencies.

Northern Ireland Search Working Group.

The Northern Ireland Search Working Group has been extremely successful in taking Northern Ireland search into the twenty-first century and through the minefield that Northern Ireland politics creates. This working group has successfully managed to rationalize the numbers of Intermediate Search Teams (historically known as All Arms Search Teams), so freeing up much needed equipment for the wider Army. The Working Group also manages the training requirement for the remaining intermediate search capability and resident advanced search capability, which after thirty years or more of success against Irish terrorism, has been complex to say the least.

Position and Profile.

Search generally has a clean bill of health, however there are some areas of immediate concern. I would suggest that the reason some commands are reluctant to give search co-ordinators and search advisers the position and profile to remain effective is due to the increase of operational demands. This has overstretched our training organizations, thus reducing opportunities to grasp and understand capabilities fully, such as search. The conditions now need to be set so this can happen.

Summary.

Reductions in the Northern Ireland intermediate search capability have been managed extremely well with assistance of the Northern Ireland Search Working Group and this has produced enough spare capacity of search equipment to furnish the joint rapid reaction force. However capabilities such as search advisers and search co-ordinators have recently not been allowed to migrate as they should. Greater utility of those with previous Northern Ireland experience could have had a significant improvement on Operation *Telic* and thus helped to reduce any initial loss in effect. The National Search Centre is designing a specific Royal Engineer Search Co-ordinators Course and Royal Engineer Search Advisers on deployed operations continue to build their credibility and confidence with their specific chain of command. It is highly recommended that commanders be encouraged to visit the National Search Centre to maintain the momentum and energy of what is a vital educational process.

Finally, it is strongly recommended that we continue to embrace new technologies to give us that tactical edge and ability to deliver an effect that many larger nations cannot. Harnessing new technologies and maintaining expertise is critical to enable United Kingdom forces to remain the envy of so many others around the world.

Dunkirk 1940 – The Little Ships – A Recollection

MAJOR A SPONG ERD

On the early evening of 27 May 1940 I was in the fifth year of my apprenticeship as a Waterman and Lighterman on the River Thames, during which I had served for three and a half years on a 100 tons gross Thames sailing barge, and then moved on to Thames tugs and lighters. It so happened that I was at home when a friend of my father, an owner of passenger craft plying between Westminster Bridge, Hampton Court and Greenwich, telephoned to ascertain my whereabouts. He wanted to know if I was instantly available and if so, would I come to Westminster Pier to take a boat (The *Queen Boadicea II*, 45 tons, length 65 foot, licensed to take 100 passengers) down river to Sheerness Naval Dockyard.

That was all he could tell me, except how important it was to get to Sheerness as soon as possible. He would advise my employers in the morning of the situation, which they would know about anyway. It was soon decided that I should go, so with a bag packed with a few things, off I went. I arrived at Westminster Pier at 1900 hours to find the *Boadicea* with the engineer and mate/deckhand on board waiting for me. We joined a small convoy of similar craft and made our way first to Southend pier to spend the night, and then travel across to Sheerness Dockyard in the morning.

On arrival at the main jetty, seven of the boat crews were escorted to the Commodore's office and briefed as to what was happening at Dunkirk. Volunteers were wanted to help man the vessels to sail there, pick up troops from the shore and then take them out to larger ships which would carry them back to England. (The *Queen Boadicea II* only drew 3 feet, so would be ideal for this operation as long as we could get her there in one piece! - the English Channel can be rather rough at times).

Those who volunteered were sure that it was what we should be doing and arrangements were made for signing on, food etc. Eventually we set off in a much larger convoy for Dunkirk and, thank heavens, the sea was calm; there was no wind and the sky was blue. The smaller vessels and the *Queen Boadicea II* were ordered to go to La Panne, a very shallow beach area north of Dunkirk.

As we made our way towards the beaches, the whole panorama was opening up before us. There was black smoke from burning oil and *godowns* (warehouses) from the dock area and destroyers and other larger vessels were steaming out of the harbour making for England. All the while, German aircraft were bombing and strafing. The noise was frantic and the Stuka bombers, with screaming devices attached to their wings, were terrifying to say the least.

Nevertheless, with luck, we and many others managed to get to the shore. Not right in of course but near enough for the troops to wade out and get on board with the help of the rubber tyres which hung from the guard railings. They were there to prevent damage being done to the side of the vessel when going alongside another (and are still in use today by some).

By this time the area inshore had become littered with the wrecks of smaller craft such as lifeboats that had been caught by the bombing and strafing – to say nothing of the bodies of the unlucky ones. The larger vessels waiting about 1½ miles off shore were unable to sail closer to land and others such as destroyers could not stay still, but steamed up and down to try and dodge the Stukas. This caused a fairly large wash to come rolling inshore which did not of course help the much smaller craft trying to pick up troops. The wash was so large that it was able to tip over the lifeboat type craft right over on their sides – very frustrating.

The *Queen Boadicea II* had an iron anchor and about sixty feet of chain in the usual forward locker. With my sailing barge knowledge I took both items aft of the boat and used them as a dredge or drag anchor. This helped to prevent her being slewed around when the wash from the destroyers hit her.

I must not forget to mention one droll incident when a rather small soldier was trying to get aboard with his Bren gun. At times he was knocked sideways with a wash, which proved too much for him. I tried to help him, and then when he refused, I suggested that he dump his gun! His language had to be heard to believed and he finished by saying " . . . I have carried it for months and I'm not going to let Jerry stop me from taking it back home to Blighty!"

At about this time there was a very painful sight. The launch *Marguerite*, which normally carried 40 passengers, but of course many more on that day, was there one minute and disappeared the next. This was a sight that I will never forget.

How many troops we carried on that first day I will never know. Going from shore to ship was a most harrowing task, but at least the weather stayed calm, which helped a great deal. The Royal Navy personnel were able to keep us fuelled for both our engine and ourselves. There was no water for washing etc, although the crews of the larger vessels did what they could for us. It was a relief to snuggle up to one if possible at night time – although of course the rest did not last for long.

The morning of the 30th May dawned bright and clear and with good news for us. We were dead-beat, dirty, frightened souls and although ready to carry on, were nevertheless told that Royal Navy personnel would be taking over at midday and we would return to Dover on one of the destroyers, the number or name of which I have not remembered.

I believe that nothing will ever happen to help me forget what I saw and did in the last days of May 1940, but I do have one final thought however. I have seen films and TV programmes where the weary troops returning to Dover from Dunkirk were given refreshments by kind ladies of the voluntary services. However we were in civilian clothes and had to buy our own tea and wads from some cafe in Dover!

Note: Alan Spong became a member of the Dunkirk Veterans Association and received a commemorative medal from the Mayor of Dunkirk. He later served in the Indian Engineers in the Arakan, Burma and Sumatra from 1941 to 1947, and was called up as a reservist for the Abrogation crisis in Egypt in 1951. Later, in 1956 he was involved again as a reservist, with 83 Inland Water Transport Regiment RE (AER) in the Suez campaign. The heritage of 83 Regiment lives on, though several reorganizations, in 165 Port Regiment RLC which saw service in Operation Telic *in the war in Iraq in 2003.*

"Nominations with Penalties Required . . ."

LIEUTENANT COLONEL J R WHITE MBE BSc(Eng) MCMI

John White was commissioned in 1976, subsequently attending No 64 Young Officer Course. He has spent most of his Regimental appointments with QGE and RGR, serving predominantly in the Far East until it was handed back. He has written extensively, including a number of articles for the RE Journal *but, due to the generally higher than acceptable levels of inappropriate and offensive remarks and libellous content, has had little published until now. After command of the Civil Affairs Group (now the Joint CIMIC Group) and nine months as Assistant to the UN Special Representative in Afghanistan, he was posted to HQ LAND Command where, for the last 18 months, he has been finding manpower from dwindling resources for an increasing range of commitments. He does however have access to everyone's records of service which can be enormously entertaining!*

As a cadet at Sandhurst in the 1980s (OK, first lie, it was actually the 70s but a sinless and carefree career to date means I can still get away with having to prove my age before buying my wine gums), we were required to attend the Arms Fair halfway through the first term which was for those who had still to decide in which regiments they wished to purchase a commission. Afterwards, the DS gloves would come off as they unashamedly toadied around the most promising future leaders in the hope of bagging a future Marlborough, Wellington or Kitchener (or Sexton or O'Donoghue). I had already decided on a career in the sappers and nothing would move me from this course; the Corps promised six months of YO training during which the ladies of Kent were totally at your mercy and, according to the smarmy talent spotter from ERLO, would do anything for a first edition Royal Engineers Pocket Book as they queued nightly at the gates of Chattenden Barracks. There was also the opportunity to use your training in basic knots and lashings and obsolescent pumps and generators to save the planet in a variety of ways, an option to which I was immediately attracted. There is still a small village in Fiji which thanked me eight years later in a particularly Fijian way for my contribution to the continuance of their gene pool.

The Gunners enticed you with a poorly zeroed Blowpipe simulator and there was no shortage of potential cloud-punchers who frustratingly just missed the target then signed away the rest of their sorry lives in the hope that they could have another go (they couldn't of course as the one simulator was always on the road drawing in more sad recruits to the Royal Regiment). The RAC played dirty with a selection of staggeringly beautiful mess kits on display and there was a story doing the rounds that the opening lesson on the RAC Troop Commanders' course ran along the lines of, "Good morning gentlemen, behind me is a Chieftain Tank; you may now have a smoke break." Few wanted to join the infantry in those dark days as it promised only countless tours to a place called The Province, when not exercising on Salisbury Plain in ageing FV 432s (yes, they were ageing in the 70s too). A fellow cadet, however, who had come from Woolwich, where after six months indoctrination he was destined for the Royal Artillery, went on to join his local battalion and became one of the most decorated soldiers of our generation (in fact he's standing behind me as I write wondering why I'm not getting on with my work).

Even the REME offered "Good Times, Good Money and Good Mates" though as these incentives seemed to be available only in the rain in Soltau whilst trying to change a Chieftain power pack, bent by a chain-smoking subaltern in the Hussars who appeared to have learned nothing from his training and in any case had a party to go to, they drew little interest . . . though not as little as the officer at the end of the corridor.

Tucked away beyond the one ladies bog in New College, in a small room called "No Smoking" (and therefore likely to attract nobody in particular) was the stand of the Royal Pioneer Corps. I do not know to this day why I ended up there but maybe some divine influence was at work and planting in my inner psyche the embryo of this account, an embryo which, after some 30 years of growth, is about to emerge through the birth canal of the *RE Journal* and finally get to the point. I remember the officer of Pioneers as a sallow looking youth with the unfortunate combination of red hair, matchless enthusiasm, green barrack dress trousers and spots. Eschewing the flashy simulators and video clips of men in battle, he had a shovel and pick axe laid interestingly on a 6ft GS table which held up a photograph of some Chunkies filling sandbags, interestingly. And this is what he told us:

"We provide the Army with its most valuable commodity: manpower!"

Silent, awestruck and biting our tongues to avoid the inevitable, we filed out, straining to remain composed long enough to be out of hearing. Not to be, as the first giggles

slipped through before the last man was out and then we ran, mimicking the speaker, until all memory faded in an orgy of exercises, drill parades, haircuts, TEWTs and range days . . . until yesterday.

Yesterday, in response to a question from upstairs, I provided my inquisitors with the information that, in the last 12 months, LAND Command (not the Forces nor the Army, just little old LAND Command) had provided manpower to the tune of 3089 augmentees to operations, exercises, Short Term Training Teams, training establishments (including temporary staff for BATUS) and other commitments worldwide that took the nominated individuals away from their current appointments for periods ranging from a few weeks to nine months. So in 2004/05 there were, at various periods, 3089 blokes not commanding their squadrons and platoons, not concocting new and exciting recipes in their own kitchens, not conducting Level 3 Collective Training in their own Battle Groups nor running the Brigade mortar concentration, not marching up and down The Mall, not commenting on staff papers (hmm . . . where do I find one of these jobs?) and, as some of the blokes were birds, not putting the kettle on. These 3089 were also not going home to their families in the evenings, despite having been on a six month operational tour the year beforehand and when they get back (or if the family is really lucky, while the head of house is still away) the Battalion will move to another country apart from those who are trickle posted to another regiment about to embark upon another commitment.

Activity	Regular	TA/Res	Total
Op *Telic*	1154	400	1554
Op *Oculus*	183	109	292
Op *Herrick*	96	21	117
Other Ops/Enablers	82	10	92
BATUS Temp Staff Etc.	697	0	697
Exercises	319	18	337
TOTAL	**2531**	**556**	**3089**

The Augmentation Bill for 2004/05.

Adjutants will be familiar with the title to this piece and probably felt their bowels tighten in a familiar yet still uncomfortable way as they read it. In order to find 3089 blokes a year we "Trawl the Command" and, where we don't have the volunteers for these plum jobs, we ask for "Nominations with Penalties". There was a time when the trawl was a rare event as, apart from lobbing time-expired compo at Balkan refugees, getting bombed by Fenians and deploying vast numbers of jolly Guardsmen to some of the more acceptable areas of the capital, there was not much else on the agenda. Thus we had visits and rehearsals for visits, regurgitated outdated justifications for unaffordable new equipment programmes, went to meetings and commented politely on doctrine; all a million miles from the core business of running round with guns and bayoneting the Queen's enemies. Occasionally trawls would arrive in the Adjutant's office seeking volunteers for another six month cull in Bongo-Bongo Land and we fell hungrily upon these like pensioners round a packet of Werther's Originals.

Posted to a particularly round hole in HQ QMG (my own fault as they were prepared to settle for a square peg, though not as much as I was prepared to settle for the promotion) it took me until NAAFI Break on Day 2 to realize I needed help. At that time there was a friend in court in the Operations Division in HQ LAND. To preserve anonymity, we shall call him Frank because I've always wanted a friend called Frank (though his real name was Ty and he has since gone on to write countless articles for this same Journal, almost rivalling that other great man of letters, Matthew Whitchurch who, incidentally, has still not returned the tin of Brasso I lent him when we were recruits in No 1 Training Regiment . . . or did he lend it to me?). Anyway, Ty (or Frank) had a portfolio of jobs that needed filling, ranging from 10 days working in EXCON on a SEATO exercise in Bangkok (plus acclimatization and herbal assisted massage) or a couple of weeks picking up the brass in Angola to a full six month deployment to Georgia and any number of training teams or, that great military catch-all, "liaison" appointments, in between. There was a snag however and it was that no matter how sad and unfulfilled you felt in your current appointment, no matter how unattractive the people you worked with, nor well qualified in terms of ability, experience, language fluency, cultural adaptability and up to date vaccinations for this trawl which had your name all over it, you needed the approval of your superior officer and he would try to dress up the "No" word by giving you even more papers to comment upon or minutes to write as you clearly had time on your hands. The good news is that all this has changed as the scope, duration, geography and variety of these jobs has increased by a factor of 3089 divided by whatever it was before. The bad news is also that all this has changed by the number of people evidently available and something clever and arithmetic with the figure 3089. But do not despair (we will do that for you) there is a way out.

Every trawl concludes with the advice, "Notification of a volunteer will stop this trawl." What that means is that, if we at HQ LAND Command get the faintest whiff of someone who fancies himself in wrap-around sunglasses acting as OC Butt Party in Fallujah or any other of the career enhancing appointments on offer, the job's as good as yours. No matter how many Staff Requirements require to be staffed or Brigade Study Days need studying, no matter if the plan for British Army 2010 has to be slipped to 2011, this 4-Star HQ with its brass-necked Staff Officers and balls of steel will overrule any penalty statement if we hear that there's someone out there who wants to make a meaningful contribution to UK Foreign Policy.

And if all this fails, then somewhere out there is a Pioneer officer, presumably still touting his mantra though his Corps was long ago consigned to a diorama at the RLC Museum. If only I could find him and maybe apologise for my earlier boorish behaviour, then at least I would be some way to meeting the bill for next year.

. . . notification of a volunteer will stop this trawl."

A Day in the Life of a Would-be Signals Officer

COLONEL E J SHARP FICE FASCE FCMI

EARLY in 1952 I was serving as the adjutant of an Engineering Regiment of the Wessex Division and like many others of my age-group at this time I volunteered for service in Korea. Having submitted the paper-work, I heard no more about it and quite forgot that I had done so. In the autumn of that year I met a rather charming lady and became quite besotted with her. Whilst totally inexplicable to me, this lady has graciously stayed with me as my wife for the over fifty years. To cut a long story short the Archdeacon married us in a Side-Chapel in Bath Abbey in early 1953. Shortly after this: about three weeks as I recall, I opened a brown paper envelope. This announced that the War Office had designated me as a "battle casualty reinforcement": a status that meant one was on very short notice to proceed to filling such an eventuality. In my case three weeks!

After seeing a theatre show, we spent our last night together in London. The following morning she came to see me mount the back ofa three ton "troop carrying vehicle" and be transported to Stansted Airport. Four other soldiers were in this party, and we flew first-class in the bomb bay of a Wellington to Japan. The crew were awfully decent and explained what we had to do if the doors opened accidentally! As I recall the journey took five days. In the process, I realised what an advantage it was to have an Empire. Without this asset, we would not have been able to land every four or five hours to refuel the aircraft. I recall we landed at a US Airforce Base: Clark Field in the Philippines. The Americans were very kind to us and gave us a nice meal under the trees. I was at the end of the table, and I recall a waiter putting a T-bone steak in front of me. Never before had I seen one, and I did what I supposed the waiters required of me. I cut it into five pieces. This action horrified the waiters, and they placed a similar mountain of meat in front of each of us. I think at the time the meat ration at home was three shillings and sixpence a week. The next day, we took off for Hong Kong. It was of course before they had built the long runway extending into the Bay. Sadly, the wind was in the wrong direction and we had to return to Clark Field. Yes! You have guessed it! We were each given another T-bone steak.

Shortly after this and without going to the Divisional Battle School at Kure, I arrived at HQRE in The British Commonwealth Divisional Headquarters. The Adjutant explained to me that I was due to replace an old friend from our Assault Brigade days: Captain Philip Crofton, in 12 Field Squadron. Sadly, while trying to defuse one of the American M6 Antipersonnel mines, it exploded and killed him. If one cut the tripwires they detonated, and the same thing happened if one pulled them. Three times the armies fought over these particular minefields. Back to Pusan; forward again and finally back to the "Jamestown Line". I then discovered that an old friend Walter Moorhouse: the Regimental Signals Officer, had sought and obtained the approval of the CO, Colonel Arthur Field that he would get the next troop commander's job available. That left me the job of: " What! RSO!" It is true I had been some four years in 42 Aslt Engr Regt. I have deliberately used abbreviations because they are what they correctly were in my days. The word assault is especially important too. In those days The Army Commander's concept of a battle plan was: The Break-In; The Dog-Fight on the Obstacle; The Break-Out and the Pursuit and Advance to Contact. Whoppee! Chaps!

By good fortune, the Regiment had the blessing of a first class Royal Signals Staff Sergeant. The Regimental 2IC: Mike Rolt said "you won't be able to do too much harm with such an expert in the offing". Then came the acid test! In my jeep I was going towards 12 Field Squadron's location. On a lonely stretch of the Brigade Supply Route there was our CO, berating his signaller because the No 19 Wireless Set in his jeep had ceased to work. As he saw me, his face lit-up with relief. "Sharp!" He announced. "It looks like I am having a little trouble here. Sort it out will you". I thought of all my options to save face but there was still a mile to go before I could surrender to the Chinese. I had no alternative but to demonstrate my prowess. Perhaps I should reword that sentence. But Providence did not abandon me after all. There was a highly complicated procedure for identifying dud valves. Switch to send and note the meter reading: then you do 'X' and then you do 'Y', and after a series of these complex actions you can identify the non-functioning valve. I am not the sort of chap to master such intricacies, I never could, nor was I able to so on this occasion. But! And an apodosis is appropriate here. This is always why a decent chap like me can evade justice. I did remember a friendly lance-corporal explaining to me that a dud-valve was always cold. I performed three quick genuflections and gave a nod in the direction of Bethlehem, and then plunged my hand into the set. The Duty Archangel led my hand to the cold valve. I replaced this with a similar one from the reserve box, and with ice-cold *sangfroid* I handed the working mike to the CO. This delighted him and thereafter he spoke very highly of me. Thirty years later, on my being appointed a director of Taylor Woodrow, he sent me an excellent reference. At my initial reception after arrival, I recall the company Chairman saying: "I am not quite sure where we can send you to benefit from your quality of being "very cool-under-fire, but I am sure something will occur".

Shortly after this incident, the OC of 12 Field Squadron, Major Jimmy Grice (the erstwhile Training Major of the TA Regiment of which I was the Adjutant), summoned me to his presence. Sometimes in this life, one does get lucky. 12 Squadron was supporting the Commonwealth Brigade, and, at this time were responsible for "Hill 355". This was on the extreme right flank of the Division's position and Eighth Army designated this as "Vital Ground". To the west of this was a feature known as "The Bowling Alley". Beyond that in an Easterly direction was the sector of The Canadian Brigade. Somewhere between the Commonwealth Division and the Chinese positions, was an important barbed-wire fence known as "The Million Dollar Fence". I never saw it in the daylight but it was very high and very wide. This feature influenced

much of the night-time patrolling. Jimmy Grice wanted to arrange a track through the minefield controlled by a circuit of electric fused mines that one could switch on or off: not unlike controlling lights from either end of a passageway.

The plan was that I was to accompany an infantry patrol out to the site to get an idea of what the task could involve. If I remember correctly, there were about five infantrymen; a dog handler and a dog plus me. This was my first and only patrol. At some stage near our destination, the dog started to shiver and shake very badly indeed. Seconds later, without my hearing anything at all, I saw a waist-high semicircle of flashing lights. The dog-handler and I dropped behind some rocks. The Chinese killed all our lads and we could hear them talking as I imagine they searched the bodies. Shortly afterwards they disappeared and reacting intuitively we started our return journey. In my inexperience I had not noted the details of our route out and could only head back in the general direction of our own lines. I somehow sensed we were approaching our own positions and I whispered to the dog handler. to walk slowly and upright immediately behind me. In the same way by a sixth-sense the old dog had noted the situation, and was also aware we were closing in to our own lines. A voice suddenly called-out: "ALT". So we "ALTED". I also heard the working parts of a machine-gun being cocked. I now knew we were only one ounce away from destiny. The notion of word pronunciation went through my mind and I called out: *"Je suis officer Anglais"*. The French Mistress of my old school would have been proud of me. It had to be the French Speaking Canadian Regiment: The Vingt-Deuxieme Regiment. The Canadian Royal Twenty Second Regiment. *"Avance:"* came the next command. Thus very slowly we inched our way forward standing bolt upright. The next second I recall being flat on my back. Now I have been rugger tackled by quite a few experts, but nothing ever like this. I recall once during the War being allowed to play for Blackheath 'B' Team against London Scottish. As we were changing in the same room before the match I remember telling them in high good humour that my family named me after "Edward Primus Malleous Scotorum": Edward The Hammer of The Scots". I recall with puzzlement my surprise at their stern reaction. From that experience I thought I knew all about being tackled. However. as the *"Vigne-douze"*: as we knew them, became satisfied we were who we claimed to be, they removed the trench knives from our throats and were quite amiable towards us. The Adjutant, Don Wright, sent a jeep for us and I recall being quite hungry. But that was the end of that!

A General Introduction to the System of Total Quality Management for Managers in the Professions

MAJOR M A NAPIER MSc FICE FIMechE

Major M A (Choke) Napier served in the Royal Engineers from 1943 to 1947 in the UK, India (Bengal Sappers and Miners), Malaya (Operation Zipper) and Burma (Flush Force). From 1952 to 1954 he was an engineer at the Atomic Weapons Establishment , Aldermaston after which he joined MEXE at Christchurch as a civilian project officer working on various equipments, particularly the Chieftain AVLB (See the RE Journal, June 1978).
In 1970 he became a member of The Defence Quality Assurance Board Executive, being promoted in 1974 to Director of Quality Assurance (Fighting Vehicles and Engineer Equipments). In 1978 he transferred to the Ministry of Defence Headquarters as Director of Standardization and Chairman of the Committee on Component Standardization in NATO. He retired in 1985, but continued in private practice until 1992.

Introduction

Fundamentals

Ruskin said, long before the advent of either the American or Japanese gurus:-

"Quality is never an accident, it is always the result of intelligent effort; there must always be a will to produce a superior thing."

Quality should not be equated with excellence but with fitness for purpose or customer satisfaction. A frequently quoted example to illustrate this point is the fact that a Rolls-Royce is superior in comfort, speed, longevity, esteem, etc. to a Mini, but not as far as fitness for purpose is concerned. They have different purposes of course, use as transportation being one they have in common.

The definition of quality is the totality of features and characteristics of a product or service that bear on its ability to satisfy a given need and the definition of quality assurance is all activities and functions concerned with the attainment of quality.

Total Quality Management is a management philosophy that provides an efficient and cost-effective service which satisfies the needs and all the expectations of the customer while providing a safe system of work which minimizes the impact on the environment. In achieving these twin objectives it maximizes the potential of all employees in the endless search for improvement. The participation of all staff in an organization is vital if real quality is to be achieved.

The existence of a special quality department is not an essential pre-requisite for the achieving of quality. In fact it can prove to have malign effects if it causes anyone to believe that quality in any area of operations is not the sole responsibility of those who work there or have influence in that area. Everyone in any organization is both customer and supplier in a chain of events, any one of which has the potential to damage the final product or service or to reduce the profitability or cost effectiveness of that organization.

Total Quality Management

Total Quality Management is all those activities which are necessary to ensure that the finished job is fit for its purpose as specified; the brief or specification may well be incomplete at best or actually wrong at worst and this creates considerable problems for quality assurance during the progress of the work.

Clarification of doubtful clauses in the brief or in the case of construction, the specification of the requirements, is an essential element of Total Quality Management in that area.

It is very important that drawings/specifications be carefully studied to determine what all the consequences will be to satisfy the client's expectations on life, durability and full-life cost. Only then may pricing/tendering take place on a basis of fair competition. There will always be an optimum tender or selling price to ensure quality since, if the cost is too high, the purpose may have to be re-examined by the client or customer.

In the case of mass produced articles, then it is selling price which is meant; if the cost is too high the customer may go elsewhere. Market research must contribute to price fixing.

What is the scope of Total Quality Management? It applies to all the activities of the enterprise whatever the nature! Where a person is in any way responsible for the actions of other people or machines, then there is a need for Total Quality Management.

All the biggest organizations are using it, be they industrial, commercial or service. Purely professional practices are now introducing it whether they are scientific, medical, legal, surveying, architectural or technical.

An old Chinese proverb states :-

"Success has many fathers but failure is an orphan"!

The most important element in the achieving of lasting success is the utilization of people to give of their best. The staff of any enterprise are its most important resource. It is vital that all realize that their participation is necessary and also that there will be a father identified in the case of failure because personal accountability is a feature of Total Quality Management.

The quality programme should be based on a plan of action; one such may be summarised as **A PACKAGE.**

A	Aims
P	Planning
A	Attitudes
C	Criticality
K	Knowledge
A	Accountability
G	Government
E	Economics

AIMS

Objectives

IT has been well said that :-

"Aiming for high turnover is vanity whilst aiming for greater profitability is sanity!"

Increasing profits must be the principal objective of companies wishing to survive and grow to increase their share of current existing markets and hopefully develop new ones. Non profit-making organizations may interpret this part of Total Quality Management as offering a greatly enhanced service for the same cost.

Mission Statement

THE objectives of an organization should always be made known to all people who will be expected to participate in the successful achievement of them. The way this may be done is by means of a mission statement. This should be short and to the point and communicated to all. Separate, more detailed and specific, statements will probably be required for the constituent parts of the larger organizations.

Business Plan

THE Training Agency has stated that:-

"A good business plan is essential because, if you can't see where you want to go, how can you expect to get there?"

One will also be necessary when approaching financial institutions or government agencies for support where desirable. A good business plan will commence with the mission statement of aims and objectives and then develop how it is intended to realize them. Next, a review of past growth and performance is instructive in order to see what lessons may be learned from past success or failures, which often give more significant information.

Staff training and general education requirements, bearing in mind essential skill levels needed for the type of work to be undertaken, should be set down in the plan and the key people identified. The appropriate organizational structure, with levels of personal responsibility, must be specified formally.

Product/Service development plans should be prepared well in advance of their expected need. Other requirements include market research, profitability and cashflow forecasts and an analysis of the competitor's performance.

Quality Strategy

THE most likely successful path to realize these stated aims is the formulation of an agreed strategy for quality management.

The first and most essential requirement is a total commitment to the concept by the board of directors or other controlling body. This commitment, once established, has to be conveyed to all senior managers who in turn have the task of ensuring that it is accepted policy throughout the organization. Business plans are one way of stating the part Total Quality Management will play in achieving the objectives. Other manifestations will consist of the documentation and records which will constitute the quality manual. Amongst the most important of these is the introduction of quality cost controls and proposed targets.

PLANNING

Strategy

STRATEGIC planning consists of a consideration of such matters as the competitors' record of success and their plans where these can be ascertained, targets for achievement in a dated programme and the types and levels of skill which will be necessary to carry out the programme. For example, one area which will repay careful scrutiny is that of customer/client relations. If the object of the enterprise is to satisfy the customers, then their expectations must be determined with a fair degree of certainty. Market research is an area of the greatest importance.

The structure of the company or other type of organization need not be conventional but must be suited to the type of work undertaken with all staff knowing the inter-relationships and their own responsibility within it.

Projects

THE team approach in manufacturing and construction industry has been shown many times to be the most cost effective. Teams assembled for particular tasks with clear responsibilities for estimating costs, co-ordinating all the various aspects of the work and setting up a sound communication network will achieve the objectives most effectively. Delegation of responsibilities should be recorded to prevent misunderstandings and permit traceability of instructions in the event of error.

Quality Plans

A QUALITY plan is a document drawn up for any new product or project to permit prior thought being given to the best way to bring it to a successful profitable conclusion without large maintenance or servicing problems after purchase, in the case of a product, or after hand-over for the construction/service areas.

All quality plans will be based on the quality manual which organizations should use, either to comply with requirements of a registration agency where relevant, or simply because it is

good practice. Quality manuals set down an organization's policy with respect to quality, documentation to assist in its attainment and records to ensure that progress is monitored.

Any quality plan relies on the manual to avoid needless costly repetition of standard procedures and forms. Audit of the organization's own activity is a vital on-going part of a quality plan and of perhaps even more immediate interest will be the audit of external suppliers detailed in the plan. No situation in human endeavour is ever static and in an ever changing world, periodic review of methods, procedures and skills is necessary to ensure success in customer satisfaction terms and cost-effective management.

The most important resource in the organization is people and their successful employment as set out in the plan depends crucially on attitudes; attitudes of the management and the consequential attitudes engendered in the staff and clients.

ATTITUDES

Motivation

STAFF will be motivated to give of their best provided certain conditions are satisfied and practically all of them are the management's responsibility.

Firstly there has to be a measure of participation in decision making by staff at all levels, even the lowest where that would be appropriate.

Secondly, fair consideration and reward for everybody's effort should be apparent to all.

Thirdly, a total commitment to the concept of Total Quality Management by the hierarchy of the organization is not only presented to the staff but is actually believed by them.

Fourthly, the information which is necessary realistically to discharge their own tasks and other related tasks is made readily available so that all can understand their position in the scheme of things and so gain a large measure of the job-satisfaction from which the work will benefit.

A policy of "need to know" is today generally discredited. In the past such a policy may well have been employed to conceal some incompetence in management or for security reasons.

Commitment

THE nature of Total Quality Management is such that a total commitment from chief executives is a pre-requisite if there is to be a realistic prospect of a successful introduction of the system. The next vital step is for the chief executive to persuade the board of directors or other ruling body, that the best hope for the healthy future of the organization lies in this course of action; a half-hearted approach is worse than useless! Once the top management accepts this enthusiastically, then the remainder of management must be brought into the scheme and given the task of encouraging participation by the whole workforce.

CRITICALITY

Anticipation

PROBLEM areas may arise in any phase of an organization's task and good management requires a timely recognition of their occurrence and, perhaps more importantly, the likely or the possible consequences.

Where the consequences can exert a disproportionate degree of financial risk it is common sense to plan contingency courses of action. This is undertaken during the preparation of the quality plan with potential problem areas analysed and proposed solutions set down in the plan.

Methods for the preparation of quality plans are adequately covered in the quality assurance literature; they must be based on the organization's quality manual.

High-Risk Areas

MANY managers enjoy the challenge of "crisis management" as it is felt to be a proof to their superiors of their worth. All it proves is a lack of contingency planning!

Genuine unforeseen circumstances do of course occur but they will be more effectively dealt with if the system is not overloaded with predictable problem areas.

The parts of a project in which the greatest risks are to be taken are obviously critical and deserve greatest attention.

Certification

IN order to ensure that the integrity of the organization's own work is not compromised by the failure of 'bought-in' items, an insistence on the use of certified items from suppliers who have been registered by an accredited certification agency, is the best course of action.

Anticipated criticality in a supplier's item requires close liaison between the quality staff of both organizations.

KNOWLEDGE

Information

NO system of quality or any other aspect of management can achieve success for an organization if the basic knowledge and skills of the staff are lacking and this requires an adequate flow of relevant information. This self-evident fact will be ignored by the organization at its peril.

Probably the most important single requirement in a programme for success is the provision made for continuous training to ensure and maintain a level of knowledge without which there cannot be long-term profitability.

Apart from training in the particular relevant skills of all staff, a knowledge of the requirements of quality assurance is now becoming essential.

Training

STAFF when recruited will be expected to possess an education standard appropriate to the kind of work to which they are assigned.

The belief that after this staff can keep up to date by their own volition is nonsensical. A suitably structured training programme has been an essential feature of all successful companies world-wide for many years.

The appropriate knowledge package for all grades of staff, and this must include managerial grades, should be determined in consultation with the staff to whom it applies but controlled by a member of management at board or equivalent level.

Training requirements should be determined by means of an appraisal and evaluation of the work carried out by individuals.

Communication

COMMUNICATION skills are essential, particularly for the senior staff, but many junior grades will give a better performance if they can express themselves adequately, both in speaking and writing.

Dissemination of information is an important element in modern management and the philosophy of "need to know" as a control of sensitive information, must be applied very sparingly indeed.

Quality Assurance

INFORMATION relating to an organization's quality programme, such as operating procedures and work instructions, should be contained in the quality manual.

In the many publications on quality assurance readily available from a variety of sources, may be found advice on how to create the quality documentation; all the tools used for activities as diverse as measurement/inspection and cost control are also amply covered in the general literature.

It is desirable in most cases for organizations to aim for assessment and registration in accordance with a quality standard, (e.g. ISO 9000) by a body certified as acceptable to carry out such activities. This will be an agency accredited by the National Accreditation Council of Certification Bodies (NACCB). Such agencies are BSI, Lloyds, Bureau Veritas, Yarsley, etc., who may all be approached for a preliminary opinion on the likely time-scale for an assessment.

A new standard for quality assurance in the service industries is available but this is purely a guidance document and is not intended to be used in assessments. In the same category is a standard for Total Quality Management.

There is some opinion in the construction/service areas which expresses an aversion to the use of any standard which is seen as being intended primarily for the purpose of the assessing of manufacturing organizations, in any of the non-hardware areas.

However in both the construction and service industries it has been found that in many cases the discipline of preparing for a ISO 9000 assessment makes the introduction of a Total Quality Management system very much easier and acceptable to the operatives.

ACCOUNTABILITY

Responsibility

IN order to make a person accountable for any task, then that person must have full responsibility. Shared accountability or responsibility is almost impossible to manage.

This fact is reducing the occurrence of a post entitled Quality Manager since persons in such a position cannot really manage quality as others in line-management must have that ultimate responsibility.

However there will always be a need for a co-ordinating role in Total Quality Management and a very senior person, with free access to the most senior person, must be appointed to this responsibility. One function of this post will be to ensure that all staff are aware of the corporate strategy for quality and the records and other documentation to support it.

Job Descriptions

THE only way in which accountability/responsibility can have any real meaning is for staff to know exactly their role, what is expected of them, to whom they report and who reports to them. A family tree showing levels of control must be created and maintained in an up to date condition. Reward and renumeration should reflect levels/roles. The the preparation of job descriptions will therefore require considerable thought and effort particularly for those posts which have to span departmental boundaries.

Customer/Supplier

ALL staff should understand the concept that everybody, in an organization with a range of activities, is both customer and supplier since he/she is a link in a chain. He/she must ensure therefore that the customer is satisfied with the work passed on as that is what they expect of their internal suppliers to their particular work-station.

Quality Failures

QUALITY failures are easier to determine in manufacture since scrap, down-time, re-work, etc. are all too apparent. However in the service sector a qualitative assessment of failure has to be made by means of an analysis of the organization's loss of credibility in its market place, leading to lost orders, the possibility of costly litigation and a demoralized staff force.

GOVERNMENTAL INVOLVEMENT

UK's Decline

In the early 1980's the government of the day became seriously alarmed at the decline of the manufacturing sector in UK.

As a result, a Cabinet Committee was set up to produce and issue an official White Paper No 8621 (1982) entitled:

"Standards, Quality and International Competitiveness"

The combination of these four words is significant as stress is placed on the importance of standards in world markets and the Government's determination to enhance the status of standards and quality assurance in the United Kingdom.

The aim was to increase the efficiency of British Industry and thereby strengthen its international competitiveness.

The intention was announced by the Secretary of State for Trade in the House of Lords on 7 June 1982.

The Remedy

THE purpose of the white paper was to explain in some detail the Government's views and the background to them. Success in world markets increasingly depends on a supplier's ability to satisfy customers on non-price factors as well as price.

Quality, which embraces the fitness of the product or service to meet throughout its life the customer's expectations (design reliability, ease of maintenance, safety, energy consumption, other environmental considerations particularly those which flow from regulatory requirements) is usually the first issue considered in purchasing decisions.

As a result of the foregoing, the Government has been actively encouraging public purchasing authorities to participate fully in standard writing and to require tenderers for all public contracts to observe the requirements of the quality assurance standards in particular. In view of the agreements

which the UK had entered into with its EEC partners relating to 1992, the emphasis was placed on the need for international standards such as the ISO 9000-9004 series.

Health and Safety

THE Health and Safety legislation requires procedures for safety in the work-place which run parallel with the same type of requirements for quality assurance. Total Quality Management has much to commend it in those parts of Industry where danger is a fact of life.

The EEC in 1992

THE EEC legislation with respect to matters such as product liability and construction materials are covered by various directives, which are already having an effect in UK and will be a more important factor as the Community enforces the provisions in the future. For example, the product liability directive of July 1985 should eventually make producers and importers liable for damage caused by defects in their products. Negligence will not have to be proved. Eurocodes could become mandatory for public works covered by the public works directive.

Enterprise Initiative

THE government through the Department of Trade & Industry, is actively promoting support for the manufacturing and service sectors of Industry in a number of important respects.

These initiatives are being run on a day to day basis by a term contractor which currently is PERA International. The main benefits are financial assistance in certain well defined cases for consultancy from experts in a number of areas, notably the introduction or improvement of quality systems.

ECONOMIC CONSIDERATIONS

Quality/Time/Cost

John David Stanhope has been quoted as saying :-

"The bitter taste of poor quality remains long after the sweet taste of low price is forgotten ".

Quality, time and cost are frequently thought to be mutually dependent in as much that each has to be traded off against one or both of the others. Time consists of two elements; the time to make and the time to use (life). The latter introduces a consideration of costs of sustaining an item/service by maintenance or repair (whole-life cost). In arriving at the economic price for the item/service, the appropriate level of quality, time to carry out, desirable life span, if relevant and cost to carry out, will all have to be given due weight.

In fact there are optima values for all of them but different perceptions of those optima values will exist in practice. The customer requires quality which includes an acceptable life span; the provider wants a high price to maximize profitability and so it would appear that these positions are irreconcilable.

The application of Total Quality Management will permit satisfaction of both by increasing profitability without reducing quality standards.

Total Quality Management Contribution

THE Institute of Cost and Works Accountants has stated that the costs of quality conformance consists of prevention, appraisal and failure costs; if the first two are less than the third then the quality system is cost-effective.

Prevention costs consist of planning, process control which can cover design, inspection, testing, proving, etc.; appraisal costs are evaluation and acceptance testing and failure costs cover scrap, re-work, re-appraisal, loss of business, repair and unplanned maintenance.

The contention that the application of Total Quality Management will alleviate this situation is based on an analysis in Industry of all the levels of failure costs, which may be as high as 70 per cent of the total quality costs, against figures for appraisal and prevention of only 30 per cent. When quality costs can be 15-30 per cent of turnover whilst the profit margins are less than 8 per cent, it is apparent how satisfaction all round can be achieved.

In a Total Quality Management situation, process cost models would feature in the planning phase of any project. The relevant British Standards Institution Standard on this subject identifies five categories of cost element:-

People, Equipment, Material, Method, Environment.

Each should be shown either as a cost of conformance or of non-conformance and the source of the data recorded; they may be actual or synthetic (notional).

CONCLUSION

Benefits

IN manufacturing industry the benefits of firstly Quality Assurance and then Total Quality Management have received widespread acknowledgement and acceptance. In the service industries this state of affairs has taken longer to achieve. However since service activities are more closely involved with the customer, then the prevention aspects of quality assurance assumes a more immediate nature.

Each operative is dealing with the real (paying) customer and must be his own inspector to ensure customer satisfaction since remedial work or rectifying omissions creates a poor impression when witnessed by the customer; Total Quality Management is at its most relevant in such situations.

In the construction industry there is still some resistance to the whole concept of quality assurance and registration to a standard; it is often ill-informed and mis-guided. Several years ago the Construction Industry Research & Information Association published their Report 109 on Quality Assurance in which a contractor recorded one company's experience:-

"Was the quality assurance worthwhile? From the contractor's point of view the answer was yes, although the implementation of the quality plan was at times frustrating, because of minor delays to the work while documentation was being processed. However, it did save time and money, probably because it became necessary to look at things in a logical way and plan ahead before commencing any work.".

Royal Engineer Support in Public Order Operations

CAPTAIN M TREFFRY-KINGDOM BA(HONS)

After completing 132 RE Troop Commander's Course, Captain Mike Treffry-Kingdom served with 1st Armoured Engineer Squadron as Support Troop Commander deploying to Bosnia in September 2002 on Operation Palatine/Oculus. *In March 2004 he moved to Northern Ireland on Operation* Banner *and took up post, first as Operations Captain for 25 Engineer Regiment, then as Operations Officer for 43 Headquarters and Support Squadron. During his time in Northern Ireland he has worked at almost every level with regard to engineer support to public order operations, including as a Battalion Group Engineer in both Londonderry and Belfast. A keen mountaineer, he was recently selected for the Army Mountaineering Association expedition to climb the West Ridge of Mount Everest in 2006.*

Introduction

During the recent riots in Belfast following the re-routed Whiterock Parade, (described by the Chief Constable of the Police Service of Northern Ireland as some of the worst rioting the UK has seen), I found myself stepping out of a Snatch Land Rover as Battalion Group Engineer[1] to the Commanding Officer of 1 CHESHIRE. Within minutes of arriving at the location of one of his companies (who had recently shot a rioter armed with a crossbow), we faced a hail of bricks and bottles from the Loyalist crowd. Little did I expect upon arriving in province last year that I would find myself diving for cover as a blast bomb went off where I had been standing only seconds before. Looking at the bullet holes in the side of the vehicle, I found it hard to believe that until recently we thought public order operations like these were a thing of the past! though at the same time, British soldiers deployed in Iraq were also facing a similar barrage of missiles and petrol bombs. It seems to me that public order operations are definitely on the up!

Having never been involved in public order operations prior to my posting to Northern Ireland, I endeavoured beforehand to read up on the subject. Whilst there was some doctrine on the conduct of infantry public order operations, I was surprised to find little in the way of formal doctrine or guidance on the conduct of Royal Engineer support to them. Whilst there are some similarities to traditional war-fighting engineer support, with terms such as counter-mobility and mobility, there were enough differences to warrant a steep learning curve! The majority of techniques, tactics and procedures for engineer support have been locally developed over the past thirty years with the knowledge slowly disseminating to the rest of the Corps through the migration of personnel and the rotations of the Roulemont Engineer Squadrons.

This article follows on from one written for the December 2001 edition of the *Journal* by Maj A G Jackson which was entitled *"RE and Public Order Operations"*. It should be read in conjunction with this one and it provides a review of many of the theoretical aspects behind public order operations. It is my aim to cover in more detail the process by which we provide support to these operations, discuss how this support may be required in world-wide operations and conclude with an argument for the transfer of this capability to the rest of the Corps. The basis of this article is a paper recently distributed to all RE units from 25 Engineer Regiment entitled, *"RE Support to Public Order Operations"*, which was an early attempt at distributing our knowledge with regard to engineer support in public order operations.

Public Order Operations

Firstly, when discussing public order operations it is vital to understand what is actually meant by the term. It is interesting to note that I could not find a single "official" definition, though as a staff officer at Headquarters Northern Ireland[2] recently stated, *"well we all know what it means . . . don't we?"* For this article I intend to suggest and use the following definition:

> *"Public order operations are those military activities that seek to contain, disperse or separate persons engaged, or likely to be engaged, in acts of public disorder."*

For many public disorder is seen as rioting, as recent events in Belfast have demonstrated, but it could also mean demonstrations and protests, e.g. G8 Summit protests in Edinburgh.

Increasingly we are now witnessing a growth in public order operations outside the UK. Operations in Afghanistan, Cyprus,

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[1] In Northern Ireland Battle Group Engineers work for Battalions as opposed to Battlegroups, hence the change in title.
[2] Headquarters Northern Ireland is a 3-star HQ which oversees all military operations in Northern Ireland.

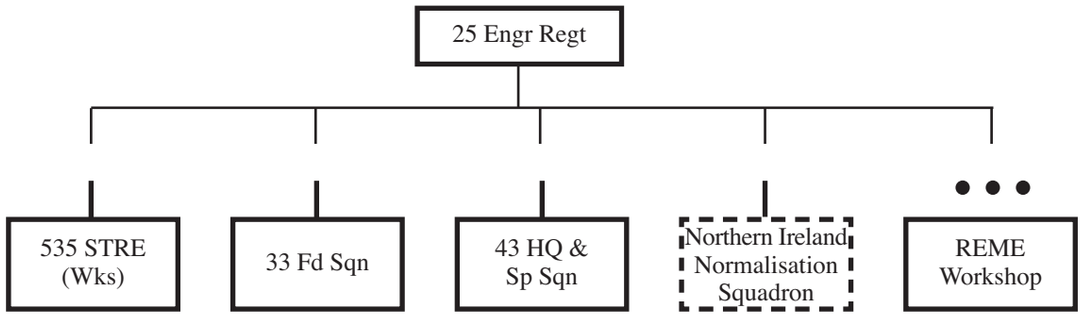

Figure 1 – 25 Engineer Regiment ORBAT.

Iraq and Kosovo, have all necessarily included public order in their spectrum of conflict. The United States Marine Corps study into the 3-block war concept[3] suggests troops can be undertaking a range of operations within the close proximity of a city block, with full spectrum war-fighting, peacekeeping and delivering humanitarian aid all happening concurrently. I would suggest this could now also include public order operations. In the turbulent states of Iraq and Afghanistan, public disorder can often be a prelude to more violent and lethal contacts. It is fair to say that public order operations may be required at any time and in any theatre. If this is the case, (and the empirical evidence I have found says it is) should the Corps be formalizing our doctrine and capability for support to these operations? Should we not be training our close support units and personnel in the lessons and tactics learned from our time in Northern Ireland? The British Army for years has developed its counter-insurgency operational doctrine based heavily on experience gained on Operation *Banner* and migrated this successfully to other operations. The RE aspects of support to it have also been developed, such as Advanced Search which has already been successfully integrated in the wider Corps. Surely it is time that we also migrate our public order expertise?

Current RE Support to Public Order Operations (Northern Ireland)

25 Engineer Regiment's mission is to provide military engineer support to Operation *Banner*, the British Army's longest running operation at 30 + years and which is due to end in 2007[4]. For interest, the current Regimental Order of Battle is shown in Fig 1. The Regiment's unique specialty is support to public order operations but it also provides support across the whole range of engineer capabilities including construction/demolition, advanced search, diving and boats. The Regiment has two regular squadrons (one manoeuvre and one support squadron) with additional RE support from the Northern Ireland Normalisation Squadron[5], which is provided by HQ LAND.

Support to public order operations is the primary focus during the summer protestant marching season. Each summer the loyal fraternal orders, The Orange Order, The Apprentice Boys of Derry and the Royal Black Institution, plan marches and parades to commemorate historical events of significance to the Protestant community. Where these marches pass through predominantly Catholic neighbourhoods they can incite civil unrest and are thus labelled "contentious" and

All soldiers undergo petrol bomb inoculation prior to any training or operational deployment.

[3] The phrase "3-block war" was coined by General Charles Krulak (United States Marine Corps Commandant 1995-1999). This concept has been proven recently in Iraq, particularly in Baghdad.
[4] During the time this article has been in draft significant changes in the situation in Northern Ireland have led to a proposed end of Operation *Banner* and the subsequent "normalisation" of the Province.
[5] The forerunner of the Northern Ireland Normalisation Squadron was Operation *Descant* provided by the Roulemont Engineer Squadron.

A Battalion Group Engineer in action at Drumcree 2004.

Heavy Public Order Team undergoing training at Massereene Barracks.

may often be blocked, banned or re-routed. Within the divided community of Northern Ireland, public disorder can occur at anytime and is not just limited to sectarian clashes. Feuding inter-paramilitary groups can also cause disorder in addition to community protests against the police and government. Due to this fractious situation, 25 Engineer Regiment have public order teams on reduced notice to move all year round. The recent rioting in Belfast was sparked after the independent Parades Commission re-routed the Whiterock parade away from a 170m stretch of contentious road. The disorder that followed was fuelled by a paramilitary presence in the crowd that exceeded expectations and led to a significant, prolonged engineer involvement over several days.

So, how do we provide this support? Within Northern Ireland, engineer advice is given by means of liaison and affiliations; these are illustrated in Fig 2. The Regiment advises Headquarters Northern Ireland and squadrons advise 8 and 39 Infantry Brigades. There are two main types of public order deployment, deliberate and short notice. Deliberate operations are commanded and controlled by the respective squadron in whose brigade the event lies, and are normally planned well in advance, eg Drumcree in Portadown. Squadrons then bid to the Regiment to be allocated the appropriate resources, which are assigned according to priorities laid down by Headquarters Northern Ireland. These operations primarily occur during the marching season and the Regiment re-roles (Fig 3) to meet this requirement. Short notice deployments are initially handled at Regimental level by the Lead Troop and by the duty operations officer and then handed over to Squadron command as soon as practicable.

On a tactical level the primary means of advice is from the Battalion Group Engineer[6] with further advice to Brigade being given by Officers Commanding/Operations Officers as required. Battalion Group Engineers use effects based planning as the tool to ensure the right equipment is used in an economic and timely manner to achieve the desired effect. Whilst similar to the standard effects of turn, fix, block, disrupt; operations in Northern Ireland include specific public order effects such as: protect, separate, screen, deny, contain and disperse. Whilst these sound similar to warfighting effects, they often have a different meaning within public order operations. An example of this would be a deployment to the Ardoyne Shop Fronts in West Belfast in 2005 where the Battalion Group Engineer was tasked to "screen" and "separate" the passing loyalist parade from the nationalist protestors; and "deny" the use of the shop roofs to prevent rioters throwing missiles down on to security forces.

The Regiment conducts training for public order operations at various times during the year. In the lead up to the marching season this sees the training commitment increase, since much of the training becomes combined with other arms and the Police Service of Northern Ireland. The Regiment provides its own

RE Liaison Structure within Northern Ireland	
Engineer Responsibility	**Organization**
CO 25 Engr Regt (CRE NI)	All Military Engineer advice to HQNI
Operations Major	All Search matters and Engineer advice to Force Troops
OC 33 Fd Sqn	Engineer advice to 39 Infantry Brigade
OC 43 HQ & Sp Sqn	Engineer advice to 8 Infantry Brigade
Battalion Group Engineer	Engineer advice to assigned Battalions
RE Search Adviser	Search advice to Brigades/Battalions

Figure 2 – RE Liaison Structure within Northern Ireland.

[6] Unlike the rest of the Corps, in Northern Ireland Battalion Group Engineers are drawn from across the Regiment, and range in rank from Sergeant to Captain.

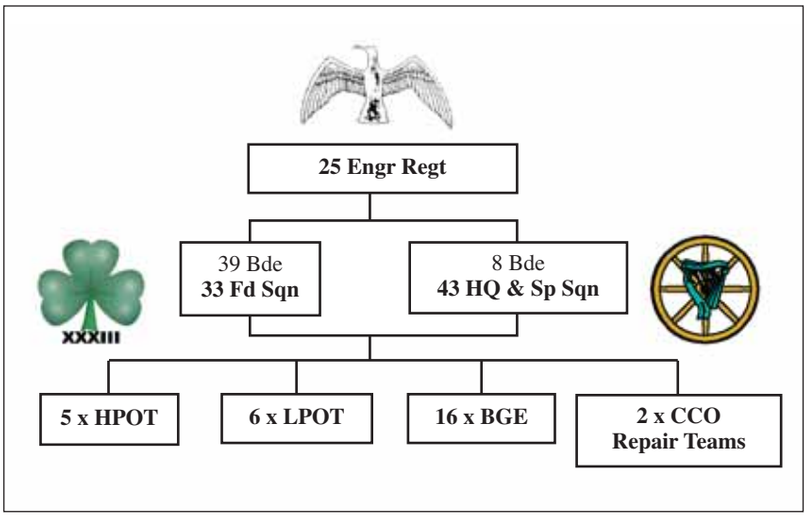

Figure 3 – 25 Engineer Regiment Public Order Operations Order of Battle.

training and validation of the Battalion Group Engineers and Light and Heavy Public Order teams prior to their deployment to support Brigade and Battalion level training. Training at this level is normally conducted at one of two purpose-built training villages which seek to realistically represent the terrain in which public order operations are held. Training helps to consolidate a common understanding of tactics and is also used to develop new ideas, tactics and obstacles. It is this almost continuous training process that enables the Regiment to maintain a high level of preparedness in all of its teams.

Engineer Public Order Equipment and Obstacles

Due to the particular needs of Northern Ireland public order operations, 25 Engineer Regiment holds a range of adapted and specific equipment in order to provide engineer support. Listed below are the key equipment, vehicles and obstacles required to support public order operations. If the Corps is to maintain a capability in this area these are the vehicles that must be made available to Engineer units.

Public Order Personnel Protective Equipment. When deployed on the ground in an in-contact role, soldiers wear specific protective clothing. The requirement for this is due to the many varied physical threats faced, including shooting, blast, petrol and paint bombs, stoning and bricking, punching and kicking. Soldiers from the Parachute Regiment in the Ardoyne area in 2004 were assaulted with a small tree that was used as a battering ram; the protective equipment they wore protected them from this too! Whereas in normal war fighting, a soldier will take the cover appropriate to the threat, within public order scenarios the soldier must remain in position unless a severe threat to life exists, e.g. pipe bomb or shooting. Forces in Northern Ireland are now issued with new Level 2 protective equipment, nicknamed "Robocop", which is shown in Fig 4.

KEY

1 Combat Helmet including Visor and nape protector, and fireproof balaclava.

2 Upper and lower arm protective pads

3 Level 2 Public Order gloves

4 Belt and groin protective pad

5 Upper and lower leg protective pads

6 Enhanced Combat body armour and chest webbing.

7 Clothing: full set of issue thermal clothing covered by Soldier 95 jacket and trousers

8 (Not shown) foot protective pads worn over issue Combat boot

Figure 4 – Sapper in Level 2 Personal Protective Equipment (Public Order).

Medium Wheeled Tractor (Protected). Within Northern Ireland it has been common for rioters to attempt to disrupt the security forces freedom of movement by using vehicles as obstacles. Some of these obstacles are substantial, including vans, buses and lorries. In order to provide mobility support to public order operations the principle vehicle used is the Medium Wheeled Tractor (Protected). It is one of most heavily armoured of all the vehicles in Northern Ireland, with the ability to protect the operator against a range of threats. It is a modified version of the standard CASE 721 medium wheeled tractor with additional ballistic protection fitted. The tractor is able to provide rapid obstacle clearance even whilst under attack by rioters and offers the operator relative impunity against petrol bombs, blast bombs and small arms fire. During the recent riots this vehicle was deployed across Belfast clearing a range of obstacles, including disabling a civilian plant vehicle that had been hijacked by the rioters and was being used to fell lampposts in a fashion similar to abatis!

Medium Wheeled Tractor (Protected).

Light Wheeled Tractor (Protected). This is a version of JCB 4CX with additional fitted protection. This is primarily used for counter-mobility tasks such as obstacle emplacement. It has limited protection for use in the in-contact role, being fitted with vehicle protection kits (protective mesh coverings over all windows and lights) and anti-riot glass that provides protection against hand thrown missiles.

Light Wheeled Tractor (Protected).

Self-Loading Dump Truck (Protected). This is a version of the standard FL12 self-loading dump truck fitted with vehicle protection kit. It is used to support both Light and Heavy Public Order Teams, providing a lift and carrying capacity. When used in conjunction with the Light Public Order Team it is filled with a stores pack appropriate to task. With the tailgate removed it can also be used in conjunction with the Medium Wheeled Tractor to remove obstacles preventing their re-use.

Self-Loading Dump Truck fitted with vehicle protection kit.

Maximum "Maxi" Crowd Control Obstacle. Counter-mobility obstacles are generally known as Crowd Control Obstacles with the "Maxi" being the largest that the Regiment can deploy. It is designed to provide a "block" effect and is normally sited in pairs in order to provide a controlled access doorway. It is based around a reinforced ISO container filled with concrete, fitted with wing walls (top and sides) and safety rails on the roof that can be used as a viewing/firing platform. It can be deployed and recovered directly from a Demountable Rack Offload and Pickup System vehicle. Other custom-made obstacles such as the Drumcree Bridge special and smaller versions known as "Minis" for lower profile road closures can also be deployed.

The "maxi" CCO.

Public Order Access Gate. This obstacle allows control of access for both vehicles and persons. It is used to provide both a "block" and "disrupt" effect allowing security forces to control and shape access and use of the urban environment. In order to change its profile it can be deployed dressed with or without wire.

Public Order Access Gate.

Crowd Control Barriers. This is one example of a variety of fencing that can be deployed by the Regiment. These are used to provide a physical separation between crowds and range from pop-concert style fencing up to 2m high solid walls.

An example of counter-mobility obstacle, Public Order fencing.

Custom built Obstacles. 25 Engineer Regiment has the capability to locally manufacture obstacles as and when required. It regularly deploys custom made obstacles built to the specific requirements of the site and effect required. A recent example was during the final planning stages for Drumcree 2005 when the requirement for a new "soft" profile obstacle was identified. It needed to remain capable of providing a significant block whilst assisting the Police with their criminal justice strategy, allowing evidence gathering and use of water cannon. From design to successful deployment took less than three weeks, including the trials period. The majority of obstacles deployed by the Regiment are relatively simple to construct and can be manufactured by RE tradesmen when and where required.

Crowd Control Obstacle Repair Team sealing the gates at Workman's Avenue prior to Whiterock Parade (Belfast September 2005).

Royal Engineer Public Order Teams and Capabilities

In order to provide support to public order operations, we have grouped the above vehicles and capabilities into two teams, the Light Public Order Team and the Heavy Public Order Team. These teams supported by resources specialists and controlled by a Battalion Group Engineer are at the core of RE support to public order operations. Outside of the Marching Season, the primary means of public order operational support is the Lead Troop. This is a grouping of rapidly deployable Sappers with a range of skills and specialist equipment, who are able to undertake a wide variety of engineer tasks (counter mobility, mobility and survivability) at short notice, Province wide. They are supported at Regimental level by a full time operations room with further support from communications and resources specialists. The key elements of engineer public order support are:

- **Battalion Group Engineer**. An officer or SNCO whose task is to provide liaison to battalions and to conduct reconnaissance and planning of engineer tasks. They provide the command and control of RE public order teams on the ground and during some large operations, such as the Whiterock Parade riots, several Battalion Group Engineers would be deployed. Due to the threats and sensitivities in Northern Ireland, Battalion Group Engineers can deploy in either green or civilian guise.
- **Heavy Public Order Team.** A Heavy Public Order Team is held on six hours notice to move to conduct short notice engineer tasks all year round as part of the Lead Troop. The Heavy Team con-

Light Public Order team deploying a mini-crowd control obstacle during Regimental training.

Flags are used across Northern Ireland to mark "tribal" areas. The French flag is used for its colour only, not to suggest any allegiance to France.

sists of four men with a self-loading dump truck, a light equipment transporter and a medium wheeled tractor (protected). Typical tasks include providing mobility support with the breaching and removal of obstacles and barricades on roads. With its protective capabilities, it is primarily used for mobility when in contact with rioters. When the team is on the ground it is commanded by a Plant Corporal who, via a Personal Role Radio, directs the operator (who has limited visibility) to his task. Normally the commander will recce the obstacle first to ascertain a safe method of removal in line with the effect to be achieved. Once a plan has been formed he will inform the local Police/Infantry Commander and direct the operator to achieve this. As he is relatively exposed he will generally be provided with an infantryman to provide close protection as the commander is focused on the task rather than protecting himself.

- **Light Public Order Teams.** One Light Pubic Order Team is held on six hours notice to move all year round to conduct short notice engineer tasks. It consists of an eight-man Field Section supported with a SNATCH Land Rover, Self Loading Dump Truck with Plant Trailer, Light Wheeled Tractor (Protected), various public order obstacle stores packs and a comprehensive range of combat engineer tools. Typical tasks are the construction of cover-from-view screens, public order fencing and gates, crowd control obstacles, anti-lob screens and minor engineer construction tasks. Due to the wide range of effects that the light team can achieve it is the most frequently deployed part of our public order capability.
- **Crowd Control Obstacle Repair Team.** The purpose of this three-man team consisting of a commander and two Welders/Fabricators, is to provide modifications and repairs to obstacles after they have been deployed. They can also provide access support by the use of oxy-acetylene cutting tools and a capability of providing a permanent welded seal if required. Like the Battalion Group Engineer, they too have the capability of deploying in green or civilian guise.

Deployment of crowd control obstacle by Light Public Order Team, Note the warning to be careful!

The Order of Battle of engineer support during a typical Marching Season is given in Fig 3. This is traditionally formed in the run up to the main marching season, when the Regimental focus shifts from construction/demolition operations to public order operations. For Marching Season and pre-planned operations, e.g. Drumcree in Portadown and Apprentice Boys in Londonderry, the Regiment can deploy in slow time its full range of capabilities dependent on the effect to be achieved. These deployments are commanded by the Squadron affiliated to the relevant Brigade. Once the initial estimate is completed, squadrons bid to the Regiment for any additional resources. Priorities are deconflicted by the Regimental operations officer in conjunction with priorities set by Headquarters Northern Ireland.

Engineer Public Order Support in Worldwide Operations

With our specialist equipment and training, 25 Engineer Regiment is well equipped to deal with public order operations within Northern Ireland, but what of the remainder of the Corps? Close support units in particular may find that they are called upon to provide support to public order operations but are lacking both equipment and knowledge of tactics. The Sappers have always been good at improvising and probably could replace some of the Northern Ireland specific vehicles, but what of the knowledge of tactics? Imagine the following situation:

"Recent political upheaval in this country has meant that the population is going to the polling stations to vote for a new government assembly. Groups opposed to the elections attempt to scare away the voters by encouraging and staging a number of riots. The British Army deploys in support of the police force that has been overwhelmed by the scale of public disorder. Suddenly there is a surge in the violence and the rioters begin to close off routes with burning vehicles preventing the civilian population reaching the polling stations and denying freedom of movement to the security forces. The senior Army commander approaches the nearby RE Squadron and asks for support in dealing with this public disorder. He wants a graduated response including counter-mobility and mobility support in order to prevent the escalation of the already tense situation. The OC tasks the Operations Officer to plan the engineer input into the overall public order operation . . ."

This scenario is feasible almost anywhere from Afghanistan to Iraq to Northern Ireland and numerous other countries where civil and social divides exist. Presently the Army (and with it, the Sappers) are deployed on a range of operations worldwide, many of which may have a requirement for public order operations. With the focus of RE support to public order operations currently embedded solely with 25 Engineer Regiment, supporting these types of operations may be unfamiliar to other engineer units. The Future Army Structures paper has earmarked a new role for 25 Engineer Regiment as an air support regiment, thus the Corps is soon to lose its only unit specialising in public order operations. Whilst each theatre will have its own peculiarities, lessons learned at 25 Engineer Regiment can provide a useful framework

Public Order Training Iraq style. Public order operations are no longer limited to the UK.

to build upon. September 2005 was a prime example of the world-wide requirement for public order operations: in Northern Ireland where we witnessed a resurgence in public disorder and violence, whilst at the same time in Iraq, the British Army was dealing with public disorder in Basra. In Belfast this led to most of the Regiment's key public order assets being deployed or held on notice-to-move ready to support the forces sent into the city. Without detailed knowledge of the support provided on Operation *Telic*, I wonder whether the same call to support public order operations is being made, or more importantly could the capability be offered?[7]

It is recognized that some of our capabilities are currently particular only to the Province, eg the Medium Wheeled Tractor (Protected). Some of these vehicles and roles can however be effectively replaced by current engineer equipment, For example providing mobility support could be realistically replaced by the Combat Engineer Tractor/Terrier. When no other option exists, the Armoured Vehicle Royal Engineer could be deployed (and incidentally was deployed in the Creggan Estate, Londonderry, on Operation *Motorman* in 1972). With the drawdown of 25 Engineer Regiment and its re-rolement into air support, most of this specialist equipment has no clear future (though some has already been deployed to Iraq), and unless we can identify a new requirement, it may be disposed of. Much in the same way specialist clothing and equipment for operations in Iraq is issued, perhaps there should be a central pool of engineer public order equipment ready to be deployed to units in those theatres that require it?

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[7] The author accepts he has little knowledge of the detail of RE support to public order operations in Iraq and proposes this as a hypothesis only; he would be interested to hear what the actual situation is.

ENGINEER SUPPORT TO PUBLIC ORDER OPERATIONS DOCTRINE?

PART of my studies when preparing this article was to look into the provision of public order operational doctrine. My own research concludes that whilst the Army has limited doctrine concerning public order operations[8], the Royal Engineers do not have any. With the expected draw down of military engineer support in Northern Ireland I fear that the lessons, tactics and doctrine developed here in supporting public order operations over a number of years, may be lost. 25 Engineer Regiment is already looking forward and beginning the preparation for our future role as air support regiment under Future Army Structures. Thus the only specialist RE public order knowledge and expertise may be lost, although some may argue that public order operations are simple enough and that "doctrine" is not required. However, as was recently stated during a Headquarters Northrn Ireland Public Order Study Period[9] by the Commander of 39 Infantry Brigade:

"such operations may be relatively straightforward, but as we are the last resort after the police we need to do what we do, correctly the first time, every time".

Many of the lessons learnt in Northern Ireland can be easily migrated to other theatres, thus allowing Royal Engineers to contribute in public order operations wherever the Army may face them. Military doctrine after all is there to provide, "a body of principles that is taught or advocated[10]." It is surely time we look to develop our own doctrine for support to these operations.

CONCLUSION

SUPPORT to public order operations is something that the Sappers in Northern Ireland have been successfully undertaking for a number of years. Whilst the Roulemont Engineer Squadron provided an effective inherent means of disseminating some of the experience gained much of this collective knowledge is lost over time. 25 Engineer Regiment, as the Corps' only full time operational public order "specialist" regiment has developed a wide range of tactics and specialist equipment to deal with this type of operation. As it scales down its support to Northern Ireland and begins to shift its focus to new arenas we are in danger of losing this specialist knowledge. RE regiments are currently deployed in a number of theatres, supporting a range of operations, many of which include public order operations. We should be developing our doctrine and spreading our capability so that the lessons learnt, the equipment developed and the specialist obstacles designed can be utilized by Sappers worldwide.

Whilst doctrine is of course important, it alone does not provide a capability. What we need before 25 Engineer Regiment re-roles, is a coherent plan for maintaining this capability Corps wide. I suggest the following as key recommendations for ensuring we maintain a public order capability:

- The creation of a central pool of specialist public order equipment and vehicles, perhaps held by PFI[11] for worldwide deployment
- The exposure on management courses to engineer support to public order operations, including case studies of public order operations, e.g. Drumcree and Belfast riots (2005).
- The documentation and publishing of designs for specialist public order obstacles.
- Development of engineer public order operations pre-deployment training packages.
- Development of formal engineer public order support doctrine in publications like the RE Pocket Book and incorporating the Northern Ireland Battalion Group Engineer memoir into a RE Tactical Aide Memoir insert.

I believe that this article provides some food for thought and that whilst we are keen to see and end to the troubles in Northern Ireland and look to the future, we should not be too hasty in our withdrawal. We may lose a very specialist capability that in these globally uncertain times we actually need more than ever.

REFERENCES

Journals

The Royal Engineers Journal December 2001 "*Royal Engineer and Public Order Operations.*" By Maj A G Jackson BEng CEng MICE.

Army Publications

Army Field Manual Vol 1 Combined Arms Operations Part 9 Tactical Guidance for Operations other than War (Crisis Response Operations) Sept 2002

Northern Ireland Force Troops Operations Order 1/04.

Northern Ireland Standing Operating Procedure No 338, Engineer Support.

Northern Ireland Public Order Tactical Aide Memoir 2004

Northern Ireland Tactical Aide Memoire

Websites

"3-Block war" quote from www.wargaming.quantico.usmc.mil/programs/JCDE/JUW05/index.asp

Everest West Ridge 2006. www.armyoneverest.com

Books

Taylor, Peter "Brits – the war against the IRA" Bloomsbury Publishing plc. 2001

Collins English Dictionary & Thesaurus 21st Century Edition. Harper Collins. 2003

8 AFM Vol 1 Combined Arms Operations Part 9 Tactical Guidance for Operations other than War (Crisis response operations) Sept 2002. Serials D24 – 26 & Northern Ireland Techniques, Tactics and Procedures 2004

9 Each year Headquarters Northern Ireland organizes a 2-day Public Order Study Period to educate all Officers/SNCOs involved with the planning of Public Order training and operations, its aim being to update them in the latest tactics and developments.

10 Collins English Dictionary and Thesaurus 21st Century Edition. Harper Collins 2003

11 Private Finance Initiative. A process where RE 'C' vehicles are supplied and maintained by a private civilian company.

The Siege of Bharatpur, 1825-26

N C HAYES MA

After graduating from the University of Lancaster in 1977 with an honours degree in History and Politics, Nicholas Hayes taught full-time in a number of secondary schools. Since completing a Master's Degree at the University of Buckingham in 1992, he has worked as a researcher, part-time teacher and free-lance writer specializing in military and naval history.

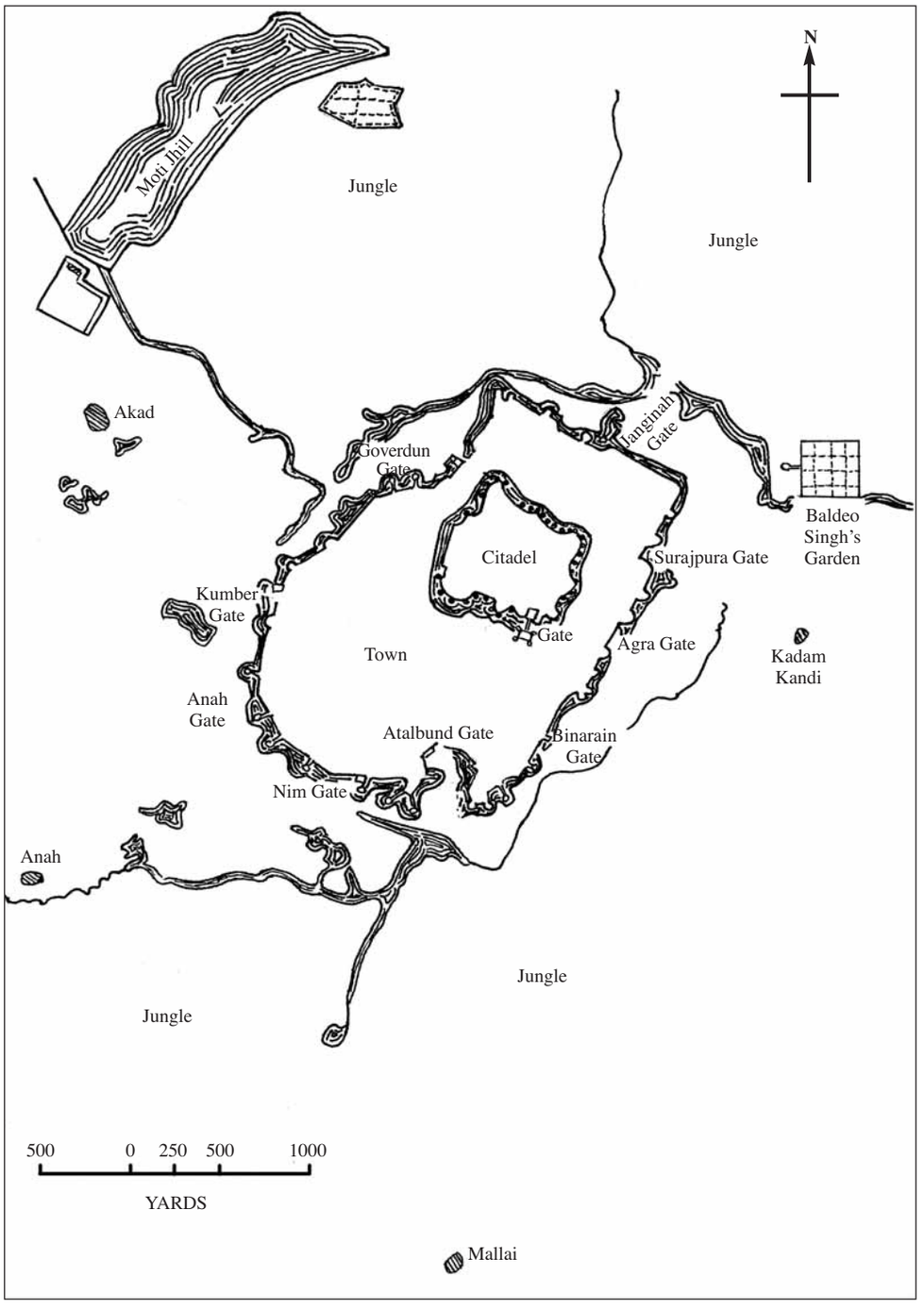
THE great fortress city of Bharatpur[1] in northern India, capital of the hardy Hindu yeomen known as Jats, was sometimes described as the "Bulwark of Hindustan." In 1805, after a British army had made four very costly and unsuccessful assaults on the city, its ruler, Rajah Baldeo Singh, made a treaty with the East India Company, which, for nearly two decades, was faithfully observed by both sides. At the beginning of 1824, the Rajah, feeling the approach of death, determined to settle the succession to his throne. He put forward his six-year-old son, Balwant Singh, and tried to ensure the child's inheritance by enlisting the support of General Sir David Ochterlony, the Company's Resident in Delhi. Ochterlony promised his support, and when the Rajah died early in 1825, the child was installed on the throne, with one of his uncles as his guardian to conduct the government. This however, was followed by a palace revolution, as a result of which Darjan Sal, nephew of the dead Rajah seized the citadel, murdered the guardian uncle, and proclaimed himself vice-regent, filling all the offices of state with his own creatures.

Ochterlony responded by denouncing Darjan Sal as a usurper, promising support to all who rose against him, and assembling an army to march against Bharatpur. The Governor-General, Lord Amherst, took exception to Ochterlony's action and said so in an extremely offensive dispatch. The troops were dispersed and Ochterlony resigned. He was succeeded as Resident by Sir Charles Metcalfe, who had already served in Delhi. He soon recognized the danger of the situation, for by then Darjan Sal had ousted the infant Rajah and placed himself on the throne. Metcalfe advised Amherst that the British had a "duty as supreme guardians of general tranquillity, law and right, to maintain the right of Bulwant Singh to the raj of Bhurtpore." Amherst thereupon performed a *volte face*, and instructed Lord Combermere, Commander-in-Chief of the Bengal Army (who, as Sir Stapleton Cotton, had been Wellington's cavalry commander in the Peninsula), to make all necessary preparations for an attack on Bharatpur.

The army which Combermere assembled for the attack of this powerful fortress consisted of two regiments of European and six of native cavalry, and two battalions of European and 16 of native infantry, with 112 siege guns and 50 field pieces. The engineering department was headed by Brigadier Thomas Anbury, and comprised Captains Robert Smith, Joseph Taylor, John Colvin and Charles Davidson, with nine lieutenants and two ensigns, all of the Bengal Engineers. There were also six companies of the newly formed Bengal Sappers and Miners and two of the Bengal Pioneers.

The town of Bharatpur was about eight miles in circumference and lay in an almost level plain, bounded on the west by a ridge of low rocks. The fortifications consisted of a citadel and an outer enceinte of thirty-five high semi-circular towers connected by curtains, the whole built of mud held together by straw and in many places strengthened by rows of tree trunks buried upright. The enceinte was surrounded by a water-course from 20 to 35 feet wide, with perpendicular banks, which had been converted into a ditch. In itself, it was an awkward obstacle, but rendered less so by numerous tributary water-courses which enabled it to be approached under cover. There were nine gates, each of which was covered by a semi-circular earthwork. The citadel, which stood on elevated ground, completely commanded the body of the place. Its ditch, nearly 50 yards broad and 20 deep, had a counterscarp revetted with stone. From the bottom of the scarp rose a perpendicular stone wall, eighty feet high, which formed a fausse-braye, and was flanked by forty semi- circular towers. Within this stood another stone wall, seventy-four feet in

[1] The old rendering was Bhurtpore, and as such it appears on the Colours of the regiments which fought there. The modern rendering of the Hindi into English is Bharatpur.

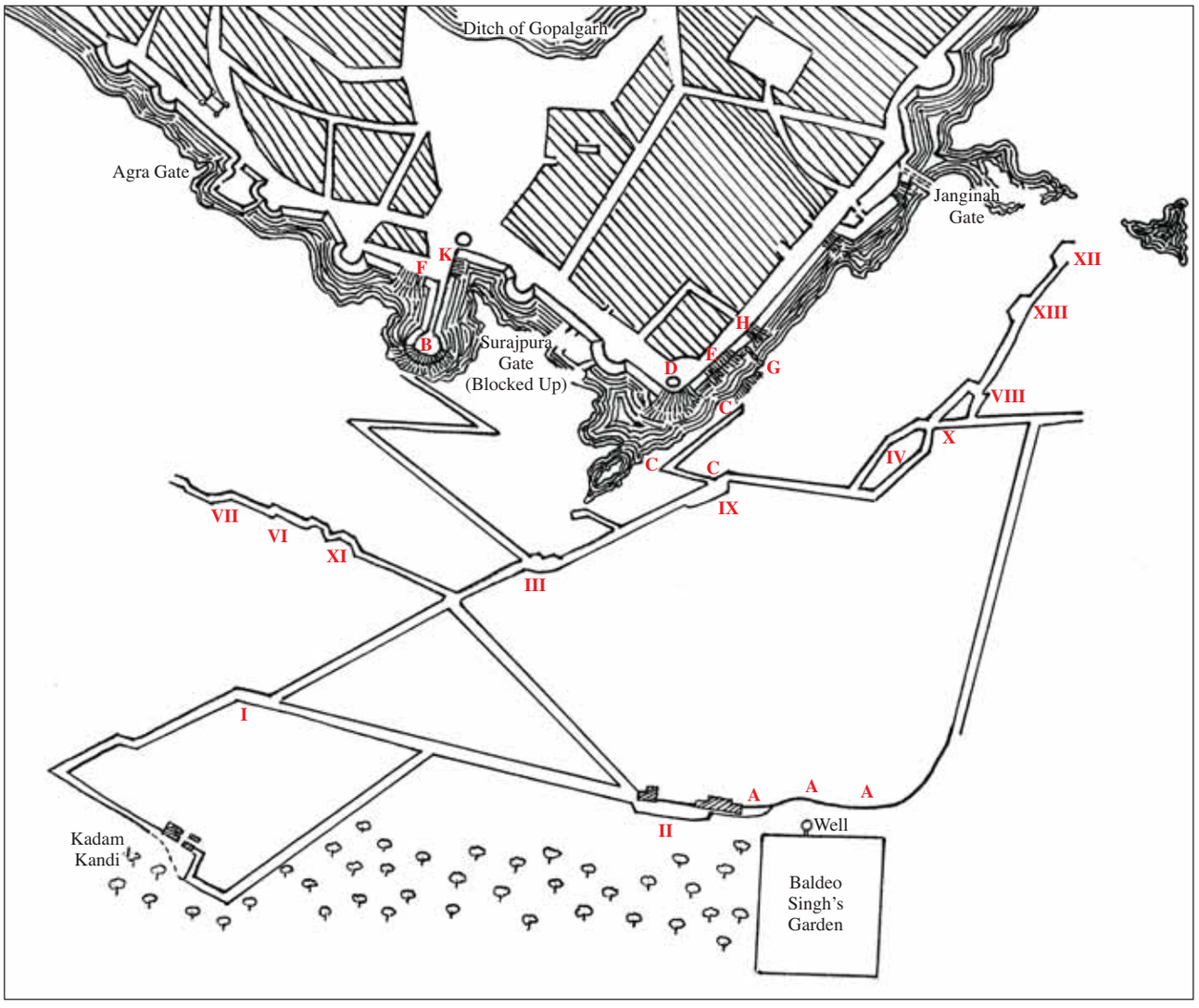


Bharatpur 1826.

height and flanked by eleven conical towers. The whole fortress was surrounded by a belt of jungle at a distance varying from 500-800 yards from the walls, with but one open space about a mile wide opposite the south-west angle, the outer perimeter of this belt being little short of twenty miles.

Combermere set the bulk of his infantry and cavalry in motion from their assembly points at Agra and Muttra on 8 December 1825, leaving the field artillery to follow next day. To the north-west of, and just over a mile from, Bharatpur was the Moti Jhil, an irregularly shaped lake secured by a *bund*, or dam. From this, a watercourse led directly to the outer ditch, which could thus be filled in a few hours and the defensive value of the fortress thereby increased, as the British had found in 1805. But the water was still all in the lake, and therefore Major-General Thomas Reynell was, on the morning of the 10th, sent forward with a troop of horse artillery, two squadrons of the 11th Light Dragoons, two regiments of native cavalry, two companies of the 14th Foot, a regiment of native infantry, and a party of sappers and miners under Lieutenant A. Irvine, Bengal Engineers. The force proceeded through the jungle surrounding the town and came upon a party of Jat horse. A few rounds from the horse artillery troop obliged them to retire, but when the guns on the walls of the town opened fire, the gunners limbered up and withdrew. Meanwhile, the Quartermaster-General, Colonel R. Stevenson, with Lieutenant Irvine's sappers, had gone straight towards the dam. It had only just been cut, and the sappers were able to stop the flow of water by sinking a boat across the aperture and then blocking it up with brushwood and any other materials that lay to hand. Thus, though a certain amount of water had already entered the ditch, it was not enough seriously to hinder a besieging force. Combermere halted for the night just to the east of the lake and prepared his dispositions for an investment of the fortress.

The belt of jungle around Bharatpur constituted one of the General's principal difficulties, for it prevented him from making a complete investment of the place even with the powerful force at his disposal. He therefore occupied only about 6-7 miles of ground on the north-east side with his infantry and distributed his cavalry at wide intervals to cover the rest, except towards the south-west angler where, the belt



Plan of the Siege Operations which led to the capture of Bharatpur.

of jungle being deep, he erected for about a mile a chain of fortified posts connected by an abattis. For the rest, the construction of the ramparts provided the engineers and gunners with some awkward problems. The rounded towers were difficult to enfilade, and the mud walls absorbed solid shot without suffering any damage beyond the making of a hole and the fall of a little dust. What was needed was shell, which, if projected by horizontal fire, could be driven into the heart of an obstacle to burst within it. But in the early nineteenth century shells were fired only from high-angle pieces, that is to say mortars and howitzers. Consequently, they could only be dropped upon a surface, and did not penetrate deeply enough to bring down large masses of the parapet. Even if, by a huge expenditure of ammunition, one of Bharatpur's walls was reduced to powder, there still remained a huge palisade of tree trunks buried inside it, "and bombardment of the palisade resulted only in a most effective abattis". (Sandes, 1933, I, 262)

Brigadier Anbury was aware of these problems and had made every preparation. Before the campaign began he had manufactured some thousands of fascines and gabions, and on arrival at Bharatpur he continued the process in the Engineer Park, where the pioneers and sappers toiled day and night. Large working parties of infantry were detailed to assist them, and paid at the rate of four annas (6d) a day to each European and a free ration of grain to each native soldier.

By 12 December, the preliminary arrangements were complete, and on the 13th and 14th the siege train arrived. Brigadier Anbury, after due reconnaissance, recommended an attack on the north-east angle because the flanking defences were weaker there than elsewhere. On the 22nd, the village of Kadamkandi, opposite the middle of the eastern front, and Baldeo Singh's garden, about a mile to the north of it, were occupied and trenches thrown up to connect the two posts. The guns of the fortress kept up a very heavy fire at long range upon the working parties, but caused little loss. On the evening of the 23rd the first parallel was opened and two batteries thrown up: No. **I**, for eight 18-pounder guns, in front of Kadamkandi; and No. **II**, for twelve 8 inch and four l0 inch mortars, in front and to the left of Baldeo Singh's garden. Ten of the mortars and all the 18-pounders opened up at a range of 600 yards at daybreak on the 24th, the fire of Battery No. **II** being directed against the town and citadel, and of No. I

against the outer defences. The fire of the enemy's guns opposed to them was silenced, and his sharp-shooters, who had been persistent and troublesome, driven behind the shelter of the parapet. Trenches were then driven forward from the two batteries, whose armament was completed in the evening by the addition of two 8 inch and four l0 inch mortars.

During the night the engineers began construction of a third battery in advance (No. **III**), but the work was much interrupted by the enemy's fire. Captain Robert Smith, who was directing the pioneers, received a severe contusion from a jingal ball. The battery was not ready in the morning in consequence, and the guns (five 18-pounders and five 24-pounders) were left in the garden. A second parallel was finished on the 25th, about 220 yards only from a prominent feature known as the Long-necked or Pathan Bastion (marked B on the plan). A double ration of rum was served out to the European soldiers in honour of the day, and 2lbs of sweetmeats to sepoys at work in the trenches. It was ordered that the latter be continued as a daily issue. Most of the Jat horse had been left outside the town, for fear, it was supposed, that they would consume too much grain. It having been reported that they were going to try to break through the line of cavalry regiments, which extended from the Moti Jhil to the village of Mallai, one of the two cavalry brigades moved down towards the Anah Gate, where they inflicted severe loss on the enemy's horsemen.

On the 26th, Battery No. **III**, being completed and armed, opened up at 8 a.m. The fire, being very efficiently delivered, soon silenced the enemy's opposing ordnance, which was withdrawn to the inner defences, from where it kept up a reduced fire. Next day, the enemy's fire suddenly became unusually accurate, especially about Combermere's headquarters at the edge of Baldeo Singh's garden, one of his servants being hit in the act of removing a chair from a table. The mystery was presently explained by the disappearance of a European artilleryman, Sergeant Herbert, who had deserted the day before, and was now seen on the ramparts of the town, laying the enemy's guns[2]. The engineers began work on a battery (No. **IV**), for four 18-pounder and eight 24-pounder guns, about 350 yards from the north face of the north-east angle of the town. From the right of Baldeo Singh's garden extended an old dyke (**AAA**), which was converted into a trench and continued up along the rear of the new battery. The fire of the enemy, however, continued during the night and greatly impeded the work. In the afternoon, the guns were withdrawn from No. **I**, which was to be converted into a mortar battery. Several cavalry skirmishes took place on the west side of the town, and, notwithstanding the precautions taken, a party of Jat horse managed to penetrate through the cavalry lines after dark. A second party was intercepted, however, and captured or cut down almost to a man.

On the 28th, Battery No. **IV**, having been armed, opened fire at 3 p.m. Battery No. **I**, now armed with ten l0-inch mortars, was ordered to fire into the town south of the citadel; No. **II**, to fire into the citadel and to the west of it; No. **III** to enfilade the east face of the citadel; and No. **IV**, to enfilade the west face. On the 29th, a battery of two 8-inch howitzers was formed near the village of Akad, under Major W.S. Whish, Bengal Horse Artillery; it was later increased to six pieces. Throughout the day all the batteries kept up a heavy fire, and after dark a battery (No. **V**) for two guns was constructed to enfilade the ditch opposite the breach to be made by No. **IV**. Next day, the ground on the right of No. **IV** being bad, that battery was extended to the left to take in four more guns. Battery No. **V**, meanwhile, was armed and opened fire.

On the night of the 30th/31st, the engineers constructed a new battery (No. VI), armed with five 18-pounder and five 24- pounder guns, on the left of the attack. The 18-pounders were drawn from Battery No. **III**, their places being taken by six 8-inch mortars from No. **II**. The four additional guns for No. **IV** were sent there in the afternoon. After dark, No. **VI** was extended to the left to form a new battery (No. **VII**) for ten l0-inch mortars. Firing on this and the previous day was slack, as the large expenditure of ammunition on the 29th had produced a considerable effect.

On 1 January, Major Whish's battery opened up, and the mortars for No. **VII** were sent there from No. **I**. Another battery, for ten 8-inch mortars (No. **VIII**) was constructed to the right of No. **IV**, and completed during the night. Lieutenant Joseph Tindal, Bengal Engineers, was killed in the evening, while marking out a site for one of the battery magazines. There was very little firing next day. A centre mortar battery (No. **IX**) was constructed in the trench connecting the right and left attacks. Its armament, six 8-inch and two 13-inch mortars, was afterwards increased by twenty-four more 8-inch mortars. Two 8-inch howitzers (No. **X**) were placed between batteries Nos. **IV** and **VIII**, and two more (No. **XI**) to the right of No. **VI**. An ammunition depot was formed in the old mortar battery in Baldeo Singh's garden, to which stores were conveyed in carts, and thence to the galleries by working parties.

On 3 January, at 7 a.m, all the batteries opened fire. The task allotted to No. **III** was destroying the defences and shelling the citadel; to No. **IV**, breaching; No. **V**, enfilading the ditch and face of the town; No. **VI**, breaching and destroying the defences to the left of the Long-necked Bastion; No. **VII**, shelling the town south of the citadel[3]; No. **VIII**, shelling the town between the citadel and the Jangina Gate; No. **IX**, shelling the citadel and the breaches; No. **X**, assisting No. **VIII**; No. **XI**, enfilading the Long-necked Bastion; and Major Whish's battery, shelling the citadel. The breaching batteries continued to be very active on the following day. Meanwhile, work began on a sap to run along the counter-scarp (**CCC**), from where a mine would be sunk under the north-east angle (**D**).

On the 5th, under a heavy fire from the town, the trenches

[2] After the fall of Bharatpur, Herbert, having been tried and sentenced to death by a court-martial, was hanged on the ruins of the north-east angle. He had fought as a gunner at Waterloo, was well spoken of by his officers, and was believed to have supported an ageing mother out of his pay. Why such a man should have deserted to the enemy is a mystery

[3] Combermere had, on 21 December, sent a letter to Darjan Sal offering a safe conduct to all women and children in Bharatpur, so that they might escape the consequences of a bombardment. He had received only an evasive reply. To a second offer no answer was returned.

were extended to the right as far as the swamp opposite the Jangina Gate, where a battery for two 18-pounder guns (No. **XII**) was marked out. Work also began upon another battery (No. **XIII**) in the same trench, and about fifty yards to the right of the mortars. By now the breaches were so far forward that orders were issued detailing the storming parties. Next day, the expenditure of shot and shell from the batteries was very heavy. Of the two breaches, the one on the right (**E**) appeared to be practicable, but the one on the left (**F**) looked very unpromising, as the ditch here was very deep and the shot, burying itself in an earthern mass strengthened with logs of wood, had not had much effect. An attempt was made to improve **E** by a mine, which was fired at daybreak; but the gallery had not been completed for fear that the work, if carried on by day, would be discovered. It was, therefore, a failure. There was now so much spadework to be done that gangs of labourers from the neighbouring villages were engaged to help the sappers above ground. They were paid at a rate of four rupees per foot.

At about 5 a.m.on the 7th, the mine under the north-east angle was fired, but as it had not been carried far enough home, and had been charged with too small a quantity of powder, it was not as successful as it should have been. Jemadar[4] of sappers Barga Singh, finding the ignition of the powder train stopped by some accident, ran up with a light and fired it, but got severely burned in the explosion. For this act of bravery, he was promoted to the rank of subadar[5] in general orders. Orders for the storm which should have taken place next day were countermanded, Brigadier Anbury having reported the breaches insufficiently practicable.

At about 2 a.m.on the 9th, a lucky shot from the town struck a loaded wagon in the ammunition depot which had been set up in Baldeo Singh's garden. There was a serious explosion, which caused but little loss of life, but which destroyed a large quantity of fixed ammunition and engineers' stores. The counterscarp opposite the right breach was blown in during the afternoon, and a good road into the ditch was thus opened. The fire from the British batteries, at first heavy, slackened during the following day. The Jats were countermining, but one of their galleries was detected and blown in.

On the 11th, two 12-pounder guns were added to Battery No. **XII**, and the two howitzers in No. **XI** changed for guns. Some of the enemy having occupied the ditch, Lieutenant J. Fisher, with a detachment of his own Sirmoor Gurkha Battalion, was sent to clear it, and Battery No. **VII** afterwards ordered to drop shells into it with reduced charges. As the British trenches here were but forty yards from the ditch, small mortars, such as the 4⅘-inch Coehorn, would have been found useful; but there were none available. Fortunately, no casualties occurred among the British troops from splinters at such a short distance. The enemy, meanwhile, were engaged in covering the Jangina Gate with an outwork. Next day, another detachment of the Sirmoor Battalion, under Lieutenant Fisher, went with Captain Taylor and Lieutenant Irvine to clear the enemy from the ditch on the northern face. They discovered that a parapet of cotton bags (**G**) had been placed across the ditch as a traverse to stop the shot from Battery No. **V**. Beyond this, a gallery (**H**) was found running under the rampart, which, it was supposed, communicated with a mine under the right breach. A number of holes in the counterscarp were found to be filled with bodies. During the day the engineers began to drive a gallery from the ditch under the left breach; and to sink a shaft from sap CC under the north-east angle. To prevent these works becoming known, strict orders were issued to prevent any person but those engaged in them from entering the trench.

At 9 p.m, Captain Taylor went with a party of the 14th Foot to destroy the gallery (**H**) which he and Irvine had discovered earlier in the day. On nearing the traverse (**G**), Taylor, dressed in a drab greatcoat and native artilleryman's cap, went forward and, getting over the cotton bags with one or two men, was attacked by the enemy, of whom there were a number in the gallery. The rest of the detachment came up, but unfortunately in the struggle which took place at the mouth of the tunnel, Taylor, wearing what, in the darkness, must have looked like the robe and turban of an Indian, received some severe bayonet wounds. Thus, the attempt to blow up the gallery failed.

During the 13th the mining continued, and the fire of the batteries slackened. The historian of the Bengal Artillery tells us:

"Much disappointment was experienced in camp at the delay of the storming, which report daily postponed for another twenty-four hours or so. Mens' minds, wound up into a state of anxious preparation for the final effort, were becoming restless under it. This will account for the number of officers who were, it is stated, in trouble for various misdemeanours at this time. None, however, appear to have been serious cases. Hope deferred is one of the experiences which it behoves a soldier to inure himself to, as for any of the other contingencies of military service". (Stubbs, 1877, II, 209-10)

A mine under the Long-necked Bastion was fired on the morning of the 14th, but it failed to explode. Lieutenant Irvine, with a party of sappers and a few men of the 14th, dislodged the enemy from gallery He held it until it was loaded with 400 lbs of gunpowder and, at 9 am, succeeded, to a certain extent, in blowing it in. Battery No. **IV** poured in a steady fire immediately afterwards and opened a small but practicable breach.

Owing to the quantity of *kankar* (rapidly forming modular limestone) in the soil, the gallery under the counterscarp leading to the left breach was abandoned on the 15th, and the Jats took advantage of the temporary suspension of operations to scarp the foot of the breach. At, this point, therefore, the batteries again opened fire. During the night, Lieutenant H. de Bude, Bengal Engineers, was severely wounded by a matchlock ball. Next day, a great mine under the Long-necked Bastion was fired at about 4 p.m. Immediately afterwards Captains Lewis Carmichael, 59th Foot, and Charles

[4] Jemadar: The junior commissioned rank in the Indian Army, roughly equivalent to an ensign or 2nd lieutenant.
[5] Subadar: The Indian Army equivalent of a lieutenant.

Davidson, Bengal Engineers, with six grenadiers of the 59th and four Gurkhas, under a heavy fire from the trenches, ran up to the top of the breach. After taking a good look at the inside and throwing some hand grenades, they returned without further loss than one of the grenadiers, who was killed just as they got back.

On the 17th, a great mine under the north-east angle was charged with 10,000 lbs of powder. Its explosion the following morning was to be the signal for the assault.

For this, Combermere formed five columns of attack. The breach made near the Janginah Gate by Battery No. **XII** was entrusted to two companies of the 1st Bengal European Regiment, a battalion of native infantry and 100 Gurkhas, the whole under Lieutenant-Colonel J. Delamain. The right breach was made over to Major-General Reynell, with two brigades under Brigadier-Generals J. McCombe and R. Paton. Each of these brigades consisted of two native infantry battalions stiffened by four companies of the 14th Foot. McCombe's was to lead the way, with the grenadiers of the 14th at its head, and to turn to the right when it reached the ramparts; Paton's was to follow and turn to the left. The left breach was committed to three native infantry battalions strengthened by the 59th Foot, the whole under Brigadier-General W.T. Edwards. Two more native battalions, under Brigadier-General J.W. Adams, were to attack the Agra Gate, immediately to the south of the left breach. Lastly, a small column, consisting of two companies of the 1st Bengal Europeans, two native infantry companies and 100 Gurkhas, the whole under Lieutenant-Colonel T. Wilson, was to escalade the re-entrant angle of the Long-necked Bastion (**K**). Each column was to be led by an engineer officer, and accompanied by a spiking party of a sergeant and sixteen rank and file from the artillery. The two cavalry brigades were to be disposed along the western side of the town as far as Mallai, so as to cut off the garrison's escape.

Every possible precaution was taken by Combermere to ensure success, for he realized that the consequences of failure might be very serious to British rule in India. The escalading parties were regularly practiced in the handling of ladders, and the 59th Foot carefully trained in the use of hand grenades, a weapon which was already nearly obsolete, but which had been now employed with success. The troops themselves assembled in the third parallel, so as to lessen the risks from the firing of mines. Great care was taken that they should enter the trenches undetected, and not a whisper was heard, nor the point of a bayonet seen, when they filed into their places at 4.30 a.m on the 18th. Nevertheless, the Jats seemed to be suspicious and, from 4 to 6 a.m, poured in a heavy fire which, their guns being incapable of much depression, fell mainly on the third parallel. Chafing under the loss this caused, the troops began to creep forward, pushing the storming parties dangerously close to the ditch. At 8 a.m the mines were reported ready, and Combermere gave the order for them to be fired. Lesser mines, to right and left of the north-east angle, were first sprung and there was a short lull, during which an engineer officer strove anxiously to force back, while there was still timer the men who had been crowded into the foremost approaches. He was too late. The great mine exploded and, a British officer wrote:

"The massive bastion trembled from level to summit, and gradually rising from its firm foundation and increasing in bulk as it rose, seemed about to precipitate its overwhelming mass upon our heads. Still it rose on high, and still it distended in one gigantic cloud of dull hue, in graceful silent sublimity, high into the blue vault of heaven. There it stood for many seconds like a tower connecting earth and sky, then slowly dissipated its particles upon the breeze of morning" (Quoted in Sandes, 1933, I, 265).

Much of the wreckage showered down upon the heads of the storming party. Brigadiers McCombe and Paton, Lieutenant Irvine, and an officer and nearly twenty NCOs and privates of the 14th Foot were struck down, killed or wounded. Combermere himself had a narrow escape, for McCombe fell at his side and two sepoys just behind were killed. There was a moment's hesitation. Combermere moved to place himself at the head of the troops, but was forcibly held back by his ADC. Then General Reynell came up, gave the word "Forward," and the storming parties of the 14th and 59th rushed simultaneously into the breaches. The four companies of the 14th very quickly crowned the summit, where a mine blew up a section, but did not stop the rest of the detachment. Owing to the firmer nature of the ground in the crater of the mine, the whole of Reynell's column went up by the breach in the north-east angle (**D**), in preference to that made by the batteries in the adjoining curtain (**E**).

On reaching the top, the companies of the 14th turned to the right along the ramparts, whereupon the enemy, recovering from the first shock of the explosion, rallied to meet them. The defence of the north-east angle had been entrusted to 800 Pathan mercenaries, and although nearly half of these had been blown in the air, the survivors fought desperately. They could not stand, however, against a bayonet charge, and were driven back to a narrow gorge, sixty feet deep, which could only be descended by a narrow flight of steps. At the edge of this gorge the fugitives perforce turned, but as they reached it another band appeared on the opposite edger with Delamain's column in hot pursuit. Delamain's men had mounted the breach near the Jangina Gate, in spite of determined opposition, and for a few minutes there was a savage hand-to-hand fight on either lip of the abyss, the British stabbing fiercely with their bayonets, or firing at such close range that the flashes set light to the cotton padded clothes of the Jats and Pathans. The gorge became fuller and fuller as one after another of the luckless Indians fell or was hurled down, and soon it was choked with a mass of some 200 bodies, all wedged tightly together, and many of them on fire. Those who were still alive could be heard crying out, amid the constant sound of explosions as the flames reached their ammunition, for a merciful shot to put an end to their agony.

But the stormers had other work to do. The united columns of McCombe and Delamain still pressed on along the ramparts to the Kumbher Gate, three-quarters of the way along the western face of the fort, where they halted and signalled for ammunition and reinforcements. A small party, however, taking a wrong turning, found themselves in the town and blundered on to the northern bridge that led across the inner ditch into the citadel. The terrified garrison closed the gates,

shutting out a party of about 100 fugitive Jats, among whom was Khoosial Singh, brother-in-law of Darjan Sal and one of his leading supporters. This courageous chief turned at bay, and, having nearly severed the arm of a British officer with his sword, was instantly bayoneted, together with every one of his followers. The British party then regained the ramparts and rejoined the column.

Meanwhile, the 59th Foot, though met by a heavy fire, scaled the left breach without firing a shot and turned to the left along the ramparts. The Jats fought bravely, and within a few minutes Brigadier-General Edwards and five other officers had been killed and five more officers wounded. But the arrival of Paton's column speedily relieved the pressure, and Wilson's party, having successfully accomplished their escalade, plunged down into the town to suppress the flanking fire from the houses. The united columns of Edwards and Paton then fought their way round the ramparts till they met the 14th at the Kumbher Gate. Adams, meanwhile, had forced the Agra Gate and also penetrated into the town. There was still desultory fighting in the streets and wild firing by some of the sepoys; but the fate of Bharatpur was decided. Combermere, who had followed up the storming parties closely, came up on the glacis just after the death of Khoosial Singh, and receiving no answer to his summons to surrender, sent at once for a couple of 12-pounders. These were dragged up to the breach and, by 3 p.m., were in a position to blow in the gate. Then a white flag appeared over the citadel, and Bharatpur was taken. Some 14,000 Jats had been killed or wounded during the siege or in the assault, and of those that fled from the fortress every man, to the number of some 7,000, was swept up by the cavalry. Darjan Sal himself, with his wife and children, was thus intercepted, and his capture gave the final touch to Combermere's success.

While British losses at Bharatpur numbered little more than 1,000, the Bengal Engineers suffered a disproportionate number of casualties during the siege. Three out of four captains were wounded and, of nine lieutenants, one was killed and four wounded. In fact, the cadre of sixteen engineers suffered losses to the extent of fifty per cent before Bharatpur fell.

The general opinion of the engineering work at Bharatpur was well expressed in a letter which appeared in the *East India United Service Journal* in 1834:

"There is no one I think who will not applaud the prudence of the Engineers and the Commander-in-Chief in waiting for the splendid breaches which crowned the exertions of the Miners. The behaviour of these men throughout the whole of the operations excited the admiration of the army: to see them exposing themselves under a hot fire with most perfect coolness and indifference might have almost made one suppose that they bore charmed lives. It is a great credit to them that they were worthy of their Engineer officers, and indeed a more efficient body than the Bengal Sappers and Miners it would be impossible to conceive. On them, of course, and on the Artillery fell the severest labour. Their precision in practice and their cheerfulness throughout their arduous work were beyond all praise. "(Quoted in Sandes, 1933, I, 264)

Anbury and his officers received full credit for their achievements. Combermere, in addition to a special acknowledgement to his Chief Engineer, wrote: "it would be difficult to appreciate fully the science, devotion and fortitude evinced by the Officers and Men of the Engineer Corps." (Quoted in Sandes, 1933, I1 264)

SOURCES

J.W. Fortescue, *A History of the British Army*, vol. XII Macmillan, London, 1923.
Lieutenant Colonel. P.R. Innes, *History of the Bengal European Regiment*, Simpkin, Marshall, London, 1885.
Captain H. O'Donnel, *Historical Records of the 14th Regiment*, A.H. Swiss, Devonport, 1893.
Lieutenant Colonel E.W.C. Sandes, *The Military Engineer in India*, vol. II The Institution of Royal Engineers, Chatham, 1933.
Major F.W. Stubbs, *History of the Organisation, Equipment, and War Services of the Regiment of Bengal Artillery*, vol. III Henry S. King, London, 1877.

Why Slowmo when you can Flymo?

The case for the Hovercraft in future land warfare

LIEUTENANT COLONEL M W WHITCHURCH MBE

As Sappers it is our duty to improve the mobility of the Army and hovercraft can help. The views and experience of readers is sought. Editor

CONSIDER a vehicle that can fly (yes, fly) over water, poor going (meaning beaches, swamps, quicksand and mud banks), snow, minefields, ditches, small walls, desert including sabka[1], savannah and normal land ***at up to 60 miles per hour.*** Cheap (as military vehicles go), low in silhouette, agile and requires little support to keep it mobile. As guarantors of mobility we should be aware, have some practical experience ***and know how to bring it into service for future training and operations.***

It is called the Hovercraft and, (wait for it), it is in service[2]! Hands up who knew these vehicles existed and have considered their use in all forms of Land Warfare?

Royal Marine Hovercraft in action. Called the Landing[3] Craft Air Cushion (LCAC), they are known to some as the Flymo.

Articles on a new capability generally make the mistake of overstating their case. Not this one. ***The Hovercraft offers mobility over soft and rough going that other vehicles cannot: an extra tool in the box of mobility that is used according to requirement.*** From crossing rivers in all conditions[4] to soft going, these craft can extend our options for mobility. Surprisingly our *Military Engineering*[5] manuals show nothing on hovercraft. To be fair this is understandable - most Army thinking looked at the central front in Germany. Add the usual pressures of money and commitments like Northern Ireland, the Falklands and other tasks it is understandable that this innovation was considered[6] (including field trials) up to 1978, but discarded for the reasons given.

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[1] Sabka is soft sand that can be impassable to wheeled and tracked vehicles. However, rising heat from the sun makes the sand hard enough to use.

[2] This particular craft is in service with the Royal Marines. 539 Assault Squadron Royal Marines stationed at Plymouth own a fleet of four. The point of contact is the Second in Command on 93771-4002.

[3] Think laterally Sir! Call it: **"Land~~ing~~ Craft Air Cushion"**

[4] Rivers in flood, tidal rivers and estuaries, water meadow and shallow water. The speed of the water flow is also irrelevant.

[5] The manuals are: *Gap Crossing Pamphlet 7 dated 2003, Watermanship Pamphlet 7c dated 2003 and Breaching Pamphlet 6 dated 2003*

[6] See Tactical Doctrine Retrieval Cell (TDRC) paper *"UKLF report on Hovercraft in 1973"*. Point of contact is David Porter, TDRC, Room 152, Building 370, Trenchard Lines Upavon, Wiltshire SN9 6BE. Contact 01980-615058 or E mail eotdrc.dgdd@gtnet.gov.uk This is one of several papers and articles on a disk called **Hovercraft**. It makes instructive reading.

SO WHY BOTHER?

Because the situation has changed. Consider:

- The state of mind where all eyes and effort on the central front in the Cold War is long over. Subsequent operations have been everywhere. Since 1989 we have taken part in seven wars and countless other operations. This will continue.

- The Army has two brigades that will shortly change from the Armoured to the Light Role. In anticipation ***we must be able to advise how these converted formations will move*** – small vehicles (*viz:* tools in the box of mobility) such as quad bikes, pack[7] transport (meaning horses and the like), mountain bikes, small tracked or wheeled carriers[8] and marching. Hovercraft must also be examined.

- Technology has progressed – hovercraft are more efficient and are cheap compared to aircraft, armoured vehicles and other amphibians.

- The practice of working with other armed services (or Joint operations) is now very close and highly regarded. The Royal Marines have had this capability for years and we should consider its wider use in all Land operations. Equally they have a trials, research and training unit that has much experience in this work. This jointness is nothing more than improved ***co-operation, flexibility, and economy of effort,*** three of the ten immutable principles of war.[9]

Therefore Hovercraft should be considered, tried out and used as required.

" Magic! … This Flymo's got Rudolf and his whingeing mates beat !"

THE CASE FOR THE HOVERCRAFT

CONSIDER: the best RE work is when no work is required *viz*: the user can get on without our assistance. However there will be occasions when the user and/or supporting RE work is needed. Readers will agree that like any other tool it is the skill of the user that determines how effective the Hovercraft will be. Equally commanders, staff and crew require to ***study and train*** for the practical application of the craft as per any other system or equipment.

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[7] Consider the mobility of our new Light Brigades. There is a splendid video tape that explains the case for pack transport. It is called *Pack - the local solution*. C1808. This tape can be obtained through The British Defence Film Library (BDFL) Customer Services can be contacted on: Tel: 01494 878252 Military 95 298 2252. Fax: 01494 878007 Military 95 298 2007. E-mail: BDFL.Customerservices@ssvc.com CASH, CHOTS and Army Mail BDFL – CUSTOMER SERVICE. Equally link this tape with the TDRC Disk 0087 on *Snow and Mountain Warfare*. Ask for David Porter.

[8] See articles called *I loved my Bren Carrier* by Carbuncle and Sydney Jary in *British Army Review* (BAR) Apr 1996 and *Achtung! Infanterie Greif an!* In *Army Doctrine Training News* (ADTN) number 15 of Summer 2001. Finally *Light Infantry – A Renaissance?* BAR Dec 1982. All make important references for any study of mobility of a future Light Brigade. Obtainable from David Porter at TDRC.

[9] With imaginative diligent application, Hovercraft could help achieve the *Aim*, improve *Offensive Action* and A*dministration* too.

In general hovercraft have the following strengths.

- Speed across poor going – up to 60 miles an hour.
- Light and airportable by fixed wing aircraft and helicopter.
- Cheap compared to armoured vehicles, aircraft and armoured amphibious vehicles.
- As easy to operate as any Armoured Vehicle.
- Reliable technology – it is simple.
- Proven on operations from the early 1960s onwards
- It gives double value – it works on land as well as water.
- Like other amphibians it can load up far away, approach, cross and exploit. It is not tied to any point.

THE IN-SERVICE HOVERCRAFT – DETAILS[10]

Speed:	25 Knots
Range:	200 nautical miles
Payload:	2200 Kg or 12 troops
Weight:	7000 Kg
Size:	12.7 m by 5 m
Engine:	Diesel 355 brake horse power (BHP) at 2100 revs per minute (RPM)-thus power to weight ratio is 19.7 BHP per tonne
Fuel:	diesel or avcat
Slopes:	1 in 12
Ground Clearance:	0.6 m
Step Climbing:	0.5 m

[10] See Website www.griffonhovercraft.com The Hovercraft in service with the Royal Marines is called the 2000TD.

MOBILITY CAPABILITY OF BATTLEGROUP VEHICLES

Serial	Vehicle	Ground clearance (metres)	Step climbing (metres)	Gap crossing (metres)	Slope climbing (metres) (i)	Shallow fording (metres) (ii)	Deep fording (metres) (ii)	Weight (tonnes)	Military Load Class'n	Remarks
(a)	*(b)*	*(c)*	*(d)*	*(e)*	*(f)*	*(g)*	*(h)*	*(i)*	*(j)*	*(k)*
1	Challenger 1	0.5	0.9	2.8	1 in 1.7	1.07	Top of turret	62	70	
2	Challenger 2	0.5	0.9	2.3	1 in 1.7	1.07	Top of turret	64.5	70	
3	Chieftain	0.5	0.9	2.8	1 in 1.4	1.06	Top of turret	54	55	
4	Challenger ARRV (CRARRV)	0.5	0.9	2.8	1 in 1.7	1.07	2.59	61.5	70	
5	Chieftain Bridgelayer	0.5	0.9	2.8	1 in 1.4	1.06	-	53.8	60*	*Complete with bridge
6	Chieftan AVRE	0.5	0.9	2.8	1 in 1.4	1.06	-	61.2	70	
7	FV 101 CVR(T)	0.35	0.5	2.96	1 in 1.4	1.07	-	8.0 approx	10	Scimitar, Samson & Sultan of the same specifications
8	CVR(W) Fax	0.4	0.5	0.6	1 in 2.2	0.75	-	6.3	8	
9	FV 432	0.4	0.6	2.05	1 in 1.4	1.07	-	15*	18	*Variations according to role
10	FV 180 (Combat Engineer Tractor)	0.5	0.6	2.3	1 in 1.14	1.8	Full flotation	17.7	18	Able to swim
11	Saxon	0.29	0.4	-	1 in 1.52	1.4	-	11.67	12	
12	Warrior	0.49	0.75	2.5		1.45	1.3	25.7	33	

Notes i. Figures show maximum climbing ability when tractive ability is good. Maximum gradients for stopping and restarting and exiting from a water crossing may be considerably less.

ii. Angles of entry and exit may be critical factors.

The more traditional method: Getting in can be a fag, crossing alright but boats stop at the water's edge – hovercraft can go on.

THE WAY WE WERE – BLASTS FROM THE PAST

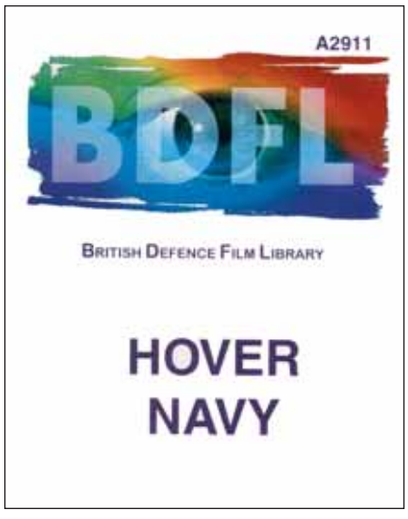
"There are many people in the Army who feel that the potential of military Hovercraft has yet to be fully appreciated[11] . . . Even though shortage of funds has brought a lull in the Army's involvement in this field, it is one that merits continuous surveillance and study"
Editor, British Army Review December 1976

Hovercraft were trialled in 60's and 70's but with emphasis at that time being on Germany[12], they were seen as a luxury that could not be afforded[13]. Trial reports and other useful information has been stored at TDRC. Roles, organization, and administration were considered for all the craft below including tactics, techniques and procedures and any consideration for future use must look to these reservoirs of experience.

Trialled from 1972, the Cushion Craft 7 (CC7) [13] was a small recce type craft. With a crew of two it carried five fully equipped troops or 0.7 tonnes. Turbine engines to 620 BHP gave a speed of up to 40 knots with an endurance of four hours. It proved its value on Exercise *Van Dyke* in 1973[14] as an offensive weapons carrier for the Army. Of note were the two centrifugal fans that made the craft both very quiet and exceptionally manoeuvrable.

HISTORY OF BRITISH MILITARY HOVERCRAFT

1958	Hovercraft model tried out
1960	First big craft tried
1961	Army involved. Joint Trials Unit formed.
1966	200 Royal Corps of Transport squadron formed. Craft established
1971-73	Ex *VAN DYKE* Trials.
1974	200 Sqn axed through lack of money
1995	LCAC in service with RM
1999	LCAC used in Congo
2003	LCAC used in 2nd Gulf War



This tape gives the history of the Hovercraft up to 1978 and illustrates its use by the Army as well as the Royal Navy..

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[11] See the TDRC Report 01777 HQ United Kingdom Land Forces *Hovercraft in the Army - Final Report August 1973*. Linking with footnote 5, this gives a very good summary of where the Army got to and requirements for future Land Operations. Also see page 29 on CC7.
[12] See TDRC Report 02352 on river crossings in Germany 1971. Our old friends the River Weser was found to be alright but the River Leine less so.
[13] "Hovercraft died of financial starvation . . ." See TDRC Report 04168 and the article *Too much too soon? The Army's Hovercraft Experiment*.
[14] TDRC Report 01946 Ex *VAN DYKE 2 – Trials Report* contains a mass of valuable lessons on use of Hovercraft like the CC7 and the SRN 5.

SRN 5 – "carried about 20 troops or two tons and cruised at 60 knots. We found it suitable for patrolling rivers and coasts, for routine surface transport, and for quick movement of small parties of troops particularly at night when the helicopter was not at its best."
Taken from *Borneo* BAR 32 August 1969
(Author's Note: This craft had a turbine engine giving 900 BHP. The crew consisted of a driver, navigator/radar operator and a crewman/gunner who manned the roof mounted general purpose machine gun. It also saw service in Vietnam – see footnote 20.)

The SRN 6 Mark 2 entered service in 1968. It was bigger and slower than the SRN 5 at 50 knots an hour, but was able to carry 30 fully equipped troops or a dismantled field gun and its ammunition and crew in the cabin to a payload of 2.3 tonnes up maximum of 3.1 tonnes in good conditions. Endurance of four hours. The crew consisted of a driver, navigator/radar operator and a crewman/gunner manning the roof mounted general purpose machine gun[11].
(Authors Note. This craft had the same turbine engine as the SRN 5 giving 900 BHP.)

THE CASE AGAINST THE HOVERCRAFT – LESS BOVVER WITH A HOVVER?

"Knowing what you <u>cannot</u> do is just as important as knowing what you <u>can</u> do" Sydney Jary

ALL vehicles have limits and the Hovercraft is no exception. Here are the known weaknesses and advice on how to tackle them.

- **Bare? They have little protection.** Ditto for a four-ton truck. Survival is obtained though stealth, profile, speed and protective firepower. Try hitting a moving target that is weaving and doing 30 (let alone 60) miles an hour. Adding a pintle-mounted machine gun and a 51 mm mortar is easy.[15] These help pre-empt attacks on the craft.
- **Loud and Proud?** About as loud as a Spartan but less noisy than a Warrior. Use of covering noise, wind conditions and skill in driving can help. Technology is making them quieter.
- **Approaches to and from rivers?** An old Sapper saying is the approaches are often a bigger problem than the water itself. Approaching a river with Assault Boats is never easy. Hovercraft can set off from an assembly area well back and advance at speed to the river and cross. Once on the river they continue to operate at speed. However getting out could be a possible problem requiring RE work or moving to a place where they can get out. One solution is to use M3 as mobile ramps. Or some floating pontoon. Really!

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[15] The 51 mm light mortar is a simple and very effective weapon for defence being able to lob smoke, high explosive and illumination rounds to 800 metres. Add a 0.50 machine-gun or a GPMG and this will help disrupt, dislocate and destroy opponents. For more on the mortar see BDFL Video Tape C1705 *The 51 mm Mortar*. See footnote 6 on seeing tape.

Soft approaches? Fly straight over them. Ditto mines.

The supporting fire for such an operation would follow normal lines. If the craft are not detailed to exit then Infantry dismount at the water's edge. As we know all water obstacles are unique and one size does not fit all! Add suitable RE work and this exit matter can be resolved. Equally the speed of such craft can give the option of going up or down river to a suitable exit - literally lateral thinking! Finally their speed makes excellent ferries. For sure they have a place in river crossings.

- **Not good at slopes.** Hovercraft cannot climb slopes greater than 1 in 12. Thus where it operates will range from desert, lakes, marshes, flatlands and so on. However, research showed that it is possible to improve power to weight ratio where Hovercraft with 166 BHP/tonne can climb slopes up to a maximum of 1 in 2.5[16]. These figures are based on 1976 technology and diesel engines have much improved. Alternatively it is worth checking the case for aircraft engine turbines[17] – favourable aircraft economics and other efficiencies in the last 20 years may help. In any case up-powering craft so they can take on slopes to 1 in 2 is prudent. See the table next to the LCAC above. ***Poor slope climbing and vertical steps are the biggest arguments against the craft in Land Warfare***. For a higher vertical step a bigger skirt seems to be the answer. Look at the tape *Hover Navy* to see what could be achieved.
- **Short gap crossing is poor.** The craft has to be doing a fair speed if it is to cross short gaps. The problem is that the air built up in the cushion escapes. Simple placing of a suitable tarpaulin tied down can solve this or other crossing aids (fascines, trackway, and earth filling). Consider the simple existing ramp below.

- **Fragile.** To do its task the hovercraft is literally flying so it must be light and built like an aircraft. It therefore has to be treated with care.
- **Special to LCAC (Light) points.** There are only four of these craft and they are very busy in support of 3 Commando Brigade. The craft are over ten years old and have been extended for five years. Low loaders and big aircraft like the C130 *Hercules* can lift it. Heli lift is possible but not confirmed. Not usable in strong winds above 27 knots.

The essential point is to use the craft within these constraints – often it may not be suitable.
If conditions are favourable then it will be a great help in achieving the aim.

Returning to the tool box analogy, if this tool does not apply then another approach may work.

Adopt, Adapt, Improve!

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16 See *A case for the Light Military Hovercraft* by Major JHV Prendergast Royal Tank Regiment. Page 58 British Army Review 54-December 1976. Available from TDRC-see footnote 5.

17 See TDRC Report 08351 *The Use of Hovercraft as Landing Craft*. See paragraphs 16,17,18 and 35. It gives an instructive description of gas versus turbine engines.

FUTURE ARMY USE OF HOVERCRAFT – LOOKING FROM THE PAST TO THE FUTURE

"Fire the imagination" FM Wavell

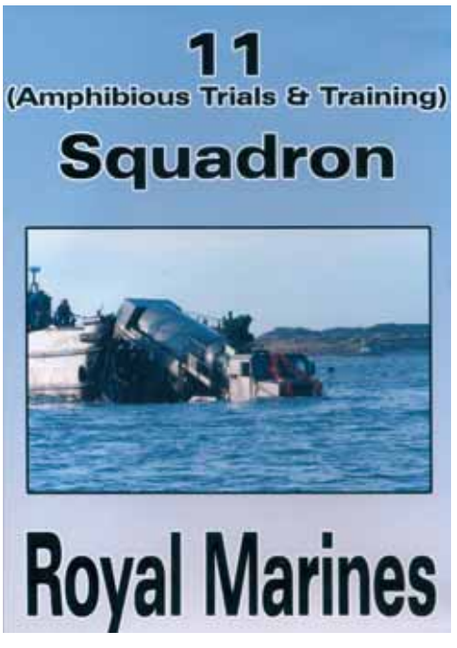
Imagine Hovercraft were available in the following operations, then consider the examples past and present.

- **Alamein[18] 1942.** The attacking allies were flanked by two impassable obstacles. In the North there was the sea and in the south the soft sea of sand called the Qattara Depression. With hovercraft a flanking attack could have been considered and assisted the main assault.
- **The Rivers Seine and Rhine[19] 1944 and 1945.** Getting in these large rivers would have been much easier and crossing much faster. However getting out would have required some RE work.
- **Supply to Leningrad[20] 1941-43.** Soviet supply over Lake Ladoga to the besieged defenders could have been longer, more flexible and faster. The hovercraft would have made the lake problem irrelevant in all weathers as well the period when forming ice hindered ships and was clearly not strong enough to take wheels or railway.
- **Crossing the Don, Dnieper, Vistula and Oder Rivers plus the Pripet Marshes[21] 1943-45.** Soviet speed over these large rivers and swamps would have been much faster. In addition the mud seasons before and after the freezing Russian winter would be no problem to hovercraft.
- **Mozambique 2000.** Supply and rescue of people in this mass flooding would be very easy especially where it was too shallow for boats
- **Congo 1999 and 2003-4.** In 1999 the evacuation across the River Congo of British nationals from Zaire (now the Democratic Republic of Congo) to Congo Brazzaville was perfectly viable with hovercraft. In late 2003 the United Nations wanted to Police the great Lakes and immediate surrounding flat lands in order to hinder arms smuggling and guerrilla activity between Burundi, Tanzania and Congo. Hovercraft would have been a good answer. The same holds true on the lakes in and around Uganda.
- **Vietnam 1966-69[22] and Borneo 1965[23].** Both theatres saw use of hovercraft in patrolling and resupply. Highly regarded.
- **Gulf 2003.** Unclassified reports state it was used with success. If any reader can expand, please write in.

A FLYING START? Or HOW TO BRING IT INTO SERVICE FOR FUTURE TRAINING AND OPERATIONS

"There is seldom any lack of attractive looking schemes in war. The difficulty is to give effect to them"
FM Sir William Robertson GCB KCVO DSO.

"Remember the 11th principle of war - keep it simple"
Anon



This DVD explains how the Royal Marines mess about with boats and water and why they are worth a visit. The location is just opposite RMB Chivenor, the home of 59 Indep Cdo Sqn RE. The DVD is held at TDRC, see footnote 5.

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18 For those readers who are unfamiliar with these campaigns, please see the book *The Times Atlas of World War Two*. For the battle of El Alamein please see pages 114-115. To get the book is simple. Link with The Prince Consort's Library on 94222 4382. Or E mail to pcl@dera.gov.uk

19 As footnote 18. Look at pages 158-159. The fighting for the Scheldt Estuary could have benefited too.

20 As footnote 18. Look at pages 64-65.

21 As footnote 18. Look at pages 126-127 and 174-175.

22 See TDRC Reports 02976 *Miscellaneous Reports from Vietnam*, 01695 and 01700. Compiled by the British Military Attaché in Saigon it contains useful coverage of Hovercraft in Riverine Operations and compares Hovercraft with Armoured Reconnaissance.

23 See *Borneo* by Lt Gen Walker, BAR 32 August 1969. Obtainable from TDRC. See footnote 5.

HAVING a good idea is easy: how to bring it about is less so. Simplicity is the key. Equally, *unless the conditions*[24] *are favourable*, any new capability is unlikely. Keep this in mind and therefore let the Royal Engineers:

- Promote awareness of the hovercraft and current breeds; CRE study days in support of the new light brigades would be a good start. Link this idea with further study days in mobility for light formations.

- Visit 11 Amphibious Trials and Training Squadron and 539 Assault Squadron Royal Marines – visit and study. Send selected officers on attachment[25].

- A doctrine discussion note led by RE on mobility for light forces must be considered. Nominate a branch of RE staff to lead and work up suitable plans and staff accordingly.

- Have a shopping list. Make a contingency plan to expand the RM fleet. So what is needed? 40 hovercraft or in other words, lift for a battalion or battle group in one go[26]. The contingency plans to be worked up with industry involvement in order that they are realistic.

- Have a good look and think about contents under "Hovercraft" on the Internet. Type in "Hovercraft" into a search engine like Google and consider.

AND FINALLY

THE Hovercraft has ***definite*** limits. But if its strengths are applied with diligence and its limits observed, it would be most useful and even decisive in future.

Take the bovver and consider the Hovver!

ACKNOWLEDGEMENTS

The author wishes to acknowledge the kindness, support and humour offered in writing this article. As usual, it has been a team effort.

- TDRC - David Porter for industrious and rapid research support
- Col Chip Wood for advice on Hovvers and the cartoon on Page 2.
- 11 Amphibious Trials and Training Squadron and 539 Assault Squadron Royal Marines for advice and comment.
- Griffon Hovercraft for advice and use of their pictures.
- The Hovercraft Society for use of their pictures.

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[24] Conditions means: political will and an operation where there is a proven role for hovercraft.

[25] Contact details are: 11 Amphibious Trials and Training Squadron, 1 Assault Group, Royal Marines Instow, Devon, EX 39 4JH. Telephone 01271- 884124. Mil 93786 - 4124. Fax 93786 - 4123. The 239 Assault Squadron point of contact is Second in Command on 93771- 4002.

[26] The other options are: Establish own unit. This would take ages and resources that do not exist. The climate for such innovation is unfavourable unless we are at war or about to go to war where such craft are required. Another option is to do nothing. Given the unpredictable future I argue this is wrong too.

Satellite Navigation in the Military

MAJOR A STROMBERG BENG(HONS) MSC AFRIN MCGI FINSTCPD

Major Alan Stromberg is coming to the end of his appointment as the Senior Instructor in Geodesy and Navigation at the Royal School of Military Survey at Hermitage, the most fulfilling posting in his service to date, that has seen the usual other command and staff appointments in UK, Germany, and with NATO. In his current post, he is also a Council member of the Royal Institute of Navigation and the Land Representative to NATO's Sub Committee 8 – Navigation. He can be contacted for advice on courses, or for further information on the content of this article via the ATN on 94231 4296, via BT on 01635 204296, or on EMS E-mail as DGI-GEG-RSMS-GEODESY-SI

KEYWORDS
Global Navigation Satellite System (GNSS),
Global Positioning System (GPS),
guidance, Inertial Navigation System (INS)

BACKGROUND

SATELLITE Navigation has revolutionised navigation, positioning, guidance and logistical tracking since its current global inception about 30 years ago. GPS-aided navigation now informs almost all manner of personal or vehicle movement. It is uncontroversial to suggest that, in the near future, almost anything that moves – and especially in the military arena – will be able to position itself or be tracked by remote command systems. Few peoples' professional or personal lives remain untouched by this technology today.

Many officers and soldiers of the Corps will have made use of GPS systems, whether MOD-supplied receivers or their own purchases. This article aims to inform those who know a little about GPS but would like to increase their technical knowledge and understanding of the concept, and also to highlight the very wide uses to which GPS is being put, outside the direct navigation arena. So, this article will also consider other military aspects of satellite navigation; the cryptographic element in GPS receivers; the increasing reliance of command and control systems on the timing service provided by GPS; and the concept of Navigation Warfare – protecting GPS signals, preserving their use in hostile conditions, while potentially preventing access to satellite navigation sources to one's enemies.

It should be borne in mind, however, that, for the soldier on the ground, a GPS receiver represents just another aid to navigation, alongside the compass or binoculars. GPS does not replace the need to train servicemen in the recognition of features on the ground, relating those features to the map, and being able to read those maps effectively for navigation. This has been implicitly recognized by the introduction, next year, of a new ITD(A) in Map Reading & Navigation.

The RSMS is the Army's "Subject Matter Expert" for both GPS and traditional precise positioning, map reading and navigation; the Geodesy Department has taken the technical lead in designing this new ITD(A). The Dept runs a variety of navigation courses: the MAPRIC is still going strong, and will be even more heavily subscribed to when the new ITD(A) will force commanders to take navigation more seriously; there are GPS Users' and Instructors' courses (four days and two weeks in length respectively) which use the Army SPGR (pronounced "spugger" – Specialist Personal GPS Receiver) as the GPS training tool; and the RSMS is also piloting, in the near future, a 3–week-long combined MAPRIC and GPS Instructor course, to bring traditional and modern techniques properly together. For advice on these courses, or for further information on the content of the article proper, please contact the SI Geodesy through the RSMS.

1. Introduction

PEOPLE have been using the stars and the sun to navigate from the earliest days, a technique known as *astronomical navigation*. Modern day navigation is simply an extension of this process – using artificial stars (satellites) on precisely known orbits to aid fixation of position.

The first satellite-aided navigation systems to be launched were the *US Transit* and the *Russian Tsikada* systems in the late 1960s – both using Doppler shift techniques. Since then, satellite-based systems have increased enormously, in terms of both accuracy and availability.

This article will take the reader through the basic theory of SATNAV[1], the equipments and accuracies that the military user can expect in Unit, the limitations of such systems, through to the likely improvements and future developments in this field.

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[1] SATNAV – Satellite Navigation

2. Global Navigation Satellite Systems

As with many military subjects, the theory of SATNAV is littered with acronyms and terminology; a short glossary can be found at the end of the article. It is important to understand a few of the fundamental concepts. SATNAV is routinely known as *GPS*. This is misleading, as GPS – the US Department of Defense NAVSTAR ***G****lobal* ***P****ositioning* ***S****ystem* – is just one of many SATNAVs or *Global Navigation Satellite Systems* (GNSS). GNSS is the generic term for all SATNAV systems, from the satellite constellations themselves (among which are GPS, the Russian GLONASS, and the developing EU system Galileo) to the control stations that monitor and manage the satellites, to the *Ground-Based* and *Satellite-Based*[2] *Augmentation Systems* (GBAS/SBAS) that operate today, as well as Users themselves. GPS was the first *fully operationally capable* (FOC) system, and remains the NATO standard for SATNAV, and hence it is still the principal navigation and positioning system in use today, by both military and civilian users. GPS/GNSS are also commonly known as *Positioning, Navigation and Timing Systems* (PNT); the timing element has become increasingly important, as will be discussed.

3. Basic Theory of GPS

GPS WORKS on the principle of *trilateration*. Just as one would calculate a resection on a map, a User receives a GPS signal from a *satellite vehicle* (SV) in view, and by calculating the time of travel of the signal, is then able to calculate the range between the receiver and the SV. Given that the signal travels at the speed of light, by simultaneously ranging to at least four satellites, the receiver is able to position itself on the earth (or on the ocean or in the sky), in three dimensions. Four SVs are required (not three) to allow for receiver clock error to be eliminated in the observation equations formed (the other three unknowns being X,Y, Z of the user's coordinates).

3.1 Satellite Constellation

The GPS constellation is configured to provide 24 SVs in six orbital planes (hence four in each), at an inclination to the equator of 55º. Each SV is approximately 20 200 km above the earth's surface, in a 12 hourly, near-circular orbit. As at May 2005, there are actually 29 SVs in orbit, and older SVs are being continually replaced by modernised versions. The constellation is designed to give global signal coverage, but the number of *satellites in view* is necessarily not as good in Polar Regions; this is a function of inclination (the satellites are never at a latitude greater than 55º). Users can acquire up to 10 – 12 SVs simultaneously, dependent upon the time of day, the User's latitude and the number of channels in his receiver (for continuous "lock" to an SV signal, each signal needs a dedicated channel). Both the Russian GLONASS and the developing EU Galileo constellations are remarkably similar in design concept.

3.2 GPS Signals

Each GPS SV transmits signals on two frequencies in the *L Band:* the *L1 signal* at 1575.42 MHz, and the *L2 signal* at 1227.60 MHz. Codes are modulated onto these signals which contain the Navigation Message (explained later). The C/A code – or *coarse/acquisition* code – is modulated onto the L1 signal only. The P code – or *precision code* – is modulated onto both the L1 and the L2 signal. As its name suggests, access to the P-code will allow a greater accuracy to the Stand-alone user – a receiver working by itself and not receiving augmentation signals. The US DoD, in terms of service, defines quality or accuracy of position: the *Standard Positioning Service* (SPS) is based on access to the C/A code only on the L1 signal; the *Precise Positioning Service* (PPS) is based on access to both the C/A and P codes on both signals. The stated accuracies of the two services are based on worst-case scenarios[3]; a User's absolute accuracy of position is routinely better than those stated for both the PPS and SPS.

3.3 Military Code

The US DoD limits access to the P-code to only recognised military allies, such as NATO forces. This limitation/authorisation is ensured by encryption of the P-code to the *Y-code*[4]; access to the encoding information (keys) is strictly controlled.

3.4 Determining a Position

There are two methods for determining a position with a GPS receiver. The more accurate method – *the carrier phase method* – is a relative or differential method that requires at least two receivers to be tracking the same set of SVs at the same time. Many of the errors associated with a position can then be eliminated or mitigated, giving greater accuracy. The method relies on using the underlying carrier signals L1 and L2. The wavelengths of the L1 and L2 signals are shorter than that of the two codes, so a more precise range solution

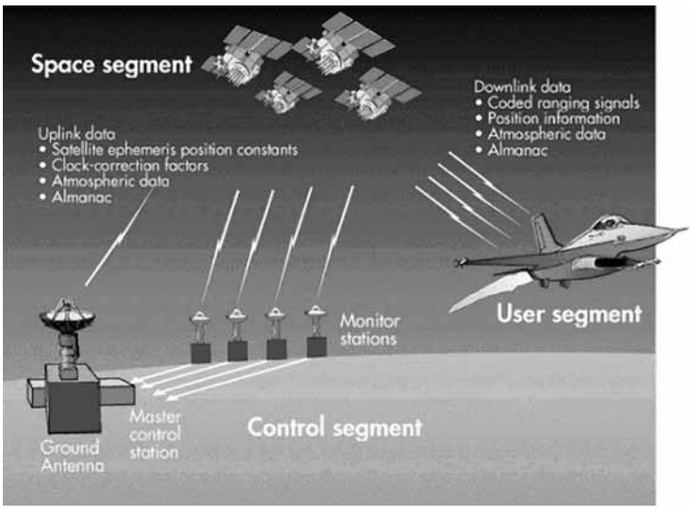

Figure 1. The Control, Space and User Segments of GPS.

[2] Augmentation in this case means additional signals, received at the antenna either from space or a ground based transmitter, that allows the user to improve his position on the ground.
[3] These stated accuracies are: 16m and 35m Spherical Error Probable (3D, 50 per cent confidence) for the PPS and SPS respectively.
[4] Y, in this case, unlike C/A and P, does not stand for anything in particular!

can be determined. However, such a solution can only be post-processed. This reduces this method's usefulness as a *navigation* tool, and so won't be considered further, save to say that this is the method commonly used by surveyors (and Military Geographic Engineers) for precise point positioning (for controlling surveys for map making, datum definition and so forth). The second method – *the code phase method* – as its name suggests, uses the navigation message modulated onto the C/A and P codes to determine a position, and a Stand-alone receiver in navigation mode can do this. From the information contained in the Navigation message, the time of transmission of the signal can be calculated, and hence the range from the SV to the receiver can be calculated, as the receiver generates its own replica copy of the signal transmitted by the SV.

The *Navigation message* contains all the necessary details to enable a receiver to calculate its position. It is transmitted continuously in both codes and contains: the accurate *system time* (SVs have atomic clocks for precise time definition); the astronomical co-ordinates of the SV for every time epoch or period (the SV's *ephemeris*); corrections for atmospheric errors; details of the SV's technical "health"; and an almanac for all other SVs in the constellation of their approximate positions in orbit – their ephemeris. The navigation message takes 12.5 minutes to be broadcast completely, and this explains why a position is not instantaneously given on a GPS receiver when it is first switched on (especially in a new area of operation) – SVs need to be *acquired* by the receiver, and its navigation message downloaded and processed.

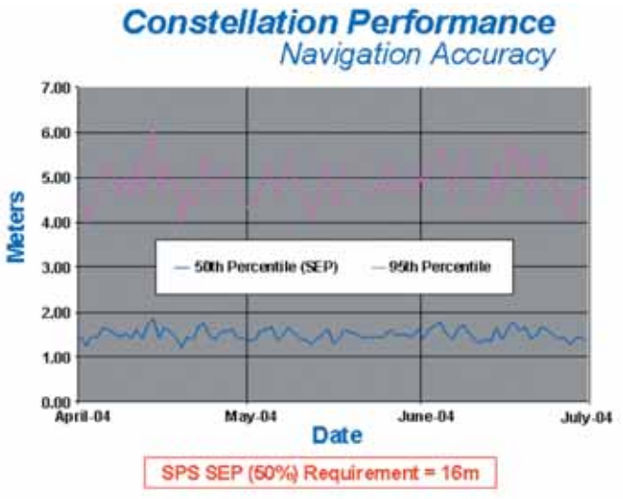

Figure 2. The GPS Standard Positioning Service; navigational accuracy statements for a period in 2004. The SPS "Spherical Error Probable" Statement of Requirement is for 16m at 50 per cent confidence level.

3.5 Accuracies

The accuracy of a particular position is dependent upon many variables: the type of receiver being used (whether it is military or civilian, single [L1] or dual [L1 and L2] frequency, the processing power and software of the receiver, etc) ; how long the receiver has been stationed at that point; how many SVs it can acquire; its latitude; and whether it is in a good location (i.e. free from vertical obstruction or *multipath*). More important, however, is the use to which that position will be put. For most navigation purposes, the GPS location will be compared to a map, and of course map grid references have their own inherent inaccuracies, owing to generalisation, map displacement or simply because of the scale of the product. Most modern and well-respected Stand-alone civilian receivers will give a 3D-position accurate to 7 – 10 m. Error will be greater in height than in plan because of SV geometry (SVs are all above the observer's local horizon, giving a relatively poor degree of accuracy in *depth* – remember the analogy of comparing GPS trilateration with a map resection). This accuracy is more than adequate when confirming location on a map at 1 : 50 000 or 1 : 25 000 scale. Military Stand-alone receivers will give slightly better accuracy in both plan and height, because of access to the P-code, but they also offer better performance in terms of resistance to interference, robustness and extra functionality. Figure 2 shows the actual accuracy versus stated requirement of the SPS service for a given period in 2004, showing that the system is easily meeting its objectives.

3.6 Errors in GPS Positioning

Gross errors or blunders are the most common problems encountered with GPS receivers in navigation mode – errors such as not selecting the correct datum for the map being used, misinterpreting geographic coordinates (lat and long), or having the wrong style of units selected – miles instead of kilometres, for example. This is why training in the use of receivers is important.

If blunders are eliminated, the accuracy of a position is entirely dependent on reducing the errors present in the calculation of range from SV to User. These errors are typically categorised into three areas – those affecting the SV itself, those induced in the signal by the atmosphere, and those suffered by the User's receiver.

3.6.1 SV Errors

SV-based errors take two forms. The first error is a bias in the atomic clock on the SV, which will then lead to marginally imperfect time of transmission of the signal. As the system is based on the travel time of the signal, and the signals travel at the speed of light, even errors in the range of nanoseconds can induce range errors in the order of metres. The second error is in the ephemeris (or position) of the SV when it transmits the signal. The exact orbital position of the SV cannot be known perfectly at the time of broadcast, but can only be estimated. Only by post-processing the signal afterwards, as referred to in 3.4, can the exact ephemeris be calculated.

3.6.2 Atmospheric Errors

The atmosphere between the SV and the user is not a vacuum, so the signal is both refracted from a straight path and delayed in its arrival at the User. The amount of delay and bending is a function of the temperature, humidity and barometric pressure of the atmosphere, as well as the amount of solar activity (or ionisation) in the upper atmosphere. More importantly, the upper atmosphere

has differing effects at different signal frequencies, so the L1 and L2 signals are affected differently. Some, but not all, of this error can be modelled or eliminated, and residual errors remain in the final position solution.

3.6.3 Receiver Errors

Principal among receiver errors are: clock error – receivers do not have atomic clocks, so a fourth SV signal is required to eliminate gross clock errors from the position solution; multipath – the reception of signals that have been reflected off nearby obstacles such as buildings, vehicles and trees; and receiver *noise* or errors/approximations in the algorithm calculations that the receiver makes to calculate a position. Good observation procedures will reduce or avoid some of these errors, such as avoiding *urban canyons* (restricted horizons) or places where shielding/surroundings may cause multipath.

4 GPS Equipments

The core elements of a GPS receiver – the antenna and the processing software – can now be manufactured on such small scales that a positioning device can be installed in the smallest of equipments; mobile telephones, pagers, PDAs and so on. Much of the rest of the hardware that comprises a typical GPS receiver – the keypad, a screen, and the power source – can be shared with the host vehicle.

A typical civilian GPS receiver needs to be of a certain size – cell phone size – to allow adequate hand manipulation of the keys, but this is the only real constraint on miniaturisation. *Garmin, Magellan* and *Trimble* are three examples of equipment manufacturers who have benefited from the massive increase in personal GPS receiver sales. Military *handheld* (HH) receivers tend to be slightly larger to allow for a more rugged frame, a greater battery compartment for longer life and for the extra functionality required, such as input devices for cryptography. Importantly, they should also have a much greater operating temperature range. The standard range of (HH) GPS receivers produced for the US DoD over the last 15 years by Rockwell Collins – the *Precision Lightweight GPS Receiver* (PLGR), the *Specialist Personal GPS Receiver* (SPGR) and now the *Defence Advanced GPS Receiver* (DAGR) – have equally reduced in size so as to be similar to their civilian equivalents.

Respectable civilian HH receivers cost as little as £100; the DAGR can now be purchased by authorised nations through FMS[5] for about £3,000. GPS chips from an Original Equipment Manufacturer (OEM), that provide one component of a system, such as a locating device within a cellphone, are only a small cost of the overall price of such a device – perhaps £3 to £5 per piece.

5 Typical Functionality of a GPS Receiver for Land Navigation

Despite the variety of manufacturers and models of HH receivers on the market, most devices perform broadly the same function. They are likely to consist of several screens with the following capability:

Figure 3. A soldier using the Rockwell Collins-manufactured PLGR (Precision Lightweight GPS Receiver).

- A position screen, displaying coordinate values. Datum, grid and coordinate style can be selected and most receivers will have the standard set of NGA[6] datums and transformation algorithms, allowing conversion between datums.
- An electronic compass or nominal compass rose to highlight True North, one's current direction of travel and the direction one needs to turn to reach a specified location (waypoint).
- The ability to mark current locations, and store those coordinates, either individually or as part of a route/track, and the ability to enter coordinates of locations that one wishes to travel to.
- Route planning tools that show, for instance, current speed, time and distance to destination, and distance covered.
- A map background, with an adjustable scale. Digital (usually vector) maps on HH receivers can be rather crude because of the power and storage limitations of these devices.

Many other "nice-to-have" features are often not worth the extra cost of the reveivers ! Buyers should really consider the performance of the receiver in the core areas mentioned above, and then in packaging – ie how rugged is it? Waterproof ? Battery life ? etc.

6 GPS Integration with other Navigation Equipments

Satellite Navigation is still a relatively young science, and many novel methods of use are currently being developed. Research and Development has concentrated on successfully integrating GPS with other navigation and guidance aids, with the advantages of each system being used to mutual benefit. GPS receivers have been integrated with *odometers* on vehicles and with *Dead Reckoning* devices on ships, but the most successful

[5] FMS – Foreign Military Sales Contract.
[6] NGA – National Geospatial Intelligence Agency (the US DoD Mapping Agency).

integration has occurred with *Inertial Navigation Systems* (INS). INS are self-contained, passive systems that contain accelerometers and gyroscopes to measure acceleration (and hence, through numerical integration, velocity and distance) and rate of turn in three planes to give a navigation solution. INS are particularly prevalent on aircraft, and have been for some decades. GPS and INS integration, through a *Kalman Filter* (numerical modelling) approach, has been particularly successful, and is now a *de facto* navigation or guidance solution on fast jet and guided missile procurement plans. The two navigation solutions offer a particular synergy that complement one another very well. For example, INS have a very fast update rate – perhaps 1000 Hz, compared to GPS of normally 1 Hz. Using an INS on a missile guidance system will therefore allow very quick position confirmation after launch. INS have a tendency to "wander" or drift after calibration, as they are passive systems. Integration with GPS will allow the GPS receiver to recalibrate the *Inertial Measurement Unit* (IMU) – combined INS/GPS – on the move, and reduce this wander during flight.

In summary, GPS / INS integration improves accuracy, flexibility and reliability.

7 Other GNSS Systems and Augmentations

The greatest advances in GNSS technology over the last five years have come about due to the needs of the commercial aircraft industry. Most aircraft are still reliant on local radar, microwave or distance measurement devices at airports for the final phases of approach and landing. The *International Civil Aviation Organisation* (ICAO), the *Federal Aviation Administration* (FAA) and other international aviation organisations have been assessing potential replacements for these guidance systems for many years. GPS in the Stand-alone mode does not meet the strict rules on accuracy, availability, integrity and reliability that is needed for approach and landing. However, both *space-based* and *ground-based augmentation systems* (SBAS/GBAS) have recently been developed which offer this increased assurance.

7.1 Differential GPS

Most of the errors associated with a position given by a receiver at a particular time and location will be the same as experienced by another receiver in close proximity. If a reference receiver is located at a known location, then these errors can be calculated and a correction to the position of the unknown (or roving) receiver can be transmitted. This is a process known as *Differential* or DGPS. Many nations now have networks of permanently established reference DGPS stations which transmit these corrections that a Stand-alone receiver can access and use to improve its co-ordinate accuracy. Maritime assistance for ships entering and leaving ports is particularly suitable for DGPS applications. This system is limited by the telemetry capabilities of the transmitted ground signal, and its accuracy also normally diminishes with distance from the Reference station. A particular type of DGPS network task is being undertaken this year in Iraq by a Troop from 13 Geo Sqn RE.

7.2 LAAS

Some airports in the US have established *Local Area Augmentation Systems* (or GBAS) that transmit correction signals in the vicinity of the airport to allow incoming aircraft to improve their GPS-derived position. This is also a technique similar to that adopted by Geographic Engineers to densify control and capture detail on site surveys.

7.3 WAAS

A more global approach to augmenting GPS positioning has been pioneered using space techniques. The *Wide Area Augmentation System* (or SBAS) uses geostationary satellites such as the INMARSAT III communications SV to transmit integrity data on the GPS *Integrity Channel*. These extra signals give timely warning, to aircraft particularly, when a GPS signal cannot be relied upon for accuracy, integrity or reliability. With advances in WAAS technology in both Europe and the Far East, near-global coverage of space-based augmentation is now available. Since 2003, even the most basic HH receivers can be purchased that are "WAAS-enabled". As well as integrity monitoring, these signals also improve the accuracy of the position solution, and can exceed that possible with the military P/Y code.

8 Navigation Warfare

Navigation Warfare is a term used to describe the particular benefits that GNSS has on the modern battlefield and to highlight the susceptibility of GPS signals to interference or spoofing[7]. An increasing number of deployable command and control systems rely on the timing aspect of the GPS constellation for coordination of programming routines and activities, as well as GPS chips now being increasingly deployed to track assets as well as to aid navigation. GPS signals are inherently weak and very easy to block or disrupt, with cheap and readily available jammers. Much effort is currently going into preserving and protecting the GPS service, as GPS is becoming an increasingly vital and fundamental tool. The NATO Navigation Sub Committee has recently written a STANAG on *Navigation Warfare* (NAVWAR) and it is establishing Operational Planning and Management Tools to help Nations preserve their PNT capability. Naturally, NATO also takes great interest in the development of other GNSS, such as Galileo and the Chinese KOMPAS system, to ensure that the signals remain compatible/interoperable, but that NAVWAR concepts are not compromised.

For Land navigators using HH receivers, the existence of a jamming threat in the vicinity can be very difficult to establish; the receiver might carry on working, but with a poorer accuracy statement, or it might simply give incorrect coordinates that the operator does not immediately notice, or indeed it might just not give any results. There are some simple procedures that an operator can take, such as shielding the receiver with one's body, or a vehicle or building, or trying to move location, but often jamming signals are significantly stronger than the GPS signals themselves, preventing the receiver from working and denying the user a PNT solution.

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[7] Spoofing is the deliberate hostile imitation of GPS signals, not with the aim of simply jamming a signal, but with the intent of giving false coordinates, and hence wrong positions to a User.

9 Future Concepts and Capabilities

Many major new concepts are being trialled and delivered in the next decade and this is an important time, especially for the procurement agencies of national MoDs, to ensure that their forces remain fully technically capable.

9.1 GPS Modernisation

The GPS *Joint Program Office* (JPO) is introducing new signals for both the military and civilian sectors, the first major change in signal design since the constellation was launched over 20 years ago. For example, a new M code (for Military) will be broadcast with a greater strength than current codes, to assist with the NAVWAR programme. Further in the future, development is underway of a *steerable* signal transmitter, so that SATNAV signals can be pointed at particular areas of operation, to both restrict access in other geographical areas and to increase the relative strength of the signal reaching earth. New SVs are launched on an annual basis, continually replacing older versions and increasing functionality and performance of the constellation.

9.2 The Galileo Programme

The first of 30 SVs of the Galileo constellation are set for launch in 2008 and these should offer a significant improvement in availability, integrity and accuracy, especially if their signals are combined with those from GPS in a dual-system receiver. Remarkably similar in concept to GPS, the key difference is that Galileo is not a military system, but will offer additional services, over and above the standard positioning service, to special interest groups such as for Search and Rescue. Like GPS, the Galileo basic (or Open) service will be free, and it has been specifically designed in conjunction with the GPS JPO to ensure that the signals and time frameworks are compatible (and that NAVWAR issues are considered). The Commercial and Public Regulated Services – with guarantees of performance – will incur charges to the User, however. These are aimed at large freight organisations, for example, and governmental organisations such as Customs and Excise. Galileo has its own integrity monitoring and Wide Area Augmentation satellite service, called the *European Geostationary Navigation Overlay Service* (EGNOS).

9.3 Other Satellite Systems

While many nations, not just European, have bought into the Galileo system, others such as China, Japan, India and Russia are instigating their own SATNAV systems. As the cost and reliability of satellite-based communications improves, this will only fuel further development, and hence its availability to the User.

9.4 User Equipment

The GPS JPO has for some time now been authorising the production of third-generation military GPS receivers and chip technology called *Selective Availability and Anti-Spoofing Module* (SAASM). While SA, the deliberate downgrading of the accuracy of the GPS signal on the C/A code to reduce the PNT ability of civilian users, was officially turned off in May 2000, the ability still exists to implement this in the future. The AS element of the module is designed to counter deliberate false signal generation (an advanced form of jamming). The SAASM module, for authorised users, along with *smart* antenna electronics, such as the ability to point antennae or to null jamming signals from a particular source, increases the capability of receivers especially in operational environments.

9.5 Military Command and Control Systems

Many nations are basing their *Command, Control and Communications Information Systems* (C3IS) on GNSS technology, both as asset tracking devices and as the timing command line. The Army's *Bowman C3IS* with integrated GPS navigation devices, and the US Army's *Force XXI Battle Command Brigade-and-Below* (FBCB2) use wireless tracking for situational awareness and battlefield decision-making. You should all be aware of Bowman; FBCB2 has recently been featured in GPS World magazine.

9.6 Location Based Services

In a non-military context, the widespread, almost omnipresent, nature of GPS has made it an excellent technology for exploitation by government and private business. Some Nations are using GPS as an aid for emergency response, by incorporating positioning technology in mobile phones – the E911 initiative in the US, for example. Many have experimented with electronic tagging and tracking of offenders. Some marketing firms are exploiting a User's location to target advertising or services. Despite the libertarian concerns of who *owns* an individual's location, geographically based services dependent on GNSS technology will only continue to proliferate.

10 Conclusions

Navigation has been transformed by GPS and it has proved especially beneficial in the military arena, and in conditions or areas of the world where navigation has been difficult in the past – in open countryside, in the desert and at sea. GPS and other sources of GNSS will continue to proliferate and become ever more fundamental to the way military operations are carried out. For basic navigation purposes, it must still be remembered that SATNAV is still just an *aid* to navigation and is not as reliable as some might hope – often for the simplest of reasons, such as running out of batteries, or being under canopy which a signal cannot penetrate. It does not reduce the need to learn how to use a map efficiently, nor should its output be relied upon to the exclusion of all other indicators. That said, the GPS receiver is now often the first piece of equipment to be packed before setting off on an expedition.

GLOSSARY

DAGR:	Defence Advanced GPS Receiver. A Military dual frequency hand held receiver, Y-code capable.
Doppler effect/shift:	The phenomenon observed by the change in the observed frequency of a radio wave caused by a change in the effective length of the path of travel between the source and the point of observation.
EGNOS:	European Geostationary Navigation and Overlay Service
GLONASS:	GLObal'naya Navigatsionaya Sputnikovaya Sistema (as GNSS)
GNSS:	Global Navigation Satellite System. A generic term that covers all satellite-based navigation and augmentation systems.
GPS:	see NAVSTAR
FMS:	Foreign Military Sales
IGS:	International GPS Service for Geodynamics
INS:	Inertial Navigation System. Typically a self-contained combination of accelerometers and gyroscopes to give velocity, position and bearing.
JPO:	Joint Program Office of the NAVSTAR GPS / USAF Space Command. Responsible, amongst other duties, for User equipment design and procurement and for Foreign Military Sales (FMS).
NAVSTAR GPS:	Navigation System for Timing and Ranging – Global Positioning System
NGA (formerly NIMA, formerly DMA):	National Geospatial Intelligence Agency (formerly National Imagery and Mapping Agency; Defence Mapping Agency) of the US DoD
PLGR:	Precision Lightweight GPS Receiver. Military dual frequency hand held receivers, Y-code capable.
SPGR:	Specialist Personal GPS Receiver. Military dual frequency hand held receivers, Y-code capable.
PPS:	Precise Positioning Service (of GPS).
SAASM:	Selective Availability and Anti-Spoofing Module.
SPS:	Standard Positioning Service (of GPS).
WGS 84:	World Geodetic System 1984, the International Terrestrial Reference Frame (similar to a horizontal and vertical datum) to which default coordinates in GPS are referred.

Have Land Rover will Travel

BRIGADIER J H JOOPER OBE SBStJ DL FCMI

I would not class myself as an expert on the subject but I have experienced several vehicular inversions in my time and the majority have been while travelling in Land Rovers. Not the best advertisement for Land Rovers you might think but I would have to admit in fairness to the vehicles they were never entirely to blame; in some cases, not even remotely. However, the first vehicular inversion I experienced occurred when I was about five or six and I was certainly not to blame on that occasion. The vehicle which inverted was a trap pulled by a nice little cob called Lively and the Jehu with the whip and reins in his hands was one of my uncle's farmhands.

We were returning from a trip to the village and having impressed the local girls with our smart turnout and Lively's even smarter trot, my driver relaxed and we were moving at a quieter pace when further visions of female pulchritude were observed which required a suitable response from the driver, at least in his view. A crack of the whip and over we went, the driver having inadvertently got his offside wheel on the higher bank of the roadside while gazing at the beauties. The net result of this was that I was thrown out of the trap and down the bank on the nearside which was covered in nettles and brambles. I registered my dismay at this development with ear-piercing shrieks of pain but was soon comforted by the beauties. A far better result than that obtained by the driver who was in hot pursuit of the cob who had broken the harness and was making for home at a fair clip. I cannot recall the final outcome for the driver but I suspect a right royal rocket from my uncle was somewhere in the result.

You will all, of course, have travelled in a Land Rover at some time in your military career and suffered the numbing sensation in an area South of the old military belt after three hours on the autobahn. You may even have had an accident in one or possibly even been overturned. I like Land Rovers despite the odd disagreement when we have, literally, parted company, and have found them infinitely superior to anything the Americans could produce for travel in Saudi Arabia or the Japanese for travel in Cambodia. In neither country are the roads wonderful. In the case of Saudi Arabia the main highways are magnificent but once off them the corrugations and potholes associated with desert tracks are par for the course. The hard mud tracks in Cambodia and Mozambique are trying hard to emulate the desert but have not quite made it; their ruts are something else again. Having sampled desert tracks in Egypt, Muscat and Oman and Somaliland as well as Saudi Arabia, I have developed a connoisseur's appreciation or the infinite variety of discomfort one can experience going over corrugations.

"To speed or not to speed?" as Hamlet would have it. Going slowly prolongs the misery and going very quickly can, sometimes, reduce the irritation and discomfort but, . . . that way disaster lies! I know, I've been there.

Cross-country driving is an art, as we all know and having tried it in the old World War 2 Jeep with which we were equipped in Egypt, the Champ which we had in Cyprus and a variety of huge American vehicles (with serious1y macho names) and an equally large number of Japanese jobs, the Land Rover gets my vote. It may not have the somewhat more comfortable suspension of the American and Japanese vehicles but in a tricky spot it is far more likely to get one out of trouble than its American and Japanese cousins. Old habits die hard and after several thousand miles of Land Rover driving I find I still drive my very comfortable private car with my thumbs resting on the steering-wheel rim rather than being employed in a prehensory fashion. However, the habit probably saved my thumbs from being broken on some of the more vicious bumps and ruts I encountered in the course of foreign travel.

In 1958 there was not a square inch of tarmac or a cubic inch of concrete in either Muscat or Oman. What was on offer was a town, Muscat, consisting of mud huts and mud forts, a few villages of mud huts and the requisite fort loosely linked by natural surfaced tracks. The journey from Nizwa to Muscat which now takes about three or four hours down a six lane highway then took about ten hours providing you were not blown up on American or British mines supplied to the rebels courtesy of an oil company and via Saudi Arabia. It was a journey I tried to avoid, much preferring to travel the wide open spaces of the Omani gravel plains and sand seas. However one had to do it once in a while, and the once in a while which caused me to part company from my Land Rover for the first time in my young life occurred with a Life Guards officer and a SAS trooper as my passengers.

The Life Guards officer later achieved notoriety through a little private enterprise venture which consisted of getting a copy made of a Stubbs painting which hung in his Knightsbridge Mess. Had he left it at that, all would have been well. He later exchanged the copy for the genuine one and sold the latter to a Bond Street dealer and hung the fake in the Mess. All would still have been well had he sold it to a dealer miles away from the barracks but the painting in the dealer's window was later seen by a fellow officer on an afternoon stroll down Bond Street. The said officer went into the shop to compliment the owner on the very fine copy of his Mess's Stubbs in the window. Not entirely happy with this summation the shop owner revealed the provenance of his painting. The cozy mess was exchanged for a prison cell with no Stubbs, genuine or otherwise, on the wall, at least as far as our hero was concerned. But he did have some nerve; and now back to the Land Rover.

The corrugations on the route to Muscat were giving me and my passengers a pain in the *derriere*, quite literally as well as figuratively and, knowing this part of the track quite well, I put my foot down. Ahead of me was a large rock which I knew was on a gentle bend which I could negotiate at a reasonable speed. The rock being on a bend did, of

course, hide the track which lay ahead of it from my view. As I rounded he bend the full effect of the previous night's flash flood was revealed. I'll put it succinctly. No track, large drop. Over we went. The Land Rover to land upside down, my passengers to land safely if not soundlessly a few yards away and the Life Guards officer well soused in the contents of the fuel tank. He was not unnaturally quite concerned that we should not calm our jangled nerves with cigarettes. As a dyed-in-wool airborne soldier (three tours under my belt by now) and in common with most airborne forces at that time, I did not have a lot of time for the SAS of that period and I was not terribly surprised when the trooper declined a further lift preferring to wait for a 3-tonner which was following. Much to his credit, the Life Guards officer did continue the journey with me after we had topped up with oil and fuel. The Land Rover, like its passengers, was uninjured.

The next over-turning I regret to say, was again entirely my fault as I was going too quickly, spotted a foot and a half deep trench running diagonally across the track too late, braked, slid sideways and dropping a wheel into the trench, gently rolled over. Again, no injury to self or vehicle but a growing reputation for bad driving. The third time was not my fault, honestly Sir! My Lance Corporal driver was at the wheel and it was a hit of bad luck rather than really bad driving. We were on exercise in BAOR in the winter with plenty of snow and ice around but not much of it on the roads which had been well ploughed and gritted. Coming around a bend we encountered an isolated patch of ice on which we pirouetted rapidly and less than gracefully and sadly, unlike Torville and Dean, failed to stay upright. We hit the verge and ended upside down in the ditch.

This inversion of fortune was much like the others in that everything happened so slowly. I was able to switch off the ignition as we went over and had time to think, "Oh Lord, here we go again". We were not wearing seat belts and the pair of us ended up lying more-or-less upside down on the backs of our necks much like the Land Rover. I wriggled around and was just about to put my booted feet through the windscreen to get out when I realized that the door had been thrown open in the fracas. I cannot remember whether the vehicle was damaged or not but neither my driver nor I were. I got some battery acid on my face which I removed using some snow. (Many would say it could only have improved my features had the acid been left). The driver was left to sort things out as I got a lift to the O Group I was scheduled to attend.

Despite many near misses, I thereafter managed to keep the right way up over some appalling going but saw some very interesting vehicular inversions in my travels. One very interesting one in Somaliland did not actually involve an inversion but a drop of some fifty feet where the vehicle in question, a tank, landed upright and from which a seriously shaken, but otherwise virtually unscathed, crew emerged. I did not see any bridges in Somaliland where even the deepest *wadis* were crossed by very long embankments leading to culverts on the wadi bed through the embankment. The culvert pipes were square in cross section and anything up to fifteen feet square. In every case they had been blown and mined and we were busy clearing the mines from the area to allow rebuilds.

The punters in the tank were in rapid retreat and travelling at speed down the causeway leading to the culvert. The gun was facing backwards in the approved fashion for a rapid retreat and the commander one can safely assume, was peering anxiously over his shoulder at his pursuers and certainly not looking at where the tank was going. No one had bothered to tell any of the crew, and certainly not the driver, that the culvert had been blown and they proved conclusively that the flight envelope or their tank was sorely inadequate to cope with the resultant gap despite taking it at some speed. The hunting advice to get ones heart over first did not work too well on this jump. However they must have got something right as they walked away from the landing. When I saw the tank it was resting neatly parallel to the course of the *wadi* and at right angles to the embankment; the tank aerodynamics had produced a ninety-degree tank bank would you believe. It was now posing a problem for the potential culvert repairers. There was not in the whole of Somaliland a crane big enough to lift a tank and the only solution to the problem to have surfaced by the time I got there was to blow the turret off at the ring and thus, hopefully, reduce the required lift to two smaller ones with which the available crane could cope. Always supposing you could get the crane down to the tank having cleared the mines and I had doubts about that as the going was by no means easy and would require the construction of some sort of road to the wadi bottom.

My suggested solution was, having cleared the mines, to drive a bulldozer down to the tank and to cut a large hole in the wadi bed alongside the tank big enough to take the tank. Then using an explosive lifting charge, overturn the tank into the hole. This solution was universally acclaimed as the best idea yet even if it does not say much for the quality of engineering advice locally available. Sadly I did not stay long enough to find out whether my solution was employed and if so with what results. Perhaps that was just as well. I am sure the old and bold from World War 2 solved dozens of similar problems before breakfast. I know that, for example, in France a World War 2 AVRE was left in the hole in the road which it had bridged and a hard top road was subsequently built over it. The AVRE was later unearthed in the Seventies by the armoured engineers of 1st Armoured Division. *

Still, it's a funny old upside-down world though.

* *The recovery of the AVRE was reported in either* The Sapper *or* The Journal. *I was CRE 1st Armd Div at the time and sanctioned the exercise.*

Journal Awards

The Budget, Investments, Membership, Scholarship, Memorial and Publications Committee announces the following awards for articles of special merit published in the August 2005 issue:

Bridge Building in Basrah
Major R S Hourahane – £100

Supporting Counter Insurgency Operations in Al Majarr Al Kabir – Operation Trojan – 12 June 2005
Captain D J Bickers – £100

Vulcan – Best Explosive Engineering Tool in the World – Probably (with apologies, or should that be thanks, to Carlsberg Lager)
Major J Q Killip – £75

Royal Engineers Support to Constructing Field Hospitals

LIEUTENANT S J O MERRETT

Lieutenant Simon Merrett was commissioned in December 2003. He met his first troop, G Troop of 69 Gurkha Field Squadron in Iraq, and led the Irrigation Reconnaissance Team. He spent his first exercise with the Squadron scaling a steep learning curve and building a Field Hospital on an airfield in Oxfordshire. In June, he almost lost his troop to the attractive Terms and Conditions of Service of the French Foreign Legion, on an exchange exercise. He is currently learning Nepali and eating vast amounts of curry in Kathmandu. Jai QGE!

Introduction

As a forum to share lessons learnt, the *Royal Engineers Journal* is an ideal place to post a piece intended to open a window on Royal Engineer support to Field Hospitals. It also makes more general assertions on the role of the Military Construction Force commander in the context of the Royal Engineers' trusted principles for construction: the triangle of Design, Resource and Construct.

A case study has been included to illustrate the perspective of the Military Construction Force in the face of the continually developing Royal Engineer response to the changing Army Medical Services doctrine (and the author's limited experience!)

Visualising the Hospital Facility

A Field Hospital has been a regular feature of the British Army's theatres of operations since before the Crimean War and as in those days, is still initially constructed from canvas. However the clinical systems and capabilities that nowadays fill the bulky labyrinth are fully comparable to today's National Health Service[1].

The field hospital may be found in many configurations, but when one visualises them, it is vital that one does not think of a fifty-bed hospital as of a 200 bed establishment. Bar some extra clinical tents and several staff, the extra 150 places on the wards require only a couple large tents with the simpler

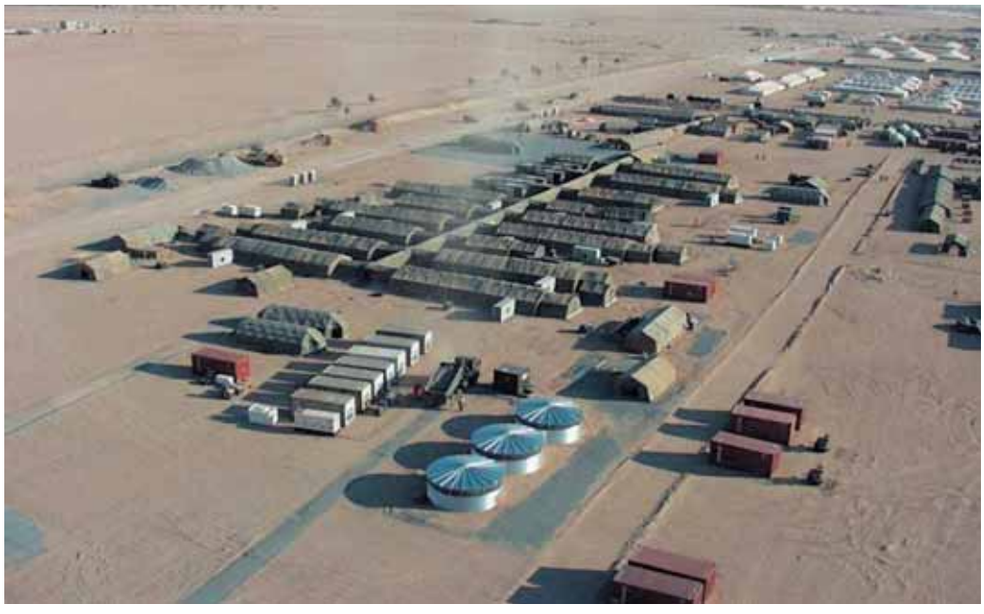

Figure 1 – The hospital itself is just one part of a sprawling and complex facility.

[1] A British fifty-bed Field Hospital can have a casualty seen by a consultant and be in theatre within five minutes.

service fittings. They are also large facilities and the word facility is justified; to a Sapper the title of "Field Hospital" probably means a single large tented structure with medical staff and equipment inside. Those staff, including non-medical, will number over 600 for a 200 bed hospital and they need ablutions, accommodation and catering (grouped and referred to as "life support"), as well as a separate RHQ, antennae farm, ISO container park for 110 units, Quartermaster's department and Motor Transport department with a Local Area Network of computers linking all the major departments. Currently, Sappers are not taken on field hospital reconnaissance.

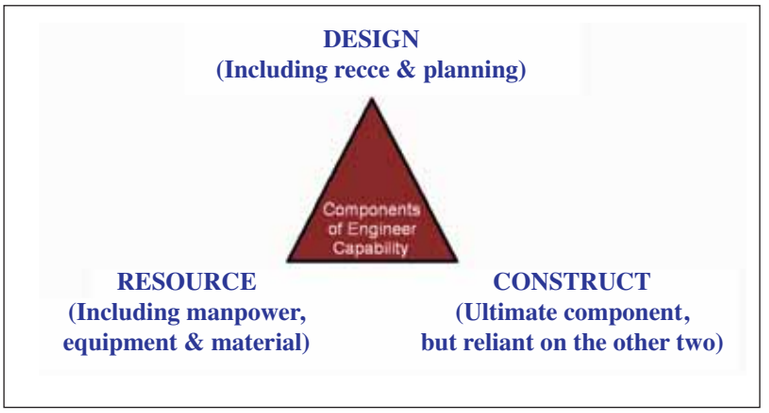

Figure 2 – The Design, Resource Construct Magic Triangle

Clinical Governance

Crucial to the moral component of leadership as well as its obvious worth in the combat service support role, the field hospital now adds an extra duty to the chain that commands it – Clinical Governance.

"Operational clinical governance is the framework by which clinicians and commanders understand and discharge both their individual and collective responsibility and accountability for quality of care, meeting their obligation to the military covenant[2]*. Good operational clinical governance safeguards best possible standards of healthcare to the deployed force and thereby contributes to military capability by maximising the number of personnel fit for task*[3]*"*

Take special note of the word "accountability". This means that commanders up and down the chain of responsibility, not just within Army Medical Services, are legally liable for the level of medical care that is provided.

Royal Engineers are *key* to the commander's commitment to clinical governance because the services we provide lead to:

- Improved hygiene (hot and cold running water, drainage).
- Less time spent bucket emptying and jerrycan filling by skilled medical staff (as above).
- Increased staff and casualty comfort (air-conditioning and heating).
- Faster and smoother casualty transfer (stable flooring, route improvement).
- Better security for all on site (force protection).

The Design Resource Construct Magic Triangle

For those who seek a reminder, Figure 2 shows the relationship that a construction project will go through in order to achieve the best chance of success.

The three areas nicely suggest the types of Sapper who would be best suited to carry out each function.

Design. Obviously, in the context of our field hospital (who in this case is the client), we would like 170 (Infrastructure Support) Engineer Group[4] to design our systems and choose the most suitable components. They will become the Military Design Authority who passes judgement on proposed design changes. The designer will already feel the constraints of clinical governance as the client is under pressure from their inspectors to ask for specifics in the Statement of Requirement. For example, special hand washing and sluice sinks are recommended over a standard unit.

- **Aim:** The design must satisfy the clinical Statement of Requirement and timelines.
- **Statement of Requirement:** This is a combined RE/client task[5].
- **Force Protection:** Needs to be designed in, not added as an afterthought.
- **Recce:** This should involve representatives of the Client, Military Design Authority and the Military Construction Force (the latter including Clerk of Works, Resources Specialist and Field Squadron representatives).
- **Reviews:** Technical design for site/environment (freezing/heat/height difference).
- **Input:** The Troop Commander and the tradesmen should have an early input.
- **Post-approval:** Limit design changes.

Resource.. Royal Engineer Field Support Squadrons have an lot to offer the budding young Military Construction Force troop commander. Of most value in his armoury is a

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[2] "Soldiers will be called upon to make personal sacrifices – including the ultimate sacrifice – in the service of the Nation. In putting the needs of the nation and the Army before their own, they forego some of the rights enjoyed by those outside the Armed Forces. In return, British soldiers must always be able to expect fair treatment, to be valued and respected as individuals, and that they (and their families) will be sustained and rewarded by commensurate terms and conditions of service." ADP Vol. 5, Soldiering, The Military Covenant, 2000.

[3] Commander's Guide to Clinical Governance.

[4] Until recently, 170 (Infrastructure Support) Engineer Group was known as the Military Works Force.

[5] The Field Hospital staff know exactly what they need to achieve. Often, they do not have the ability to put it into succinct, technical parameters that guide rather than restrict the Military Design Authority.

Figure 3 – A frozen water pipe is not just for Christmas . . .

Resources Specialist with local purchase authority for those tricky little bits that snap, turn up wrong on site or just don't turn up at all.

- **Involve HQ and Field Support Squadrons as soon as possible –** the time factor acutely affects their procedures .
- **Check resources early –** the smallest component can be a potential show-stopper.
- **Create a both robust and timely resources network –** a Resources Node is needed to confirm local suppliers and Host Nation support.
- **Budget -** ensure someone has got a budget and the authority to spend it!
- **Be flexible –** what you want may not be what you get!

Construct. "Hurrah for the field troop, the artisans, the tradesmen! Look what a wonderful piece they have built."

Perhaps we can take the classic layman's view, that does not see or appreciate the design and resourcing work that has happened prior to the build, and look at it another way:

If the Military Construction Force takes a touch more than its fair share of the credit when the task succeeds, who takes responsibility when life is not so rosy and, more importantly, who takes overall responsibility for making sure Design, Resource Construct all happen in the best possible way to achieve the mission?

It is important that the commander of the Military Construction Force realises that his and their remit is not just to assemble the parts, but goes much further in taking overall responsibility for the success of the project. This must be right from the start, when Royal Engineers are advising the field hospital on the statement of requirement.

Figure 4 – Royal Engineer Field Support Squadrons deliver the goods.

Figure 5 – Gravity fed drainage is given the correct slope.

- **Task Organization: –** Squadron HQ, Field Troop, Support Troop and Echelon.
- **Others?:** Possibly Resources Node and Construction Supervision Cell**.**
- **Planning Figures:** Estimated Time of Completion is two weeks (with full complement of tradesmen and resources sorted out).
- **Joint build:** Command and Control and Health and Safety issues need to be shared with RAMC, Pioneers etc – TAKE THE LEAD ON Health and Safety.

Operations & Maintenance Team

The Sappers' responsibility to the hospital does not end when it has been commissioned. The construction force has to take responsibility for the correct function and good repair of all services that they install. The ideal make-up of an Operations and Maintenance team includes a dedicated commander and varies from hospital to hospital, but in short it should contain the tradesmen suited to each service installed, and must be able to provide routine maintenance and a 24-hour repair capability. The construction force should be prepared to reinforce the team, even while on other tasks, to ensure success.

CASE STUDY – Ex *Log Viper 05* from the Military Construction Force Troop's Perspective

The task set during Exercise *Log Viper 05* was to construct the services for a 200 bed field hospital, incorporating a field kitchen and accommodation and ablutions for 300 people. The services included hot and cold running water, drainage, lighting and heating, although it should be noted that the stores for the heating and lighting facilities came from the hospital's Equipment Table.

Description of the Troop

The field troop varied between 25 and 30 soldiers. It was supported by Light Wheeled Tractors with forks, as much of the kit was palletised, and Medium Wheeled Tractors fitted with beam dispensers[6] to lay the Class 30 Trackway[7]. The task was extremely artisan intensive. Class 1 tradesmen were vital and of the electricians, plumbers and carpenters, the plumbers were the most extensively tested. The troop composition will obviously be task dependant. For example, if services had been buried rather than ground laid, there would have been far more reliance on plant. If pumps had been more widely used, fitters would have been more important.

Actions before Deployment

Prior to deployment, the Class 1 tradesmen were consulted about the works table while the majority of the troop practised laying the Class 30 and AM2 matting[8]. There were also coordination meetings between the hospital, the design authority, the construction force commander and the tradesmen.

Order of Build

- **SETTING OUT**. It may sound obvious, but this must be right if you want to avoid building the hospital off the site and running out of resources. Surveyors should be supervised closely by a SNCO.
- **GROUND PREPARATION**. See Figure 8. In areas where no Class 30 was laid, the results are clear – these areas not only present damage control issues, but also those of mobility for equipment moving machines.
- **WATER SUPPLY.** Cuplock towers were used for the hospital, kitchen and ablutions. LOOK FOR EXISTING SERVICES ON THE RECCE. (Figure 3).
- **RING-MAINS.** These were laid outside the hospital and, during a cold spell, the supply pipes froze. This led to a rapid design addition of some insulation[9], which was locally purchased, ensuring the water flowed during exercise play.
- **PREPARING ASSEMBLIES**. These were especially complex for the hospital sinks, incorporating: sinks, sluices, varying tap sizes, flash heaters, expansion vessels and drainage pumps.

Figure 6 – Class 30 Trackway forms the perimeter track.

[6] Beam dispensers are hydraulically powered frames that attach to the front of the tractor and can unroll or roll Class 30 Trackway.
[7] Class 30 Trackway is a roll of jointed aluminium slats that form a stable, grippy road surface suitable for wheeled vehicles up to 30 tonnes. On Exercise *Log Viper* it was used as a perimeter track around the filed hospital to allow water refills, waste tank emptying and access to the rear of the hospital for ambulances.
[8] AM2 matting is an aluminium panel system that slots together as if one were laying a wooden floor. It is designed for used as an aircraft runway surface, but was used to create a stable floor in the hospital areas with most need of it, e.g. the central spine and resuscitation, where there was most trolley movement.
[9] Insulation was offered to the client at the design stage, but was rejected for budgetary reasons.

Figure 7 – The Exercise *Log Viper 05* hospital with ground damage.

- **CONNECTING TO THE RING-MAINS**. The period of testing and commissioning that follows connection is critical for mission success and safety. There was a potent mix of electricity, water and steel in close proximity to each other at all the sinks.

Lessons Learnt

- **Do not expect resources to be perfect –** The local purchase authority must be co-located with the construction force.
- **Expect to make design changes –** The design authority must be close, responsive and flexible.
- **Liaison -** The construction force must liaise closely with the hospital to ensure elements deploy as required to attain full operating capability.
- **Services -** Ground laid or buried? The decision has major implications on the order of build[10].
- **Force Protection –** Should be planned and, in some cases, built before construction commences.
- **On-site representaion -** A hospital representative on site is vital, preferably the TQM/RQMS; they have the technical knowledge and the influence to make things happen!
- **Recovery –** Hospitals may move within the battle space. The construction force commander should consider how to salvage everything he builds into the task.

The Look Forward

The classic adage of the Sappers being "First in and last out" may be under threat of being usurped in the world of Army Medical Services in the field. Field Hospital doctrine is changing, deploying the more mobile "50-Bed Field Hospital (Forward)", designed to support the manoeuvre brigades. These are then backed up close to the theatre's point of entry by the larger facilities. The case study looked at a field hospital where the Sappers did the setting out and built the 200 bed facility alongside the hospital staff. By the time this article is published, a similar 50-bed facility will have been constructed, initially using just one RE electrician. Once the hospital had reached a preliminary full operating capability after about 48 hours on site, it will have had running water and drainage retro-fitted by a troop sized military construction force. Much less life support[11] will have been required for that facility, including no running water for the kitchens or ablutions. This is how the Army Medical Services sees hospitals deploying in future.

The Sapper's blank canvas work site is thrown out of the window and right from the statement of requirement stage, the decisions on what can reasonably be retro-fitted to the facility without disrupting clinical governance must be made. For example, laying a hard floor under the clinical

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[10] For example, you cannot fork lift a heavy X-ray machine over surface laid pipes, but you can fault check the pipe. By the same token, you cannot backfill a trench for buried services until you are sure that they functioning perfectly, but once filled, you can drive your X-ray machine in and out as you like.

[11] This reflects the clinical governance focus – the hospital systems, routes and protection are the priority for Royal Engineer work.

Figure 8 – What goes in, must come out! Check for existing services on reconnaissance.

departments and down the narrow central spine was written out and the Rolla-trak[12] left in. Force Protection issues also need to be re-considered, as plant access and Hesco Bastion construction become impractical once the tentage is erected. 170 (Infra Sp) Engr Gp has designed a template for services to the 50 Bed Field Hospital (Forward). When a similar design is done for the 100 – 200 bed facilities, the various hospitals will hopefully be more constrained in their layout, presumably easing the Sapper input to the design, resource, construct process.

Summary and Conclusions

Sappers are key to the Field Hospitals' success. Royal Engineers are just one of the means used to realise HQ LAND and the Commander Joint Operation's responsibilities to soldiers under Clinical Governance. We can provide the services that ensure medical staff can deliver the best possible care.

Field Hospitals are complex facilities. The key to our success is to have sound project management, retain flexibility and understand that the build is a joint effort between the field hospital and the military construction force.

All Field Hospital designs should be laid down in as few versions as possible. Field hospitals are overly Sapper intensive, in all areas of design, resource, construct mainly because they are nearly all bespoke builds. Designs are standardising as Army Medical Services doctrine allows. Hopefully this will also allow both resource and construct to standardise.

Class 1 tradesmen are critical. They should always be consulted at the very earliest opportunity because they make or break the relationship between design and construct.

Royal Engineers should always be used on the reconnaissance for Field Hospitals. This is vital, especially now that doctrine precludes thorough ground preparation for the 50-Bed Hospital. Even though Sappers may be highly committed on both operations and other works, our expertise could certainly save effort in the building and operation of a field hospital.

The resourcers should be given as much time to act as possible. The time appreciation must include some incisive questions to be asked of the resources chain. It is also important to have a Resource Node on site.

The Military Construction Force must take the lead and command the design, resource, construct process. No other single party will take as much praise or criticism for a project as the Construction Force, and this will largely depend on how well design, resource, construct has been applied. Other departments should work to the construction force chain of command.

Figure 9 – Complex assemblies should be replaced by combination units in the new designs.

[12] Rolla-trak is a tessellating, hinged plastic grid that is used as flooring. It is fairly brittle and will not even out rough surfaces, which make it more prone to breakage. It is held within field hospitals and therefore can be built into one that has no initial RE support.

PILES at the GEMENCHE

LIEUTENANT COLONEL G N RITCHIE

George Newbigging Ritchie was commissioned into the Corps in 1947 after studies at Manchester University and Emergency Commissioned Service in India. Served tours in BAOR with 7th Armd Div Engrs and 35 Fd Engr Regt but most of his regimental service was with the QGE in Malaya and Borneo. In 1974 he was invited by the University of Manchester to join the Dept of Administrative Studies for Overseas Visiting Fellows where he was to spend three years in research into the effects of natural disaster in the developing countries and the implications of this upon the training of public servants. He lectured and taught in these subjects and has been involved through the Commonwealth Secretariat and the United Nations in consultancies and workshops concerning disaster in the South Pacific, India and Bangladesh, Mozambique, China, Nepal and the Caribbean. On retiring he took up an appointment as a Senor Research Scientist at the RMCS where he established and was founding Director of the Cranfield Disaster Preparedness Centre. He is presently Chair of the Board of the Global Association for Disaster Reduction. In 1967 he was awarded the Arthur ffolliott Garrett prize for his article "Airstrip Construction in Borneo".

BEFORE I joined the Gurkha Engineers, 50 Fd Engr Regt RE, as it was in those days, I was already somewhat under suspicion by my peers; old hands like Tom Spring Smyth, Dick Francis, Hank Bowen, John Orange-Bromehead, Johnny Downes, Billy Brown, Douggie Millar, John Freeland and other bachelors of that ilk. I was **married(!)** and even more to put me under suspicion, I had already passed my captain to major promotion exam.

Ian Thomson met me at Kuala Lumpur station off the night train from Singapore and greeted me as "George". From my first day in the Army, the only Scot in a barrack room of sassenachs, I had always enjoyed the sobriquet "Jock". But my 199A had preceded me and all was already known. A Queen's Gurkha Officer, returning from Nepal leave was also on the train and he, his wife and two, perhaps three children, piled into the back of Ian's Morris Minor open top tourer whilst various orderlies loaded our mountain of kit into the duty 3-tonner.

It was all so different from the National Service army, which I had just left. I recalled an occasion when I heard Sgt "Yacker" Yates of 4 Fd Sqn say, "Smith. Put Captain Ritchie's kit in the back of his jeep" and the reply "If he wants his ******* kit in the back of his ******* jeep let him put it there his ******* self". "Right", said "Yacker", "but I have an 'orrible premonition that you will be drawing a lot of short straws when I am nominating guards and panel and transom parties during this exercise, and you will be on a charge when we get back here!"

And so began my first tour with the Gurkha Engineers, now of course the Queen's Gurkha Engineers. All was just as it had been in the Indian Army, which I had left in 1948.

The next week was taken up with important things like getting me properly dressed in starched and pressed shirts and those wonderful airy shorts which, for those less used to wearing the kilt than I, often caused embarrassment when sitting on low chairs! Joining the "Dog" (The Selangor Club), opening my account with *"Honkers and Shankers"* (now HSBC!) and being fitted out with my orderly Bimbahadur were all seen as equally important.

Then I was off to Gemas to join 67 Squadron, who, with 68 Squadron, were building class 70 piled timber trestle bridges to carry the Caterpillar D7s towing loaded scrapers. The bridges were for use by the Jahore Public Works Department (under Malcolm Campbell's brother-in-law) in building the Gemas-Rompin road link, (see page 119 et seq. *Gurkha Sapper* by Maj Gen LECM Perowne, CB CBE KSt J)

Jack Spencer put me as Don Cameron's (Capt DER Cameron MC) troop officer to learn the ropes of working with Gurkha sappers. One of the first things to happen to me was a very hurried exit from my first attendance at an OC's 'O' Goup to remove about 20 large red ants that had penetrated my 'Drawers cellular, OG' and were making hay where there should only have been talcum powder!

Then on to the site. As described in the piece from *Gurkha Sapper* quoted above, driving 12in x 12in timber piles to a satisfactory set in the soft river bottom of the river Gemenche was not a simple task. It invariably required two 25 foot lengths of 12in x 12in meranti hardwood to be spliced together in the vertical, whilst suspended from the jib of the ancient 19 RB which 410 Plant Tp was operating for us. Although this was my first experience of pile driving I felt that there must be a better way but I was not sure what.

Easter was almost upon us and as one whose family were still in UK, I volunteered to look after the shop whilst all the British officers shot off to Sungei Besi and the delights of Kuala Lumpur, leaving me with the squadron and Peter Burleigh's invaluable 410 Plant Troop detachment. I decided to experiment.

I did the simple sums which showed that the combined weight of a 50 ft pile plus the piling rig and the driving monkey were within the lift capacity of the 19 RB. I discussed my plan with my troop QGO (Lt (QGO) Deobahadur Thapa) and the 19 RB operator (Sgt McCormick of the Federation Engrs who later showed himself to have the split-second

reactions of a fighter pilot). My plan was to splice two 12in x 2in piles on the bank, ensuring that they were straight and true in both planes, swing the 19 RB from its piling position on the most advanced bay of bridge with the driving monkey in place, attach the lifting cable from the 19 RB, winch the pile from the bank up to the leaders and start driving the pile.

Deobahadur Saheb set up a jig to ensure that his spliced piles were straight and true. Splicing on the bank in this way was easy in comparison with the acrobatics which cutting the splice on the driven pile, drilling 3/4 in holes through fibrous hardwood (meranti?), lined up with eight holes in the steel plates, securing the splice on both sides had involved. We saw that we had cracked it.

Or I thought that we had!

McCormick swung the jib to its maximum traverse. His mate climbed the ladder on the jib ready to secure the pile in the leaders. Deobahadur Sahib attached the lifting cable to the collar on the 50-foot pile and McCormick engaged his clutch. The head of the pile lifted until it was at about 45 degrees and then McCormick began to swing the 19 RB back into line of bridge.

There were two assault boats with working parties who had been fitting bracing to previously driven trestle bents and who had been withdrawn and were anchored downstream and "out from under". I had my back to the 19 RB and was watching all this.

I suddenly realized that parallax was affecting what I was looking at. The pile was not being lifted to the jib ! I turned to see the tracks of the 19 RB about 2 feet off the deck at the rear of the machine. We were winching the 19 RB down! But McCormick had been thinking ahead of me. He threw his clutch on the winch and the pile splashed down into the river, mercifully missing both assault boats. But still the machine was tipping forward and about to follow the pile. I don't know if 19 RB operators have IAs (Immediate Action as Bren gunners will remember) as part of their training but McCormick showed his then. He threw the clutch on the 1 ton monkey which followed the pile into the river. That did the trick. The machine rocked back on to level keel with a jolt.

All this time, McCormick's mate had been clinging to the ladder on the driving rig for dear life. (His name neither Peter Burleigh nor I can remember. He was tall, skinny, freckled and red haired, that I do remember!) The jolt of the 19 RB, banging back as it did, dislodged him like a stone from a catapult and I can still see him sailing through the air, arms and legs outstretched like a frog and then splashing down into the river 30 odd feet below, to join the pile and the monkey. For the working parties in the boats it had been the greatest show on earth and they were laughing their heads off as they pulled the poor chap on board.

As we recovered the various bits from the river, I had time to think. I knew what had gone right! No one had been hurt. No damage had been done. (Joan is always telling me that I have a lucky streak, having recovered a lost passport at Bombay airport left in my jacket pocket in the Airport Manager's office, a credit card from a telephone booth at London airport, a wallet stuffed with French francs left on a bar somewhere at the beginning of a day out and recovered from *"Madame, ma mere"* on the off-chance on the way home. The list goes on and on, but I always seem to recover that which others would have lost for ever!)

But what had gone wrong this time? I checked my sums. No error there. And then it came to me. The co-efficient of friction of course! The tip of the pile had buried itself ever deeper into the mud as it was dragged forward until it became a dead weight.

On to Plan B. I tried winching the pile with D4 tractors from the far bank but the bank height was too low to achieve enough upward resolution of the horizontal pull and that too failed. As did grounding the monkey and trying to crane the pile up on to the leaders. Friction continued to defeat us.

Bill Branford with 68 Squadron later used this technique successfully when building the bridge over the Muar River. But I think the bank height was much higher and the horizontal winch pull from the far bank had greater advantage. But I may be wrong.

This is the unexpurgated version of the operation mentioned at the foot of page 121 of *Gurkha Sapper.*

As an interesting sequel to this account of events; last year I received an Email from Nepal with an attached scanned photograph from Hon Major Surja Bahadur MVO, late QGE, of himself and his father Deobahadur Thapa the QGO of this tale. Deobahadur Saheb had a vivid recollection of the event and with great hilarity filled in some of the details that I had forgotten.

John Freeland later had less luck than I with a 19 RB. He built a ramp for a back actor, or face shovel rig, to load laterite into tippers. This time the machine toppled off sideways because the ramp had not been sufficiently stabilized The machine sustained quite minor damage but John Bowring suggested that John should make a contribution to HM Treasury to remind him about consolidation of fill on any future occasion.

Some weeks later I was driving from Segamat to Seremban and found John's 19 RB again lying on its side at the Tampin roundabout. This time the machine was quite badly bent! Enquiries revealed that REME in the process of back-loading the machine for repair of its previous minor damage, had managed to off-load it sideways from their low-loader whilst cornering rather too fast on the roundabout. They, the REME crew, winched the machine back on to the trailer and delivered it for repair as required! I don't think a refund of John's previous financial contribution arose.

It was a similar cock-up, which resulted in a perfectly serviceable D7 ending nose-down in Labuan harbour in Borneo in 1963. 69 Sqn had handed the D7 over to the Port Squadron for back loading from Brunei to Singapore. Needing a volley ball pitch, the Port Squadron or REME detachment in Labuan decided to put it to the use for which we in 69 Sqn never had.

Breaking off for lunch the machine was left going chunkity-chunk on the job, but lined up on the cookhouse. Two local youths climbed aboard and started fiddling with this and that. It rumbled forward and they abandoned ship sharpish. A cook looked up from his work to see this monster rumbling towards his apple pie. Brave cook that he was, he rushed out and climbed aboard. But his soufflés must have been better than his tractor operating. He too abandoned ship, just as the D7 entered his cookhouse flattened the front wall, then through his apple pie, before diving blade first into the briny. There cannot be many who have, thanks to the Active Service accounting procedures which were in force, written off a drowned D7. I did!

RB - Ruston Bucyrus - manufacturers of plant vehicles.

Memoirs

LIEUTENANT COLONEL J R HILL
Born 8 September 1932, died 9 March 2005, aged 72.

JOHN Hill was no ordinary man. He had an unusual intellect, and was something of an eccentric. He had a strong character, a marked capacity for attention to detail and a dogged determination to achieve things, although his objectives did not always reflect his superiors' priorities. He was a lateral thinker, and questioned accepted procedures with well reasoned arguments. He was well known for his outrageous behaviour, and in preparing this obituary, enough tales of his escapades have been offered to fill a book. In today's climate of political correctness, such behaviour would probably not be tolerated in the way it was then.

He was always good company, and would adopt extreme opinions, in support of which he argued with great skill. He was a man of unusual physical strength, and enjoyed making people wince when he shook hands. He once embarked on changing the engine in a car. The manual said that this could not be done without a crane. John saw this as a challenge, and achieved the exchange by brute force. Talking of cars, travelling as a passenger with John was an experience that one did not forget. But when his cars left the road, or collided with immovable objects, somehow it was always sheer bad luck. His humour and wit always made any time spent with him stimulating and fun.

He had very poor eyesight, and it is remarkable that he was ever accepted for the Army. On the rugby field he once touched down for a try over the 25, and on another occasion tackled the referee. Overcoming this disadvantage to succeed in so many physical endeavours reflects great credit on him. He also had the reputation of falling asleep at times, which was normally attributed to over-indulgence. It was not until he had retired that he was diagnosed with narcolepsy, which represented another disadvantage with which he had to cope.

John was born in 1932 in Tralee, Co Kerry, where his mother came from, and went, when he was very small, to India (or rather what is now Bangladesh). Typically of those times, his *ayah* was a major influence in his life, and he spoke Bengali before he learned English. He was sent home to preparatory school in 1939, spending his holidays with his uncle, aunt and cousins at Cooden Beach, in Battle of Britain territory, where his uncle was the air raid warden. Perhaps it was at this early age, while collecting shrapnel and unexploded ordnance on Pevensey Sands, and constructing rockets which never took off, that his lifelong interest in anything that goes bang, started.

After the war, his parents returned to UK, and made their home in Fleet. He went to Uppingham, where he distinguished himself on the rugby field, becoming captain of the XV, on the rifle range and academically, securing a place at Cambridge. Chemistry classes provided him with the opportunity and the materials to further his interest in explosions.

In 1951 he joined the Army, and after his statutory sixteen weeks in the ranks, he went to Sandhurst, where he became an under officer, despite his habit of attempting to shoot out the street lights in the grounds while riding his bicycle back from the town. In 1953 he was commissioned into the Royal Engineers, but despite having secured a place at Cambridge, was not one of the lucky ones to be sent there. He went instead to the Royal Military College of Science to read for an engineering degree. Ken Marchant who arrived at the same time, had a box with a padlock of which he had lost the key. John offered to solve this problem with the application of a quantity of plastic explosive which he just happened to have. There was a huge bang, and the padlock disappeared. When Ken opened the box it became clear where it had gone – every piece of clothing had a neat padlock shaped hole in it. John was a great collector of firearms, and at this time acquired a 2 pounder anti-tank gun from which he fired golf balls down the corridors. John did not complete the course. This was not because of intellectual inability, but because he had just had enough of educational institutions after the best part of fifteeen years of preparatory school, public school, Sandhurst and Shrivenham.

He then had a short spell in 25 Regiment at Maidstone, while he waited to do his Young Officer courses. He had always been a good shot, and while there he concentrated on pistol shooting, winning the Army 30. On completeion of his training, he was posted to Hong Kong together with a contemporary, Spike Winn. In a place where immoderate behaviour was common, their wild antics became legendary. At the end of his Far East tour, John had a short spell in Singapore, from where he drove back to UK with a friend, which in

those days (1960) was a considerable adventure. The remainder of John's military career was divided between airborne forces, the technical staff and the Territorial Army.

He started his airborne career with 9 Parachute Squadron, which enjoys a special reputation, not only within the Corps, but in the Army as a whole. His attention to detail was illustrated by his success in demolishing a silo successfully, which had to be dropped in a particular direction within tight limitations. When running pre-parachute courses, he demonstrated his leadership skills, by insisting that the tests should be arranged in such a way that those who failed to make the grade, should not feel diminished. There was once a dinner in 9 Squadron to which a senior officer had been invited, who expressed a desire to watch a title fight on television. John did not approve of such interruptions to a guest night, and when the antiquated set was switched on there was a hissing noise but no picture. John assured their guest that the picture would appear shortly, and they waited until the fuse which he had placed in the set burnt through, and the detonator to which it was attached exploded.

His successful qualification for the SAS was one of the things of which he was probably most proud. Technically he was over age when he embarked on it, but his physical strength, determination and courage, combined with his strong character and sharp intellect, made him ideal material for this sort of special service. He was with the Regiment from 1968 to 1971.

From 1971 to 1973 he commanded 131 Parachute Engineer Squadron (TA). Here he displayed his tough, unforgiving standards. On his first exercise, as they gathered on the dropping zone, he told his officers that their standards were unacceptable, that they should leave the training to their senior NCOs, who were much more capable than they, and should accompany him. He set off at breakneck speed, and when they had reached a suitable spot, stopped and opened his huge bergen. From it he produced bottles of claret, which lubricated his explanation of the standards he expected of them. While in command, he discovered a gap in the infantry arms plot to Sharjah, and managed to insert 131 Squadron into the slot, so that they benefited from an unexpected overseas exercise, in an area where they had been on active service only six years before.

In 1964 after leaving 9 Squadron, John started his Technical Staff career by attending the Technical Staff Officer's course at Shrivenham. He was critical of the theoretical nature of the training which included, amongst other things, the solving of differential equations. His invariable question to any officer lecturing to the course was "how many times during your Technical Staff career have you had occasion to use differential equations?", to which the rather puzzled reply was always "never". His first Technical Staff tour was at MEXE, from where he went to Aden to carry out some bulk fuel trials. While there in 1967 he married Gina, who by that time he had known for about three years. Many officers have guards of honour at their weddings with drawn swords, but John typically had soldiers with loaded weapons to protect the happy couple from possible terrorist attack, as recorded in a dramatic picture in the Daily Telegraph at the time. His next technical staff tour was in Australia from 1973 to1975, with the British Defence Liaison Staff. At the end of his career he had tours at RARDE and in Defence Sales.

His career with the TA encompassed his command of 131 Parachute Squadron, and then from 1975 to1977 of 74 Engineer Regiment in Northern Ireland. This was not an easy command, as the Regiment was located in an operational area, but not involved in the operations, and comprised representatives from both communities. One of his TA officers says that he saved the Regiment from extinction, and handed over a well recruited and motivated unit.

After leaving the Army in 1982 John worked for Laird (Anglesey) Ltd, and as a Retired Officer at Chatham, before retiring finally to Hythe. He and Gina were francophiles and spent a good deal of time in France. John, who had always been artistic, turned his talents to silversmithing. He shot during the season, played some golf, sailed occasionally, and spent a great deal of time improving his property. It is on a steep hill, and the drive which he constructed is a prodigious feat of engineering, reminiscent of the South Col of Everest.

John and Gina had two daughters, Emily and Melanie, both of whom achieved considerable academic success. They were respectively at Oxford and Cambridge at the same time, which John attributed entirely to his genes! They are both married, and John lived to see his first grandchild, but sadly not his second, who was born six months after his death. He was devoted to his family, and although he was probably not the easiest husband or father to live with, it was a very close-knit unit, and apart from their obvious love for one another, John and Gina were always good friends and companions.

A very special person has passed. He will be remembered for his wit and humour, his eccentricity, his remarkable intellect, his determination, his generosity and hospitality, his outrageous ideas and sometimes behaviour, his good company, and even his bone-crushing handshake. As one of his TA officers said "John was born 20 years too late. What he needed was a good war".

JBA FDB JNSD JHE CW, JW

BRIGADIER H G W HAMILTON CBE DL

Born 16 May 1918, died 17 June 2005, aged 87.

HUGH Gray Whybrants Hamilton was born into a military family, his father being Lieutenant Colonel H W Hamilton of the 15th Bengal Lancers and the 5th Dragoon Guards. He was educated at Wellington College, Peterhouse College Cambridge and the Royal Military Academy, Woolwich. He was commissioned on 28th January 1938 from No 39 Young Officer Batch.

He was posted as a troop officer to 105 Corps Field Park Company being with them in the British Expeditionary Force in 1939-40. On his return to the UK, he remained as a troop officer, but with No 5 Commando. This was followed by three years in 6 Armoured Division Engineers where he held appointments as troop officer, adjutant and squadron commander, in both the UK and North Africa. In late 1943 he returned to the UK for a posting to Headquarters 30 Corps as SO2 in BLA. In 1945 he went to Australia as SO2 RE on the Liaison Staff, remaining there until 1948 when he returned home to become the DAA&QMG at HQ SME, Chatham. He then did a stint as both a squadron commander and second-in-command in 23 Engineer Regiment in BAOR, followed by a tour on the Directing Staff at the Staff College, Camberley.

In 1959 he became SO1 at HQ LANDCENT (NATO), returning from France in 1960 to command 124 Corps Engineer Regiment at Stafford. He then spent two years at the Ministry of Defence as Director of Secondment Policy. This was followed by a year as a student at the Imperial Defence College before moving to Edinburgh to command 129 Engineer Brigade TA.

On his retirement from active service in 1968, he became General Manager of the Corby Development Corporation, a post he held until 1980. In 1977 he joined the Forces Help Society and Lord Roberts' Workshops and was appointed Chairman for some fifteen years. He initiated the amalgamation of SSAFA and the Forces Help Society towards the end of his term of office. He was particularly concerned that disabled ex-servicemen were to be made redundant in the Liverpool and Dundee workshops through lack of orders, so he designed a collection of simple furniture, one piece being based on the Military Chest. The resulting collection was sold in the Lord Roberts' Shop opposite Harrods and abroad, together with the well-known brushes made in the Edinburgh workshop. Whilst Chairman of Forces Help, he became involved with the Northamptonshire Association of Youth Clubs. He became vice-president of the Association and remained so until his death. He also became an active member of the Kettering and District Branch of the Royal Engineers Association. He kept in contact with many members of the Corps, and in these last few years has been of great assistance to the Assistant Secretary of the Institution in the preparation of memoirs for this *Journal*.

His sporting inclinations were towards sailing, skiing and horses – he was a Steward of the British Horse Society and rode regularly and took part in point-to-points and horse trials. His other interests included do-it-yourself where he designed and made various items ranging from furniture to electric tricycles.

In 1944, he married Claire Buxton (having met her when she was nursing some of his troops in North Africa) who survives him along with their two daughters, Jane and Brigit.

HGWH JS

MAJOR GENERAL C J POPHAM CB

Born 2 April 1927, died 25 July 2005, aged 78.

CHRISTOPHER John Popham was born in Finchley, London, the son of G F B Popham, and was educated at the Merchant Taylor's School. He joined the Army in January 1945 and was commissioned into the Corps in March 1946. His first appointment was in No 8 Training Battalion at Lockerbie as a Party Officer giving basic engineer training to recruits. In November 1946, he was posted to India to King George V's Own Bengal Sappers and Miners at Roorkee, moving to Sialkot in Pakistan after the grant of independence, to help set up the Pakistan Engineer Centre. On his return to the UK, he went to 9 Training Regiment at Farnborough. For most of the 1950s, General Popham was in BAOR, initially in Minden as second-in-command of 1st Field Squadron in 27 Field Engineer Regiment, later becoming the regimental adjutant. He then became GSO 3 RE in Engineer Branch of HQ BAOR, Rheindahlen, returning to the UK for staff training at Camberley in 1958.

After Staff College, he attended the Amphibious Warfare Course and moved to HQ Cyprus to help organise the run-down of British troops prior to independence. He was then responsible for the closure of the headquarters itself, subsequently moving to Episkopi as a member of the CinC Secretariat HQ Near East, serving on both joint service and international committees.

Between 1962 and 1965, he held appointments at 1 Training Regiment and 4 Field Squadron before attending the Joint Services Staff College at Latimer. He then became Military Assistant to the Quarter Master General which enabled him to visit every overseas post in which the British Army was serving at the time. He then took command of 36 Engineer Regiment at Maidstone, a post which involved lots of travelling with two of its four squadrons always being away at any one time due to its being on Strategic Reserve. Over two and a half years he visited Canada, Gibraltar, Germany, Belize, Africa and the Gulf. 1971 saw him become CRE 4th Division at Herford, after which he was appointed the Commander, 12 Engineer Brigade.

In 1976, he returned to the continent as Assistant Chief of Staff (Intelligence) at HQ Northern Army Group and then, having been promoted to Major General in 1979, in a similar appointment SHAPE. Of his latter appointment, Brigadier Norman Allen wrote: *"General Chris Popham was my kindly boss at SHAPE. I worked closely with him, especially on the annual NATO Intelligence Conferences which he chaired with consummate skill (I was secretary). His wisdom, diplomacy and good humour were tested to the full over three intense days and nights, spent marshalling, cajoling and entertaining the disparate intelligence community. His memos were authenticated with the figure of a white rabbit. It was the signature of a dedicated professional, an officer of great integrity, always in a hurry, fulfilling a critical role with the key players as the Cold War drew to a close"*.

While at SHAPE, General Popham was given the chance to deliver a lecture at the US War College in Pennsylvania. The thought was somewhat daunting as they were known to be very critical and good at heckling speakers. However he must have gone down well as he was not only asked back the following year, but was made an alumnus of the College.

In 1982, General Popham was appointed a Companion of the Bath and left the Army to take up the post of Director of The British Atlantic Committee which had been formed to improve the perception of the importance of the work of NATO. He retired in 1992, but during his tenure, he laid down the groundwork which saw the committee merge with the Peace Through NATO Organisation as The Atlantic Council of the United Kingdom in 1994.

Even while commuting daily from his home near Andover to London to the offices of the British Atlantic Committee, he took a great part in village life, especially the church. He was a churchwarden for at least four years and then became Secretary of the PCC until, sadly, it became too difficult for him to write the minutes.

General Chris had many hobbies including stamp and coin collecting, but mostly anything to do with trains, aeroplanes and ships, both full-size and models. One room had a model railway round it and some of his aircraft models are in the Army Air Museum at Middle Wallop. He also loved photography and found watercolour painting very relaxing. He was a devoted family man and spent as much time as he could with them while they were still at home.

Major General Popham died in July 2005 after a long struggle with Alzheimer's Disease. In 1950 he married Heather Dawson who together with their two sons survives him.

HP NA

CAPTAIN E SHAW MC Silver Star (US)
Born 30 September 1920, died 12 August 2005, aged 84.

ELLIS Shaw was born at Sandbach in Cheshire being educated at Sandbach Grammar School before starting work as an engineer and surveyor in Cheshire before joining the Army early in the war. He commanded a platoon in a field company before being joining 617 Assault Squadron which was equipped with Churchill AVREs. He was given command of a half-troop of six tanks and embarked with his unit, arriving in Normandy in August 1944. In early September on the first night of the attack on the heavily defended port of Le Havre, he led his tanks over several thousand yards of deeply cratered ground in pitch darkness, walking in front with a shaded torch to avoid the craters. Later on they cleared a mined road block. The next day they joined with their other half troop of the squadron in an attack on Rouelles using *Petards* and *Besas* to force out prisoners for the leading infantry, without the support of any other tanks. Later that evening, his troop commander was wounded. Ellis took over the troop, remaining in command until the end of the war in Europe.

His next operation was at Overloon where the task was to make a crossing over the heavily defended Molenbeek waterway. He and his sergeant had to abandon their recce without measuring the gap accurately, although they got so close to the Germans they could hear them talking. In the event, a 32-foot assault bridge was launched from an AVRE under heavy enemy fire and became the only crossing available to the whole of the 3rd Division for twenty-four hours. The AVRE commander was awarded a bar to his Military Medal while Ellis' actions were later to form the basis of the citation for his Military Cross.

He saw more action at the Scheldt estuary where he charged a steel road block with his tank, breaking through at the second attempt. At Knokke, he personally accepted the surrender of a senior German commander from whom he 'liberated' a pistol and a large Plymouth motor car. The troop then moved on to Geilenkirchen in support of the US 84th Division. During this operation, he attacked several concrete pill boxes with Petards bringing out prisoners for the US infantry. On occasions, he was so close to the enemy, he was using his pistol. For the work he did with the Americans, he was awarded the US Silver Star Medal, the citation for which concluded with the words:

"The bravery and skill and aggressive action with which acting Captain Shaw conducted the operation was of material assistance to the advance of the infantry troops and reflects credit on himself and the military service of his country".

When his Military Cross came through, it was for the actions in which he had a leading role at Le Havre, Overloon and Geilenkirchen. An extract from the citation reads: *"This officer invariably shows great bravery, initiative and skill in handling his troop in all operations in which he is involved. The success of his troop's operations to date are undoubtedly due to a large extent to his extremely good powers of leadership and his own very fine personal example which is always an inspiration to his men".*

After Geilenkirchen, he and his unit took part in the Rhine crossing and the liberation of the western Netherlands. In April 1945, he led a column of AVREs, flails, battle tanks, self-propelled guns and tank destroyers through the burning streets of Arnhem, flushing out the enemy with *Petard* fire on the houses where they were ensconced. He personally took some prisoners using the German officer's pistol he had acquired at Knokke!

After the war he worked in Cambridgeshire whilst studying to become a Civil Engineer and later moved to Ludlow as Engineer and Surveyor to the Local Government Authority in Shropshire. In the early years he specialised in the development of water resources until it was nationalised as Severn-Trent Water.

Ellis completed a total of forty-two years in Local Government before retiring and remaining in Ludlow. He was a keen musician and singer and for forty years was a member of Ludlow Choral Society, also undertaking a spell as its Chairman. Numbered amongst his other activities are being Chairman of Ludlow College Governors from 1987-1992, founder member and first Chairman of Ludlow Round Table and a member of Ludlow Parochial Church Council.

He was a regular supporter of Assault Engineer Reunions at Chatham and Manchester and also attended the 50-year ceremonies at Le Havre and Perham Down in 1995. He has also written several vivid personal accounts of his war service which have been lodged in both the Corps Library and the Imperial War Museum.

In the last few years, he suffered severely with angina which restricted his movements somewhat, but he remained business-like and cheerful to the end.

In 1947, Ellis married Doreen Newall who survives him together with their two sons and four grandchildren.

REW

Memoirs in Brief

Major John Boxer CD RE and RCE, died on 11 April 2005 aged 92. A graduate of London University, he worked at the Royal Aeronautical Establishment Farnborough and was granted patents on early development of jet aircraft in 1936. He was constructing airfields in Cairo at the outbreak of WW2 and was employed as a civilian engineer with HQ British Troops until being appointed a Lieutenant in the 8th Army. He served in Syria, Cairo, Tunis, Libya, Italy, Northern Greece, Austria, and Egypt. He was then deployed to Iraq until being demobilised in 1947 and transferring to the Royal Canadian Engineers, serving with 2nd Field Engineer Regiment in Toronto until 1960. Following the devastating destruction of Hurricane *Hazel* in 1954, he was involved with replacing six strategic bridges with Bailey Bridges to reconnect Toronto. One of these remains as a testament to the effort and was reconstructed by his sapper officer son in 1989.

John Boxer was a life member of the Society of Professional Engineers in Ontario and operated a civil engineering and construction business from 1948 until retiring in the 1970s. He maintained a strong affiliation with his many sapper friends around the world, almost always wearing a Sapper tie. During the 1960s he retraced some WW2 experiences, pointing out familiar Bailey Bridges and other engineer works still in use.

In 2001 he suffered 13 fractures after being struck by a car outside his house in Toronto. Despite recovering fully, he remained unable to walk and resided in Sunnybrook Veteran's Hospital in Toronto until his death.

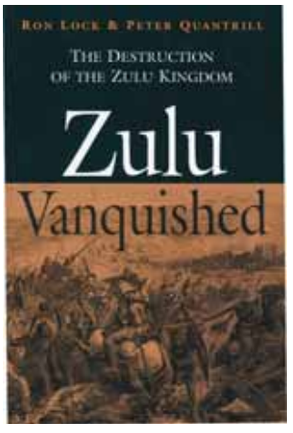
WO1 John Firth, known as Jack, was born on 17 July 1910 at Toxteth Park, Liverpool. He enlisted in the Royal Engineers on 7 February 1933 and served for twenty-two years. He served with 10 Railway Company at Longmoor from 1934-1939 when he was posted to 30 Fortress Company in Singapore. In 1942 he was taken prisoner and held by the Japanese until the end of the war, working on the infamous Siam to Burma Railway. On his return home, he served at Ripon from 1945 to 1948 and the Middle East from 1948 to 1951. His final posting was with CRE Catterick Camp from 1951 to 1955.

After retirement Jack worked for CRE Chester and with the Garrison Engineer Merseyside. He was also employed by the Liverpool Regional Hospital Board Engineering Department until his final retirement in 1975.

Although Jack's health suffered severely while he was a prisoner of war, he maintained a cheerful and optimistic outlook on life. He was very much involved with the history of the Corps and was always willing to share his experiences with those who showed an interest. He died peacefully in bed on 19 August 2005, a month after his 95th birthday and shortly after the 60th anniversary of VJ Day. He will be missed by all those who knew him.

Reviews

ZULU VANQUISHED
(The Destruction of the Zulu Kingdom)
RON LOCK AND PETER QUANTRILL



First published 2005 by Greenhill Books/Lionel Leventhal Limited. Park House, 1 Russell Gardens, London. NW11 9NN www.greenhillbooks.com Price £25, 296pp, 24pp Illustrations (8 colour) + 9 maps ISBN 1 85367 660 8

"British soldiers (officers and men alike) will persist in underrating the enemy, especially if he wears a black skin."
The Graphic, London, 12 April 1879

THIS book complements *Zulu Victory (The Epic of Isandlwana and the Cover-Up)*; now available as a good quality paperback. It is a refreshingly interesting, vigorous, useful and well-illustrated account of what followed. The co-authors are not professional historians but their enthusiasm has carried them through decades of immersion in the subject and their accumulated knowledge and research is reinforced by many long days of walking the battlefields. Unsurprisingly, not all of their views match the more cautious conventional wisdoms of other writers. However, theirs is a generally more lively approach and delivers a very readable and entertaining book. It is robustly backed up by probing research, perceptive reappraisals of material not always carefully evaluated, and a broad-based search of many sources and commentaries. They each wrote specific chapters and the overall effect is not seamless, but, it still has many strengths.

This is a difficult campaign to write about at sustainable levels of interest and detail. Writers usually address its two "book ends" – the origins of the war and the actions at Isandlwana and Rorke's Drift, then, the final battle of Ulundi and the destruction of the Zulu kingdom. In between, they tend to wobble a bit. This one plunges quickly into the gripping succession of significant actions and battles, but manages to maintain its momentum. As the authors demonstrate, the Zulus and their allies were by no means a pushover; even at the end. Most of the many battles were much tougher prospects for the invading British and more hazardously fought than is usually acknowledged. Tactical mistakes were rapidly punished.

They draw judiciously on a rich cross section of the many first hand accounts that survive, paring away the linking narrative to only that essential to keeping the storyline going and to feed key judgements on the actions of those prominently involved. Some of these are decidedly pithy, and there is a breezy "warts and all" character to their depictions of some very famous Victorian figures, their flaws and foibles. But, it all gives a richer flavour to the book, and introduces us vividly to the extraordinary cast of amazing characters who appeared, and often re-appeared, as each dramatic fight was fought. If it was written as fiction, nobody would believe it.

We are given more than usually stimulating snapshots from the vicious and disastrous Hlobane Mountain battle, with "new" material challenging previous impressions of the conduct of Colonel Evelyn Wood VC under the pressures of battle. There are also incisive and perceptive accounts of the fiasco and massacre at Meyer's Drift (also known as Ntombi Drift); the decisive battles of Khambula, Gingindlovu and the relief of Eshowe; and the Prince Imperial's sensational death at Zulu hands. Finally, we are led to the torching of the Zulu capital at oNdini after the crushing final battle on the Ulundi plain. There, brave Zulus staggered through a hail of artillery, Gatling, and rifle fire to get within 30 yards of the huge British square. There are indications that a few might have even penetrated it.

All was not well in the British and Colonial force, hastily assembled and poorly balanced for the hardships and dangers it would face. There were envious rivalries between key political and military figures. As the book opens, the most seasoned British infantry were either dead at Isandlwana, neutralised in and near Eshowe, or yet to be tested and proven in battle against this most agile and enterprising foe. Reinforcements from all sources were a varied lot of uncertain quality, including some battalions of suspect steadiness. Local Volunteer units included: ". . . as forbidding a lot of mixed Hottentots and scum of the diamond fields as was ever collected together outside a prison wall."

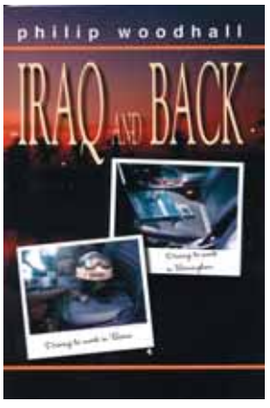
A very large Sapper contingent deployed to South Africa, and there are reasonable mentions of their involvement, and the prominent roles played by some individuals. Few in the Corps will be aware, for example, of how close the 5th Coy RE came to sharing the firing line of the 2nd/21st (today's RHF) on their face of the square at Ulundi, being doubled into position to counter a Zulu breakthrough thought imminent.

Should you buy it? Yes, I think so. It's stirring stuff and a good read. Its main strengths are its insights into "people"; its ability to draw out what a tough campaign this was and the real significance and immediate consequences of "events"; how units and individuals were rigorously tested, and how some succeeded impressively whilst others cannot truly be said to have done so. There are still modern military and personal lessons in there for perceptive readers, and we might usefully ponder (again) how we might have done in similar circumstances.

MCMcC

IRAQ AND BACK

BY CORPORAL PHILIP WOODHALL RE(V)



Published by
Trafford Publishing (UK) Ltd,
Enterprise House,
Wistaston Road Business Centre,
Crewe, Cheshire. CW2 7RP
Price £11.99.
ISBN 1-4120-4543-6.

MANY of the books received for review have been produced so descendants know "what Dad did in the war". I do not necessarily decry this because good or bad, they all have one vital ingredient that the official versions lack – the personal touch. Some are very well written and others are pages of text and fuzzy photographs that perhaps only loving relatives will plough through. Some do however make it into the *Journal*, mostly those that tell how things were done by the men who did them, rather than lists of achievements and technical descriptions by those in charge.

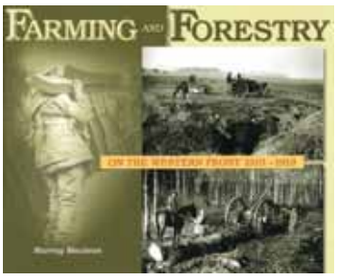
On Operation *Telic*, 629 RE TA personnel received call-up papers of whom 426 were successfully mobilized. Corporal Woodhall of 350 Field Squadron (Volunteers), sets out to tell what it was like, but it is not a war story. *Iraq and Back* tells of a man who gets duped into joining the reserve army and eleven years later finds himself in the heat and fear of the desert in the Gulf. He gives the real facts involved with leaving three young children and a wife to go to war, when he has never before been away from home for more than two weeks. The book is essentially a diary kept by email describing events as they happen, but it is not as disjointed as it sounds. Corporal Woodhall has managed to weave it into a readable story; all the way through one gets a feeling that he is the honest broker – telling it as it really was with his thoughts, hopes and fears, interspersed with cameos of daily life for both the British soldier and the Iraqi people. Whilst on R&R he broke his arm skateboarding with his children. He still returned to theatre but was found out and this gives him the opportunity to describe the medical care arrangements, the aeromedical evacuation procedure and also what happens to a TA soldier when he arrives back in UK under those conditions. The book concludes with his thoughts on adapting back into civilian life afterwards, and also his mantra; *"I am just a bloke who did what was asked of him because I believe that if you wear the uniform and take the money, then you must do the job asked of you when the time comes"*.

As a generalization, regular soldiers do not know enough about the territorials, but readers of this book will know a whole lot more about one of the most valuable resources the UK possesses; the men and women who for one reason or another do not aspire to full time service, but all the same are prepared to put their life on the line when called.

JEB

FARMING AND FORESTRY ON THE WESTERN FRONT 1915-1919

BY MURRAY MACLEAN



Published by
Old Pond Publishing,
Dencora Business Centre,
36 White House Road,
Ipswich, Suffolk. IP1 5LT.
Price £17.95.
ISBN 1-903366-64-X.

THIS is not a normal war history book. Any publication to do with the First World War always tends to be quite large in terms of page numbers and chapters; after all whatever the subject there is always a lot to be covered. In that sense, this one is no different, but unlike the latest Harry Potter, this book only has 143 pages in three chapters. Each starts off with a detailed explanatory text and the story then continues in a series of photographs, each supported by a well-written caption. It is said that a picture is worth a thousand words and with Mr Maclean's book, you get full value for money.

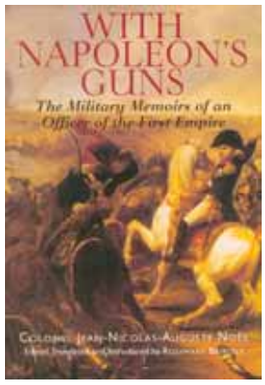
By the end of the war in 1918, British agriculture, if it had had to do so, would only have been able to feed the nation for 155 days out of 365, so was extremely dependent on imports and from 1915, these were severely disrupted by the German submarine offensive. The army in France therefore had to be develop some form of self-sufficiency. At the height of the war, there were 416,000 horses and mules in France and Flanders and each was given 5 kg of oats, 4 kg of hay and as much water as they needed daily. The hay alone amounted to 70,000 tons a month and it had to be brought from England, sometimes at the expense of other stores, space-wise, on the ships. When the Germans withdrew back to the Hindenburg Line in 1917, they left behind thousands of acres of good, if scorched land. As a result of the GHQ Hay Scheme, this land was utilised for fodder and at the end of July 1917, had produced 4,688 tons of hay, thus freeing up the equivalent cargo space.

This enterprise was applied to various other areas. Fresh vegetables were a must and whenever land was freed up, it was used. The story of the Canadian assault on Vimy Ridge is well known, but it may not be so well known that by August 1918, the slopes of the ridge were being used for potato growing. The Royal Engineers of course were fully involved. Wood especially was needed for the trenches (fascines, woven hurdles, picket stakes and duckboards), mines (props and duckboards), plank roads and of course for the sleepers of the light railways that moved all the stores to the front.

So the book is not especially about the activities of the Corps, but it is a truly fascinating insight into the work of those troops that supported the fighting men in that far off conflict. As a final thought, stop and reflect on some of the articles that appear in *The Journal* and *Sapper*; modern stories of construction tasks where resupply is difficult so self-sufficiency is the name of the game – this book could even give you some ideas!

JEB

WITH NAPOLEON'S GUNS
The Military Memoirs of an Officer of the First Empire
EDITED, TRANSLATED AND INTRODUCED BY ROSEMARY BRINDLE



Greenhill Books, Park House, 1 Russell Gardens, London. NW11 9NN.
232 pages, hardback.
Price £18.99.
ISBN 1-95367-642-X

FOR twenty dramatic years the armies of Napoleon Bonaparte marched and fought throughout Europe displaying ruthless military might. Despite the miseries caused by his conquests he was widely regarded by friend and foe alike as the greatest military genius of all time. It is said that all ranks fell under the spell of his personal charisma. It is clear from this excellent book that the adulation was tempered by a healthy scepticism widely shared through the ranks, at least from the time when the former corporal took on the mantle of Emperor.

Jean-Nicolas-Auguste Noël was an artillery officer who served throughout these extraordinary years, rising to the rank of Colonel. He was present with his unit at the Emperor's coronation (or consecration, as he put it) and was unimpressed by the theatricality of the ceremonies. "Why was he not content with this title [First Consul] under which he had achieved so many good things? Our history had shown us clearly how absolute power leads to abuse. Why, having suffered a bloody revolution, were we to return so quickly to the past?" Napoleon's underhand acquisition of Spain brought further disillusionment, followed by the disastrous invasion of Russia.

The journal on which this book is based was written up in 1850 during Noël's retirement and not published until the end of the century. So there could be an element of wisdom after the event in these observations. However, the paradox that allows a flawed personality to exert inspiring leadership emerges clearly from the narrative. Even in 1814 in the aftermath of the decisive defeat at Leipzig, Napoleon was able to return to the army and change everything. "The fascination exercised by this man was still extraordinary. We all knew everything about him, his obstinacy, his pride, his political failures . . . and yet, with the arrival of Napoleon, confidence and even hope revived in the army. His presence alone filled the command with a vigour, a resolution and an energy that we had ceased to experience. We felt in the presence of a leader – a good leader."

Noël's service took him all over Europe and his experiences of the Russian campaign and the difficulties that followed are vividly described. He also took part in the Peninsular War, principally as commander of the cavalry division artillery of Junot's 8th Corps and this is perhaps the most interesting section of the book to a British reader. It is clear that the French soldiers hated serving in Spain and Portugal with all its difficulties of terrain, climate and the ever-present threat of guerrilla attack. Nevertheless, they took it all as simply another task to be accepted professionally. Noël himself seems to have overcome the challenge of living with the effects of Wellington's scorched earth policy, finding quite sufficient food for his men and repairing the mills broken to deny them the ability to grind corn and oil. His criticisms of the English ". . . it did not matter that they spread ruin in Portugal in order to starve us, for they were not making war in their own country" are a little incongruous from a member of an army whose policy of supplying food was openly based on pillage.

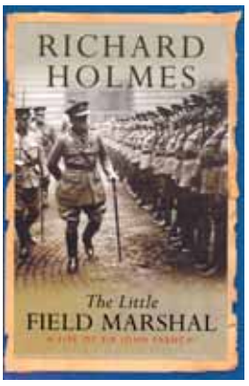
Noël is in no doubt of the effectiveness of the Lines of Torres Vedras. "We had thought ourselves to be victorious, to be near the end of a glorious campaign, and about to be moved into winter quarters in the Portuguese capital, whereas we were now obliged to spend the winter in a devastated and ruined countryside at the foot of those terrible lines, the strength of which no one could doubt."

This book, carries conviction from its calm and factual tone while still putting across the appalling trials and terrors of the dramatic events lived through by its author. It is presented with a dozen black and white illustrations and two broad maps. It is very well translated, edited and introduced. The footnotes on the various names that appear in the text could perhaps have done with a little more elaboration but this is a quibble in what is otherwise an enjoyable book to read giving a fascinating view from "the other side of the hill". Do not be put off by thinking it is a pure gunner story. It is much wider than that and contains plenty of sapper interest including one of the most disastrous reserved demolition stories in history.

GWAN

THE LITTLE FIELD MARSHAL

BY RICHARD HOLMES



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Price £8.99.
ISBN 1 304 36702 8

THE First World War is always inextricably linked with Field Marshal Douglas Haig. What is not so well known is that the BEF was commanded until December 1915 by another Field Marshal, Sir John French who presided over the battles of Mons, first and second Ypres and the series of actions which attempted to break into the plain between Lille and Douai at Neuve Chapelle, Aubers Ridge, Festubert and Loos – this last sealing his fate as the BEF's field commander.

This admirable book is a reprint from a 1981 work by the popular military historian, Richard Holmes. It is not just another history of the First World War, although much of the content deals with the strategic events and military, logistical and political shenanigans of 1914-18. Rather, it examines the long military life of a brave and colourful soldier who, by all accounts, tried to do his duty for the good of his country and for the soldiers that he commanded.

French was born in 1852, but Irish ancestry lay heavily across his English birthright. This link was to colour his character with Irish traits of warmth, generosity, courage and temper, the latter to become his trademark. His father died in 1854 leaving the quiet, reserved but stubborn French to be brought up his mother. Initially he joined the Royal Navy, being posted to *HMS Warrior* in 1868. *Warrior* was in the Channel squadron and spent much of her time at Lisbon, where French used to take shore leave and ride over Wellington's battlefields. More at home in the saddle and with a bad head for heights, he resigned from the Navy and sought entry to the Army via the Militia. Even as an inexperienced cavalry subaltern, French noted the introspective outlook of all arms who concentrated on unit training rather than the almost complete lack of collective training and ignoring the science of warfare. French was a conscientious officer and his career prospered, being promoted captain in 1880 and moving to Morpeth in 1881 as adjutant to the Northumberland Hussars. His own regiment, the 19th Hussars, was ordered to Egypt as part of the Khedive's Relief Expedition and as a new captain, French saw himself being left behind in terms of operational experience. However, events in the Sudan took a hand with the rise of the Mahdi and French rejoined the 19th in 1884. He received his baptism of fire at the Relief of Khartoum, being mentioned in dispatches by the Force Commander during the withdrawal in contact. He came home in 1886 with his military reputation enhanced, taking command of his regiment at Aldershot where he set in train realistic and rigorous training which contrasted dramatically with the formal parade ground manoeuvres adopted by other units. French also pioneered the squadron system that was subsequently adopted throughout the cavalry. In 1891 the 19th embarked for India where its battle procedure caught the eye of the Inspector-General of Cavalry, Sir George Luck, engendering a close affinity between the two officers which was to stand French in good stead as he progressed upwards. In 1895, he was appointed Assistant Adjutant General, producing a field manual for the organisation of mounted troops, and also drove forward the introduction of permanent cavalry brigades. French sailed for South Africa in 1899 as Commander of the Cavalry component and in a war characterised by incompetence, French's competence as a field commander shone like a star and he returned to Aldershot in 1902 to be appointed Commander 1st Army Corps where his main effort was to weld it into a homogeneous fighting formation. In 1912 French became Chief of the Imperial General Staff where he regarded his task as getting the Army ready for what was an ominous inevitability – "the dark beauty" of war. In 1913 he fell out with Haig and having previously fallen foul of Smith-Dorrien, he was now at odds with the two men who were to be his Corps Commanders in the looming conflict.

The BEF marched off to war in 1914 and the omens were not good. French suffered from poor communications, squabbling and duplicitous Corps Commanders with direct links to the King, and logistic and manpower shortages. Ultimately the front stabilised as the respective armies fought themselves to a standstill and the old regular army, which French knew and loved, was gone. It was the politically demanded battles of 1915 which were to prove French's undoing and the issue of the general reserve at Loos was the final nail in the coffin. It was a disaster and French's head would roll. Asquith prepared the ground well for his dismissal with both the King and Kitchener, but on 6 December French resigned. As he embarked for England his old regiment had the last word – they cheered themselves hoarse. In spite of his shortcomings French was still a soldier's general. His career though was effectively over. He was appointed CinC Home Forces and from 1918 Lord Lieutenant of Ireland where he presided over the difficult Home Rule issue. He retired in 1921 and died four years later from cancer of the bladder.

Churchill's verdict on French was that he was a natural soldier and imaginative commander with a deep military insight although not with the intellectual capacity of Haig. Lloyd George considered French to have a broader operational view than Haig and saw him as a victim of a military conspiracy in which Haig played a big part.

This is an immensely readable portrait of a man who was at the cutting edge of military events for some 30 years. French was probably unlucky to pay the penalty in 1915 when Haig survived far more contentious failures later in the Great War and if he had survived he may well have turned out to be a great commander. It is well worth a read as it places the personal life of a soldier's commander, who did much for the Army, very much in the context of contemporary events.

MDC

Correspondence

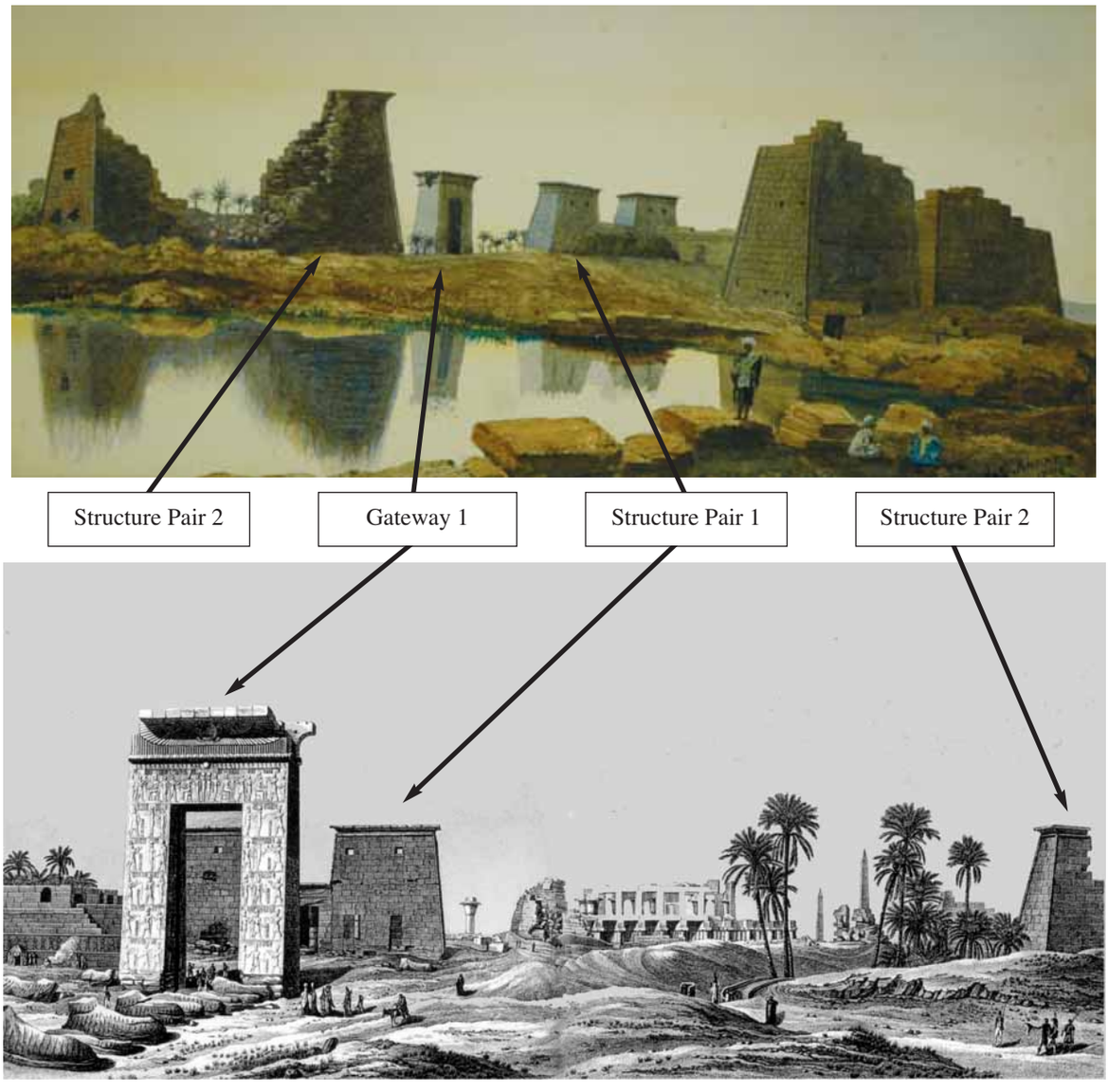
MAJOR GENERAL SIR JOHN ARDAGH KCMG KCIE CB

From Lieutenant Colonel J M Gunns

Sir, – I read with great interest the article in the August *Journal* concerning Major General Sir John Ardagh KCMG KCIE CB. My attention was particularly caught by the paintings and descriptions of Egypt, in part because in 1987 I served for six months in Egypt with the Multi National Force and Observers and I have recently completed a university correspondence course in Egyptian archaeology.

The footnote to the article states that the location of the painting at the top of page 87 is unknown. The scene immediately reminded me of the great temple at Karnak in Thebes (now modern Luxor). I enclose a picture of the temple for comparison taken from an illustration prepared during Napoleon's campaign in Egypt, by a curious coincidence the same campaign mentioned elsewhere in the August *Journal*. If you compare the pictures, you will see that the scene is similar although the painting appears to have been made from the other side of the temple at approximately 135 degrees from the older illustration. In addition to the general similarity of the subject matter, particular features that stand out are:

- The obvious projection to the top right hand side of the structure pair 2 in the upper picture/top left hand side in the lower picture.
- The projection at the top right hand side of gateway 1 in the lower picture shown as a shadow/dark feature on the top left hand side in the upper picture.



I note that General Sir John left over 700 paintings and sketches although it is not clear how many are owned by the Corps. I also note from General Keith Cima's book 'Reflections from the Bridge' that the Abney photographic legacy includes photographs from Egypt. I am not sure how well these items are publicised outside the Corps, but the photographs in particular would seem to be of great interest to those studying Egypt. During my admittedly limited research, I did not come across references to these pictures. Additionally, there seems to be an almost insatiable demand for books on Egypt. Many of these seem to recycle very similar pictures and there may be a commercial opportunity here for the Corps to publicise the existence of these pictures. Some examples of current publications are:

- Paintings of Egypt by David Roberts RA dating from 1839. These are very similar in style to General Sir John's paintings and are very popular being found on numerous postcards as well as in many books. These pictures suffer somewhat from over-exposure and some fresh pictures might be welcomed.

- "Miss Brocklehurst on the Nile". A recently published diary account, including sketches and paintings of a voyage on the Nile in 1873/74. The diary entries in this book were somewhat dull and, if General Sir John left behind more descriptions about his journey on the Nile of the type mentioned in the article, then this, combined with some of the pictures, could make a very attractive book.

There might also be scope for an Egypt then-and-now style book with a mixture of paintings and photographs from the Corps collection interspersed with photographs of the sites today. Now, who might we get to prepare this . . .

On a final note, I think that the larger format of the *Journal*, and particularly the increased use of colour, make it far more attractive and readable. Funnily enough, I had not noticed the change to the cover. As we are not trying to tempt busy commuters to pick the magazine off the news stand, the cover is possibly less important – the main benefit of a distinctive cover might be to assist in remembering in which issue a particular article can be found. Yours sincerely – Jon Gunns.

FORCE PROTECTION

From WO2 (retd) C A Wright

Sir, – After reading the letter fromLieutenant Colonel Whitchurch in the August edition, I thought you may be interested to know that STRE have been involved in some trials over a number of years of a system commercially known as *Dynablok*. In essence, a *Dynablok* wall @ 60cm thick will offer the same level of protection as a 3m gabion wall (*Hesco* etc). Whilst *Dynablok* is not well suited for rapid deployment operations, it may well have applications in post-conflict theatres of operations such as Iraq and Afghanistan. Further details may be found on their website at www.dynablok.co.uk

Having also read Major Walton-Knight's article regarding protecting a tented site, I agree that a trench with overhead protection or even a slit trench would have offered the best protection from mortar fire/airburst munitions in the circumstances. It is amazing how quickly a soldier can move into his trench when he hears the thump of "incoming" coming towards his position.

I have enjoyed Lieutenant Colonel Whitchurch's writings in the *Journal* over the years and urge him to keep up the good work. Yours sincerely – Cliff Wright

DOWSING

From John Baker, Chairman, London and Thameside Dowsers

Sir, – Being on the Council of the British Society of Dowsers, I have gone into its history and discovered that the modern UK movement had its origins with members of the Royal Engineers in 1933, and also that the Society has had a long line of Army Presidents up to the year 2000.

The RE Corps Library has a number of references to water divining, but it is important to realise that it is just not water, but pipes and cables etc. that can be followed and with practice, leaks in pipes can be found. For the really gifted, one lifetime will not be long enough to explore all the avenues that will open up.

For those who would like to find out more, I would recommend the book *Dowsing One Man's Way* by Major General Scott Elliott, which is available from the British Society of Dowsers, 2 St Anne's Road, Malvern, Worcs WR14 4RG at £9.99 include p&p.

In addition, if anyone is interested in a "hands-on" talk/demonstration on this fascinating subject, I may be contacted via the Assistant Secretary at the Institution. Yours sincerely – John Baker.

FORTS AND FRAGGING

From Captain C E Nodder

Sir, – I enjoyed reading the chain of correspondence kicked off by Lieutenant Colonel Whitchurch regarding field forts, fragging, etc. I would like to raise my head above the parapet – pun intended! – and reflect on the utility of camouflage and dummy installations. As is rightly pointed out, dropping mortars from nearly 5km distance would be no hard thing, and there would not be a need to adjust, as currently we build in such a way that there would always be a target. However, were we to use more real estate (there's plenty!), and put up some dummy installations/individual shelters and buildings, the chances of a hit on something that matters would be very much reduced.

The other thing to do is some kind of maskirovka exercise; Khan did not have to hide on the Steppe – he was mobile, so having gone firm, we need to be a deal more creative; I am sure there must be something on file at Hayes!

Jasper Maskelyne (stage illusionist and sapper officer, hurrah!) was an alumnus of the Farnborough camouflage centre and in charge of the operation that constructed dummy tanks out of plywood, and even a dummy water pipeline, that were used to deceive Rommel about our ability to supply troops with water. Perhaps we need some dummy Hesco Bastions and false dry walls, or a modern version of Maskelyne's rotating mirrors and lights that were used to obscure the actual location of the Suez Canal?

I currently work in the field of digitization, where to be accused of providing a "smoke and mirrors" solution is not at all good. In the area of force protection, however, it might be an element worth re-visiting. Yours sincerely – Clive Nodder

FORCE PROTECTION – A QUESTION OF SCALE

From Major C C Benfield

Sir, – In the correspondence on force protection (*Fragging, Luck, Abbreviations and Acronyms*), it is clear to me that the ideas of both Major Walton-Knight and Lieutenant Colonel Whitchurch have their place. Dry walling as practised by Maj Walton-Knight would appear to be a sound solution for smaller-scale, soft-skinned accommodation as at Fortress Lines; the "overhead cover" approach of Lieutenant Colonel Whitchurch favours cooler climes and shorter (or more intense) operations.

However, both of these solutions discussed only the effects of fragmentation. Would either author (or anyone else!) care to educate an E&M officer on the pressure effects of larger calibre mortar and artillery on soft-skinned people? Are these effects of marginal importance and have the proposed designs countered them?

Picking up on the response by Lieutenant Colonel Sealy-Thompson in regard to the larger bases such as Shaibah, the costs of successfully hardening such an area must be huge. Whilst Sappers love fortification, has active protection been considered? I believe that ground-based *Goalkeeper*[1] would cost in the region of £5m per unit; one could be deployed at each large base. Such a system will stop any incoming mortar or artillery shells, including rocket artillery and no longer require depleted uranium rounds. They may be programmed to avoid arcs of fire in which the return trajectory endangers civilian centres such as schools etc, or aircraft approach corridors. Whilst the initial cost is high, the system could of course be used for successive operations. Yours, in anticipation of illuminated replies – C C Benfield.

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[1] *Goalkeeper*, manufactured by Thales, is an autonomous close-in weapon system in which the entire engagement sequence from search to destruction is carried out automatically. It consists of a Vulcan 30mm gun and search radar. In a multiple engagement *Goalkeeper* automatically designates the higher priority target. (Source – *Janes*)