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Annual Report to the Corps by the Engineer in Chief

INTRODUCTION

THIS is my first annual report to the Corps. Sadly, it is also my last as I leave shortly to take up the appointment as Resident Governor of Her Majesty's Tower of London.

With the exception of the Gulf War, this has been the Corps' busiest year for a long time. I report later on our contribution to operations in Bosnia, Northern. Ireland and elsewhere, and on our continuing programme of overseas exercises and projects. Running in parallel with this has been the drawdown to the new order of battle with the consequential disbandments, amalgamations and unit moves. We have had to cope with the effects of redundancy. And with the visit of Her Majesty The Queen, to Germany, the 50th Anniversary of D-Day and other high profile events there has been a great deal going on in terms of Regimental affairs, as I shall report .

I am pleased to say that our efforts are being CGS (Chief of the General Staff) recognized. and VCDS (Vice-Chief of the Defence Staff) have both written to me about the performance of Sappers in Bosnia. CGS said: "During my visits to Bosnia, I have always been left with a deep sense of pride in the achievements of our Sappers. They have done a wonderful job tackling all their projects with skill and enthusiasm." And from VCDS: "There is little doubt that the Royal Engineers are some of the unsung heroes of Operation Grapple. Their efforts, working long hours, to improve the Main particularly Supply Route between Tomislavgrad and Vitez are obvious and, frankly, amazing."

OPERATIONS AND DEPLOYMENTS

MUCH of last year's report was concerned with the involvement of the Corps in military engineering across the whole diverse spectrum of our capabilities. This year is little different as we have continued to be heavily committed to a wide range of operations and deployments worldwide at both individual and unit level, and our contributions have attracted much well deserved recognition and praise for the Corps.

Our continued commitment to United Nations (UN) operations has been the focus for a major part of the Corps' effort over the past year. Our major contribution is in the former Republic of Yugoslavia (FRY) where we currently have 387 all ranks deployed on Operation Grapple. Recognition of the scale of the engineer effort and the requirement for proper command and control at an appropriate level, resulted in approval for the deployment of a tactical regimental headquarters (RHQ) from 38 Engineer Regiment in February to enhance 11 Field Squadron Group. The deployment of a second British infantry battalion in March was accompanied by additional Sapper support in the form of elements of 32 Field Squadron, and this deployment was subsequently enhanced in May. I am now satisfied that we have a proper level of Sapper support in-theatre to meet the demands and challenges that operations in Bosnia provide.

As a result of the latest roulement, we have RHQ 36 Engineer Regiment, 5 Field Squadron, 32 Field Squadron, 61 Field Support Squadron, 524 Specialist Team Royal Engineers (STRE) (Works) and an explosive ordnance disposal (EOD) section from 33 Engineer Regiment (EOD), deployed in-theatre. These units continue to provide route development and maintenance, camp hardening and infrastructure support as priority tasks, with excellent results being achieved in all respects. In addition, there have been teams from the Military Works Force throughout. including in-theatre the Well Drilling teams, which have provided secure water supplies to both British and Dutch bases. Military Survey. Military Survey has continued to support the UK contribution to UN operations in the FRY. Some 20 Military Survey officers and soldiers are currently serving on the staff of Headquarters (HQ) UNPROFOR in Zagreb, HQ Bosnia-Herzegovina command in Kiseljak near Sarajevo and HO BRITFOR in Split, providing policy planning support, terrain geographical analysis and graphics in the HO and running the map supply chain in-theatre. One officer and five soldiers have, in addition, been supporting Royal Artillery operations in-theatre, most recently the positioning of mortar-locating radars for the monitoring of heavy weapon activity around Sarajevo, a reminder of the need for such support when deploying away from the

well-trodden plains of northern Germany. Map and graphic support in-theatre is principally concerned with operational products such as information summaries or other aids to planning, but has also included the production of maps for ceasefire negotiations.

Individual efforts by members of the Corps have been recognized by the following operational appointments and awards for service in the FRY, NI and Cambodia:

OBE	1
MBE	5
Mentioned in Despatches	5
Queen's Commendation for Brave Conduct	1
Queen's Commendation for Valuable Service	5
Joint Commander's Commendation	Ι
General Officer Commanding's Commendation	4

Sadly I have to report the tragic death in March of Corporal Warburton who was killed at Stari Vitez whilst serving with the EOD detachment from 33 Engineer Regiment (EOD). He was well known as a rugby player and a popular member of his unit.

Support to the UN has not been confined to operations in Bosnia. A team from 28 Engineer Regiment deployed to another part of the Balkans to train Bulgarians and Romanians in the use of the Combat Support Boat after three of those boats were donated as part of the Western European Union' sanctions initiative on the Danube. In Cambodia we had the last of three teams on Operation Lecturer which conducted invaluable work in the supervision and training of local teams in mine clearance operations. (See articles: UK Participation in UN Operations in Cambodia in the April 1993 Journal, and Operation Lecturer - Cambodia, in the December 1993 Journal.) Individual support from the Military Works Force and 12 Engineer Brigade to RAF operations in the UN declared air exclusion zone in Iraq continues and individuals have deployed with UN teams monitoring weapons of mass destruction. In addition, we have had other requests from the UN for assistance which, although declined, have involved much contingency planning.

We continue to be heavily committed to the emergency tour plot (ETP). A squadron group remains deployed in the Falkland Islands where it continues to conduct a wide variety of tasks in support of the garrison. Our commitment to Belize is coming to an end now that the Garrison is to be withdrawn. 7 Field Squadron will be there until September and is currently busy providing infrastructure for the new training and support unit to be established, assisting with the drawdown, and providing artisan training for the Belize Defence Force.

Work in Northern Ireland continues at its normal high level of intensity and we continue to deploy a roulement squadron and search troop to 25 Engineer Regiment. Major military engineering projects for the Regiment include refurbishment and rebuilding of fortification works in security force bases and sites throughout the Province. Recently major works have been completed in Crossmaglen and have attracted unstinting praise from both the GOC (General Officer Commanding) and CLF (Commander Land Forces).

Only in one area is our commitment decreasing, and that is in support to overseas garrisons. Sadly we have seen the demise of the Berlin Field Squadron, the Fortress STRE in Gibraltar and a reduction in the Queen's Gurkha Engineer presence in Hong Kong. In Cyprus 62 Support Squadron continues to conduct operations in support of the garrison and UN operations, supplemented by troop deployments from UKLE.

Disaster relief has continued to place demands on the Corps and we have seen bridging operations to alleviate flooding conducted by the Queen's Gurkha Engineers in Nepal, and by 36 Engineer Regiment and 78 Engineer Regiment (V) in Sussex. 68 Field Squadron from the Queen's Gurkha Engineers deployed to Nepal from Hong Kong in August and built a number of Bailey and Mabey Johnson bridges, as well as assisting with many other tasks, and earned considerable praise for their professionalism and efforts. (See article Disaster Relief in Central Nepal in this Journal). In January a squadron group from 36 Engineer Regiment, based upon 9 Parachute Squadron, provided four Bailey bridges in Chichester in order to reopen routes after extensive flooding. The bridges were later recovered by 127 Field Squadron (V), and the whole operation similarly attracted much well deserved praise.

In the UK routine tasking in support of the civil ministries continues, and in particular 33 Engineer Regiment (EOD) has continued to provide invaluable search support. Worldwide the Corps has provided military assistance training teams to Egypt, Mexico, Ghana, and the

Conference on Security and Cooperation in Europe, and these deployments, along with many others, continue to provide not only invaluable experience for individuals but also show the versatility and value of the Corps.

PROJECTS AND EXERCISES

THECorps has continued to gain valuable training experience from numerous projects and exercises abroad as well as in the UK and troops or squadrons have deployed overseas for project work to Kenya, Canada, Cyprus, Gibraltar, Norway and Hong Kong. It is also very good to see that the Corps has been involved in so many All Arms exercises in such disparate countries as Kenya, USA, Canada, Cyprus, Gibraltar and for the first time this year a troop supporting a battle group in the Oman. 12 Engineer Brigade have continued to support the RAF and have been involved in numerous exercises within the UK and in Germany. 73 Engineer Regiment(V) supported the first major Harrier Force deployment for four years on their annual camp in Denmark. This provided a very successful demonstration of the Regiment's fitness for its new air support role. Such overseas deployments give squadron and troop commanders, as well as the junior leadership in squadrons, quite excellent training for operations such as we are seeing in Bosnia at the moment.

The Corps has seen the successful completion of the ammunition compound at Ladyville in Belize which involved many squadrons over the last few years. (See *The Corps, Construction and the Future* in the April 1994 *Journal.*) Its final cost to the Foreign and Commonwealth Office was just short of £740K and the date of its handover coincided with the announcement of the impending withdrawal of British troops from the country!

All the regiments in the UK deserve recognition for the considerable amount of time and effort they have spent trying to improve their local training areas and facilities. In addition the Corps has recently become involved in planning improvements to the major UKLF training areas in an effort to ease pressure on the defence vote. This load will be heavy but I am very keen to see no reduction in our overseas project work, if possible. We need to maintain a good balance of engineer projects and exercises at home and abroad; we must also look to the future and retain our training opportunities overseas, in order to both ease pressure on UK training areas and to provide our soldiers with the right level of training for future operations.

ORGANIZATIONAL CHANGES

MUCHof the Royal Engineers reroling process has been completed in Germany and engineer support to 1 (UK) Armoured Division is now largely reorganized, but the process will run on until late 1994. In the UK we see a similar picture with many of the changes needed to meet the engineer support structure within 3 (UK) Division having already been completed.

In the UK, 22 Engineer Regiment has completed its reorganization and now has an orbat of two armoured, one field and one HO squadron. The Regiment has taken delivery of the new Chieftain armoured vehicle RE (CHAVRE) from Vickers, and refurbished Chieftain armoured vehicle launched bridge (CHAVLB) from Germany. The reorganization of 38 Engineer Regiment was completed in August 1993 at the same time as it became responsible for the Bosnia commitment. 33 Engineer Regiment (EOD) is now firmly established in Wimbish, and 25 Engineer Regiment is now fully operational in Northern Ireland.

39 Engineer Regiment will complete its reorganization later this year when it will comprise an HQ squadron and three air support field squadrons. 25 Engineer Regiment was to have included 12 Field Squadron as part of the Northern Ireland orhat in 1994. However, the fundamental problem of balancing our data book manpower allocation, which did not include 23 Amphibious Squadron and 69 Gurkha Squadron, across the Corps has meant difficult decisions having to be made. Having "cadreized" to the maximum acceptable extent possible, it was clear that we still had a deficit of some 200 posts. The decision was therefore taken to disband 12 Squadron as a field squadron, and to transfer the number to the HQ Squadron in 25 Engineer Regiment. This means that 25 Engineer Regiment will continue to have one of its squadrons found from roulement for the foreseeable future but, in due course, based in Massereene.

The reorganization of RE units in Germany continues to progress ahead of schedule. 32 Engineer Regiment moved from Munsterlager in September 1993 and is now fully operational in Hohne. 26 Engineer Regiment disbanded in July 1994 and 12 Field Squadron and 71 Amphibious Engineer Support Squadron will disband by September 1994, some six months ahead of the target date. The early drawdown of these units will help to relieve the pressure on manning levels which will be felt increasingly later this year.

In the Far East, the Queen's Gurkha Engineers will run down earlier than originally planned and will be down to a single field squadron (67 Squadron) by the end of 1994.

Reorganization of the Territorial Army continues with considerable progress having been made in adjusting to new organizations and new roles. We will be faced with further adjustments but details will not be clear until later in the year.

My own Directorate is reorganizing, and is due to move to a new block at Minley later this year.

ESTABLISHMENT MATTERS

OVER the last 18 months units and engineer staffs have been intimately involved in the development of new establishments for the Option W orbat. We have been required to justify every man, vehicle and piece of equipment at the Army Establishment Committee (AEC), the Army Vehicle Liability Committee and the Army Communications Committee. The process has been both exhaustive and exhausting and I should like to pay tribute to the staffs involved, whose efforts have ensured the best possible outcome for the Corps.

At the end of the AEC process, the manpower approved on unit establishments totals 8268 all

ranks, an increase of 77 on the original allocation. When including Survey, those posts held on other sponsors' establishments, and the E2 and Supernumerary Allowances, the 1 April 1995 projected regular strength of the Corps will be some 8800. Excessive "cadreization" remains a problem but I am pleased to confirm that some 250 posts will be restored to the armoured and mechanized field squadrons next year.

TRAINING

SINCE my last report the training organization has continued to feel the wind of change. The new command structure of the Royal School of Military Engineering (RSME), which became effective on 1 April 1993, is expected to be complete by 1 April 1995. It is shown on the "wiring diagram" at the bottom of the page.

The process of evolution has not been an easy one but is on course to achieve its target. Some of the milestones are shown below:

- February 1994: The training of drivers ~ moved to Army School of Mechanical Transport Leconfield on the closure of 56 (Motor Transport) Training Squadron
- 09-11 February 1994. The functions of Plant Road and Airfield (PRA) Wing were absorbed by the newly formed Design Engineering Wing and Construction Wing.
- 1 April 1994. 24 Field Squadron retitled 24 Training Support Squadron.
- 10 June 1994. Army Apprentice College Chepstow ceased training.



- 1994. Design o 1 July Engineering Wing and Construction Wing reorganized to form the MOOhanical Electrical and Wing and the Construction Wingllmder whose mantle will be the old Civil Engineer Wing and PRA Wing.
- September 1994. 12 RSME Regiment amalgamates with Depot Regiment to form I RSME Regiment.
- December 1994. Army Apprentice College is handed over to Wales & Western District prior to becoming an infantry baroaCks.
- By April 1995. Chattenden Barracks closes.

The last of the officer cadets who were trained on the Standard Military Courses and Standard Graduate Courses were commissioned into the Corps last year. All cadets at Royal Military Academy Sandhurst (RMAS) now attend the Commissioning Course, which is common to graduates and non-graduates. As a result of the reduced intake into the Corps from RMAS, from Troop Commanders' Course Number 113, there will be only two courses per year (in October and July).

In September 1993 a pilot scheme was started which allowed Weibexians to read for a first degree, as officer cadets, at Royal Military College Shrivenham prior to attending RMAS. This will result inex-Welbexians attending RMAS in their rarly twenties rather than at 18 plus when they will be more physically and mentally mature and thus better able to compete with the majooiity of RMAS entrants who at present arrive having already sat their degree. The scheme is >fow approaching the end of its first year in which !there has been one RE sponsored officer. The 'scheme's progress is being monitored closely 'by the technical Corps.

The RE Employment Structure Review which is being undertaken by Colonel Mounde and Lieut Colonel Rogers, is now well under way and is looking at the future requirements of the Corps in terms of a trade structure that will complement the move towards a capability-based Army. It should also help us to develop our input to Inspector General Doctrine and Training's Training 2000 Study which aims at making considerable savings in the training budget in forthcoming years.

Following the final pass out parade in June, Chepstow has effectively closed; those apprentices who had yet to complete their training will continue at RSME (Chatham). In the future, apprentices will undertake the core subjects common military syllabus, education, combat engineer class 3 and external leadership - at Minley prior to moving to Chatham for trade training to class 2 level.

The first of the single entrant recruits have already joined the field army following their common military syllabus training at Army Training Regiment Bassingbourn, where 28 Training Squadron moved in January 1993, and combat engineer and trade training at RSME. We are now midway through implementing the new special to arm training for RE recruits. Under this revised system, all will be trained to combat engineer class 3 and to a second class 3 trade before joining the field army.

DOCTRINE

ENGINEER4 has begun to work closely with the new Directorate of Land Warfare (DLW), in addressing work resulting from the British Army (BA) 2000 Study. There is a need for the Army to evolve from a threat-orientated to a capability-based one. It is hoped that the process will provide a solid foundation upon which tomorrow's military structures can be developed and from which the MOD can establish a more coherent approach to the long term co stings (LTC) process.

By the end of 1993, DLW had produced three high level policy papers:

- A Military Strategy for the British Army.
- o Future Military Activities for the British Army.
- Functions in Combat as Components of Capability for BA2000.

These sought to establish the broad way ahead, set out a spectrum of conflict and produce the start point for further work. Eleven Force Development Working Groups (FDWG) have been established, each to examine a particular area. We have strong involvement in a large number of these groups. Work is in the early stages at present, but should keep Engineer 4 busy until the end of the year.

During the last year or so, Engineer 4 produced the following papers:

- o Future Military Bridging.
- Future Family of Mines.
- Counter-Mine Warfare.
- Engineer Operations in Force Projection and Sustainment.

The RE Tactical Doctrine Committee (RETDC) is also very busy and is currently addressing a number of important issues for the Corps. We intend to produce All Arms and Sapper tactical doctrine on the following subjects over the coming year:

- C2 of Engineers at Brigade and Battle Group Level.
- Engineer Reconnaissance.
- Engineer Support to UN Peace Support Operations.
- HQ Squadrons and Engineer Resources.
- The Employment of Vehicle Launched Scatterable Mine System (VLSMS).
- The Employment of BR 90.
- Engineer Intelligence.

We also aim to redraft all the engineer related Army formation Standard Operation Procedures (SOPs) as new land SOPs in the coming months.

EQUIPMENT MATIERS

THE year has seen steady progress in a number of areas of the engineer equipment programme. A production contract for BR90 has been let. The Acceptance meeting for the general and close support bridges is planned for August 1994 and full production will then be able to commence. The trials of the long span set, which increases the span of the general support bridge to 44m, and the two-span set, which allows construction of multiple span bridges over fixed or floating piers, are due to start with 35 Engineer Regiment in Germany in the late summer.

The M3 production tenders have been assessed and a preferred contractor identified. The production contract should be let during the summer.

In the field of of mine warfare, the two contenders for VLSMS were evaluated last autumn. Equipments from Alliant Techsystems (US) and GIAT (France), both mounted on the Alvis Stormer, were compared in a comprehensive trial carried out by 36 Engineer Regiment. Both companies have been invited to tender for the production contract and best value for money selection will be made when the final production prices are known. The international development programme for the ACEATM (aimed controlled effect antitank mine), our new offroute mine, should be complete at the beginning of 1995. There have been some problems with the safety and arming unit of the midlife to Giant Viper, improvements now called Python, and the programme has been delayed but solutions are in sight.

Both the Case 721 medium wheeled tractor (MWT), as a replacement for our old Terex MWTs, and the Terex 3066 frame steer dump truck, have entered service. It has been decided to refurbish rather than replace the Caterpillar D6D medium crawler tractor fleet in order to ensure we retain a rugged and reliable machine. Considerable improvements in our capability to move bulk fuel ashore are in hand. The first off equipments of an improved system to discharge towed flexible barges (dracones) have been trialled and proved a great step forward. The trial of a new ship to shore pipeline system will be carried out by 59 Independent Commando Squadron and 516 STRE (Bulk Petroleum) this October.

MANNING

PH7. PBTs main concern at the moment is that of implementing the Phase 3 redundancy programme. There are 66 voluntary and four compulsory redundancies in this phase bringing the total numbers for all three phases to 186 voluntary and 47 compulsory; this represents a major outflow of experience and talent from the Corps. Limited feedback from the officers who have left so far is quite encouraging however, since the majority seem to have found gainful employment or have embarked on some form of training scheme.

Overall, it is perhaps a better picture than we may have expected. Certainly after March 1995, when the post Options manning levels should be effective, the Corps is likely to be quite well placed to face the future with no significant difficulties over our officer structure being evident. This compares favourably with some other Arms and Corps which are already experiencing difficulties such as "black holes" in their junior officer manning. However, in the short term, the Corps in common with the rest of the Army, is having to cope with the problems associated with the gapping of posts which will continue until the drawdown of unit manpower establishments and the ad hoc demands for officers, eg for UN posts, matches the available manpower.

REMRO (RE Manning & Records Office). Due to the unprecedented change because of *Options*, drawdown and redundancy, the soldier strength of the Corps has reduced from 11,600 soldiers in 1992 to 9300 now and will reduce to approximately 7700 by 1 April 1995. One effect of the speed of this reduction is that there will be a projected shortfall of up to 500 trained soldiers against the establishment by the end of this year, however the manpower target (MPT) of about 7700 will be reached by 1 April 1995. In order to ensure that this shortfall is balanced across the Corps now and in the future, I have introduced the following priorities for manning:

- Priority 1. Units warned for ETP tours must be manned to peace establishment.
- Priority 2. The ATO (Army Training Organization), 25 Engineer Regiment, 9 Parachute Squadron, 59 Independent Commando Squadron, and 62 Cyprus Support Squadron, should be manned to peace establishment.
- Priority 3. All other units to be manned after priorities I and 2 have been satisfied.

<u>Promotion</u>. From MPT 1995 the promotion rates will be proportionally_ broadly similar to those at present. It is essential that soldiers are qualified, as well as recommended for promotion, before they can be considered by a Board. A sad fact of life is that a number of soldiers miss promotion Boards because they are not qualified; a situation brought about in part by the high level of overstretch which our units are experiencing.

<u>Postings.</u> Tour lengths are likely to be longer from 1995 but inevitably there will be a degree of turbulence during this year because of redundancy and the disbandment of units, subject to the outcome of the Defence Costs Study.

The 12-Year Manning Control Point. With effect from 1 April 1995 the 12-year Manning Control Point, at present suspended, will be reintroduced. REMRO will be reviewing soldiers' careers this autumn for possible discharges from 1 April 1996.

<u>REMRO.</u> The new Army Personnel Centre is planned to form in Kentigern House, Glasgow, in 1995 and will comprise all the manning and records offices, personnel branches plus Director of Manning (Army), Director General Army Manning and Recruiting, Director of Army Recruiting and Military' Secretary' and Adjutant General Staff.

MILITARY SECRETARY

LAST year saw the announcement of the following key senior appointments:

- Major General M P G Wilson as Director General Military Survey in November 1993.
- Major General S C Grant as Chief of Staff HQ BAOR/HQ UK Support Command (Germany) in February 1994.

• Major General A D Pigott CBE as Director General Land Warfare in November 1994.

We continue to be well represented and honoured in the Honours and Awards lists with the Corps having received the following in the New Year, Operational Service and Queen's Birthday Honours:

OBE	4
MBE	21
Mentioned in Despatches	5
Queen's Commendation for Brave Conduct	Ι
Queen's Commendation for Valuable Service	5
Joint Commander's Commendation	Ι
General Officer Commander's Commendation	5

CORPS AFFAIRS

SADLY, General Sir Charles Richardson GCB CBE DSO died on 7 February 1994. (His memoir is published in this *Journal.*) He was a most distinguished officer and a former Chief Royal Engineer. A memorial service was held at the Royal Hospital Chelsea on 27 April 1994. The Queen was represented by the Adjutant General.

Major General. R Wood was appointed Colonel Commandant on 1 September 1993, and Major General G B Fawcus CB was appointed Representative Colonel Commandant for 1994.

Air Marshal Sir John Kemball. KCB CBE, Major General J A J P Barr CB CBE and Major D Q Hall have been appointed Honorary Colonels respectively of 77 Engineer Regiment (V), The Engineer and Transport Staff Corps and 74 Independent Field Squadron (V).

The highlight of the past year was the visit of our Colonel-in-Chief to the Corps in Germany, which took place at Hameln on 3/4 November 1993. Mter flying into Hanover on the afternoon of 3 November, Her Majesty dined with the officers of the Corps in Bindon Barracks, before retiring to a suite above the Officers' Mess. The next morning, her tour started with a visit to Stadt Hameln where she got a rapturous reception. In perfect sunny weather, she then saw a demonstration of Sapper equipment and capabilities at Upnor, crossing the Weser on an M2 ferry which flew the Royal Standard. Lunch with officers and NCOs and their wives followed in Gordon Barracks. The Queen then opened the Sapper Autumn Fair in the gymnasium and had tea with the wives. All Sapper units in Germany participated in this memorable visit, which was clearly

thoroughly enjoyed by Her Majesty. The Queen was presented with garden chairs and table and boot scrapers made in the workshops at Chatham, and a specially bound edition of Volume XI of the Corps History.

The year has seen a number of other major Corps events, associated with commemorations or disbandments. 38 (Berlin) Field Squadron held a series of farewell events in early March 1994, culminating in an impressive disbandment parade. A number of veterans of the Squadron were able to attend through arrangements made by the Friends of the RE Museum. The Squadron also sent a detachment to Chatham which erected a section of the Berlin Wall outside the Museum, amongst other tasks.

The disbandment of the Fortress STRE was another sad occasion. There has been a continuous Sapper presence in Gibraltar since 1704, and the first body of soldiers of the Corps was formed there in 1772. We took advantage of the deployment of 60 Field Squadron on the Rock to exercise our Freedom of Gibraltar on 26 March, in the presence of the Governor, Field Marshal Sir John Chapple GCB CBE, the Chief Royal Engineer. and a distinguished Sapper ex-Governor, General Sir William Jackson GBE KCB MC. During this parade, the Chief Royal Engineer presented to the Chief Minister a magnificent bronze statue of a soldier artificer of $17\overline{7}2$; this stands on a massive stone plinth in a prominent position in Main Street.

The drawdown in Germany was completed with the disbandment of 26 Engineer Regiment at Iserlohn on 28 May, in the presence of the Chief Royal Engineer. This was followed by the final pass out parade at Chepstow on 10 June. Still to come is the amalgamation of Depot Regiment and 12 RSME Regiment on 10 September.

The 50th Anniversary of D-Day could not be allowed to pass without recognition of the immense contribution which the Corps made to the invasion. The special D-Day exhibition in the Museum was opened on 16 May by the Secretary of State for the National Heritage, Peter Brooke, who was a National Service Sapper. He spoke to a number of veterans who discussed the exhibits with him. The Corps commissioned a Portland stone memorial, which was built on the cliffs at Arromanches by Central Volunteer HQ. This was unveiled on 7 June by a former Chief Royal Engineer, Lieut General Sir David Willison KCB OBE MC, who was wounded on D-Day in command of 17 Field Company. The Chief Royal Engineer was present, together with a party of Normandy veterans, the Chairman RE Association, detachments from 32 and 36 Engineer Regiments and the Corps Band.

The opening of the special exhibition on 16 May was followed by a Joint Professional Meeting at Chatham with the Institution of Civil Engineers on the subject of that amazing engineering achievement, Mulberry Harbour. The presentation was fascinating, and questions were answered afterwards by a panel of Mulberry veterans. The Sapper contribution to D-Day has also been well covered by a series of articles in the *Journal*.

As regards other Institution publications, Volume XI of the Corps History is now on sale and Colonel G W A Napier has started work to assemble information for Volume XII.

The special exhibition will remain open until 5 November and I hope that all will make an effort to see it. The courtyard will then be cleared and work will start on setting up the permanent post World War Two display. This will bring the story up to date, and will complete the essential elements of the Museum development plan. I would like to thank units for their generous contributions to my predecessor's appeal, which raised over £31,000 for the post World War Two display. Together with other donations received, we are now well within sight of accumulating sufficient funds for the permanent courtyard display.

The Museum Foundation, under the chairmanship of John Fitzmaurice, has been tireless in its fund raising efforts. A number of receptions in aid of the Museum have been held this year, including events in Gibraltar and Pitreavie. One was held in Hong Kong on 22 April, with the able assistance of the Queen's Gurkha Engineers, on the theme that Sappers have been in Hong Kong for 150 years. A further major fund-raising reception was held by courtesy of the Lord Major of London in the Mansion House on 13 June. A large selection of Corps silver was displayed and we emphasized the links between the Corps and the City, particularly bomb disposal during the Blitz. We borrowed for the occasion the George Crosses awarded to Lieutenant Davies and Sapper Wylie for their work in removing a bomb from St Paul's in September 1940. We took the opportunity to ask the Lord Mayor to present the Institution of Royal Engineers Gold Medal to Colonel J N Blashford-Snell MBE;awarded by the Institution Council in recognition of his contribution to exploration and science.

The running costs of the Museum continue to be a cause for concern, particularly in view of the possibility of reduced Ministry of Defence funding in future. However, the Endowment Fund, which draws its income mainly from retired members of the Corps, has now accumulated a balance of over £100,000; this will be allowed to grow over the next few years until it reaches £250,000, at which point it will be possible to draw a substantial income to help offset the proportion of running costs borne by Corps Funds.

Captain R T Arnold was appointed as Corps Librarian in September 1993.

The funds of the Corps continue to be buoyant. Despite the drop in income under the Day's Pay Scheme and expenditure on events such as the Royal visit, the Central Charitable Trust Fund still managed to show a surplus for the year of £161,000. Our investments have continued to perform strongly, and at the end of 1993 our assets stood at:

Corps	£1,976,000
Institution	£511,000
RE Association	£4,125,000

This represents an overall increase of 19.2 per cent since December 1992, although the market has since fallen somewhat.

The Band has now reduced to its new strength of 35; the reduction was achieved through voluntary redundancy and transfers to other Army bands. The Band has a particularly busy programme in 1994 and has to take its turn as the RMAS duty band for the whole of the autumn term. There is every indication that the same high standards will be maintained and the Band continues to perform at prestige events, induding at the opening of the Channel Tunnel.

Lieut Colonel J W Ray took over as Controller RE Association in August 1993 from Major C F Cooper MBE, who has given many years of sterling service to the Association, and is still continuing to do so in a part-time capacity. The Controller spends most of his time working on benevolence; the complexity of these cases continues to increase, although overall expenditure on benevolence appears to be levelling off.

Staff Sergeant Hoare retired in July after 18 years' loyal and efficient service as the Manager of Corps Enterprises; a new Manager has been appointed, Warrant Officer Class 1 D B Moffatt.: Following a study into the future of Coq>s Enterprises completed last year, it has been decided that a new retail outlet will be established in the Brompton Study Centre, which will be more accessible to those serving in or passing through Brompton Barracks.

The Johnny Jonas painting to commemorate the Gulf War was unveiled at the Corps Guest Night in February, and prints are now on sale. The Corps has also purchased a replica Army Football Cup to be held by 28 Engineer Regiment in view of their unprecedented success in this sport.

Overall this has been an exceptionally busy year for the staff of RHQ RE and I would like to record my thanks for their hard work and dedication.

SPORT

As ever the Corps continues to be at the forefront of Army sport. There have been a series of fine team and individual performances throughout the year.

The Corps rugby cups were competed for as fiercely as ever. The Fern Cup, between 3 RSME Regiment and 39 Engineer Regiment was won by 3 RSME Regiment 33 points to 8. 3 RSME Regiment went on to contest the Campbell Cup the following week at Chatham against 21 Engineer Regiment. The final score was 13 points to 8 in favour of 3 RSME Regiment. The Corps XV has also had a fine season winning their games against the RLC (Royal Logistic Corps), Infantry and Royal Marines, but losing to the Royal Electrical and Mechanical Engineers, Royal Signals and finally to the Royal Artillery Rugby Football Club.

Once again the Corps showed its strength in Association Football with 28 Engineer Regiment winning the Army Cup for the fifth consecutive time, this time against 2 Division Signal Regiment. The Blythe Cup was fought between 3 RSME Regiment and 42 Survey Engineer Group. Against the odds 42 Survey Engineer Group won 2-0.

The Corps was very well represented at the Winter Olympic Games in Lillehammer. Half of the British Biathlon Team were Sappers, Sergeant Dixon and Corporal Woods, and we should also recognize: the efforts of Lance Corporals Ryan and Sklenar, who trained with the team all year but were not selected. Their efforts at the Games, under the able leadership of Major Eddie Lowe BEM, represented the best ever results for the country although they were not able to clinch any

medals against formidable opponents. Captain Hutchison also competed in the moguls event. New talent continues to be found, Sapper Nadollek represented Great Britain at the world Junior Biathlon Championships gaining the top British placing in both events.

Boxing has featured strongly this year. 59 Independent Commando Squadron won the Army Minor Units Boxing Championships convincingly against Base Ordnance Depot Bicester RLC. Lance Corporal Powell became the Welsh Amateur Boxing Association (ABA) Lightweight Champion and has been boxing for Wales and the Army. Sapper Watts became the England ABA Super Heavyweight Champion, although he has yet to complete his recruit training! It is hoped he will be selected for the England Commonwealth Games squad.

Shooting is going through a dramatic change designed to encourage more participation across all ranks and abilities. However, mention must be made for our top two marksmen, Staff Sergeants Delany and Quilliam, who won the Army Rifle Association Gold and Silver Jewels respectively .at this year's Bisley RASAAM (Regular Army Skill_ at Arms Meeting), both were presented with their trophies by Her Majesty The Queen.

In rawing, five Sappers were selected for the Army VIII which won the Inter-Services title, and three Sappers rowed in the Army IV which did likewise.

22 Engineer Regiment won the Army Basketball Finals; 28 Engineer Regiment won the Army Cross Country Championships and then later won the Army Road Relay Championships; and the Corps Squash Team retained its Inter-Corps Champions title. All other sports 'have been very well represented but there is not enough time or space to list each and everyone's achievements. Suffice it to say that all participants whether individual or part of a team effort, either on the winning side or those who took part in the competition, deserve praise and encouragement. Well done, indeed, to you all.

CONCLUSION

I believe I can repart confidently that, throughout a hectic year *an* all fronts, the Corps is in good shape. We are smaller and we have lost many good people. But we are better balanced and, when the equipment enhancements 1 have outlined appear in service, we will be significantly better equipped. As I go round the Corps, Regular and TA, I never fail to find anything other than units full of highly motivated and enthusiastic people getting on with the job in hand. Above all, we have demonstrated on operations that the quality of our officers and soldiers and their ability to tackle any tasks which may be thrown at them is second to none.

It would be wrong if I were to imply that all is sweetness and light. This is not so. I am concerned for example at the loss of a number of senior appointments and the effect this will have on the career prospects of our officers. I am concerned about further cuts in funding, particularly as they affect training. But these are problems which affect the Army as a whole and we will continue to ensure that we do not bear a disproportionate share of the pain.

On balance, we are well in credit and, so long as we have theopp>ortunity to demonstrate our capabilities on operations, there is n0danger of the Army forgetting that without Sappers it cannot live, move or fight.

50th Anniversary Articles

THE editor would be pleased to receive further articles from anyone who took part in World War Two, with a view *ta* their publication on or near *ta* the date *of* the events described. We are now considering articles covering the periods September to December 1944 and to April 1945, but accaunts of later events are always welcome as they can be kept *far* publication in the appropriate issue.

Disaster Relief in Central Nepal

MAJOR J R WHITE MBE BSc(Eng)



John White was commissioned into the Corps in 1976 and much of his Regimental service has been spent with the Queen's Gurkha Engineers, both in the United Kingdom and the Far East. After attending Staff College, he returned to Hong Kong and was OC 68 Gurkha Field Squadron at the time of Operation Rivers. Following disbandment of the Squadron in December 1993, he moved to the Surveillance, Target Acquisition, Night Observation and Countersurveillance Centre at Larkhill as SO2 Countersurveillance.

IN July and August 1993, Nepal was struck by the beaviest recorded rainfall for over 100 years. In the immediate aftermath of the floods that followed, over 2000 people lost their lives and 30,000 were left homeless. The hydroelectric station at Hetauda to the southwest of Kathmandu, which supplied 20 per cent of the country's power, was virtually destroyed and would take many months to bring on line again. Most significant however, the Prithvi Rajpath, the vital route from India into Kathmandu, was closed due to landslides, undercutting and the destruction of three bridges along its length. With one million people cut off in the Kathmandu valley, requiring almost 1500 trucks a day to supply them with fuel, cooking oil and food, it was crucial to reopen the road link. Over the following five weeks, a unique operation took place in which Gurkha soldiers, for the first time in their 180 years of service with the British Army, returned to their own country to assist in its time of need. During their deployment they built four temporary bridges and, against a background of communist inspired rioting, which in the weeks leading up to the floods had lowered the standing of the government, saved the capital from starvation and restored faith in the ruling party.

The Queen's Gurkha Engineers' (QGE) involvement in the operation began on the morning of 21 July when the regiment received a copy of a signal sent by the Defence Attaché (DA) in Kathmandu, Colonel Mike Kefford, to Headquarters British Forces (HQBF) Hong Kong, in which were details, such as they were at that early stage, of the extent of the disaster. The British Ambassador to Nepal, Mr Timothy George, had received an informal approach for assistance as had the ambassadors of all the major donor nations. The DA believed that there might follow a request for engineer assistance or equipment from Hong Kong which, as far as the QGE was concerned, was as good as issuing boarding passes. The Commandant, Lieut Colonel Peter Blundell, called an O Group and I was asked to form a recee team ready to move to Nepal within 48hrs.

Having no idea of the likely tasks we may be called upon to carry out, and working between the parameters that any deployment would be for a maximum of 100 all ranks and for no longer than six weeks, I went for a broad band of expertise in selecting WO2 Mansfield, our recently arrived Military Plant Foreman, and Staff Sergeant Bhala Rai, our Clerk of Works(C). There was no question of my leaving Hong Kong without a Q representative, so the fourth member of the team was my squadron quartermaster sergeant (SQMS), SSgt Dinesh Gurung, who was also a resources specialist. Drawing on lessons entired from Oversetion

Drawing on lessons gained from Operation Furtherance, a disaster relief operation carried out

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by one of my troops in Western Samoa the previous year, some time was spent drawing up stores lists and playing with various orbats based on an organization of two field troops and a squadron headquarters support element. The stores concerned were mainly those required to live and survive but, with a weather eve open to the chronic problem of water purity in Nepal, we also bid for two water points and asked for a combat medical technician from the British Military

Hospital; the latter items proved among the highest valued assets in the deployment that followed.

A series of 'phone calls the following day from the Garrison Engineer in Kathmandu, Major Bob Cross, examined the possibility of flying either the Bailey or Medium Girder bridge, from the OGE Park, to Nepal and for the first time hinted that the loss of the Prithvi Rajpath was the most acute problem faced by an administration still reeling from the initial shock of the flood. However, a signal from MOD (Ministry of Defence) later that afternoon indicated that our response, if any, would be the dispatch of a squadron, and that the prohibitive cost of flying bridging equipment in would almost certainly discount that option. Feeling that we would probably not go at all, and therefore not having even bothered to pack a bag, I retired early feeling a little jaded from the cocktail of vaccinations I had been given, just in case. At 2230hrs the Duty Officer at HOBF Hong Kong called; following receipt of a further signal from MOD a recce team was to deploy to Nepal immediately and was "to report through the DA in Kathmandu who would provide direction on Nepal Government (HMGN) priorities." By lunchtime the following day, following an 0615 flight via Bangkok, we were seated in the Department of Roads (OOR) in Kathmandu being briefed by the DA, the Garrison Engineer and the Director of Roads. A subsequent signal allocated the codewords "Operation *Rivers*" to the UK military support to the disaster relief in NepaL

Confused and conflicting reports from a variety of agencies suggested that at least five bridges were down between Naubise and Mugling and that a



Map of Nepal showing main area of flooding and damage.

1500m stretch of landslip at Jogimara would make the route impassable for weeks to come. The Clerk of Works(E) in Kathmandu, W02 Hunter, had driven as far as Mahadev Besi before he was stopped by a 66m gap where a three-span bridge had stood previously, and his photographs provided evidence not just of the damage at that point, but of landslides and loss of property along the route. We were asked to carry out a recce along this section in order to give a clear idea of the scope of work required to enable the road to be reopened as soon as possible to commercial traffic. Through the influence of Colonel Kefford, the following day we were flown by Royal Nepalese Army (RNA) helicopter as far as Mugling, before turning and following the route as closely as possible back to Naubise. The outcome of this flight, apart from a fully charged air sickness bag from the DOR representative for whom the excitement had proved too much, was that only three bridges were down but numerous stretches of landslip and undercutting had reduced the route to single lane traffic along much of the road's length. Under DOR direction, work had already started on repairs and clearance in these areas using the plentiful resource of unskilled labour. I therefore advised the DA that if the Squadron was to be called forward from Hong Kong, then we should be given the technically more demanding task of restoring the three crossing sites. With this in mind I presented him with a stores list, the bottom line of which was 170m of load class 30 bridging equipment, thereby leaving the donor nations, all of whom would have different solutions to the problem, to decide how best to fulftl the request. By now it was clear that

only the UK or the USA would be in a position to assist in restoring the highway.

Back in Hong Kong, 68 Gurkha Field Squadron remained at 48hrs notice to move and, working on the assumption that they were likely to be involved in a bridging gallop across Central Nepal, the troops adjusted their freight accordingly. Due to ongoing commitments, it was eventually a troop from my own squadron and the boat troop from 67 Gurkha Field Squadron whicf1 deployed. As my own 21C, Captain Pat Coxen was on leave, the Training Officer, Captain Tim Treanor, had filled his seat; when Par returned from Bali 10 days later it would be to an empty squadron block and a couple of white feathers in his "In" tray from two irreverent subalterns! On the evening of 27 July, one week after we had first heard of the disaster, we were notified by MOD that the Government had agreed to deploy one QGE Squadron to Nepal to assist with the constructielllitm temporary crossings along the Highway.

Following the helicopter over-flight, the recce team spent two days on mountain bikes which my SOMS had hired at an unbeatable rate. This was the only reliable way to travel the entire route and, for my own part, it gave me time to think through the plan so far (time which had hitherto been denied me due to the swift course of events). A Land Rover took us as far as the first fallen bridge at Mahadev Besi where we made detailed measurements and selected a possible campsite for the Squadron. We then carried our bikes across the river, which was still flowing fast and about a metre higher than normal, before cycling the next 18km to Belkhu, where the measurement procedure was repeated. At this stage the plan was to build first at Mahadev Besi, then move the whole Squadron down the route to Belkhu, before finally putting in the third bridge at Malekhu. On reaching Malekhu, we learned that the landslip at Jogimara had been cleared but, being gluttons for punishment, we cycled on the extra 20km in order to see it for ourselves, which was just as well as the DOR office at Mugling had been unable to contact Kathmandu and we were able to pass on the news when we returned, saddle-sore and dehvdrated, that night.

At a meeting the following morning at the British Embassy, the US Charge d'Affaires and the DA confirmed that US Air Force C5 Galaxy aircraft would fly the bridges in; the origin of the bridges at that stage was Iancertain. However, the Overseas Development Administration (ODA) had received quotes from Mabey & Johnson and Thomas Storey Ltd for the supply of equipment for the two long (70m) spans, and we had already earmarked the 100ft Bailey bridge from Hong Kong as being suitable for the shorter gap at Malekhu. The Ambassador drafted a Status of Forces Agreement, which he later presented to HMGN, and which covered, among other issues, the wearing of uniform by foreign troops. The latter was such a sensitive point that when the doors of the first Galaxy swung open at Tribhuwan Airport ten days later, the crew emerged in Reeboks, shorts, fluorescent T-Shirts and baseball caps; to give them their due, it had been a particularly sunny afternoon in California when they took off 48hrs beforehand.

As the advance party started to arrive, it was immediately apparent that concerns over the recent announcement of swingeing cuts to the garrison in Hong Kong, which would ultimately affect over half the regiment, had been put aside and morale was extremely high.

Over the next few days, the water levels at Mahadev Besi and Belkhu receded a little and the DOR arranged construction of temporary fords at these sites, giving limited access along the highway. The priority was therefore to put a bridge in at Malekhu to open the route along its entire length into Kathmandu. Squeezing as many as possible into a Land Rover, we carried out a confrrmatory recce at Mahadey Besi before fording the river and moving down to Belkhu to repeat the operation. We were unable to cross there but, trusting that the OOR would continue to maintain the crossing at Mahadev Besi and within a few days complete the work at Belkhu, I decided to establish the squadron camp permanently at the site of the old Chinese road construction camp as this was almost midway between the two outside sites and of course adjacent to Belkhu itself. The penalty would be about 40 minutes' travel to each of the other sites although, as the monsoon continued, there were some days when landslips prevented any travel along these routes at all. The benefits, would be stability, comfort and, by the time Lieut William Judge's troop had finished preparing the camp for the rest of us, showers and electricity. We also set up an operations room at the Brigade of Gurkhas' Transit Camp in Kathmandu, from which we maintained high frequency (HF) radio communications to Belkhu 70km away and which gave us access to a fax (facsimile) machine and the Commcen (communication centre). The Chief of



Launching the 25m Bailey bridge at Malekhu.

Staff, Lieut Colonel Paul Gilham, threw open his doors to us providing valuable G1/G4 support and, as a logistician, he gave advice on the Engineer Park which I set up at the airport, under my squadron sergeant major, in time for the arrival of the first consignment of Bailey from Hong Kong.

There was almost a carnival atmosphere at Tribhuwan Airport on the morning of 4 August when a chartered Antonov 124, the world's largest aircraft, bearing 130 tons of Bailey bridge and other stores, taxied to a halt. This was of course the first tangible evidence that steps were being taken to repair the country's infrastructure and after the initial euphoria had worn off, attention very soon switched to the men of 68 Squadron who were to get on with it! The aircraft had taken over 12hrs to load at Kai Tak from a convoy of 80 assorted vehicles which had moved the equipment from 70 Support Squadron's stores in Sek Kong. Due to some thorough planning by Lieutenant lain Stewart, who had been tasked with the build at Malekhu, the aircraft was unloaded in four hours and the parts transferred to a collection of waiting Tata trucks that formed our bridge train. The following morning, as the move to Malekhu was about to begin, the drivers struck for more pay (a problem not normally addressed during a young officer's training) but, with the assistance of our friends in the DOR, and I suspect one or two packs of the 3200 Gurkha compo rations that had also been sent out, the Bailey bridge, which had been earmarked for "disposal in FY 1994/95" set out on the 90km journey along what remained of the Prithvi Rajpath to Malekhu.

William Judge's men had been redeployed to assist the RNA in maintaining the crossing at Belkhu which had started to break up following moderate rain in the last 12hrs. We needed at least three clear days in which to move the whole bridge down to Malekhu, given that our bridge train consisted of only 15 trucks, each of which would have to make the journey three or four times. The site at Malekhu was far from ideal. The approach was very narrow and on a bend and for the past two weeks, since the bridge had been swept away, had become a resting place for about 50 abandoned trucks and buses. Into this confusion came the advance party of 2 Troop under SSgt Krishnadhoj Sahi, who began setting out the site and, with scant assistance from the police who did little to control

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hundreds of onlookers, received the first of the bridging vehicles. I was fortunate in having 50 engineers of the RNA under command and while the daily presence of their Chief Engineer, Brigadier General Pratap Malla, caused lain Stewart to slip into the vernacular from time to time, they worked extremely well with my own men; there was never any indication that the vastly different conditions of pay and service of the two armies caused friction between them. Even with their help, I had not imagined in my wildest dreams that Malekhu would be completed in the time it eventually took. Nevertheless, within 90hrs of the Antonov arriving at Kathmandu, the equipment had been offloaded, sorted from its flight configuration. sent down a precarious and unproven route and assembled, so that by Sunday 8 August limited access was restored into the capital. lain Stewart's triumph was capped by an unexpected visit from the Prime Minister, Mr Girijiprasad Khoirala, for whom the bridge was quickly closed so that it could be officially handed over!

With the road now partially open, interest faded a little though the technically more demanding problems of the 70m gaps at Belkhu and Mahadev Besi still lay between us and a satisfactory conclusion to the operation. It was mooted that the DOR could continue to maintain the causeways at these two sites until the end of the monsoon, two months away, after which they could easily be forded until the following year. However an acute lack of material to keep them passable meant that a more permanent solution would still be necessary so we pressed on. As Malekhu was approaching completion, William Judge's men had started excavating through 2m of deposited silt and sand to locate the foundations of the old piers at Belkhu and late on Monday 9 August found what they had been looking for. The plan was to build up from these, then place improvised equipment piers on top, over which the new bridge could be launched. I therefore returned to Kathmandu to tie up the arrangements for the arrival of the rest of the equipment. The ODA had opted to buy Mabey & Johnson bridges directly from the factory in the UK; the decision being partly influenced by the arrival in Kathmandu of the company's representative. Mr Jim Dienn (formerly RSM of 21 Engineer Regiment), who gave considerable advice and would continue to do so as the weeks went on. We were joined that week by another sapper, Richard Dennis, who left the Corps in 1979 and whose company, Frank

Graham Consultants, had been retained by the DOR to form their Flood Damage Liaison Group. Over the next 48hrs, both these former REs would sing for their supper!

Early on 10 August, William Judge came over the HF with the news that the river had risen 2m overnight at Belkhu. All his work had been washed away and though he had managed to rescue his plant and tools, half of his troop was now stranded on the wrong side of the river. The causeway had been completely destroyed so Kathmandu was once again cut off. Further to this they had witnessed large boulders being bounced down the river and were of the opinion that, had there been equipment piers in the way, they would not have survived; their view was that only a single span bridge would survive similar treatment. Working closely with Jim Dienn and the fax machine which, after the helicopter, I now believe to be one of the greatest aids to the disaster relief planner, Mabey & Johnson's engineers in Reading advised that a single span equipment bridge of 70m would require double storey construction and would incur such restrictions as to make it unviable; with a 25 ton Tata truck at mid-span it would also be extremely lively! I therefore opted for a compromise and the design was adjusted to a twospan bridge; by halving the number of piers, the number of potential "targets" would also be halved. Besides this, the US DA in Kathmandu believed that the State Department would not be receptive to a doubling of the airlift this late in the game as much of the Mabey & Johnson equipment had already been transported to RAF Mildenhall and the first of five Galaxy aircraft was about to leave.

Throughout the gloom of this day, there came a shining light in the form of a message from W02 Mansfield. Together with SSgt Bhala, he had been sent down the week beforehand to assist the RNA in constructing a 32m Bailey at Bhainse on the Tribhuwan Rajpath, an alternate route into Kathmandu. Speaking no Nepali and only a little Welsh, W02 Mansfield became an inspiration to the workforce who, knowing even less than he did about equipment bridging operations, was clearly lifted by his example. Despite the rain and floods which were as much obstacles to progress in the Terai as on the main route, the bridge was trafficked that evening and an exhausted but justifiably proud MPF returned to the fold two days later.

As well as destroying much of the work at Belkhu, the floods of 10 August also caused more



Constructing the pier at Mahadev Besi for the 70m two-span bridge.

landslips and the break up of the road between Mahadev Besi and Belkhu. I was not happy about moving another bridge train along this part of the route until it had been repaired so once again changed my plan and decided to concentrate on Mahadev Besi, leaving the DOR to carry out repairs to the road. The plan for both the remaining sites was for a double single bridge supported over a single pier founded on the remains of one of the destroyed piers. At both sites the piers were improvised, using spare Bailey parts at Mahadev Besi and Christchurch cribs at Belkhu. It took about three more days of digging at both sites before we found the stubs of the original piers which had been sheared off by the debris brought down in the original flooding in July. Around these were placed gabion baskets lined with plastic then filled with concrete in a pour that went on around the clock for three days, using two 600-litre mixers that had seen better days but which were kept running by the non-stop efforts of one of our fitters, Sapper Angkaljang Sherpa. Throughout this pour, the SSM had been sending the newly arrived bridges down the road on an opportunity basis so that building was able to begin on the home bank at Mahadev Besi, where a

near unrestricted site allowed construction of all but two of the 23 bays. He had also persuaded enough of the drivers to move on down to Belkhu so that work could go on concurrently there. Despite this, it was clear that an apparent lack of activity on the Prithvi Rajpath following the rapid build at Malekhu was frustrating the many drivers still stranded along the route. Inaccurate reports in the press claimed that at least one of the other sites was now open; this caused a queue of traffic stretching back for several miles, at one stage blocking access to the site for two days. Not for the first time I turned to the DA for help and a senior police officer was dispatched from Kathmandu to control the situation.

On 27 August, under the indomitable SSgt Krishna, who for the past four days had been working with a broken wrist, the bridge at Mahadev Besi was pushed out on its rollers. Word of the impending launch had filtered through to diplomatic circles in Kathmandu and a convoy of visitors from the various embassies, many clearly expecting some kind of Queen Mary spectacular at the sound of the word "launch", arrived to witness the event. There was one tense moment for Iain Stewart astride the pier

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as the rollers momentarily seized, causing it to tilt, but a tap from a hammer freed them and the structure rocked back into place. Shortly before lunch, the 23 bay bridge touched down on the far bank to a polite ripple of applause from the international assembly and bewildered looks from the long suffering locals. The nose section was quickly removed and sent down to Belkhu where William Judge was patiently waiting to close his gap. W02 Mansfield, clearly happy at the chance to play with earth and plant once again, moved in to begin construction of the approach ramps which he had literally designed all the backs of about a dozen cigareUe packets, once he had taken care of their contents. In an emotional and dewy eyed address that evening, Major Uttam Kharki, the OC of the attached RNA Engineers, us all his brothers before declared being reminded that there was still ane more gap and about 140m of decking to complete before this union could be consummated.

Against the background of this fraternal bonhomie, work continued apace and three days' later the final pin was knocked home at Belkhu. On the afternoon of Wednesday 1 September. Sapper Ashokkumar Rai, the 'youngest man in the Squadron, cut the tape over the bridge at Belkhu which was immediately proved by a backlog of almost 1500 heavily laden Tata trucks. For the first time since 19 July, the Prithvi Rajpath was open along its entire length and over the next 48hrs, as supplies began to reach Kathmandu, prices in the capital started falling back to their pre-flood levels. Under the SOMS we had already begun dismantling the camp and after one false start, caused by anather landslide delaying our return by one day, we finally left Belkhu on 2 September. Under the SSM, who: had kept meticulous records throughout '€Iur deployment, the contents of the Engineer Park were handed over to the RNA~ it will probably be another three years before they need the equipment to extract the bridges. With the disbandment of 68 Squadron just three months away, we handed over the bulk of our G1098 equipment to the Garrison Engineer who had been struggling for months to justify a new equipment table. After a well earned period of local leave for the men, one of whom managed just one afternoon in his village before beginning the three-day trek back to Kathmandu, we returned to: Hong Kong on 11 September.

It would be less than tactful to conclude this article without a brief look at some of the factors that contributed to Operation Rivers' undoubted success. This was by no means a solo effort by 68 Squadron though some of the accolades that followed our return may mistakenly have led a casual observer to believe there was no other involvement! We were merely the at the end of a very long chain contractors involving at one stage, virtually the whole of the Hong Kong B vehicle fleet in moving just one bridge from:the New Territories:to.Kai Tak; those familiar with the Territory can imagine the staff planning required for that aspect alone. Mabey and Johnson opened their factary during the summer holiday closure to produce 140m of bridge; plus a little more when a QGE Squadron Commander. 5000 miles away, changed his design 24hrs before the bridge was due to be loaded into a fleet of five USAF Galaxy aircraft for the journey to Kathmandu. Two. factors however, merit special attentian. The first was the support provided by Headquarters British Gurkhas Nepal. 'Without this establishment which supplied, fed, maved and provided us with the vital communications from a bridge site, 40km from the nearest telephone, to the ODA in Landon, I would constantly 'have been travelling a road prone to daily blockage in order to check 'up an myriad mundane minutiae and not in my rightful place, at the "front" ready to anticipate problems anrl.plan ahead. Secondly, in the midst of the confusion and shock 'which at times appeared to cloud rational thaughtin the days following the rains, the DA and I were able to identify tasks which I knew were within the capabilities of my Squadron, even though at that early stage there were many problems still to. be addressed. Working within those limits, the operatian was mounted with great drive. Within eight days of the 5'.qnadran arriving in theatre, the first bridge was trafficked and three weeks later all tasks were completed with preparations for the recovery back to: Hang Kong well in hand. In this way thel'e was no lingering an an open-ended task wifh rfhe inherent danger of overstaving our welcome. As a faotnate I should add that thase two, other indispensable assets to the Squadron Cammander, flexibility and incredibly good luck, were my canstant campanians through aut the seven weeks I spent in Nepal.

Well Drilling in Bosnia

MAJOR T W WYE MIHIE MIMOT



The author enlisted in 1960 and trained as a plant operator. Tours in BAOR and Aden followed before he was posted to the Plant Roads and Airfields Wing for the first time. A busy plant-orientated tour with 66 Plant Squadron gave him the opportunity to visit Hong Kong and Canada before completing his Military Plant Foreman training in 1976. During another tour with 66 Plant Squadron he commanded Operation Loneline 1 in Cyprus. His career highlight, a two-year tour in Nepal, was succeeded by the penance of tours in the Training Regiments and Plant Roads and Airfields again.

Commissioned in 1984, he served as Resources Troop Commander 60 Field Support Squadron, Plant Officer Headquarters 12 Engineer Brigade and then moved to the Royal School of Military Engineering as Assistant Instructor Practical Training and, later, Quartermaster (Plant).

He is currently nearing the end of his tour with 521 Specialist Team Royal Engineers (Well Drilling) as Officer Commanding, and looking for any job that has not been poached or redesignated for the exclusive use of the PQE fraternity.

INTRODUCTION

FOLLOWING the inevitable deterioration in the infrastructure after months of civil war, it came as no surprise when Military Works Force was tasked with carrying out a feasibility study into the supply of water for the British troops in Bosnia, located in Split on the Croatian Adriatic coast to Tuzla in the north of Central Bosnia. The fact that water had been used as a bargaining chip by local warlords and that there had been a not too thinly disguised threat to poison some supplies, certainly helped to concentrate the mind.

Water was being taken from a variety of sources. Some bases had a good potable supply piped in from local waterworks, others had an intermittent supply which required constant monitoring and treatment, and the worst off relied on water abstracted from rivers (akin to open sewers) and treated using in-service water purification units. None of the bases enjoyed a dedicated supply controlled completely from inside the secure perimeter of the base and all had to employ scarce Sapper manpower on water supply duties.

The initial reconnaissance team, consisting of CRE 62 CRE (Works), a geologist from the Royal Engineer Specialist Advisory Team and Officer Commanding 521 Specialist Team Royal Engineers (Well Drilling) (STRE(WD)), deployed in July 1993 and inspected all British bases; Tomislavgrad (two sites), Gornji Vakuf, Vitez (two sites) and Tuzla.

The requirement was for secure supplies of potable water in quantities ranging from 60m³ to 200m³/day. Even in the earliest days of the reconnaissance it was obvious that the construction of production boreholes would be the only feasible and completely satisfactory solution.

That water would be available from aquifers within the geological succession at each of the locations was quickly confirmed. Further studies, and where possible discussions with locals, concluded that the aquifers were all within the drilling ranges of in-service rigs, although these conclusions could not be confirmed by field tests as the required equipment was not available in theatre at that time.

The reconnaissance team concluded that it was feasible to construct a water production borehole within the perimeter of each British base and that 521 STRE (WD) had the necessary skills and equipment to undertake the task.

Subsequently, boreholes were designed for each location, stores lists produced and costings compiled. The proposed solution to the water supply problems of the British bases was to construct ten boreholes at a total cost of £73.5K. The critical path analysis indicated that the work could be completed by 11 members of 521 STRE (WD) within 17 weeks.

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Figure 1. Overburden system in drilling position.

The Pikon light drilling rig (LDR) was proposed for drilling in the alluvial deposits expected at Tuzla, Gomji Vakuf, Tomislavgrad and one of the sites in Vitez, as it was easier to transport over the mountain roads/tracks of the main supply route (MSR). The 32-tonne, Dando 250 heavy drilling rig (HDR) was proposed for drilling in the limestone and for drilling the greater depths at Vitez.

Unfortunately, the degree of urgency expressed by the base commanders was not supported by the UN bureaucrats and many weeks were wasted before a decision was reached. In the event the British decided to act unilaterally, get the bore-



Figure 2. Overburden system in insertion and extraction position.

holes constructed and argue about finance later. This proved to be the correct decision as the bureaucrats stretched the decision-making process from many weeks to several months.

The well drilling team, consisting of an officer, a SNCO and nine ORs, deployed to Bosnia in early September, complete with sufficient stores to carry out the task. All went to plan with the exception of the arrival of the HDR which was held up in Rijeka by a ferry breakdown, delaying its arrival in Split by a week.

VITEZ SCHOOL

WORKstarted on the fIrst borehole in Vitez School using the Pikon LDR. Unfortunately the expected alluvial deposits were not found and bedrock was struck at depths of 2 to 7m. This resulted in the first week's work being wasted as the LDR could not penetrate bedrock and no real headway was made until the arrival of the HDR, when rapid progress was made using it in its rotary percussion role, employing the overburden system and utilizing air and foam as the drilling medium.

The overburden system of drilling is unique in that it allows the construction casing, or the permanent casing, to be inserted as the borehole is being drilled - particularly useful in loose stony ground which is prone to collapse. The system is based on the principle of reaming a hole slightly larger than the casing using an overburden tool fItted to the in-service, conventional, down the hole hammer (DTHH) used in the rotary percussion mode. This casing is driven, without rotating, down by the DTHH using air or foam as the drilling medium. When the required depth is reached, the tool string is reversed allowing the overburden tool to swing inwards around the eccentric shaft enabling it to be raised inside the casing (Figures 1 and 2) - this method of drilling can be carried out to depths of up to 100m. The Achilles heel of this method arises during the welding together of the 5m lengths of casing. The welds, as well as being strong, must not impede the movement of the tools inside the casing, the need for maximum side penetration is paramount.

The limestone at the Vitez School site proved to be well fractured and copious amounts of water were obviously going to be available. The borehole was completed to a depth of 5lm and developed using an airlift, the water took some time to clear and problems occurred with silts collapsing back into the hole, to a depth of 40m. A submersible pump was installed and the resulting pump tests proved the borehole capable of sustaining yields in excess of $20m^3$ fhr with a draw down of 4m and a recovery of 20 minutes. (*Figure* 3) The actual yield was restricted by the capabilities of the 100mm diameter pump but still netted the requirement of the base for $200m^3$ /day.

Towards the end of the test pumping, a strong smell of diesel developed, and tests conducted by the Royal Army Medical Corps (RAMC) proved that the borehole was contaminated by diesel. As some poor refuelling practices had been observed at the school, the pollution source was quickly identified and action taken to prevent further spillage, or so it was thought! The clean up operation took many days and 5500m³ of polluted water was pumped to waste before the water was declared potable. 1 Field Squadron Group quickly constructed a rather luxurious wellhead, the well drilling team fitted the automatic chlorinator and associated fittings and the borehole was handed of 1 and 11 Field over before the roulement Squadrons was completed. In the first weeks of its life, this borehole supplied all water for the school and garage bases, and the Dutch were able to take 60,000 litres/day to subsidize their own inadequate supply. This borehole made a tremendous difference to the quality of life as water was "on tap" 24hrs/day. Houses being supplied by jerry cans and water trailers were also plumbed into the supply.

Completion of this borehole released a section of Sappers for other duties, a fact which the incoming Sapper squadron did not initially appreciate.

GORNnVAKUF

WHILE the Vitez hole was being constructed, the Pilcon LDR and a section of four personnel deployed to Gomji Vakuf and started drilling using the percussion method, with 300mm casing and with the intention of reducing in stages to 200mm diameter. Unfortunately the 250mm tools and casing, which had been procured from different sources, proved incompatible and it was necessary to drill directly from 300 to 200mm casing. This slowed the drilling up but did not adversely affect the completed borehole as all construction casing was removed once the permanent plastic casing and stainless steel screen had been installed. The first borehole, drilled to a depth of 35m, was abandoned, as expected sand and gravel aquifers were not encountered. Further consultations with the geologist resulted in a design change and the remaining boreholes being constructed to a depth of only 22m. These tapped the shallow aquifers



Figure 3. Typical borehole drilled using overburden systems.

located at a depth of 5m. (Figure 4 over the page) The water source proved to be of good quality and capable of yielding $4m^3/hr$. The pump test confirmed that the yield could be achieved with a draw down of 1.2m and a recovery of 45 minutes.

These boreholes were constructed under most difficult conditions. The base at Gomji Vakuf was situated between the Croat and Muslim lines and both sides treated the UN with scant respect... Artillery, mortar and small arms fire landing inside the base perimeter were regular occurrences. On one occasion the situation degenerated so badly that the team was evacuated by Warrior to Vitez.

The location of the second (reserve) borehole was changed on the advice of the base commander, as the site was in direct line of fire of "incoming hardware". It was a relieved section that departed Gomji Vakuf for the safer haven of Tomislavgrad.

VITEZ

AGAINthe expected geology of alluvial deposits was not encountered and the Pilcon LDR would have proved useless in the bedrock, it had in any



Figure 4. Typical borehole drilled using percussion method (Piicon).

case suffered mechanical failure and was not to be used again. Meanwhile, the HDR had completed a similar borehole at another site in the Vitez School base and, following installation of a submersible pump, pollution was detected. 'This time the source was found to be a full and leaking cesspit which had been covered over with aggregate on top of which was a stores ISO container. It was subsequently decided to construct the reserve borehole adjacent to the main one. This would utilize the same aquifer and would be available in the event of a mechanical failure of the equipment in the first borehole. The borehole was constructed to a total depth of 36m with the first 6.4m being constructed using the overburden system. The completed borehole yielded a total 20m3fhr with negligible draw down and a recovery of only 25 minutes. The decision to insist on constructing a reserve borehole at every base, against the advice of United Nations Protection Force (UNPROFOR) "experts", proved

correct as this reserve source was soon to become the main supply for the school base when diesel pollution, again from the generator farm, resulted in the main borehole being taken out of service while cleansing operations were repeated.

The boreholes in the Vitez garage base proved reasonably easy to construct. Expected bedrock at depths ranging between 15-25m was not encountered and it was necessary to drill through nearly 1DOm of clays at the first site before water was struck in a sand and gravel aquifer. An attempt wasmade to raise the water through an artificial gravel funnel but this had only limited success and was not repeated on the second borehole.

The second borehole utilized the 250mm casing that had been procured for use with the Pilcon LOR. A conventional tricone bit was used to drill to a depth of 17.6m, after which the borehole was drilled in the open hole mode to a completed depth of 81.5m. Plastic casing, 150mm diameter, was inserted and local aggregate used to hold it in position. The borehole proved capable of yielding $15m^3fhr$ with a draw down of only 0.33m and complete recovery was obtained in 15 minutes. Undoubtedly, this borehole, if fitted with a larger pump, would have supplied all British troops in theatre.

BUSOVACA

THROUGHOUTdrilling operations at Vitez and Gomji Vakuf, the Dutch unit at Busovaca had been pleading with UNPROFOR to authorize the team to construct a borehole for them. The OC 521 STRE (WD) carried out a reconnaissance and recommended that the stores procured for the Tuzla base, now no longer British, should be used to alleviate the real problems the Dutch were experiencing. The fact that they were BRITBAT's (British battalion's) nearest neighbours and that they had provided invaluable assistance to Engineer Group (North) in providing men and equipment for work on the MSR, certainly had some influence on the decision to recommend assistance.

Eventually the necessary authorization was obtained and the HDR deployed. Again the overburden method was employed but with this borehole the casing was used for construction purposes only and removed once the 150mm plastic casing and stainless steel screen were in position. The borehole was drilled to a depth of 22m and after development using airlift, it produced $12m^3/hr$, with a draw down of only 0.9m and a recovery of 20 minutes. The Dutch were ecstatic with their new asset and showed their appreciation in the time-honoured way. They had a very liberal interpretation of the two cans/day rule, in fact it was discovered that the Dutch cannot count and drink at the same time. Pity! Unfortunately they did not want another borehole constructed and, due to the demise of the Pilcon LDR, the team had to depart for the final drilling location on the other side of the mountains, at Tomislavgrad.

TOMISLAVGRAD

USING the HDR, the team encountered bedrock after only 2m of drilling. Fortunately it was only

necessary to drill using the overburden method for the first 7m, after which the conventional open hole method of using the DTHH was employed. Drilling rates were extremely fast and both broeholes were drilled, developed, test pumped and the head works constructed, in record time. It was consequently possible to rearrange earlier flights home; quite a popular move for some of the younger and newly married personnel. The boreholes proved to have yields of between 10 and 11.4m³/hr, a draw down of 17-19m and recovery was completed within 40 and 70 minutes respectively.

A point of interest arose during the testing, for potability – the responsibility of the RAMC – of all water produced from boreholes constructed by the team. High levels of potassium permanganate were detected in samples analysed by a Croatian laboratory, but consultations with testing agencies in the UK determined that potassium permanganate was used to sterilize laboratory equipment and did not exist in a natural state in water. Thus a potential crisis was averted, and the RAMC was happy to issue the necessary "Certificates of Potability".

CONCLUSION

The operation was completed well within the estimated time. A total of nine production boreholes, were drilled, developed, test pumped, the water analysed and the head works. (see photo left) consisting of pumps, starters, automatic chlorinators with associated plumbing and electrical work, installed within 16 weeks. A further two boreholes, less the head works, had been completed but abandoned because of pollution or poor yield. The Dando HDR had proved to be totally reliable as not a single day was lost through mechanical fail-



A typical wellhead.

ure during its use.

Team members gained invaluable operational experience and made the most of the opportunity to display their skills and show off their capabilities. At a time when every discipline is being scrutinized and the threat of "contracterization" hangs over every unit, it was a perfect opportunity to advertise our services in an operational environment. Many visiting senior officers and politicians were made aware of our existence and hopefully this will help our cause when, and if, the team is identified as a possible "saving".

Finally, all the British bases and one Dutch base had been provided with secure sources of potable water, and our small team had released Sappers for other duties.

The well drilling team generated a great deal of interest while in Bosnia, every unit wanting its own borehole. Initial reconnaissances were carried out for the French at Sarajevo, the Canadians at Visoko, the Russians at Erdut, Orolik and Nijernci and the Belgiums at Novi Ceminac and Batina. It was concluded that boreholes were feasible propositions at all of the sites but that detailed reconnaissances would be necessary.

As at 1 April 1994, that is how the situation remained, 521 STRE (WD) departed from theatre in mid-January having left the majority of its equipment and stores in Split in anticipation of further tasking. The British army has the only well-drilling capability available to the UN in Bosnia. Undoubtedly civilian contractors will become interested once peace breaks out, but to date, 521 STRE (WD) remains the only team that is ready, willing and certainly able to carry out this work in such a hostile environment. Having experienced freezing temperatures, we now look for-

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Supplying Water to the British Army During the Gulf War

CAPTAIN M P WALTON-KNIGHT BENG(H) /



Captain Matthew Walton-Knight was commissioned into the Corps in 1989. After partying heavily during 100 (The Ton) Young Officer course, he left early to take command of a field troop in 3 Field Squadron, Tidworth, Deploying immediately on Operation Granby, he was responsible for a variety of construction tasks including water supply. He has since commanded a support troop and the Recce Troop, when 22 Engineer Regiment rerolled as a close support regiment.

Currently he is training to be a chartered engineer on the Professional Engineer Training (Civils) course, which began in October 1993.

(The following paper, considerably edited to suit publication in the *Journal*, was presented to the South Eastern Association of the Institution of Civil Engineers on 13 April 1994.)

INTRODUCTION

As I think most readers will already know, water supply in the British Army is the responsibility of the Royal Engineers. The problems of water production, storage and supply during the Gulf war were many: limited availability of water sources, the ease by which water could have been contaminated by the use of nuclear, biological or chemical weapons, and the immense quantities of water required by an army conducting operations in a desert, are but a few.

Water supply was very high on the list of priorities – 1st British Armoured Division carried only three day's supply – without resupply it would certainly have foundered, and the responsibility, from January to March 1991, for the production, supply and storage of much of the aforementioned water was mine. As a Second Lieutenant, 22 years of age, and two months out of training, my brief was basically to "go into the desert and make water."

THE REQUIREMENT

THE initial requirement was to supply 75,000 litres per day of potable water for the British Forward Force Maintenance Area (FFMA) the organization responsible for providing logistic support to the 15,000 men of the 1st British Armoured Division. As the Division moved forward the requirement was increased to 450,000 litres per day, to include provision for two 200-bed field hospitals. Later it became necessary to supply the 1st United States Infantry Division as well, taking the requirement to 1 million litres per day.

As well as water production, there was a requirement to operate water storage facilities, with a capacity of 3.5 million litres; both of these provisions had to be capable of operating within an environment where the use of nuclear, biological and chemical weapons was considered highly likely. Spread over 60km on an area centred approximately 90km southwest of the triborder between Iraq, Saudi Arabia and Kuwait.

WATER PRODUCTION EQUIPMENT

To meet all of the requirements stated above, reverse osmosis (RO) water production equipment was deployed (specially manufactured by Caird & Rayner Ltd and Weir Westgarth Ltd) mounted inside standard ISO (International Standard Organization) containers.

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Captain M P Walton-Knight Supplying water to the British Army p154

The principle of RO is relatively simple. Osmotic processes are dependent on the use of membranes. semipermeable Essentially. these allow the passage through them of a single material - in this case water. If a concentrated solution, for example salt water, is placed on one side of a semipermeable membrane and pure water is placed on the other side, a natural pressure difference is set up across the membrane. There is then a tendency for water to flow across the membrane into the concentrated solution This natural process is termed osmosis, and is shown in *figure* 1. The flow of water across the membrane will continue until the pressures on both sides of the membrane are equal and the system is in balance, as shown in figure 2. The difference in head between the two solutions is termed the osmotic head. If a pressure was to be applied to the concentrated solution which overcomes the osmotic head, water would flow out of the concentrated solution across the semipermeable membrane This process is termed reverse osmosis, and is shown in figure 3. In effect the semipermeable membrane is used as a very high pressure ionic filter. (That is below the molecular range!)

RO is the finest level of filtration available. The semipermeable membrane acts as a barrier to all dissolved salts and inorganic molecules, as well as to organic molecules with a molecular weight greater than 100. Water molecules can pass freely through the membrane creating a very pure water product. Rejection of dissolved salts and chemical contaminants is typically 95 to 99 per cent. The concentrate, being the solution of the rejected salts, is passed to waste, the percentage of concentrate being dependent on the quality of the raw water.

The RO semipermeable membrane used during the Gulf war was made from metaphenylenediamine. The membrane is remarkable in that it has surface pores of approximately 0.015 micrometers in diameter. The membrane layer is 0.2 micrometers thick but it can withstand the high operating pressure of up to 69 bars due to the support provided by a 160 micrometer combined polysulfane and polyester support layer. It is very resistant to mechanical stresses and chemical degradation due to this support layer.

The RO plants had a nominal_production capacity of 100,000 litres per day, but with on-site modification this was increased up to 350,000. Five plants were deployed with my troop although only four survived the move into the interior. Further plants were held in reserve.

Pre RO Treatment. To prevent premature fouling of the semipermeable membranes, a sand or cartridge filter (depending on the plant type) operating at a pressure of 3 bars, was used to remove suspended solids from the raw water, removing all solids above 5 micrometers in diameter. A coagulant, kieselguhr, was used to assist in this filtration, and the water was then subjected to the RO process.

Post RO Treatment. After RO filtration the water was dosed with calcium hypochlorite by variable volume dosing within the RO plants. A residual, chlorine level of 5 milligrams per litre was required, primarily to prevent post-contamination of the water product but also to destroy anthrax spores. Unfortunately this caused diarrhoea and vomiting among many soldiers, and so dosing was reduced to 2.5 milligrams per litre residual which just prevented post-contamination. Dosing to 5 milligrams per litre was then only implemented when the anthrax threat was



Figure 1. Osmosis.

Figure 2. In balance.



Figure 4.

considered to be high. Water was held in product tanks so that its purity and residual chlorine level could be checked before being pumped into storage tanks.

Electrical Generation. Each RO plant and its associated pumps required a 3-phase 50kW electric supply of 415 volts at 50Hz. Electrical power was generated by 160kW Dawson Keith diesel generators, one was supplied with each RO plant, again mounted inside an ISO container.

To allow storage of potable Water Storage. within a contaminated environment. water 136,000-litre collapsible fabric pillow tanks were deployed. Initially the tanks had been intended for storage of aviation fuel but were ideal for water storage as long as they had not previously been used. Being pillow tanks they would prevent air and, therefore, chemical contamination of their contents. A total of 30 were deployed. Equipment Carriage. All the ISO containers and pillow tanks were mounted on special pallets for the British Army's dismountable rack and off-loading pick-up system (DROPS). DROPS vehicles have medium mobility, and enable rapid loading and off-loading of pallets. Due to rapid

off-loading of equipment, it was possible for water production to start within two hours of arrival on site.

WATER PRODUCTION FACILITIES

WATERproduction, up to January 1991, was provided by the host nation and by a Royal Engineer reverse osmosis water production site located to the north of Al Jubayl.

The initial production site which I established on 20 January 1991. was at Al Qaysumah, and was called R02. The site utilized an existing borehole drawing from an aquifer which vielded up to 70,000 litres per day. Two RO plants were deployed with two pillow tanks for water storage, giving a storage capacity of 270,000 litres, adequate for the initial requirement for the FFMA but not enough for the increase to 450,000 litres per day. This site was maintained until 5 February 1991

as it was at least a guaranteed source of water.

The site to meet the increased production was established lOkm south of Hafar Al Batin on the Wadi AI Batin. Imaginatively called R03, it was established on 28 January 1991 and is shown diagrammatically in figure 4. A rough water irrigation pipeline was utilized, which was supplied by six boreholes spread over 30km, all drawing from the AI Batin aquifer over 50km to the south of Hafar Al Batin. The maximum flow in the pipeline was 28 million litres per day with pressure maintained by a pumping station 20km upstream, at 0.8 bars. The raw water had a total dissolved salts concentration of 40 parts per million. The length of the pipeline presented a major security problem, but choice of site was restricted by the British ability to transport water forward, which limited how far south the facility could be, and by Saudi Arabian political constraints which kept us away from any settlements. A combined production and storage facility was established with all four working RO plants and ten pillow tanks giving a storage capacity of 1.4 million litres. R03 also supplied non-potable water on demand to a United States prisoner of war camp located near Al Qaysumah, through a 4km, 150mm diameter flexible fabric pipeline laid by the United States Corps of Engineers.

On 12 February 1991, using the same equipment, the production capacity of R03 had to be increased to 900,000 litres per day, requiring equipment modification which will be discussed later, to supply the 1st United States Infantry Division and a third field hospital. On 18 March 1991, instructions- were received to supply the 1st United States Cavalry Division with nonpotable water. Thankfully a day later I was instructed to dismantle R03 and headed for Al Jubayl and, eventually, home.

R03 had a production capacity of 1.3 million litres of potable water per day; at peak demand it issued more than 1 million litres of potable water per day. During the war it produced and issued over 25 million litres of potable water and immeasurable amounts of non-potable water.

WATER STORAGE FACILITIES.

Two forward water storage sites

(WSS) were established on 2 February 1991, up to 60km away from the production site. Ten pillow tanks were deployed at WSS7, located 25km northwest of Hafm Al Batin, giving a storage capacity of 1.4 million litres; this site operated until 6 March 1991. Five pillow tanks were deployed at WSS8, located 45km northwest of Hafar Al Batin, having a storage capacity of 700,000 litres; this site operated until 9 March 1991. These storage sites were positioned within what was to be the assembly area for the 1st British Armoured Division, before it headed north into Iraq.

R03 supplied water in bulk to 12,000-litre water bowsers - up to 100 per day. These in turn supplied major users, such as field hospitals, and resupplied the water storage sites which then supplied water directly to unit bowsers.

PRODUCTION PROBLEMS

INITIAL reconnaissance of the production sites and their design, together with the design of the storage facilities, had been conducted by a Specialist Team Royal Engineers. The confirmatory reconnaissance and the problems of operating the facilities were left to me.

Training. My troop, of 64 men, contained only 12 specialists trained in the use of RO equipment and so rapid on-the-job training was conducted for the remainder; fortunately the equipment is relatively simple to operate and

Map of area covered by article.

within a few days all were able to conduct basic operation. When shutting it down, a problem occurred which resulted in calcium hypochlorite instead of sodium meta bisulphate (a preservative) being flushed on to one of the semipermeable membranes; this resulted in the partial destruction of the membrane in one plant - an expensive mistake which, with better training, could have been avoided.

Water Sources. Raw water, as already mentioned, was drawn from aquifers, either from existing boreholes or irrigation pipelines supplied by a group of boreholes. The pipeline was meant to operate at 0.8 bars pressure but when this reduced to 0.3 bars, water could not be lifted to the surface at the production site; this occurred far too regularly, and was mainly due to problems at the pumping station. Ideally the production site should have been moved to a lower height but this was not possible. In the end the pipeline was used effectively as a reservoir and water was pumped out of it. A reserve of 200,000 litres of raw water was therefore maintained on the surface, in raw water tanks to provide a reserve of water.

The length of the unguarded pipeline also presented a security problem which was solved by the use of United States Military Police. Despite this, the pipeline was fractured four times by the back hoe of a crawler tractor belonging to a telecommunications contractor (who should not



have been near the pipeline) and had all its control valves shut down on two separate occasions - why this occurred was never discovered, and no one knew who closed the control valves.

With encouragement, the fractures were temporarily repaired by the Hafar Al Batin Water Company; but the work took 48hrs to complete causing many queries, from senior British and United States engineering officers, as to why production had halted.

Site Meetings. Many meetings were held with people from the Hafar Al Batin Water Company, who were responsible for the pipeline and who claimed to know nothing about an approval (made at governmental level) for us to draw water from the pipeline. Agreement that the pipeline could be used was gained at a meeting conducted cross-legged on the floor, in pidgin English, while sharing food. In similar meetings a good working relationship was soon built up.

Plant Modification. When the initial water requirement was increased, it was necessary to carry out on-site modification to the RO plants because I was instructed to meet the requirement now with the equipment I had. This involved the over-riding of most of the plants' control systems and the removal of all constrictions to flow Modification was easier on the three Caird & Rayner plants, as they were more robust and primarily of a stainless steel and bolted construction. The two Weir Westgarth plants, however, were of a plastic and welded construction which made modification very difficult and the plants easy to damage. Both types had a nominal production capacity of 100,000 litres per day but this was increased for the Caird & Rayner plants to 350,000 litres per day and the Weir Westgarth to 250,000 litres per day.

Water Temperature. The water temperature in the irrigation pipeline was 42°C, this was the temperature ; that water came up from the aquifer at. This was outside of the normal operating range for the RO plants of 5 to 35°C. This problem was only critical when the production capacity was at a high rate, which meant that the raw water did not have adequate time to air cool in the raw water tanks. A system to cool the raw water, using evaporation was designed but was not used, as once the temperature control system was removed from the RO plants, as process, the plants part: of the modification stopped shutting down. The water quality was, still_ classed as acceptable, although the

increased temperature did reduce the life of the semipermeable membrane.

Communications. I was located 90km from my OC, with no telephone or radio links. My daily reports were sent via a Ptarmigan link situated 40km away, though briefly, for a two-week period, a link existed only 30km away. Daily control of the WSS, each commanded by a corporal, was carried out by daily and often nightly visits. All this created a need for a very flexible plan and lots of initiative, but gave considerable freedom of operation. It also highlighted the trust and responsibility delegated to junior commanders within our Corps;

VehicleFleet. The troop had a small vehicle fleet, one Ferret Scout Car (FSC) (manufactured in 1947), one Toyota Landcruiser, two Landrovers and three Bedford 4-tonners, plus four 160kW generators. Most items operated using diesel held in bulk at R03. The FSC, the Landcruiser and Landrover used petrol, a less common military fuel, and this presented a major resupply problem which was never overcome. Because of lack of fuel, these vehicles were often used only every other day.

Water Transportation. Water was normally transported between the production site and the water storage sites by a Royal Corps of Transport troop of DROPS vehicles, each carrying a 12,000-litre bowser. When 1st British Armoured Division started its advance into Iraq, DROPS vehicles transported water to the Divisional Rear Maintenance Area. When the Division reached Kuwait City, the round trip took up to 48hrs cross country. This time was reduced to 24hrs after Support Troop, 3 Field Squadron, repaired the Hafar Al Batin to Kuwait City road.

After the Ground War. The division was supplied with water by bowser until a new water production facility, R04, was established on the coast at Kuwait City. This facility used sea water as its source and was operated by other Royal Engineers. My troop then maintained water supplies to rear area units, including three: field hospitals, the prisoner of war camp and the 1st United States Infantry division, together with a number of Saudi Arabian and Syrian army units.

CONCLUSION

WATER supply in this, as in any, military operation obviously had a high priority, especially because of the desert environment.

A PIECE OF FORGOTTEN CORPS HISTORY

For almost three months 1 was responsible for the production, storage and supply of most of the water used by the 1st British Armoured Division. For a month I supplied the 1st United States Infantry Division too. At peak demand, my troop issued more than one million litres of potable water per day. In total, during the war, we produced and issued over 25 million litres of potable water and an unmeasured amount of non-potable water.

Royal Engineers, with the use of modern water production equipment, flexible plans and by delegating responsibility to commanders at all levels, were able to ensure that there was always adequate water available for the British Army during the Gulf war.

A Piece of Forgotten Corps History

COLONEL J E NOWERS BSc(Econ) FIMGT, MUSEUM DIRECTOR



Photograph by courtery of Asprey, New Bond Street, London.

This fine piece of silver recently passed through the hands of a London silversmiths. It stands about 20in high and was made by Paul Storr in London between May 1813 and May 1814. The inscription reads:

"To General Robert Morse as a mark of gratitude and respect for his able and unremitting exertions to promote the honour and efficiency of the Corps of Royal Engineers, whilst under his command from 1797 to 1811, Presented by the Colonels, Field Officers and Captains of the Corps 1814"

Robert Morse was commissioned into the Corps in 1758. He took part in Marlborough's expeditions to St Malo and Cherbourg the same year and later joined the expedition to the Caribbean. He was present at the siege of Belleisle off Brittany in 1761 and served in the Westphalian campaign of 1762 and 1763. In 1773 he was appointed CRE West Indies and, after a spell of duty in England, went to New York in 1782 as Chief Engineer North America followed by duty in England. In 1791 he became CRE Gibraltar and remained there for five years. In 1802 he became the first Inspector General of Fortifications and a colonel commandant of the Corps. He resigned his appointment through ill-health in 1811 and died at his London home in 1818. A memorial tablet was erected in Marylebone Church.

Nothing is known of the circumstances of the presentation. However the piece has remained in the family until now when it is destined for America at a reputed price of £60,000.

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United Nations Operation Somalia II German Engineers – Lessons Learned

BRIGADEGENERAL A WITTENBERG



Brigadegeneral Andreas Wittenberg, who was born in Munich in 1938, joined the Armed Forces of the Federal Republic of Germany (Bundeswehr) in 1957.

His earlier appointments included tours as a platoon commander, an instructor at the Engineer School (Munich) and at the Armed Forces School for Athletics (Sonthofen), Company Commander and as a staff officer at the Army Office (Cologne), Following attendance, in 1971, at the German Armed Forces Command and General Staff College (Hamburg), he served as G4 and G3 of the Mechanized Infantry Brigade in Ahlen, before being appointed Battalion Commander of Engineer Battalion 5 (Lahustein).

After attending the Armed Forces Staff College in Norfolk, Virginia, he returned to the German Armed Forces Command and General Staff College, first as instructor and later as course supervisor. Then followed a tour in the United States as the Chief of the German Army Liaison Organization before being appointed Commanding Officer Armoured Brigade 12 (Amberg).

In the course of Germany's reunification, he became the Commanding Officer of the former East German 7 Armoured

Division, which he had to downsize, restructure and convert to the Home Defence Brigade 37. On 1 October 1991, he assumed his present assignment as General of Engineer and NBC Defence Forces of the German Army which made him also the Chief of Division X in the Army Office which also includes the responsibility for all military affairs related to environmental protection, infrastructure and occupational safety.

THE FIRST UNITED NATIONS MISSION FOR THE GERMAN (GE) CORPS OF ENGINEERS

WHEN, in May 1992, German television showed the first pictures from the United Nations (UN) mission of the GE Medical Corps in Cambodia, the telephones at the Director of Engineer's office started buzzing. Outraged and disappointed engineer commanders wanted to know why the medical personnel on the ground had to build and furnish their hospital themselves. "Carpentry and roofing, electrical installations and water supply is our job, not theirs. We know much better how to fix these things", was the tone of the calls.

Well, the UN had asked our government for a hospital and not for engineer support. This changed when the next large scale UN mission¹ of German forces deployed to Somalia.

THE DOMESTIC PROBLEM

DEPLOYMENT of the GE United Nations Operation Somalia II (UNOSOM II) contingent in 1993/94 caused a lot of commotion within Germany and sometimes our Allies did not quite understand the reason why. It would seem necessary, therefore, to explain the legal problems related to this mission in a few words.

For almost 40 years the situation has been very clear and simple. Our basic law, ie the German constitution, obliges the Federal Republic of Germany to raise armed forces "for defence". It was well understood and commonly agreed upon that defence meant the defence of German territory and the territory of our Allies, During the Cold War we concentrated on our defence plan and prepared for it exclusively.

Other UN missions:	 Operation Provide Comfort (Iran). Support by air force and navy units to monitor the ban on flying over Bosnia and Herzegovina and the embargo against the rump state of Yugoslavia. Support of UN verification teams in Iran. 	
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BrigadeGeneral A Wittenburg United Nations Operation Somalia II p160 We also paid our share for the AMF(L) (ACE (Allied Command Europe) Mobile Force (Land») but, apart from those units earmarked for those missions in Norway and Turkey, no German soldier expected that he might fight outside of Germany. Neither, for that matter, did our government, nor did our compatriots.

Germany joined the UN without reservations, fully accepting Article 43 of the UN Charter, which binds all member states to contribute to the maintenance of world peace and international security. So we must contribute armed forces to the Security Council on its request and take part in the full range of UN military missions, including "peace keeping, peace making, peace enforcement and peace building operations". At least that is, how one half of the German legal experts interpret our constitution. The other half, however, argues that, for a deployment of German forces outside the NATO (North Atlantic Treaty Organization) area, a change of the constitution is necessary:

Thus, in January 1993, the Federal Government reversed its decision of 17 December 1992, to support resolution No 733 of the Security Council by deploying 1500 German soldiers in support of UN operations.

On 26 March 1993, the Security Council decided to continue the UNOSOM II (Resolution number 814). On 12 April 1993, the Secretary General of the UN asked the Federal Government for support.

Despite considerable objections from the opposition in parliament, the Federal Government decided to comply with this request on 21 April 1993. The decision was as follows:

"UN OS OM II will be supported by a reinforced supply and transport, battalion which will be deployed to a 'pacified region' in Somalia to participate in setting up, supporting and ensuring the distribution network for relief goods and logistic assets as part of UN humanitarian activities."

After that, Headquarters UNOSOM II agreed with the Federal Government on the following mission for this German support unit:

"Placed under operational control of the Logistic Support Command (LSC), the German support unit (German Composite Force in Somalia - GECOMP-FORSOM) will:

- deploy to the Belet Uen area,
- prepare for the logistic support of a UNOSOM II unit of about 4000 men, and

• be prepared to deploy to the north to provide sim ilar logistic support there."

With a view to engineer and nuclear, biological and chemical defence (NBC) units, an analysis of this mission revealed the following essential tasks:

- To produce some 450,000 litres of drinking water per day and to hold in reserve 320,000 litres of this water in cooled interim storage facilities.
- To keep operational the supply points, supply routes and runways used by GECOMPFORSOM and/or to set up new ones, if required.
- To provide humanitarian assistance to the local population within available capacities.

As regards humanitarian assistance, a huge number of requests had already been made by UNOSOM II as well as by relief organizations and the local population. Among others, assistance was requested in the following areas:

- support of hospitals (water treatment, provision of medicine, out-patient treatment), and
- repair of school buildings.

Despite the fact that the mission of the German contingent clearly was of a logistic and humanitarian nature, fundamental reservations persisted in Germany.

On 15 May 1993, the parliamentary faction of the Social Democratic Party (SDP) appealed to the Federal Constitutional Court for a temporary injunction against the employment of the Federal Armed Forces in Somalia - the next day, the advance party of the German unit arrived in Belet Uen.

On 23 June 1993, the Federal Constitutional Court issued a temporary injunction to the effect that: The Federal Armed Forces may stay in Somalia until the German Parliament, "under its own responsibility", decides upon the German participation in the UN mission.

The majority of the German parliament agreed to the German participation.

Following the hearing at the Federal Constitutional Court in April 1994, where the opponents and supporters of the German involvement presented their positions once more, the final decision of the Court is scheduled to be taken in June 1994. At the time this *Journal* went to press, it was still pending.

PREPARATIONS

Selection of Personnel. In accordance with a decision of the Federal Minister of Defence,



Figure 1. Organizational chart of the first contingent.

regular soldiers and temporary career volunteers could be ordered to deploy to Somalia whereas conscripts could only be considered if they had volunteered for this mission. This necessitated a large scale screening during which some 9400 soldiers serving in the basic training units of the reaction forces were interviewed.

The result was that the predetermined brigades and battalions did, in fact, provide the required companies and platoons of the individual arms and services but these "cores" had to be fleshed out by individuals or groups from other units.

Apart from obtaining volunteers, we also had to consider the training readiness and physical fitness of the soldiers and, for conscripts, their discharge date.

In the Federal Armed Forces, many territorial defence tasks are assigned to units which are exclusively manned by reservists. As there was no aggression against Germany or its Allies, these reservists could only be called up if they volunteered for employment. Without these reservists, it would not have been possible to ensure fire protection, military postal services or legal, psychological and geophysical counselling.

Thus, we set up a unit led by a colonel in line with the task force principle. The first contingent comprised 1700 soldiers from nearly 170 different units and agencies. (Figure 1) The second contingent, which was deployed from December 1993, comprised 1340 soldiers from 251 different agencies and units. Both contingents each included an engineer and an NBC defence company. (Figure 2) Parent units of the engineers/NBC defence personnel of the second contingent are shown on *Figure 3*.

Training. The soldiers earmarked for employment within the individual elements of GECOMPFOR-SOM were assembled in the home garrisons of the "framework units" and trained in line with the tasks assigned to their respective anns and services. Training was completed by a oneweek exercise at the Combat Arms School 1 in Hammelburg.

For the Corps of Engineers it was a lucky coincidence that the establishment of the Minefield Documentation Centre at the Engineer School, which had been ordered in December 1992, had progressed so far by the spring of 1993 as to enable the so-called "Somalia Minefield Manual" to be edited and printed in time for use by the advance party in Somalia.

Training in the garrisons, at the Engineer School and in Hammelburg relied to a very large extent on the lessons learned by friendly and Allied armed forces.

In the presence of the Chief of Staff, Army, for example, a BAOR briefing team in February 1993 briefed the German Army Staff on lessons learned by British forces in the course of the UN Protection Force (UNPROFOR) operation. The first commander, GECOMPFORSOM, ie the commander of Airborne Brigade 26. received the required information for the drafting of the German training concept for the Somalia mission at the UN Training Centre of the British forces in Sennelager.

Moreover, British, Belgian, French and Canadian experts provided direct training support during the preparation of German engineers. Challenge for the Corps of Engineers. For the German Corps of Engineers, the Somalia mission coincided with a critical phase of the reorganization of its units in line with the new German Army Structure 5 (See article German Engineers. History, Structure and Tasks, by Lieut Colonel R Von Reden, August 1993 Journal). At the same time, it was just at the beginning of a process of rethinking its operational missions.

While the NBC Defence Corps had the organizational elements and most of the equipment required for its "water treatment" and "decontamination" missions at its disposal, things looked different for the Corps of Engineers. Over decades, it had been optimized for terdefence missions ritorial under the General Defence Plan. In particular, German engineer equipment for barrier operations far outstripped all NATO armies.

With a view to their mission, this leading position was a necessity. However, the other side of the coin was that other engineer tasks had been assigned to inactive units and these tasks had taken a back seat in the training of active units.

For construction work, from road and bridge repair to the construction of troop camps - a matter of course for British, US or French engineers - the German Corps of Engineers was not nearly as well-equipped as for barrier operations at the old Inner-German Border. Things had been different in the past. Up to the early seventies, water and power supply, construction of roads and heavy bridges were fields in which engineers were strongly engaged. The relevant regulations and lessons learned, however, disappeared in the

archives of the Engineer School when the respective training and demonstration units were disbanded - a requirement of the then valid mission.

The Corps of Engineers, however, had retained one important capability, ie to improvise on the basis of the solid technical training of its leaders. Thus we could assemble and procure the required equipment for Somalia within a very short time and this equipment ranged from the concrete mixers (which had to be procured since they were no



Figure 2. Organization of the engineer company.

longer part of our establishment tables) to carpenters shops and to well boring rigs which were originally meant to serve as demolition shaft excavators. (*Figure* 4 over the page)

RESULTS

THE mission of GECOMPFORSOM had been to set up and operate the logistic base for other UNOSOM II forces. As far as the physical construction of this base and the reconnaissance and planning work required for its operation were concerned, this mission was successfully carried out. When the UN changed their plans, the German forces were withdrawn.

Despite the fact that the original logistic mission turned out to be unnecessary in the end, the



Figure 3. Parent units of the engineersINBC defence personnel of the second contingent.



Figure 4. Number of engineer plant belonging to the engineer group.

engineer and NBC defence companies had more than enough to do as part of the day-to-day operations of the troop camp, the preparation of the logistic mission and the provision of humanitarian assistance. (*Figure 5*)

CONSEQUENCES FOR THE CORPS OF ENGINEERS **Equipment.** In general, the basic engineer equipment stood the test during the Somalia mission. However, the type and number of engineer equipments available did not cover the entire range of possible tasks.

The decision as to whether the required engineer equipments should be procured and held in store or whether it should be procured or leased on a case-by-case basis is still pending. In any case, we will have to procure a basic stock of diggers, compressors, graders, containers and small tools for training purposes.

The drilling equipment used for well drilling achieved maximum depths of 214m and has proven to be a good investment. Nevertheless the driller itself must be upgraded and auxiliary equipment for well construction must be procured.

A Working Group for the "further development of the Engineer School" has been tasked to draft a catalogue of engineer equipment required for UN operations. This catalogue will serve as a planning guideline/decision making tool for the future equipment allowance of the Corps of Engineers.

In the beginning, I addressed the 'phone calls of disappointed unit commanders with regard to the construction of the Federal Armed Forces hospital in Pnom Phen. Against this backdrop, the engineers will be tasked to set up and operate field camps in the future, thus assuming the lead responsibility (planning, organization, coordifor the Federal nation) Armed Forces as a whole. Training. The large range of potential future tasks of the Corps of Engineers calls for a "multipurpose engineer" who must be welltrained in the main building trades such as bricklayer, carpenter, road maker, locksmith and mechanic. and also electrician.

The construction missions in Somalia revealed that nei-

ther junior ranks nor military leaders will be able to fulfil their tasks in a satisfactory way unless they have completed a corresponding civilian training/education in the construction industry.

The Engineer School and Army School of Constructional Engineering will therefore be tasked to organize additional training courses in the areas of construction planning and execution of construction work. As part of this effort, 50 per cent of the platoon leader NCOs will be trained to become nationally recognized structural engineers.

As in the past, the Engineer School will continue to offer training courses in the fields of well drilling, bridge construction and reinforcement, handling of foreign engineer equipment (eg bridging equipment) as well as minefield reconnaissance and clearing.

Structure. Given the fact that territorial defence and thus combined arms combat will continue to be given the highest priority in Germany even in the future, whilst, at the same time, the probability of an involvement in UN operations - to include humanitarian assistance - is increasing, we must raise the question of an optimum structure of the Corps of Engineers.

This structure must live up to the challenges of combined arms combat as well as to the more coincidental challenges of a UN mission, which are determined by the respective area of operations, climate, type of conflict/mission and so on.

A task force oriented to both the mission and the mission environment would be the most viable option to meet these requirements.
In this regard, the assembly of engineer forces for Somalia out of this existing basic structure has successfully stood the test.

The German Army should keep in mind that its main mission, ie territorial defence, will be the least probable one for the foreseeable future.

We are much more likely to be confronted with missions in support of Allied defence, UN peace-supporting or enforcing operations and humanitarian assistance. Such missions would take place outside Germany. For us as German engineers this means that we will have to relearn the lessons our engineer Allies have never forgotten.

> Engineers doing their survey, well supported by a little Somali.



Construction of the airfield 7 August to 3 September 1993			NBC • Water treatment: Total quantity of purified water: 10,315,000 litres				
Length: Width: Water: Material: Kilometres travelled:	2200m 40m 1,700,500 litres 16,442m ³ (Beled li 63,000	mestone)	 Motor vehicles and trailers disinfected: 133 Fire fighting missions: 3 with fire fighting vehicles, decontamination vehicles, ambulances and armoured medical evacuation vehicles as well as a total of 360 soldiers. 				
EOD		Well Drilling					
Hand grenades: Mines		23		Depth	Max Performance	Drilling Time	
20mm HE projectiles Rifle grenades Hard-freed antitank grenade RPG 7		3	Water Treatment Plant Warsam School	18m 18m	9000 lites/hr 4000 lites/hr	14hrs 36hrs	
Artillery fuzes 37.122mm projectiles		20 126	Comaat	214m	4000 inestr	14 days	
106x610 HEAT cartridges 3		Total consumption of self-mined filter gravel: some 36t					

Construction Tasks

 Repair of a dam over some 60m to re-establish an artificial flood area (1200 hectares = 4.6 square miles); construction of a new dam (500m) to irrigate 5000 hectares (19.3 square miles).

· Repair of four schools (stone buildings) and the construction of seven small schools.

Figure 5. Performace data of engineer and NBC defence companies.

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51 (Airfields) Squadron Airfield Revisited, Kuala Penarik 1967-1993

LIEUT COLONEL J S FARMBROUGH



INTRODUCTION

IN 1967 an airfield was built by 51 (Airfields) Squadron on the east coast of what was then west Malaysia, at a place called Penarik. This was during the time when there were relatively large British forces in the Far East. Penarik was, and still is, a large military training area to the west of the road between Kuala Terengganu and Kuala Dungun. Recently the author, who was in charge of this project back in the sixties, had the



The first touchdown.

opportunity to revisit the area to see if the airstrip was still there 26 years later.

BACKGROUND

51 SQUADRON moved to Singapore in December 1965 as part of the Corps' takeover of the airfield construction responsibility from the RAF during a previous rationalization campaign. The squadron settled into the accommodation of 5001 Construction Squadron RAF at RAF Seletar. Eighteen months later the powers-that-be decided the squadron really ought to build an airfield so as to live up to its name – up to then its biggest project had been the car park at RAF Changi air terminal. So the project was conceived.

THE PROJECT

THE site chosen for the airstrip was in the Penarik training area on part of a flood plain containing a light aircraft strip capable of accepting the Army Air Corps Beaver aircraft or the RAF single and twin Pioneers. The technical description of the proposed new airstrip was "Tac (T) MR", which stood for Tactical Transport Medium Range, and it would be capable of accepting the RAF Beverley. The proposal was for a 3700 by 140ft runway with two parking areas. The air photograph opposite right, taken in October 1967 after completion of the tasks, shows the new runway, parking areas and, to their right, the light aircraft strip. The surface was designed as a mechanically stabilized soil construction with an oil sealing to finish it off. The task con-

sisted mainly of plant work with earth moving, soil stabilization, compacting etc. The biggest challenge was to do all this at a remote site, and to be completely self sufficient about eight hours and four ferries from base.

EXECUTION

THE first task was to gain access to the site, which required spanning the local stream with a Bailey bridge.

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Lt Col J S Farmbrough 51 (Airfields) Sqn Airfield Revisited (p166)

During this phase four items of plant were airdropped to the site. A camp for 70 men. complete with all services, had to be built, and the necessary heavy plant had to be transported in by road convoy and by landing craft before the project could start. The task was completed in five months and culminated with the landing of a Beverley which had on board the Colonel (E) and his deputy, thereby risking the loss of all the senior airfield construction staff in the Far East.

TODAY

The airstrip is still there today and has still not been surfaced. The centre of the runway is in good condition with local vegetation encroaching from the shoulders. Apparently the training area was never owned by the Malaysian Defence Forces, only leased from the state authorities who are threatening to repossess it. The surrounding area which was undeveloped 26 years ago

has been extensively planted with tobacco, and there is now an infantry company semipermanent camp at the site. The occupying unit is at present the 104 LAW Battalion, a TA unit with local coast watch responsibilities.

POSTSCRIPT

THE country around Penarik is still delightful. When we were there in 1967 a man was eaten by a tiger only 15 miles from where we were: this does not happen today although there are still occasional tiger sightings.

South of the site there has been extensive development associated with the discovery of oil in the South China sea. Turtles come ashore to lay their eggs in the area



Photograph of the airfield, taken in the sixties, approaching from the north, showing the coast road running south to Kuala Dungan.

and are still a major tourist attraction. The journey from Singapore by road now takes a little over five hours for the 300 miles; in 1967 it required crossing five rivers by ferry but these are now gone, replaced by modern bridges. I would recommend the trip to anyone who finds themselves in the area.



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Excavation of a 2200 Tonne Gold Dredge from Frozen Ground

MAJOR G B O R JONES BSc



Major Gareth Jones graduated from University College Durham in 1980 and has since served in Nienburg, Waterbeach, Minley and the Falkland Islands (twice). After completing PET(C) in 1989 he was sent to Winnipeg to join 1 Construction Engineering Unit for an exchange tour with the Canadian Forces. He is now back in Britain and presently commands a training squadron at the Army Apprentice College, Chepstow.

INTRODUCTION

RELATIVELY few members of the Corps know that there is an exchange officer serving with the Canadian Military Engineers in 1 Construction Engineering Unit (1 CEU), the Canadian Forces' equivalent to the Military Works Force. Unlike an STRE (Specialist Team Royal Engineers), however, a team from 1 CEU not only designs and plans a project but also goes to site, hires civilian labour, equipment, vehicles etc, and carries out the task.

I served with 1 CEU from November 1989 to August 1992, carrying out a variety of studies and projects covering subjects as varied as timber structures, water distribution, erosion control and ammunition depot construction. My major project, however, was the relocation of Dredge #4 near Dawson City in the Yukon. The job included an engineering study, design, planning and cost estimating followed by command of the site for construction phases of five months in 1991 and three months in 1992. It also involved considerable financial freedom with an allocation of \$1079K to cover all aspects of work on site, less military pay. This article gives a brief outline of the plan to thaw, excavate and move the dredge, and an analysis of the more interesting problems encountered on site during the work.

BACKGROUND

AFTER the Klondike gold rush of 1898, gold mining in the Yukon became the preserve of large companies owning hundreds of claims each. The gold was mined using huge floating dredges of up to 3000t displacement, which would dig their way up the creeks extracting the gold bearing gravel from in front, screening and sluicing it before dumping it behind in characteristic mounds. These mounds exist to this day and cover the valleys of the Klondike River and its tributaries, looking like enormous worm casts of rounded cobbles and boulders.

In the late 1970s the Canadian Parks Service (CPS) acquired the largest wooden-hulled gold dredge in North America. The dredge, Canadian #4, was in sound condition, but was buried approximately 6m deep in the frozen silt of Bonanza Creek, near Dawson City, and was filled to ground level with ice and frozen silt. It became clear to CPS engineers that ground movement was distorting its hull and superstructure, and that the resulting strains

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Maj G B O R Jones Excavation of a 2200 tonne gold dredge p168 and stresses were damag-ing this historic artefact. Although the exposed superstructure was maintained and painted, it was also suspected that the buried elements were being attacked by rot.

Bonanza Creek is documented as the site of the gold initiated strike that the Klondike Gold Rush. Claim 14BD, where this dredge worked. is 17km from Dawson City, the heart of the gold rush area and, until 1953 the capital of the Yukon. With a population of approximately 1800, Dawson City is the Yukon's second city, 525km by road from the present capital, Whitehorse. and 175km from the nearest

community at Stewart Crossing. The Dawson economy is based almost entirely on gold mining and tourism.

During the early 1980s, tourist trade expanded in Dawson and the local CPS office, Klondike National Historic Site (KNHS), became more active. CPS carried out a study into the situation of the dredge, which was their biggest asset, and decided that the best solution would be to relocate it out of the silt to remove the malign influence of the ground conditions and to expose the structure for repairs and maintenance.

Northern Region Headquarters in Yellowknife was approached to ask if the Canadian Forces would be interested in the task, and I CEU was tasked with Project 87-CEU-15, to investigate the dredge's condition and propose a solution.

In March 1988, concluding that the dredge was basically structurally. sound but deteriorating, 1 CEU recommended that it be relocated by floating it onto a gravel pad on the nearby car park. The report included an outline plan and estimated the cost at \$500K. After a number of meetings CPS agreed the Unit's plan with a revised cost of \$IOOOK (still significantly lower than half the cost estimate provided by their inhouse engineers from Public Works Canada) and asked them to go ahead with a design and estimating study.

In late July 1990, I deployed with a team of four to carry out a study of the dredge site to

Map of area covered by article.

enable detailed design and a cost estimate to be drawn up. The structure of the dredge and the soil conditions were studied and detailed requirements were discussed with KNHS. Up to date cost data was gathered and contact made with potential suppliers and subcontractors. The results of the study were reported in early November 1991, estimating the project cost at \$954K with an additional \$166K to cover late changes to the plan by CPS: a foundation of \$52K, and crew accommodation at \$114K. The total was later adjusted to \$1079K.

During November and December 1990 meetings were held to discuss and approve detailed aspects of geotechnical design. A computer model of the excavation was made to study the interaction of ground loading and the high water table on slope stability. Groundwater flow was modelled to confirm dewatering capacity, and contingency plans to cover unexpected ground conditions were developed. CPS confirmed acceptance of the design in late December 1990.

Critical items of equipment necessary for the excavation task had a lead time from the suppliers of ten weeks. Supply and Services Canada (SSC) required six weeks to process requisitions. In order to meet the proposed start date of 29 April 1991, I CEU asked for confirmation of effective funding from CPS by 7 January 1991, this was received on 31 January. I CEU carried out procurement for the project



from February to April and deployed the project recce team in March to confirm administrative requirements for the project. The supervisory crew of five consisted of a project commander, production superintendent, a financial clerk, (CEP Tech), labour supervisor and surveyor. They deployed to Dawson on 29 April 1991 and work started on site with six civilian workmen on 1 May 1991.

THE SCOPE OF WORK

THEscope of work consisted of the following tasks:

- Excavation of silt from around the dredge, thawing and removal of frozen material in it.
- Building a foundation on the nearby car park.
- Lifting the dredge and moving it to rest on the foundation.
- Building a protective berm around the dredge in this new location to guard against flooding.
- If it was found to be impractical to move the dredge, then a fallback option was to be implemented to backfill the excavation with gravel and reflood the hull *in situ*.
- All work not directly related to relocation was excluded, such as restoration, provision of tourist facilities and landscaping.

PHASE 1: SUMMER 1991

Plan. THE plan for the first year's phase of the project was based on the original study published in 1988, and the first task was to excavate the hull.

The surface of the ground was frozen to a depth of 0.5 to 1.5m and the initial stage of the excavation involved removal of this layer using a 360° excavator fitted with a frost bucket loading $9m^3$ dump trucks. The remainder of the silt was to be excavated underwater using an agitator pump suspended from a raft. This pump was designed to chum the silt into a slurry with water, then pump the slurry into a pond where the silt would settle out and the clean water would run off to the creek.

Thawing of the hull contents (discussed in detail later) was planned to run concurrently with excavation by the agitator pump.

The intended method of moving the dredge was by refloating it. In order to float the dredge to a high enough level so that the bottom of the hull could clear the top of the foundation, the water level was calculated at 457m ASL (above sea level), 4.8m above ground level, to float the dredge high enough so that the bottom of the hull could clear the top of the foundation. A bund was to be built with crest height of 457.5m ASL to retain water. The computer analysis had shown that for an adequate factor of safety, the bund side slope should be 1:1.65, with the toe at 30m from the side of the dredge. The bund was to be built 5.3m high with a 4m wide crest to allow sufficient width for heavy equipment to travel. This necessitated a base width of 22m. Once the bund was complete it was to be lined with a waterproof geomembrane to seal it. A valved culvert was to be inserted at the base of the bund both to flood the lower part of the pond and, once the dredge was in place, to empty it.

One noticeable change to the plan outlined in study 87-CEU-15 was the construction of a preserved timber foundation. This was requested by KNHS in August 1990. A modular foundation was designed with 46 identical units connected laterally by cross-bracing, and relying on their 4.88m length to resist overturning longitudinally. It was also designed to absorb impact from the moving dredge, and was to be anchored against impact and flotation using 1.83m steel angle-section anchors.

The final task planned for 1991 was repair of the hull. This was a very difficult task to estimate as little was known of the state of repair of the structure. A number of tentative repairs were designed for specific shapes and sizes of holes in the hull, and time and money were allocated to sheath the hull with polythene to seal it. Beyond that, no further plans could be made because of lack of information. Unanticipated damage was to be assessed and repairs designed on site.

EXCAVATION

Site Conditions. The site consisted of a siltedup dredge pond. It was bounded to the east by Bonanza Creek and to the west by the Bonanza Creek road. The road and adjacent car park were underlain by well-graded gravel tailings from gold miners' sluice boxes, on top of poorly graded soil. The soil surrounding the dredge was stratified sandy silt containing organic materials - matted roots, branches and twigs. Soil within 1 to 2m of the dredge was frozen against the hull and superstructure sides. The top .5 to 1.5m of soil was frozen over the whole site. The water table was high - within 200 to 300mm of the surface even in late summer. Frozen material filled the interior of the dredge; the bottom 500mm of the hull was frozen silt and the remainder of the hull was full of clear ice. The

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main deck was covered with 1.5m of frozen silt which in turn was covered with 1 to 1.5m of ice.

Plan. In order to float the dredge the silt had to be removed from around its outside and the frozen material inside had to be removed. The outline of the plan was to excavate the material outside, thaw and wash the silt off the main deck and pump the water out of the hull.

Excavation of Frost. The intention was to run a 360° excavator on top of the frozen ground and use a frost bucket to excavate the frozen surface layer and expose the saturated silt below. The frost laver was not as firm as had been believed and a gravel road had to be built down each side of the dredge to support the excavator whilst digging, and to provide a firm route for dump trucks to the spoil. To provide remove concurrent activity and to increase the work rate of the dump trucks. bund construction was advanced so that trucks were loaded with excavated silt, which was dumped in the refuse area, and then moved to the gravel pit to be loaded with

gravel, which was dumped on the base of the bund, before they returned to the excavation. Three end-dump trucks were found to match the load and dump cycle time and the frost was excavated within the planned time.

Excavation to Keel Level. The next task was to excavate the remaining unfrozen silt underwater using an agitator pump suspended from a raft. While the pump was removing silt slurry from the bottom of the excavation, the water in the excavation would thaw the silt frozen to the dredge sides. Simultaneously the silt on the main deck was to be thawed and washed into the excavation to be picked up and pumped away. The pump method of excavation seemed ideal for the site. The soil was of ideal grain size and site investigation had shown no rocks and only very small pieces of organic material. The submersible. electrically_ powered pump was designed with an agitator paddle underneath. it to stir up the silt, and would accept and pump up to



Diagrammatic sketches of dredge.

50mm spherical solids. The calculated rate of pumping was 50 litres/sec at about 30 per cent solids by weight, giving a silt removal rate of $45\text{m}^3\text{fhr}$ of *in situ* silt. Because the pump could be run about 20hrs per day, this equated to 900m^3 /day, or 100 truckloads - very close to the output of an excavator, loading dump trucks at a five minute turnaround for an eight-hour day. The difference was that the pump, associated generator and operator totalled about \$15K a month and could be run in shifts for seven days a week, whilst the heavy equipment cost \$47K a month for five-day weeks.

Problems. Once the pump was deployed on site, it failed to achieve the rate of pumping it should have. The major problem it faced was stratified, thin, matted layers of vegetation. These had not been considered a problem during the soil investigation because the auger sampling method had broken up the vegetation into harmless, small pieces. The organic materials clogged the pump

intake, blocked the impeller and physically. shielded the silt below them from being slurrified. After a period of trying to overcome these problems the pump was removed from site and the excavation commenced by heavy equipment. Heavy Equipment Excavation To allow the heavy equipment to excavate to keel level. gravel roads had to be rebuilt on top of the silt. The excavation was carried out concurrently. with the removal of silt from the interior, as first planned. This resulted in a very wet excavation, and it was found that the excavator could not dig more than about 1.5m down because the silt excavation sides tended to slough into the holes. The excavator dug right round the dredge, then the road was rebuilt and a second pass was dug, reducing the ground level by about 3m. At this point the excavation was halted and the thawing of the hull was completed. Once the hull was empty and there was no further need to pump water onto the site, the excavation was drained and two deep sumps dug at the bow. Excavation recommenced with two excavators, one working on each side of the hull, and three trucks serving both. The dry ground produced by the drained sumps made for vas.tly improved efficiency. The excavators dug down 3m, reaching the bottom of the hull in one pass. Where the saturated silt had lain at 1 in 3 to 1 in 5, slopes of steeper than t in 2 were achieved in the drained material. The final phase of the excavation involved removing the 4m deep mass of frozen silt in the slot in the centre of the front of the hull beneath the digging ladder. This was washed out using a 35 litres/sec monitor and pumped out of the sumps using 100 and 150mm pumps at 125 to 200 litres/sec

THAWING

Situation. The dredge hull was an average of 4m deep below the main deck, and site investigations had shown it to be covered by 1.5m of partly frozen silt during the summer. On arrival on site, the crew found the silt completely frozen and overlain by a further 1.5m of ice. Plan. The plan was to wash the silt off the deck

Plan. The plan was to wash the slit off the deck using one 125 litres/sec pump, locate the hatches in the deck, then achieve a flow between pairs of hatches until the whole surface of the belowdeck ice was exposed. Thawing would then continue by washing the exposed surface with cold water at 125 litres/sec. The planned rate of removal for both silt and ice was 75mm/day (equating to 55t of ice/day).

Faults. The initial problem was to remove the ice from the top of the frozen silt. As it was easily accessible and the dredge superstructure reasonably well ventilated, the ice was removed by chainsaw in advance of the pumps' arrival on site for the planned start of the thawing. However, due to the problems with the excavation, the washing of silt off the main deck was frequently interrupted because the silt level was below external ground level. The silt often settled out of suspension before it reached the outside of the hull. Finally, when the hatches were uncovered, there was only one hatch into each of the five hull compartments, precluding flow of water between hatches.

Solutions. To overcome these problems, the velocity of the washed silt was increased by cutting narrow channels for it to flow to the dredge doorways. This kept the silt in suspension until_ it left the dredge. Thawing and washing the ice and silt was accelerated to make up for early interruptions once the excavation reached a reasonable depth. Achieved by recycling water from the excavation rather than pumping to and from the creek, this had two beneficial effects: first, the water in the excavation was cloudy and still, with a large surface area so that it absorbed plenty of heat from the sun during the long, clear, subarctic davs. Second, it allowed the use of all pumps pumping water into the dredge, which ran out by gravity back into the excavation, rather than employing half the pumps to pump from and half to pump back to the creek. The hull was thawed working outward from each hatch. A hole was advanced to the bottom of the dredge of ice au gering using a combination and melting with cold water. Water was then pumped to the bottom of the hole, allowed to return up the hole and out of the hatch, melting the ice into a cavern which was drained once a week when the cold water hose was moved to pump against the receding ice face. By this method the hull contents were thawed in five, six-day weeks at an average rate, for the 4m hull depth, of 135mmlday or almost twice the planned rate.

CONCLUSIONS DRAWN FROM PHASE **1** THE ground was frozen inside the dredge, against its sides and under it. The ground to the south was frozen to a depth of only 500mm in places, whereas to the north it was frozen to depths of approximately 1.5m. The shade of the dredge appears to have increased the surface layer of frozen ground. More significantly the ground in the Bonanza Creek Valley thaws completely every summer. The ice and silt within the dredge was constantly shaded and so the surface froze every winter, but summer never thawed it. A large block of frozen material built up within the dredge which then refrigerated the ground around it, and this explains the distribution of frozen ground found at the start of the project.

Excavation by agitator pump can be faster and significantly cheaper than excavation by conventional means, but careful investigation of the ground is required, and the presence of significant quantities of organic material may preclude its use.

For maximum efficiency of digging by excavator, the excavation should be kept as dry as possible.

The most efficient method of thawing frozen ground or ice is by the use of large quantities of cold water. The ideal source of such water in warm weather is a pond of large surface area which absorbs sunlight. For water running over a surface of $80m^2$ of ice at 170 litres/sec, 150t of water at $4^{\circ}C$ drops in temperature to $3.5^{\circ}C$ to melt one ton of ice. These figures can be used as a guideline to plan rates of thawing. Frozen soil will thaw more easily for a given mass because of the lower ice content and therefore the lower specific heat of fusion. However, greater flow is required to wash the thawed ground away.

The work done was completed to schedule and well within budget.

PHASE 2: SUMMER 1992

AT the end of 1991 then, the work remaining to be completed on the project was:

- Thawing and draining the excavations at the beginning of 1992.
- Checking hull integrity after winter layup.
- Removal of the final traces of silt in the hull.
- Installation of a suction-breaking network in the hull bottom.
- Filling the excavations and berm with water, thus floating the dredge.
- Tow the dredge into its final location and sink it onto the foundations.
- Empty the dredge pond, build a protective berm around the dredge, clear and reinstate the site.

Plan. The plan for the second year's work started with keeping the excavation dry during the winter and allowing the ground to freeze to a considerable depth to fmm an impermeable layer to line the pool. On return to site a suctionbreaking system (consisting of a network of pipes to allow water to be pumped through holes in the hall b<rttm) would then be installed and the dredge anchored. The pool would then be filled to the gunwales of the dredge and the suction breaker pressurized, floating the dredge.

Once the dredge was afloat it was to be winched into place using six dozers with winches, and then slowly sunk,by pumping; water back into it. Once the dredge was confirmed 10 be in place, the valved culvert was to be opened to drain the pond. The bund would then be dozed back into the excavation to reinstate the site. A protecti¥e bund and drainage ditch would finally be huilt round the relocated dredge.

Preparations. The reason why the plan for the winter layup involved keeping the excavation dry over the winter and allowing the soil to freeze was to ensure an impervimis barrier to retain water once the excavation was reflooded and to keep lhe excavation slope stable during the change in water level. However, there were two potential problems with this method which became apparent towards the end of the first vear's work. The expostlre of the hull bottom to very cold air throughout the winter would freeze the hull to the soil beneath it. Although the pumping of cold, pressurized water through the hun bottom was intended to thaw it, the six months of freeze would slow the restart of the project. Secondly, consultation with locals revealed that the soil was unlikely ever to freeze completely and that groundwater would seep throughout the winter causing glaciation which in the extreme case could fill the excavation. To reduce the risk. I decided to allow the excavation to reflood for the winter as calculations showed that the saving gained by not running pumps all winter to drain the excavation would cover the cost of thawing the 1.5 to 25m of expected surface ice (calculated with the data from the first year's work). Analysis of the underwater slope before and during drainage indicated that there would be no major problem with slippage. This new plan also ensured that the hull bottom was kept in contact with water at OOC or more and allowed the soil next to the hull to begin to thaw.



Foundation before anchoring.

RETHAWING

On return in April 1992, the site looked depressingly as it had before work had begun the previous year. The snow on top of the ice was at the level of the ground and none of the hull was visible. The first job was to clear a drainage route through the bund and set up the two large (combined 530 litres/sec) pumps in preparation for the initial thaw. The ice proved to be 1.5 to 2m thick and the enormous flow of water soon started melting the ice inside the dredge. The ice outside was ignored as it had no effect on operations at this stage. After three solid weeks pumping round the clock (representing some 1.2 billion litres of water) the last trace of ice was melted. The ice outside the hull had also melted away from the hull and a pontoon bridge was built for access across the pond.

FLOTATION

THE 125 litre/sec pumps used last year were now moved on deck to provide bilge pumps and set to work draining the hull. After a very short time it became apparent that the hull was not draining and that the repairs must have failed. Under pressure of time now it was essential to drain the pool and renew the hull repairs. The large pumps soon had the hole drained and work started in shifts to install the suction-breaker and repair the hull. At this stage another problem became apparent: the water used to thaw the ice had carried tons of silt into the hull, blocking access to install the suction breaker and threatening to prevent the dredge from floating. The repairs took another week and the pool was again filled to provide maximum buoyancy while work continued inside the hull.

During this time I was kept busy in the office in town recalculating time and costs and adjusting the plan to bring the project back on line after the installation was complete. One day after a long telephone call to CPS Headquarters in Winnipeg I was called urgently to site. The site foreman met me and was visibly agitated. He told me that the dredge

seemed to have shifted slightly and was concerned that the excavation had started to collapse underwater. I set up a theodolite and and sighted on part of the dredge to monitor the movement, if there was any. In the time it took to answer a call of nature it was clear that the dredge had moved 200mm sideways and, barely able to contain my excitement, I ran to the edge of the pool and put all my weight against the gangplank.

I had never before displaced a 3000t weight with my bare hands. I am sure the crew was amazed to see their normally sober British officer yelling with excitement. The dredge was floating! Work stopped immediately on the pipes in the hull and all hands set to work tightening the anchor ropes and setting up the bilge pumps in case of leaks.

RELOCATION

VERY swiftly the 530 litre/sec pumps were set in place to fill the pool and started. Measurements on the side of the hull showed that the dredge was floating lower in the water than expected and another 300mm was added to the top of the bund while the pool filled. Markers were attached to the hull to monitor its position over the foundation and we waited for the pool to fill. After five days the water level was nearly high enough for the hull bottom to clear the foundation.

Suddenly, disaster threatened. Water was seeping through the ground under the bund, weakening the

Maj G B O R Jones Excavation of a 2200 tonne gold dredge p174



Aerial view of site.

soil; ominous cracks started forming as the outer face began to slip away, threatening to breach the dyke and flood the mines all the way to Dawson City. The options available were to dig deep drains to take the water away below the level of the bund or to try to seal and shore up the bund by pushing the excavated silt against its back face. The former option was safer but would delay the operation by weeks and cost thousands of dollars. The latter was only a temporary measure but was fast and cheap, and it worked. We worked to get every ounce of output from the pumps as the massive D8 and D9 dozers ran flat out to maintain the bund. Just as the dozers were using the last available backfill the water reached the critical level and winches started pulling the dredge into place. It took all morning to place accurately over the foundation then in the afternoon it was finally sunk in place and the valve opened to drain the pool and relieve the pressure on the bund. The project was a success.

THE AFTERMATH

THE site was reinstated as planned and the dredge handed over to CPS' Director, Prairie and Northern Region, in July 1992. The project had been completed ten days early and \$76,213 under budget. It had cost \$1,003,287 and taken a total of eight months over two summers. Dawson City has a major part of its heritage preserved for posterity and I have memories of engineering in the Yukon to last me a lifetime.

Excavation of a 2200 tonne gold dredge (p175)

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16 Assault Squadron June-October 1944

MAJOR GENERAL J C WOOLLETT CBE MC MA CENG FICE



Commissioned in 1935, the author went to France with 23 Field Company in 1939, After Dunkirk he served in 6 Commando and took part in raids to Norway, before returning to the Corps to command 16 Field Squadron in 1942, which converted to 16 Assault Squadron in 1943.

After the war he attended the Staff College, joined the Burma Mission, and commanded 51 Port Squadron at Marchwood, before returning to Camberley on the Directing Staff.

In 1954 he commanded 28 Field Engineer Regiment in Korea and later on Christmas Island. GSO 1 (Exercise Plans) Northern Anny Group came next, then two years as the British Instructor at the United States Army Staff College, before returning to Rhine Army as Deputy Quartermaster General (Movements) and in 1964 becoming Commandant at the Transport Training Centre at Longmoor. In 1966 he was Deputy Engineer in Chief and then Chief Engineer British Arms of the Rhine from 1967-70.

AUTUMN 1944

AFTER the break out from Normandy and the Seine crossing at the end of August, the advance of 21 Army Group towards Belgium and Holland was rapid and the airborne operation to secure a crossing over the Rhine at Arnhem was launched on 17 September, with 30 Corps opening a corridor across the southern Netherlands to join up. By the end of September the crossing over the Waal at Nijmegen was secure, but the Rhine bridge at Arnhem had not been captured. One factor in this failure was that all maintenance had to be brought up by road some 400 miles from Normandy, restricting intensive operations to a small force.

Although the port of Antwerp had been captured more or less intact on 5 September, the estuary of the Scheldt was in German hands and operations began in October to clear both banks. Further east the corridor to Nijmegen was to be widened north, and south to the banks of the Waal.

Meanwhile 2 Canadian Corps had been clearing the Channel ports, supported by 6 and 42 Assault Regiments. The limited capacity and the damage done to these ports meant that they could do little to assist the maintenance problems of bringing supplies by road from Normandy. One result of this was that tank transporters were having to be used for taking up petrol in jerry cans, and ammunition, so that there was only limited capacity for moving AVREs (Army Vehicles Royal Engineers) up. This affected us, in 16 Assault Squadron (16 Sqn), because, after the capture of Le Harve, we were billeted in a village north of that city.

As the days went by there was a growing feeling that we had been left out of things, and after a week or so I set off in my car and drove towards Belgium. I stopped south of Lille in the village of Elmez, and went to the farm where we had established 23 Field Company officers mess in 1939 and where the OC had been billetted. An attractive teenage girl stared at me for a moment, then smiled broadly and rushed into the house. Out she came with her father who greeted me warmly "C'est pour vous, la première maison de France." They pressed me to stay "La Chambre de M le Commandant" - I had been a subaltern there before. I was able to give them some rare supplies - soap, chocolate, cigarettes - and a chicken was killed for our supper.

The next day I went on into Belgium and found that 1st Assault Brigade RE headquarters were in the throes of organizing the capture of Walcheren and other parts of the Schelde estuary to open access to the port of Antwerp. For this 5 Assault Regiment (5 Assit Regt) had taken over amphibious tracked vehicles known as Buffalces in place

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Maj Gen J C Woollett CBE MC 16 Assault Sqn Jun - Oct 1944 (p176)

of their AVRE (a good example of Sapper flexibility). Brigadier Watkinson told me that 16 Sun had been sent for and were now on the way up. I found my squadron near Leopoldsburg in Belgium, which was the limit for travel on transports requiring a Class 70 bridge. Thereafter we moved on tracks (Class 40). We moved up through Helmond and harboured in a village north of the town. This was our first time in the Netherlands, and

although we had been welcomed elsewhere, this was quite special. At the end of the day's activities the crews carried out "last parade maintenance." This involved refuelling the AVREs, checking everything and cleaning up. The cleaning of the 22 bogey wheels and springs on which the Churchill tracks ran was particularly onerous. On this occasion I found each crew being assisted by one or two Dutch children, whose small hands were well adapted to cleaning the bogeys.

The plan was now to widen the corridor, to the north, by an advance towards 's-Hertogenbosch from the east, and a dash to secure a bridgehead over the river Dommel at St Michaels Gastel by 7 Armoured Division. The problem was to get the armour over the river quickly in support of the bridgehead, and this we achieved on 24 October by towing up Bailey bridging in sledges for some ten miles behind the AVREs, and building a 60ft bridge to the south west of the village, thus enabling a squadron of Sherman tanks to get across so that the divisional engineers could construct an all-purpose Bailey on the road bridge site behind a secure bridgehead. I had selected the site from aerial photos and the approaches, which were across a field, stood up to the passage of the tank squadron before becoming too muddy. The next day we were required to carry out a similar task at Esch, a few miles to the southwest, where aerial photos had indicated that the gap in the road bridge over the river Beerge was small enough to be crossed in



Map of area covered by article.

this way. That evening the infantry attacked and established a bridgehead, but on getting down to the river I discovered that the bridge abutments were so damaged that a much larger bridge would be needed. Whilst more equipment was sent for, a working party of some 12 Sappers began to prepare the site. What followed turned out to be one of the worst nights, for the squadron, of the whole campaign. Shortly after we started work a few shells came down on the site. The divisional artillery responded by endeavouring to sound-locate the guns, and to bring down heavy fire on their positions, but without effect as the fire was repeated every 20 minutes or so. We had now acquired a Dutch liaison officer, Jerry van Hees, a nice young man but without much military background. I sent him across the river in an assault boat to contact the local resistance people to find out where the fire was coming from, and he came back with no



Buffaloes on exercise.

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AVREs of 16 Assault Squadron entering Tilburg

information but brought with him an unfortunate woman who was about to have a baby.

I walked up to the bridge site, and a shell burst between me and Captain Norman Weston, the troop commander in charge, wounding him but leaving me unharmed. By now we had had extensive casualties amongst the advance party, and had achieved nothing over several hours. With a heavy heart I spoke to the CRE 7 Armoured Division on the radio, and told him the situation. To my relief he told me that the crossing to the north at Voorburg was going well and to stop work on the Esch site. Later we found that the fire had come from a self-propelled gun which had accurately registered the bridge site from a series of embanked gun sites, moving from one to another after firing a few rounds, thus deceiving the sound locaters and avoiding the counter-battery fire.

Later the next day we moved to the south of Tilburg where 15 (Scottish) Division were preparing to attack. The three miles of road into the town from Hilvarenbeek was cratered and two bridges



AVRE with small box girder bridge mounted.

had been destroyed. The gaps were all within the capability of our assault bridges, so we built and mounted three of them. The attack started in daylight on 28 October after a short preliminary bombardment, and the leading AVRE moved up with the infantry and dropped the first bridge. The opposition was very light and soon ceased, and our AVREs began to move faster and faster to keep up with the advancing infantry. The assault bridges placed a heavy load on the front bogies, which with the distance and speed overheated and caught fire, and the second AVRE completed its task with two crew members running beside it squirting the bogies with fire extinguishers. By the time that the third AVRE was in position to bridge the gap at the start of the town, the streets were crammed with local people and, as the bridge dropped, a loud cheer went up. The commander of the reserve brigade now arrived to lead his brigade (mounted in armoured personnel carriers) after the retreating Germans. He was a tall, raw-boned Scotsman and was waving his arms and shouting "please let my brigade through" whilst being greeted enthusiastically by the local people. It took half an hour to clear the streets and the German forces got clean away. Shortly after this 15 Scottish Division left for the south of the corridor, where a German counterattack was threatened, leaving 16 Sqn the only troops in the town, I believe. We established ourselves in a small factory where a number of the local town's people came to visit us. In the course of the celebrations I proposed the toast to "Queen Wilhelmina" which was enthusiastically drunk. A Dutchman then leapt to his feet and shouted "Ladies and Gentlemen, Lloyd George", which was soon corrected amid general laughter. The next day 16 Sqn moved south for operations towards Venlo.

This pattern of operations continued throughout the winter. Instructions were received to report to a divisional headquarters where one met the CRE and was given an outline of the plan. I was then usually taken to meet the Divisional Commander and was able to tell him of the contribution that Assault RE could make to the operation, as Assault RE capabilities were not widely known at that time. Then the equipment was ordered via 42 Assault Regiment Headquarters and was usually delivered with great speed and efficiency.

The divisional RE helped with the assembly of the equipment and the attacks duly took place. Then it was goodbye and thank you every three days during this period. I need not have worried about being left out of things after Le Harve!

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Amazon Bridge

COLONEL A P DANIELL

The following is an extract from the author's book entitled "Mediterranean Safari, March 1943-October 1994", a copy of which is held in the Royal Engineers Library at Chatham.

WEDNESDAYmorning, 10 May, still at Mignano. We had a free day: it would be the last for some time to come and was given over to chores, mainly washing clothes and writing letters. It was a lovely sunny day. Everyone needed a rest. The bridging team had practiced bridge-building a total of five times under progressively more difficult conditions, and the training throughout had gone remarkably well; the team had good reason to be optimistic. The rest of the company had been for eight nights consecutively working on improving tracks to the Rapido and were now feeling distinctly weary. There was the usual calm before the storm: everything that could be done had been done.

The following day was devoted to briefing every member of the team, sappers, fusiliers and drivers - all included, and I read out the message of the Army Commander, General Sir Oliver Leese. The briefing was done with the help of three visual aids; the first was a most excellent model of the river, including our bend and the hinterland behind it, built by John Notley almost entirely from air photos. In addition, we had sufficient vertical air photos for every man to study; and thirdly, perhaps most useful of all, we had a set of lowlevel oblique-angle air photos of the river line looking towards the Germans.

That night the team moved to a "lying up" area just behind Mount Trocchio, about a mile from the river. The whole area was surrounded by guns and was in fact a part of the "Divisional Gun Area." When I remarked upon this to some gunners while doing a recce for the team, they said, "Oh yes, we usually get plastered 'bout Wpm." Just when the team was due to arrive! Time went on, and no sign of them. I was getting very anxious when at last they arrived, about an hour late. I was in a furious temper, and ordered them to dig in immediately. However, luck was with us, and no shells came in. I drove back to company headquarters at Mignano in the early hours of the morning, tired but relieved.

Next day, 12 May, I came up with the CRE in the afternoon as he wanted to wish the Sappers luck. We were sitting on the ground, with perhaps 25 Sappers grouped round, when suddenly shells started arriving, roaring in allover the area. All we could do was lie flat, pressed to the earth and pray, while the ground shook and heaved all round. It was very frightening, one literally bit the dust trying to make oneself smaller. In two minutes it was allover; we had had 80 shells - ten rounds of gunfire - from two batteries and incredibly, not a soul was hurt except Sapper Hughes, who was sitting on the latrine and had stopped a small fragment of shrapnel. Our kit, however, motorcycles and the two trucks were riddled which we took as a good omen, and said that our luck was in.

"H" hour was at 2200hrs. Suddenly the heavens were rent open as every gun fired simultaneously. There were, it was said, 900 guns firing in the Allied barrage. The noise was quite indescribable, and the flashes made it light as day, but infinitely lurid, while nearer the river itself could be heard the continuous swish of shells passing overhead. The whole effect was to make each individual feel extremely small.

Meanwhile the German, cunning fellow that he always was, did not retreat under the barrage but instead came forward, to the line of the shingle bank of the river, with machine guns. It was originally a still night with mist hanging over the river; but to add to the general confusion, the Germans thickened up this natural mist with smoke till it was an impenetrable fog some hundred yards or more wide.

Into this thickest of "pea soup" fogs the infantry advanced on a wide front carrying their boats in good order straight towards the river. "W", or water hour, was three quarters of an hour after "H" hour. But once in the fog they were lost; some went right, some went left, and nearly all went round in circles, coming back out of the fog into unfamiliar surroundings.

Meanwhile the Germans, who could not see either, fired their Spandau machine guns intermittently into the fog as well as mortaring spasmodically all along the river. All this fire was of course unobserved and therefore not very dangerous but,



Sketch map of Amazon Bridge on 13 May 1944.

in the fog, extremely frightening. Some, very few, of the boats did get across but the infantry's main intention on landing was to get inland and seize their objectives, which they did all too easily, there being no Germans at their objectives. However, they did not clear the enemy off the far bank, nor were we able to get anybody to do this vital though invidious task, I did not want to use Sappers to do this, as we hardly had enough for our engineer tasks as it was.

Half an hour after "W" hour, I set up our bridge headquarters at the top of the approach track and at the same time the bulldozer trundled down the track to the river. This seemed to enrage the enemy, who directed all his available fire in the direction of the sound; bringing the bulldozer to a standstill, with one driver wounded but not until he had got almost to the bank. Every time he started up after that, a hail of bullets arrived. Next the Sappers arrived with the first of the lorries, but nothing could be done in that awful fog with bullets whizzing overhead: we simply had to get some men across to deal with those Spandau machine guns.

At this juncture the CRE arrived, and together we searched for some officers or warrant officers - but not one could we find, only dejected parties of infantry milling around with their boats. Meanwhile, however, Peter Boston had swum across with a rope and secured both ends to trees, passing it through the bow fairlead of an assault boat, thus making a foolproof ferry. He then found an infantry officer who raised a platoon. and promised to clear the enemy out; but they soon came back, having got hopelessly lost in the Jog.

All this time, of course, the bridging lorries had been arriving, strictly according to timetable, and were merely piling up at the top of the track. I stopped them eventually, but not until at least 20 out of the 32 had arrived. During this time Ben Chubb was able to do a bit of improvement on the track, but even that was under difficulties and several track materiaUorries were hit.

As the night wore on this state of chaos increased steadily, and to cut a long and exasperating story short, When dawn began to break absolutely nothing hadbeen achieved. The Germans must have seen or sensed our concentration of vehicles at the top of the track, for suddenly they began shelling. The following half hour was the worst, while we tried to turn the trucks around and get them out of it. Lieutenant Williams did magnificent work, finally being seriously wounded, and Sergeant Cox was also badly wounded in this jam of struggling vehicles. At this time, too, the White scout car, which was our bridge headquarters carrying wireless links to company headquarters and the CRE, received a bit of shrapnel the size of a fist through the radiator - much to the consternation of Company Sergeant Major Tutton, inside.

Things looked pretty bad; it was full daylight now, and the Germans had started putting over *minenwerfers* in salvoes of six. The river was clearly in view from the monastery, and so were we. I asked for the CRE on the wireless, explained the situation, and asked for orders; to our relief he said "Get everybody back to the lying up area." I sent the White scout car off at once and passed the word round to all the men to return individually to our field of yesterday, behind Trocchio. Finally Peter, Ben and I walked slowly back together. None of us spoke a word, our tails could not have been lower. How could it have failed after all our planning and training!

We did not know until later in the day that both the other bridges had equally failed. There was no bridge across the Rapido, and although the infantry were across and holding their objectives, the situation was very serious. On our left flank was 8th (Indian) Division. Their Sappers had also tried all night to put a Bailey bridge across the Rapido further downstream by launching it balanced on the chassis of a Sherman tank, but this also had failed.

In the original Sapper plan for Operation *Honker*, each field company was to build a bridge across the Rapido on the night of 12 May, immediately after the infantry had crossed in assault boats and secured a bridgehead. Unfortunately this bridgehead was never secured in sufficient strength to allow any of the bridges to be commenced.

Therefore, since all attempts to bridge the river Rapido on the night of 12 May had failed, the CRE decided to make an "all-out" divisional Sapper attempt to bridge the river on the next night, 13 May, employing each company in turn with the intention of getting a bridge across at all costs which would be capable of carrying tanks. The site chosen was the original site of 225 Field Company (225 Fd Coy) bridge "Amazon". The plan adopted was also 225 Fd Coy's own original plan, and Officer Commanding 225 Fd Coy -Major Robin Gabbett - was therefore put in charge of the operation. The companies were to relieve each other as each became exhausted, in the order 225 Fd Coy, 7 Field Company (7 Fd Coy) and lastly 59 Field Company (59 Fd Coy). The bridge was to be an 80ft - orthodox - double girder Bailey bridge class 40.

We were advised that due to the action of our own infantry who the previous night had taken and were still holding key positions behind the enemy lines, some half a mile or so beyond the river line, there was likely to be less effective enemy interference on the far bank. This was indeed found to be the case although enemy shell and mortar fire continued unabated.

Work began soon after 1700hrs by 225 Fd Coy on the near bank and near approach. 7 Fd Coy moved from their "lying up" area to the railway cutting, arriving about 1900hrs. 59 Fd Coy moved up next to an area behind the railway cutting, arriving at about 2000hrs. I went forward with Peter and Ben to report to Robin Gabbett at about 2030hrs; on the way I met Lieutenant Hobson of 7 Fd Coy who was just taking his men down to the bridge site to relieve 225 Fd Coy; the latter had had a difficult time owing to enemy observation in the fading light. I also met Lieutenant Severn of 225 Fd Coy on his way back from the bridge site. He told me that he had finished bulldozing and had the launching rollers in position. We then went on to report to Robin Gabbett at his bridge headquarters near the "barracks".

It was decided that I should bring 59 Fd Coy sections down to the railway cutting as each section of 7 Fd Coy went out, so as to be as near as possible to the job, and at the same time to set up my tactical headquarters in the small building opposite the advanced dressing station. On my way back I met the commander of the section of 586 Field Company RE, which was also to be available to finish off construction if necessary and to take over the bridge when complete; in the event, the section was not used. We then went back to bring up the company.

The railway cutting referred to is the subject of a sketch I drew when we were working on these tracks well prior to the battle. But it does show very clearly the extent to which the monastery dominated the whole area. It can be located on the map by reference to the two bomb craters on the railway line. Also it is interesting to note that all the sleepers of the left hand track had been broken by means of a huge ripper cutting hook dragged behind a heavy locomotive. This would have disturbed the track bed so much that the same



My sketch of the Monastery hill drawn 31 May 1944 as seen from the railway cutting waiting area behind Amazon Bridge site.

operation could not have been repeated on the track the other side.

Going back up the lane we saw the bulldozer grinding slowly across the flelds, back towards the railway cutting, with the driver walking crouched be-hind his machine. This fleld was in full view of the opposite bank and was periodically swept by fire from an enemy Spandau. When he got to the cutting I asked him how he had got on: he told me he had flnished the job, but that his blade elevating gear had been hit and put out of action. There was still a smaller D4 bulldozer on the site, which was working.

At the advance dressing station I heard bad news, that Major Mike Low - Officer Commanding 7 Fd Coy - had been hit in the legs by the same Spandau on the track just to the south of the one we had come up. Apparently he and the CRE had gone down this track to see how things were getting on; at a rather open stretch the CRE had doubled across, with Mike Low following him. Suddenly the Spandau opened up and hit Mike in both legs, whereupon the CRE carried him back up the track to the railway. From there he was taken to the advance dressing station on a stretcher, and had just left the station when I arrived.

By the time the men were down in the cutting it was dark, about 2130hrs. I left John Notley and Company Sergeant Major Tutton at my tactical headquarters to collect the men and dispatch them down to the bridge site as required. Lieutenant Bames of 7 Fd Coy then arrived and asked for a In the railway cutting waiting In the railway cutting waiting Iorries were required at the bridge site, a demand was sent over the air to vehicle control, a channel of communication which worked extremely well right

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through the job. Throughout the operation Robin Gabbett was in charge. He set up his bridge headquarters in some slit trenches just off the road behind the "barracks", and installed in it his own wireless set direct to CRE, and his company wireless set to vehicle control. He had with him his own personal runner and one or two company runners. Communication with the bridge site was originally by "walkie talkie" wireless sets, but later on the set at the bridge was damaged and communication was by runner. This chain of communication was maintained without a break throughout the night until after the tanks had gone through, in spite of bridge headquarters' quick move to a culvert under the road some 50yds away. This was when a lorry belonging to the smoke people was hit on the road beside bridge headquarters, at about 0200hrs; it immediately caught fIre and blazed furiously for about two hours, its load of smoke canisters contributing substantially to the flames, and attracting fIre from the enemy. Efforts were made to put it out, but failed effectively as it was too hot to approach. At the same time enemy shelling set fIre to some hay ricks at the top of the fleld, adding to the conflagration. Our culvert proved a nice safe place for the rest of the night.

Shortly after returning to bridge headquarters at 2200hrs, Lieutenant Hobson of 7 Fd Coy, who

was officer in charge of construction, asked me for a party to work on the far bank. Peter went down with two sub-sections of 2 Section, the remaining two sub-sections following shortly afterwards. On arrival several attempts were made to get a ferry across, but failed due to enemy snipers on the far bank. The plan to build a ferry was therefore abandoned for the time being, and Peter with his party assisted in the construction of the bridge.

By this time the launching nose was nearly finished and the bridge proper was ready to be commenced on the building rollers. This was actually delayed until all the lorries had been unloaded; there were not enough men to unload and to build at the same time, as it was not considered wise to have too many men on the site. However, due to the high shingle bank the building site was comparatively immune to small arms fire from the far bank, although the lorries were very vulnerable to mortar fire. It was therefore essential to get them away quickly, and all bar one got safely back.

Meanwhile the bridging lorries were arriving somewhat irregularly, due to the traffic regulating system having broken down so that empty lorries were meeting full ones in the narrow lanes. I dispatched John Notley to sort it out, which he did, and the remainder of the bridging lorries all arrived and were unloaded by 3 Section by about midnight.

A small incident occurred shortly before midnight which is worthy of note. One of 225 Fd Coy's lorries stuck in the narrow lane leading down to the "barracks", with broken front wheel steering, completely blocking the lane and preventing the last of the bridging lorries from getting through to the site. To clear this Peter brought the D4 bulldozer up from the bridge site, and coupled it to the front axle; after much straining and slithering, the lorry was pulled clear into a field.

By midnight the position at the bridge site was that the skeleton nose was complete, all stores unloaded, and all was ready to commence building the bridge proper. At this juncture Peter took over complete control of the building from Lieutenant Hobson of 7 Fd Coy - who still remained at the site to assist in spite of being very tired. Peter, who already had his own 2 Section and 3 Section (both of which had just finished unloading), asked for Ben Chubb and the two remaining sub-sections of 1 Section of 59 Fd Coy. Two sub-sections only of this 1 Section were available, the other two being away with infantry battalions. These two sub-sections went down with Ben to the bridge. Most of 7 Fd Coy now left the site. I was at bridge headquarters at this time, and reported probable time of completion as 0200hrs.

However this was not to be: enemy shelling and mortaring became rather more intense, and tended to be accurate. The enemy also developed a trick of firing very light flares behind the building site, which silhouetted the men against the white mist and made them easy targets for enemy snipers. I therefore called for counter battery fire, speaking direct to the CRE on the wireless, and in a very short while it came over in great strength, from 6 Army Group Royal Artillery (RA), consisting of five medium regiments and two field regiments. But at the same time a number fell short, sounding terrifyingly near; a call to "pitch them up" was immediately put through to CRE, giving the approximate bearing from whence they came. This had the desired results in a very few minutes, and no more fell short. This magnificent counter battery shoot did in fact virtually silence the enemy shelling for quite a while.

Meanwhile a large mine-clearing party of two officers and 39 sappers from 8 Field Squadron (8 Fd Sqn) of the Armoured Division, which was to follow up, arrived to clear a tank lane on the other side; but as no ferry yet existed and the other side was extremely unhealthy, we advised only a small recce party to go across at first, and for the remainder to go further back and wait. This recce party eventually crossed by the bridge; later, unfortunately, the officer stepped on a *schuh* mine and lost his foot.

At about OlOOhrs Sherman tanks were heard coming down the road, presumably expecting to cross the bridge at 0200hrs. Fearing that the noise would attract fire, Robin Gabbett asked me to try and stop them. I ran off up the road, and stopped the leading tank about 200yds off, but the damage was done, and shelling of the area increased considerably for a short while.

Meanwhile building went on steadily but slowly, due to periodical enemy interference. First of all the time of completion was amended to 0300hrs and later, out of sheer desperation, to 0500hrs. Eventually, at about 0300hrs, the bridge was pushed forward partly by hand and partly with the help of the D4 bulldozer (the D7 having long since left the field with its blade elevating gear out of action). For some time one particular Spandau on the left had been causing almost continuous interference and quite a few casualties; so Sergeant Parry of 59 Fd Coy decided to go across on the launching nose and deal with this man. He lay full length on the leading transom until it grounded, and at once ran a few yards along the bank, throwing himself on the ground to take cover. When the Spandau opened fire he got the direction and made a dash towards the spot, firing two magazines of his Tommy gun. The Spandau did not fire again, and Sergeant Parry' returned to organize getting the launching nose onto rollers. The 8 Fd Sqn recce party went across at about this time.

When the job of lifting the nose on to rollers was done and the bridge moved forward again, more Spandau bursts appeared to be coming from directly inland. Once more Sergeant Parry, but this time with Sapper Halliday, decided to go after it. They were going straight towards the Spandau when they heard cries to the right, on going to investigate they found two wounded men, an officer with his foot blown off by a schuh mine, and a badly wounded sergeant. Sergeant Parry took the officer back to the bridge on his back, while Sapper Halliday and Sapper Coombs carried the sergeant back; they were the 8 Fd Sqn recce party, Sergeant Parry' and Sapper Halliday then returned to shoot up the Spandau, which they must have succeeded in doing, as it ceased firing.

Occasional strafing from the "moaning Minni" multiple mortars continued intermittently. and about this time Peter received a lump of shrapnel in the biceps of his left arm. However, he was not at the time in serious pain and continued to take charge of the bridge.

As far as I can recollect, I recommended Sergeant Parry for a Military Medal in recognition of his courage and dedication during the launching of Amazon Bridge. But I never heard if he received it posthumously, as unfortunately he was killed a month later beyond Palombara.

The bridge was complete by 0400hrs, with only the last four bays decked, and the decking of the other four bays piled on the last bay as counterweight. Every available man plus the D4 came round to push it into position; this required a considerable effort, as it was an up-hill launch.

All went well until, with 20ft to go, the bulldozer seized up and gave out completely; both radiator and sump had been punctured some time before.

This was a major setback, as, owing to the high flood banks, the tail of the bridge was about 7ft from the ground and it was obviously impossible to push it forward manually at this height. Peter decided that our only salvation was to find a tank to come and push in place of the bulldozer. He ran off to find one while I went to the wireless set to report the delay and the action which we were taking.

Peter's report read as follows:

There was nothing further which anybody could do till we found some means of mechanical propulsion, so I ordered everyone to take cover where they could and ran off towards the area where we had previously heard the tanks taking up their positions. It was not totally dark and I could run fairly freely, and after quartering the semi-darkness for a few minutes I was exhilarated when the unmistakable black shape of a Sherman loomed up ahead of me. I fumbled my way round it, shouting I don't know what, but all the hatches were closed and there was absolutely no sign of life within. I redoubled my shouts and beat on the armour with my fist till my knuckles bled, but could raise absolutely no response. It was like a nightmare, and I felt as useless as an ant on the hide of an elephant. In desperation, I was reduced to the inanity of kicking the tank with my toecaps - a procedure which appeared to produce absolutely no noise whatever. It was agonising to have salvation so near at hand and yet to be totally unable to make myself known. They were evidently all asleep inside, and separated from me by 2in of steel. Finally I clambered up on to one of the sprocket wheels, took out my revolver, and, with the butt, beat a furious 1-2-3, 1-2-3, on the armour plate of the turret and continued this for a minute or two. Eventually, to my unspeakable relief, the driver's visor opened and I was aware of a dim light coming though from the interior and a sleepy eye regarding me. I explained our predicament, asked for his help and without a moment's hesitation the driver agreed to help us out.

I clambered on to the front and grasped the gun barrel for support and guided the tank up to the building site.

Everybody had clearly heard us coming and they were all on their feet in keen anticipation. With the aid of the tank we yanked the bulldozer unceremoniously out of the way and I guided the driver carefully up to the bridge. We applied the muzzle of the gun to the centre of the last transom. We were lucky in having a splendid driver - he took to the job as a duck to water, pushing gently at exactly the right speed and stopping and starting with great precision according to my shouted instructions.

When I got back to the site the tank had pulled the bulldozer out of the way and was slowly pushing the bridge forward. The enemy took extreme exception to this, and put down a number of well-aimed mortar rounds, causing several minor casualties. It was therefore decided not to waste time jacking down, but to push the bridge clean off the rollers onto the ground. It did in fact fall nicely on to the base plates; but the far side had to be jacked up to remove the plain rollers. Once this was done the launching nose was dismantled and the ramps were quickly built. I returned to the wireless set to report this excellent progress.

In Terence Cuneo's picture of Amazon Bridge which was commissioned by the Corps of Royal Engineers and which hangs in the the Headquarters Mess at Chatham, the figure standing on the bridge is Peter Boston.

When the rollers were removed from the far end, the bridge rested simply on the shingle bank, and in fact only one of the two girders on each side was carrying the load, as it had been impossible to build a proper bank seat. The bridge therefore was not strictly a Class 40 bridge; however, as speed was so essential, it was decided to leave it in this condition and trust to luck. It did in fact hold up to a squadron of tanks and considerable traffic without showing any signs of failure. Two days later it was jacked up and correctly finished off.

Meanwhile there arose a considerable risk of the enemy staging a local counterattack and rushing the bridge, for at this time every available Sapper was working and unarmed, and there was no one available to form a covering party. Therefore Robin Gabbett, who knew the whereabouts of the infantry battalion, went off to get an infantry party as protection for the bridge. At almost exactly 0500hrs a runner arrived, rather breathless, from Peter, to say that the bridge was open. A runner was immediately sent along the road to pass this information on to the tanks and, at the same time, I reporteci "Amazon" open to traffic to the CRE. At approximately 0520hrs the 17th/21st Lancer Squadron of tanks was across.

The bridge was completed, having taken 12 hours and the whole resources of the 4th Division RE to build it. Credit is due to Robin Gabbett: for having made the plan, laid on the organization, and controlled the operation throughout; and credit is also due to Lieutenant Severn of 225 Fd Coy, Lieutenant Hobson of 7 Fd Coy, and Peter Boston of 59 Fd Coy, for their part in the actual building, which could never have been completed without their fine leadership and complete disregard for personal danger. Finally, great credit is due to a small mixed party of NCOs and men from all three companies, who worked unceasingly from the beginning to the end of the operation. Unfortunately during the night quite a number of Sappers were wounded, mostly by shrapnel from bursting mortar shells. I do not recollect how many because most of them returned in due course to the company. However, we did lose four Sappers seriously wounded by a mortar bomb which landed right in their midst and who later died from their wounds. When the bridge was finally complete Peter went off to have his arm dealt with and was sent to hospital in Bari. We did not see him again for a month or so. He had the satisfaction of seeing the bridge completed before allowing himself to be taken to a dressing station.

To: GOC 4th Division

HQ, XIII Corps 18 May 1944

Now that Cassino has fallen to your Division I would like to let you know how well I consider they have done. The assault across the Rapido was undoubtedly a most formidable undertaking, as the river, so aptly named is swift and deep and the defences were well prepared and strong. The overrunning of the enemy's position was a magnificent effort, the work of your Sappers on the second night was first class, and the building of the bridge which allowed you to pass over your tanks was a turning point in the battle. Each subsequent advance which you were asked to make has been quickly and successfully carried out. What has been achieved will long be remembered as a credit to the 4th Division.

> (Signed)SC Kirkman Lieut General Commanding

Next day, Sunday 14 May, the Germans were pushed back and the far bank of the Rapido cleared of enemy, which would allow the building of a second bridge as originally planned. So it was that John Notley, with 2 Section, as Peter Boston had not yet returned, was able to build Blackwater bridge without incident. The next two days were spent improving the track over Blackwater to join up with Route 6 beyond Cassino town.

Meanwhile fierce fighting was still raging on Monte Cassino hill, and around the ruins of the monastery, 78th Division passed through 4th Division and finally cleared the hill, linking up with the Polish Corps on Thursday 18 May. The remnants of the garrison surrendered once they were surrounded.

Infantry First? A Possible Solution

LIEUTENANT I E S NICHOLS



Lieutenant Nichols joined the Army as an adult recruit Sapper in August 1988. After serving with 59 Independent Commando Squadron he entered Royal Millitary Academy Sundhurst in May 1991 and afterwards attended 107 Troop Commander Course. In February 1993 he was posted to 38 (Berlin) Field Squadron where he served as the last Berlin Field Troop Commander, and is now Squadron Operations Officer, 28 Engineer Regiment.

AFTER the rigours of 107 Troop Commander Course, I was posted to 38 (Berlin) Field Squadron, Following eight months at Chatham studying the intricacies of field engineering. I had expected to reach Germany and begin the process of learning my trades as a Royal Engineer troop commander.

It soon became apparent that the amount of engineering I was to be involved in would be minimal and that the majority of my time would be spent either on attachment or on exchange training. Initially I viewed this with some trepidation as I found it sufficiently taxing attempting to understand the "black arts" of my own Corps in my own army, without considering the problems of other arms or nations. However, after commanding my troop on exercise I was beginning to gain confidence and looked forward to the undoubted finale which was an attachment for my troop as a rifle platoon to bat Battalion The Queen's Lancashire Regiment (IQLR) for exercise Grand Prix I in Kenya.

Prior to deployment there was a brief period of work-up training which served to refresh us in the infantry role and provide a short introduction into the methods and personalities of 1QLR. After a final stint of kit issues, injections, health briefs and general orientation lectures we departed on 28 October 1993.

On arrival at Nairobi, we quickly moved to Nanyuki. The intention was to separate the exercise into four distinct packages, these each taking place at one of several outstations. Prior to the beginning of the first package we undertook a three-day period of acclimatization at Mpala Farm, in a somewhat barren landscape approximately 80km (or three hours by vehicle) north of Nanyuki. Low level basic tactics were revised and adapted for use in the Kenyan climate and terrain. The severity of the Kenyan climate and terrain. The severity of the Kenyan climate and the problems of personal and troop administration in what, in places, was little more than a desert!

Suitably worried by horror stories of dehydration and over friendly but underfed wildlife, we departed for Archer's Post, which, in relation to Mpala Farm at 10,000ft above sea level, is some 6000ft lower and frequently up to 10°C botter. It is recorded as one of the bottest places on earth with temperatures commonly approaching 40°C and was intended as the initial exercise area to be used for the battalion live firing exercise.

The package was designed as a tactical exercise and involved platoons and companies being tasked according to a battalion plan. After a companyorganized march-in of approximately 15km (fortunately by night) we underwent vehicle anti-ambush drills, preparation of a company defensive position, foot anti-ambush drills, a company in defense night shoot, a company deliberate attack by day

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and by night, battalion route clearance and culminating in a battalion level deliberate attack by day and finally at night. All operations during this phase used live ammunition and battalion level operations used battalion assets such as mortar and sustained fire combined with All Arms support from engineers and artillery. The majority of my troop had little experience in terms of live firing and what experience there was stopped at section level. To experience such operations at first hand and see the reality of All Arms theory at that level, was extremely valuable both for myself and my men as it served to demonstrate what we had only previously been taught in classrooms.

From Archer's Post we moved onto company field firing at Mpala Farm. Here we undertook section and troop ambush shoots, combined with section in defence and various close quarter battle (COB) shoots, which served to clarify further the lessons which had been learned at battalion level. Towards the end of this package, I had the opportunity to "remove" commanders thus allowing subordinates the chance to experience the job from a higher level. This resulted in lance corporals commanding sections and sappers acting as 2ICs, again using live ammunition throughout. This enabled the original commanders to view all operations and supply a valuable "critique" afterwards, resulting in promising, up and coming soldiers obtaining worthwhile practical experience for the future.

Next we had the opportunity to undertake some adventurous training. The main options on offer were an attempt on Mount Kenya at 17,000ft,a trek through the Aberdare National Park to assist with map and wildlife surveys, or a water sports holiday at Lake Naivasha involving canoeing, with elephant and hippopotamuses and general close exposure to wildlife.

This was followed by possibly the most interesting package of the tour - jungle training, which took place in the foothills of Mount Kenya in what was officially termed primary jungle but what was discredited by "experts" as a "spot of camping in the woods". The package included a brief introduction to jungle warfare skills in a hastily constructed jungle school consisting of a freshly hacked clearing, a waterproof canopy for instructors, and various designs of log seating. Here we covered techniques ranging from individual skills such as navigation, to drills for operations such as the halftroop strength camp attack. After instruction we then proceeded onto a live firing package which ranged from individual CQB up to the awesome camp attack otherwise known as the "predator" shoot (as in the film where ammunition was used to create an instant jungle clearing) and sufficiently adrenaline-surging for even the most ardent "Rambo" types. The finale was a dry, platoonstrength exercise where I was assigned a mission and left to get on with it. The intention was to navigate through various tasks, including an ambush and a close target recce, culminating in the aforementioned camp attack. Here the learning curve proceeded to go wild and with live enemy on the ground the prospect of severe geographical embarrassment followed by endless guerrilla style harassment was not one I relished. Fortunately this did not happen and after an extremely wet few days the mission was accomplished.

On reflection, I value the experience highly as one of the most realistic and worthwhile training opportunities in my short career so far. In extremes of terrain and climate, we operated as an integral part of an infantry battalion which provided valuable experience for myself and my men. The level of understanding of infantry and All Arms tactics rose steadily throughout the tour. The end result was individuals trained and ready to assist in the infantry role.

In these days of cutbacks and increasing commitments, and in view of the Corps' commitment to soldiers as "infantry first", the training attachment is possibly a solution to a seemingly unsolvable problem.

Faced with the Sappers' problems of low ammunition allocations, and the requirement of training resources elsewhere, the higher priority training combined with the infantry's problems of incomplete Orbats due to manpower shortages and redundancy, why not supplement battalions with Sapper troops? This would have the effect of maximizing the training benefits of opportunities such as BATUS and Kenya and additionally would benefit the Sappers with otherwise unobtainable training and expertise.

If COs and OCs are unsure of the benefits and consider such attachments as potential "jollies" I can assure them that the work is hard and the benefit real. Any commander in search of some unique training for his men would do well to consider the option of re-enforcing his local battle group for such a tour. I am extremely grateful to have had the opportunity and can only hope that future subalterns are given similar opportunities to gain this type of valuable experience.

Bing Force

COLONEL I T C WILSON MBE MC BSc



Colonel Ian Wilson enlisted in 1942, and left the army in 1979 when he became a schoolmaster. He started rebuilding his house in 1986 and is now in the sixth year of his first five-year plan. He counts himself very fortunate in having enjoyed a life full of variety and travel.

At dawn, on 6 June 1944, two landing craft tanks (LCT) loaded with *Bing* Force, formed part of the armada of invasion vessels wallowing in choppy seas towards the Normandy coast. The 3rd Canadian Infantry Divisional Operation Order No 1 stated "... this force is to push forward ... to destroy bridges over the river Orne ...". The Force's subsequent fortunes have received scant mention in any of the accounts of the Normandy invasion. Written evidence is meagre and, after many years, memories tend to be very personal and sometimes conflicting. But the story of determination and courage deserves recording.

In February 1944, Lieut Colonel R A G Bingley, commanding the Inns of Court Regiment (Armoured Cars) was given the outline of an operation in connection with the invasion. Intelligence sources had located components of the German reserve XLVII Panzer Corps, including 21st Panzer Division which, harboured in the Forét de Cinglais, south of Caen, posed the most urgent threat to the invasion beaches, a location which was confirmed by "Ultra" (information from breaking German signal code) as late as May 1944. The river Ome, and its tributary the river Odon, ran between that location and the beachheads; it was suggested that the bridges across these rivers could be destroyed by a small force dashing inland from the coast. A comparison would perhaps be an enemy landing on the south coast of

England with demolition targets on the river Medway. The force would have to be small because landing craft space was at a premium and, in any case, speed, stealth and surprise seemed to offer better chances of success than sheer strength.

There were six road bridges and two railway bridges across the Orne, one of the latter being a railway viaduct making two crossings across a loop in the river. The most distant bridge was at Thury Harcourt, some 50km from the coast, the nearest was at Feuguerolles, about 15km closer. The stretch to be covered on the river Odon included five road bridges from Ragny in the southwest, to Gavrus.

It was decided to use a single squadron only. C Squadron, Inns of Court Regiment, was reorganized into 12 half-troops, each with a Daimler armoured car and a scout car. Some of these half-troops also included a White half-track vehicle loaded with explosives, with driver and radio operator from the squadron and a Royal Engineers detachment. C Squadron reinforced by three subalterns from 112th Regiment, Royal Armoured Corps (previously 9th Battalion, the Sherwood Foresters) and five subalterns and 35 NCOs and Sappers from 72, 73 and 175 Field Companies RE, constituted Bing Force, with a small command cell from the regimental headquarters. The total strength was 24 officers and 124 rank and file. Each of the eight sites on the river Orne was allocated to one of the demolition half-troops, another

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Col I T C Wilson MBE MC Bing Force p188 was to deal with the five Odon bridges. It was not expected that return to the beachhead would be feasible so a subsequent task was to observe and report on the enemy, particularly moves of the Panzer reserves, and some halftroops were given specific areas on the far side of the river. After completing their primary task, the Sappers were to concentrate, help the destruction of the Odon bridges and carry out any other demolitions which might help to delay enemy movement, until the expected advance of Allied troops reached them. At first sight, it, seemed to be a fantastic plan with but a one-in-a-thousand chance of success: certainly it was ambitious and daring; and it caught the imagination and fired enthusiasm.

In the following months plans and rehearsed. were studied Aerial photographs, picture postcards and reports from agents had been used to produce models and maps of the landing beaches. Low-level oblique photographs of the bridges and their surrounds were made available. All these were examined, together with until known probable routes. virtually by heart, and each halftroop was thoroughly versed in its task. The problem allotted of fitting all the necessary vehicles

into two landing craft (LCT Mark IV) was solved by the regimental chaplain, J du B Lance, who confessed to some mathematical skills and then worked out a loading plan using scale models to take advantage of every square inch of space. For this work, he was rewarded with a place in the force headquarters, where he assumed the role of emergency medical officer. Since each half-troop had to be self-contained, extra storage bins were bolted on the outside of the vehicles. The armoured cars had a device called a "littlejohn" fixed to their two-pounder guns to increase muzzle velocity. All vehicles were painted black, with the white recognition star-and-circle on the tops, hence visible from the air, not from the ground.

The Sapper teams, each with a specific target, could not all use the same demolition plan. Each prepared



Sketch map to show *Bing* Force action.

and loaded for the quickest and most effective way to blow up its own particular bridge, and experimented accordingly. Early ideas of using artillery shells or aircraft bombs were soon discarded. The overall technique which evolved was to attack the abutments and at least one pier of the masonry bridges by means of the standard issue cratering equipment currently in service, while shaped charges would be used on girder bridges. "General Wades", the shaped charges in service at the time, were also loaded as spare explosives, being quick and effective for hasty demolition work. The possibility of acquiring explosives from German sources as well as for use on possible subsidiary tasks was not ignored. Actual bridges were blown up as training, both in the Tyne Valley and in the Pulborough area. Inns of Court drivers and

operators also found the demolition training of interest and became skilled at it. In turn, the Sappers sharpened their radio procedures and weapon skills.

Preparations for the actual landing were tested in two full-scale exercises, one at Strete in Devon and one near Littlehampton in Sussex. A briefing for officers, after the unit had moved into a sealed camp in the Southampton area, was made on real maps which included enemy locations. Overlays with fictitious names in Chinagraph, were used for troop briefing, and curiosity prompted at least one attempt to read the names under the Chinagraph. Eventually all was ready, and Bing Force embarked and, after a frustrating 24-hour delay, set sail for France. A half-troop commander wrote 'The human mind performs extraordinary feats and nobody aboard felt any serious doubt that the tasks - that seemed foolhardy when first explained - were achievable. There was an almost palpable feel of energy and impatience."

Bing Force was attached to 3rd Canadian Infantry Division for the landing and was scheduled to go ashore on Mike Green sector of Juno Beach, near Graye-sur-Mer, 35 minutes behind the assault by 7 Canadian Brigade. In addition to the main body, there were two *Bing* Force liaison officers. Captain Gill was to land with the Royal Winnipeg Rifles, and Lieutenant Kaye with 50 Division which was to go ashore on Gold Beach, further west. H-hour on Juno Beach had been set at 0735hrs, ten minutes later than on Gold Beach, so that the incoming tide sweeping along the coast would allow a few more inches of water over rocks. Once ashore, the half-troops without demolition half-tracks were to reconnoitre forward, clearing two routes to the river Seulles in the area of Tierceville. The other half-troops would follow closely, then those heading for the more southerly targets were to move west of the river to cross it at Tilly-sur-Seulles, while the others crossed at Creully. From these crossing points, each half-troop would act independently following its own preselected route, with variations made necessary by circumstance. A summary of the half-troops and their objectives is set out below.

At first light, the coast was visible from the sea and an Inns of Court observer noted "the beach, clear and quiet, seemed to offer every prospect of a quick getaway, a feeling of elation diluted by the realization that the Canadians had not yet landed." The rough seas caused delay; and it was not until 0756hrs that the log of a naval officer reported the assaulting infantry on Mike Green Beach. By the time the two Bing Force LCTs made their run in, the tide, which was usually high because of the wind, had begun to cover many of the beach obstacles. As the two craft surged towards the shore, all aboard were filled with a mixture of exhilaration and apprehension as they waited for the familiar crunch of keel on sand. The beach still seemed almost empty, with small groups of infantry making for the cover of the dunes. Within yards of touchdown, the left-hand LCT' struck a mined beach obstacle, then, backing off, hit at least one more by the stern. The other LCT, on the right, beached safely and

Half Troop	Commander	IC Sappers	Objective	LCT
1	Lieutenant Black	Lieutenant Pibworth	Feuguerolles-sur-Odon	LH
la	Sergeant W Wright	L Sergeant deL Evans	Odon bridges	LH
2	Lieutenant Yodaiken	not known	Grimbosq	RH
2a	Sergeant McQuistan	none	reconnaissance	RH
3	Lieutenant Sinnatt	{Lieutenant Symm	Two bridges on the loop	RH
		and	of the river Orne north	
3a	Lieutenant Shaw	Lance Sergeant?	of Thury Harcourt	RH
4	Lieutenant Reeve	Lieutenant Bridgett	Amaye-sur-Orne (widest)	LH
4a	Sergeant J Wright	none	reconnaissance	LH
5	Lieutenant Corke	Lieutenant Taylor	Thury Harcourt	LH
5a	Lieutenant Gwynne-Jones	Lieutenant Lofts	Railway viaduct over Orne	RH
6	Lieutenant Wall	not known	Railway bridge south of Feuguerolles-sur-Ome	LH
6a	Lieutenant Wigram	Lance Corporal Nicholls	Railway viaduct?	RH

Note: The role of 6a has not been recorded with accuracy. It was loaded on a different LCT' from its demolition half-track, which did not join 6a until the afternoon. It is possible that this demolition half-track was a reserve for the railway viaduct, which also might account for the junior rank of the Sapper commander. A survivor of 6a is certain that his half-troop had a demolition objective

discharged its cargo despite a partially fouled ramp. On the stricken LCT, the explosion damaged two scout cars and wounded Sergeant Pepper and Corporal Llewellyn. At attempt to drive vehicles ashore resulted in two drowned half-tracks, one being the explosives vehicle for Thury Harcourt bridge, the other, carrying the squadron reserve of petrol, rolled over and jammed under the vessel ramp. There was nothing for it but to wait for the tide to ebb, and it was some three hours later that the remaining vehicles aboard managed to struggle ashore despite a strong current in water so deep that some of the drivers wondered if they would ever see daylight again.

Inevitably, this mishap must have affected the speed off the beach for at least some of the half-troops ashore. The Sapper commander for Thury Harcourt bridge, Taylor, remembers talking to his counterpart in 5a, Lofts, before that half-troop set off; it seems that another demolition half-track was unserviceable as well. The commanding officer also managed to get ashore from the damaged LCT, and no doubt had a word with the squadron commander, Major Strakosch who had already landed safely. The first half-troops away seem to have been 3, which used the right-hand beach exit then headed westwards, and 6a which used the same exit but headed towards Graye-sur-Mer. There were two beach exits, trouble with mines in both throughout the day; however, occurred Trooper Collinge, gunner/operator in 6a armoured car wrote "... we stopped on the lateral road (behind the beach exit), I ran back to give a message to Major Strakosch, ... if this track was mined, I was lucky." Held up short of Grave-sur-Mer, 6a by-passed the town towards Banville when a wheel of the armoured car went into a slit trench and was stuck until pulled out by a tank about noon. 3a passed safely through the left exit and was stopped on the lateral road by Lieut Colonel Bingley when the armoured car was hit by the enemy, killing the driver, Dixon, and wounding the operator, Carr, and the commander, Shaw, who lost his left leg and was taken back to the beach, but died of his wound.

As they came ashore from the damaged LCT the halftroops hastened to catch up those that had already started. The scout car from 5 lost a wheel on a mine at the lefthand exit, this left the commander, Corke, with only his armoured car since his demolition half-track was still waterlogged; from his subsequent movements it seems that he had been given a modified role already. Finding the exit on the right blocked, 4 moved to the left-hand one, the demolition half-track roared through, the scout car following hit a mine and lost its rear suspension, fortunately without casualty. The commander, Reeve, in his armoured car, returned to the first exit, got clear this time and rejoined the half-track. The Sapper commander in la, deL Evans, remembers doing some mine-clearance on a beach exit before proceeding inland.

Concurrent with this activity, a report of machine gun opposition came from 3, near la Riviere and immediately following came the news that the armoured car had been hit killing the commander, Sinnatt, and operator, Hall.

Sporadic delays were caused to all half-troops by groups of enemy and frequent diversions had to be made. Working together, 1 and 4a had crossed the Seulles River near Creully and 4a was backtracking to circle around some enemy when the armoured car was fired on by a Canadian tank. Jack Wright, 4a commander, (brother to la commander, Bill Wright), and his operator, Smith were killed, the driver, Hudspith was wounded and was left in a nearby chateau. Perhaps the tank commander can hardly be blamed for firing on a half-seen, black armoured vehicle coming towards him, but it was a tragic mistake.

This news was received by 4 commander, Reeve, as he was taking in the scene looking down on the Seulles valley from Tierceville, and seeing the flashes of enemy artillery on the rising ground beyond the river. Almost simultaneously, came a report of enemy contact at Villiers-Ie-Sec, and soon after Reeve noticed that the commanding officer apparently decided to override the brief that half-troops were to act independently. 6a armoured car operator, Collinge, then on the road approaching Villiers-Ie-Sec, wrote "I was in action, firing like mad at enemy transport while down my earphones was the CO bellowing 'will you give me that bloody information." What he thought of my request to get off the air as we were too busy. I never knew." 4, 5a, 6a and 5 (briefly) were operating together in this area. 4 and 6a moved northwards to bypass the enemy in Villiers-Ie-Sec, they drove along a farm track in close country when machine gun fire was opened on them. Instant reaction turn right, traverse left, smoke, open fire with their own machine gun and reverse gear - proved effective for 4 armoured car, but a shell touched the tip of the twopounder and caused the turret to spin wildly. Shortly afterwards 4 enlisted some help in locating enemy from some Green Howards of 50 Infantry Division who had landed on Gold Beach

There had been no aircraft activity inland, no enemy planes had posed any threat, none in fact had been seen. It was alarming, therefore, in the late afternoon, to be attacked by United States Air Force Thunderbolts, obviously unaware that the small group of black vehicles, now grey with dust, were friendly - the white stars, yellow silk panels and yellow smoke all failed to stop the cannon shells. The half-troops near Villiers-Ie-Sec were then told to wait for further orders. It was around this time



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Capture of Tilly-sur-Sculles. Royal Engineers with the 1st Dorsets, 211st Brigade, clearing mixes from the main street in Tilly-sur-Sculles when the town was occupied by Bonish Tricops. 19 June 1944 Photograph contress of RE Library.

that Collinge in 6a remembers being joined by the demolition half-track with Nicholls, he also mentions meeting 5a and, briefly, 1a before it made its way eastwards. Then, towards dusk, 2, 4 and 6a were told to reconnoirre to the Bayeax-Caen railway line where enemy movement, with all the signs of hasty positioning was observed in the vicinity of Bassy. On reporting back, all half-troops were ordered to halt for the night. 2, 4, 5a and 6a harboured near the main Bayeax-Caen road, 1a further cast. On the other side of the Sculles, 1, 2a and 6 had been joined by 5 and harboured, not all together, in the area of Cully, It was some 18 hours since awakening on the LCTs and weariness made the decision to stop a welcome relief.

Dawn on D-Day+1 was misty with the promise of a glorious summer day, the instructions were to press on. Pibworth, in 1, tells of gathering wild strawberries for breakfast, and soon after glimpsing a vehicle approaching, first thought to be enemy but it turned out to be a demolition half-track on its own, which then joined 1 as it continued its advance inland. 2a, 5 and 6 half-troops' paths periodically crossed that of 1 as they moved through the close country. Enemy armour had moved to defend Caen, the opposition was hardening and periodic tank engagements were observed as Canadian armour tried to advance. The fusiest wheel change on record was claimed by 5 having gone over a mine in the face of the enemy, while 1 had the alarming experience of seeing some 50 enemy tanks heading towards if then turning to pass by, having failed to notice the British vehicles. As the day drew on, 1 and 5 were reported reaching the railway near Bronay, 2a south of the main Bayeux-Caen road halfway from Bronay to Carpiquet and 6, with 1a which had crossed the Scalles early that morning to the south of 5t Leger.

On the west side of the river Sculles, the half-troop leaders had agreed to cross the railway, make for the road numing from Bayeux to Tilly-sur-Sculles and explore several routes from there, taking separate ways to avoid being trapped together. Above and to the south came the sound of aircraft and, when 4 reached the Tilly road, there was a smouldering Bren gun carrier of the Green Howards.

4 commander wrote "We swung left onto a straight highway where there was space and light after the closed chambers of hedges. A few kilometres on we reached le Douet-Jerusalem crossroads and experienced the lift of heart and sense of fulfilment as villagers came out with flags, hidden for years, wine and Calvados. It was a memorable, tearful episode ...". 2 and 6a joined in the brief celebration, then made for Tilly while 4 took the road heading due south. Almost as they left, Thunderbolt aircraft attacked, coming down on the village leaving shattered walls and bodies. Some 3km on, 4 armoured car entered a village and found the road full of black uniformed troops moving towards it, instantaneous reaction saved it and 4 returned to Jerusalem to find a better route. 5a was there and the two half-troop leaders storped to confer, the enemy just encountered must have come from 12 Schutzstaffel (SS) Panzer Division, now reinforcing the defence. Suddenly came a cry of warning, three Thunderbolts were approaching line abreast; yellow silk recognition panels again gave no protection and rockets hit. 5a half-track with its 1500kg of explosive virtually disappeared, so did Lofts and the crew of driver. operator and four Sappers; Gwynne-Jones was killed; 4 commander, Reeve, was wounded, his driver, Pecket, was blinded and the armoured car was mined. A scout car was burning, its operator, Rogers, was wounded. The buildings around the crossrouds had either collapsed or were roofless, a sad reward for the welcome given earlier.

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Joined by Bridgett in 4 demolition half-track on the road to Tilly, 2 and 6a found themselves forced onto side roads and progress slowed in the close country. 6a was attacked by Thunderbolts when about 2km from the crossroads, mercifully without casualty even though the armoured car was hit by machine gun flre. The Seulles was crossed at Pont Roch and the two half-troops joined but were unable to move far from there, being forced at times to reconnoitre on foot. They harboured for the night to the south of Audrieu.

The third day, D-Day+2, brought no relief. Orders were to advance to the Odon at least 2 and 6a were the only operative half-troops in the Tilly area and soon ran into outposts of what seemed to be a battle group forming a fIrm line. The demolition half-tracks separated from the armoured vehicles which then pushed on. At one stage, near the outskirts of Tilly, an enemy column passed between the two armoured cars without seeing them. The half-troops moved into a copse to the south of Cristot to lie up while observing, and surprise was mutual when an enemy artillery headquarters drove into the same copse; with some persuasion an angry colonel of artillery was made prisoner. Ordered to "get him back at all costs", 2 and 6a had a brush with a roadblock on the edge of Cristot, and shortly afterwards were ambushed. Yodaiken and Wigram were killed; Newman and Collinge wounded badly, and Bown slightly. Fowler, Fuller and Bell, helped Bown who was unable to walk easily, and made their way back in the next two days and nights. Newman and Collinge crawled into a ditch where they lay for several days without food or attention until taken prisoner.

Further east, la and 6 crossed the railway, probing south and found themselves periodically in action, the former reached the outskirts of Brouay. Black and Corke, with the armoured vehicles of 1 and 5, went off to reconnoitre deeper into enemy territory, having agreed with Pibworth that the two half-tracks should move as circumstances dictated. Having been subjected to some shelling. Pibworth felt that he was too near something attractive and decided to move. He took his vehicles as far as the perimeter fence of the airfield at Carpiquet, but there too was enemy activity, and being but lightly armoured and filled with explosive, it seemed prudent to withdraw. On the way they found themselves in the midst of some enemy infantry who wanted to surrender, so they collected the weapons, pointed the prisoners in the right direction, and heard later of their safe arrival in British hands. Towards evening Pibworth met the explosive vehicle of either 3 or 3a whose demolition commander, Symm, had been wounded, not now known how, where or when.

That night the task was called off and the remnants of *Bing* Force returned to their headquarters near Villiers-le-Sec; out of the 12 half-troops, fIve were left, at least one with no vehicles.

History reveals that a part of 21st Panzer Division, in particular artillery, was already in position to defend Caen on D-Day. The armour of the division started moving later that morning. The 12th SS Panzer Division did not dare to move until dusk but then made remarkable speed; i_{P} and another reserve, the Panzer *L.ehr* Division was also ordered, that evening, to move. Those Orne bridges would have had to be demolished on D-Day for full effect. The misfortunes which beset *Bing* Force on the beach had caused vital time to be lost which could not be made up.

It remains for consideration whether an effort to press on, using darkness and speed to defeat recognition, would have enabled the half-troops to clear the enemy defensive crust during the first night, enabling them to reach their objectives. By next dawn the enemy were consolidating and, since the bridges across the Orne remained intact, reinforcements were already on their way. This prompts speculation about a possible change of orders to Lieut Colonel Bingley. He gave an interview to George McCarthy of the Daily Mirror published on 24 June under the heading - "The mission failed - magnificently". The article says the orders were to push inland to be the eves and ears of the Army - no mention of the bridge demolition role which had been the core of all briefing to the half-troops. Several survivors have commented about the colonel's demands over the air to know what was happening, and undoubtedly much useful information was passed back. No doubt he was under considerable pressure from higher headquarters for such information.

The task given to *Bing* Force would surely have been hailed as one of the epics of D-Day if it had succeeded. As it was, the attempt reflected great credit on those who were there. It had been a gallant attempt pursued with resolute tenacity. The information sent back must have been invaluable and it must have been very disconcerting to enemy morale to run across an armoured patrol deep inland, but the real worth of these factors cannot be assessed. One thing is certain, all the participants can be justifiably proud of their membership of *Bing* Force.

Footnote: The name *Bing* Force, obviously owing its derivation from the Commanding Officer Bingley, seems to have originated in Canadian... records.: It does not appear. in the Inns of Court war diaries, nor do many survivors remember, its use at the time. To add to confusion, the title is spelt Byng in two other contemporary. documents.

Reminiscences of Days with the Royal Bombay Sappers and Miners

BRIGADIER J R G FINCH OBE BA



The author was commissioned into the Royal Engineers in January 1930 and retired in 1964. After young officer training at Chatham and Cambridge, he was posted to India, serving with the Royal Bombay Sappers and Miners until December 1944 when he became CRE 4th British Division. During World War Two he served in India, Burma, then Italy and Greece.

I ARRIVED in Kirkee, 80 miles from Bombay, in March 1934, and was attached to 20th Field Company of the Bombay Sappers and Miners. First impressions were of the smell of cheap soap, in the evening the noise of crickets, and of being escorted across the parade ground on a searing hot day wearing my Wolsey helmet (the sort with which film goers will be familiar). In the Indian Army the Wolsey had been replaced by the Pith helmet except for important parades when the Wolsey was still worn by British officers and NCOs.

Field companies were 300 strong with five Viceroy's commissioned officers and three British; of the latter, one was usually on leave. A three-month attachment was served on first arrival and it was then decided whether you could stay with the Sappers and Miners or be posted to Military Engineering Services which, for some reason, was not considered so attractive a posting. I was posted to 17th Field Company, Quetta, commanded by Captain Pat Easton, the other subaltern with me was Harold Kitson.

The first major affair was that of going on manoeuvres north, towards the Afghan frontier, as part of 4th Indian Brigade. It was a desolate khaki coloured area surrounded by rocky mountains 5-6000ft high. The streams were all underground. During the manoeuvres my section, with some Royal Scots and Gurkhas, became separated from the main force and had great fun raiding the line of advance of 5th Brigade and another Sapper company attached to it. We captured its commander.

In winter we went skiing, mostly on Chiltarn, south of Quetta, but also to Gulmarg, in Kashmir, where I learnt to ski quite well. Skis were attached to one's boots with a yard long *lapthong*. The Kandahar binding had not yet reached India.

In February 1935, 17th Company moved back to Kirkee. Moves to Headquarters were never popular as troops were sent off on courses and few remained to command; and there was liable to be much interference from the Colonel Commandant. I got two months' leave to visit Tibet and climb in northern Sikkim. I went to Gyantsi to inspect the fort garrisoned by the Escort to the British Trade Agent. The Escort consisted of a company of Indian infantry mounted on shaggy Tibetan ponies. My leave coincided with a major earthquake in Quetta, killing some 20,000. On my return 17th and 19th Companies were sent there to

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Map of areas in India and neighbouring countries.

reduce two-storey barrack buildings to one in order to have enough bricks to build huts for the winter, with brick walls and chimneys to which tent roofs were added.

Quetta at that time saw a very large collection of Sapper officers, many of whom made a name for themselves in World War Two. John Cowley, I might mention, received the Albert Medal for rescuing lepers from fallen buildings (the Albert Medal was subsequently replaced by the George Cross).

In the items a field company then carried were no wireless sets or telephone equipment. Messages were sent through brigade headquarters by runner. We only had three lorries - two 30cwt transports and a workshops lorry. These were polished and cleaned a lot but saw very little use. The working transport consisted of mules (imports from Argentina), 20 to a field company, and army transport carts. Tending to the mules was much more rewarding than looking after lorries. Water supply equipment was driven by a single cylinder Petter engine weighing a ton. The water was not pumped but drawn-up by scoops on an endless chain from the well, or *karez* as the underground streams in Baluchistan are called.

On our return from Quetta, Major A Prain, known as Sandy, took over command of the company. He was a surveyor in the Royal Engineers who came to the Bombay Sappers for a period of regimental duty.

At the Centre, Colonel Hamilton was the Commandant, and Major Crawford the Officer in Charge of Workshops. Crawford had been a prisoner of war of the Turks; captured in Kut in World War One, the experience had much impaired his memory. Unfortunately he was subsequently captured by the Japanese, in Singapore, in World War Two, but somehow survived that.

Leave was normally two months a year, or if you were in a frontier section three, if the Regiment could spare you. Once in five years there was long leave (seven to nine months) to return to England and recover from the rigours of the Indian climate.

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The trouble with this was that after three months, pay changed back to British scales, which were a lot less and curtailed activities. In 1937 I went on long leave and on return was posted to 22nd Company in Kohat but with a detached section in Chitral of which I took command in January 1938.

A variety of allowances made life easy. One was for passing a test in the local language; in my case the examiner had passed the test only three months earlier, and was somewhat shaky. The language did not have a very large vocabulary and 200 words covered most needs.

At that time promotion was not based on any fixed length of service, but on vacancies when they occurred. This changed as war approached, and I became a captain at eight years' service.

I had two Mahratta sections during my time in Chitral, (a small area, the size of Wales, lying along the Afghan frontier, with some hundred peaks of 20,000ft or over), each section equivalent to a platoon. One section followed another when the relief of the garrison took place and Ratray's Sikhs were replaced by a Rajputana regiment. In August 1938, of the Mahrattas in the section I chiefly remember Ananda Jagtap who, early in the war, became a Subedar (a Viceroy's commissioned officer; normally the highest Indian rank in a unit) (I think in 21st Company when it fIrst went out to the Sudan), and also Hari Powar who was then a Lance Naik (corporal). The latter, much later in life became Group Subedar Major and Honorary Captain. Hari Powar used to come mountaineering with me and got as high as 20,000ft.

The work of the section consisted of assisting Military Engineer Services, and normal military training, and one summer we went up the Madaglasht valley to build a bridge which was later reconstructed in Chitral town. Also built was a hut of mud, rocks and wooden poles at about 13,000ffor *shikar* (hunting) and skiing.

There were a lot of very flne suspension bridges in Chitral and I enquired where the wire rope had come from. It seems it was salvaged from a project undertaken earlier in the century when, to supply the garrison at the top of the Khyber Pass, an aerial ropeway was constructed to save sending escorted supply columns up the road; unfortunately Pathans could stand on the ridges and help themselves from the containers as they passed and the ropeway was therefore dismantled.

The suspension bridge cables presented the garrison engineer with a problem; he could not

hire anybody to paint them because to do so meant hanging over gorges several hundred feet deep. Eventually I got a couple of volunteers from the Sapper and Miner section and I must say their job was a most spectacular one. They were quite happy and earned quite a bit of extra cash.

For a long time it had been the custom in Chitral to use maintenance money (received from the CRE for widening and improving the one main road in Chitra!) for other things. Eventually the CRE paid a visit and was absolutely horrified that the road had no parapet walls; driving up to Chitral had been a very frightening experience. From then on maintenance money was spent on maintenance.

In 1937, when Charles Richardson was commanding the section, a fIlm company turned up, filming *The Life of a Bengal Lancer*. They needed an escort of British troops to be fIlmed going over a pass and, as there were none in Chitra!, the Mahrattas were dressed up in topis and were used instead.

A German team also arrived, ostensibly to study high altitude wheat. In fact, judging by their subsequent report, they carried out a general survey of the country of the sort useful for German intelligence archives. Relations with them were very cordial until one unfortunate guestnight in Drosh, when towards the end of the evening somebody struck up the *Red Flag* on the piano having no sense of humour, the Germans immediately marched out.

Earthquakes were frequent in Chitral and could be heard rumbling up the valley rather like country buses; the drill was to pop outside and wait until they had passed. However, in 1938 there were different sorts of earthquakes occurring in Europe and I remember, at the time of Munich, going up to the Afghan_frontier. Not knowing what on earth had happened, I telephoned the Chitral Scout's mess to fInd out whether we had gone to war or not. A somewhat drunken reply came, "It is peace in our time."

The *Mehtar* (Ruler) of Chitral was a local maharajah who lit his palace from a generator mounted on the packing case it had arrived in, and driven by one of the streams outside the palace. When all the lights were on they showed a very attractive pink glow but were not much use for reading.

I returned to England for a two-year course of instruction in engineering in February 1939, calling in on Switzerland on the way for some

skiing, and travelling from Karachi to Marseille in three days by Imperial Airways flyingboat. The war cut short my efforts to become an E&M specialist and I returned to Kirkee in September 1940 just in time to see 21st Company marching out on its way to the Sudan. At that time the company was dressed in baggy, turn-up shorts. The idea was to turn the shorts down at night so as not to be bitten by mosquitoes. Quinine and mosquito nets were the only antimalarial precautions available.

Before the war, when an Indian went to the reserve he had two pairs of boots allocated, a size larger than the size he had worn during his regimental service. The idea was that when he got home and started running about with bare feet, the feet



Section Transport 17 Company Royal Bombay Sappers & Mineers - 1935.

would spread and when recalled he would therefore not be able to get into the size of boot originally worn.

I was always interested in the mobilization scheme. We had a sort of Russian psychosis dating from Kitchener's time, when mobilization involved marching out from India and taking up a position on the Helmand River in Afghanistan to stop the Russians coming further. Every year we had to check our indents for this move and knew exactly where to get such things as *bhoosa* (hay), for our mules. When World War Two came and the Japanese invaded Malaya and Burma, these schemes were, of course, of very little use.

In September 1940 I became second in command, of 45 Army Troops Company, then forming up. When it moved off to Malaya, I was left behind to take command of the Depot Battalion. I was promoted major which was nice but the job was very dull and hard work.

The policy of recruiting from three communities, with different religions, into the Bombay Sappers had with it the automatic corollary of preserving a balance and this was never easy. For instance, if a Mahratta blacksmith was required we often did not have one to offer, only a Sikh or a Muslim. Mechanization arrived and with it the problem of training drivers. We started with requisitioning large numbers of bicycles, through Poona contractors, and the chaps used to ride along the main road to learn a bit of road sense. Later we obtained country buses. They were not terribly reliable after a hard life, and our accident rate was fairly high.

At the end of 1941, I took over the newly raised 91 Field Company. The only battle experienced person in the unit was one NCO who had returned from the Western Desert. *Subedar* Narayan Hande had a very difficult time trying to knock some sense into really green troops who had had only six months in the training battalion; before the war two years was thought the minimum.

In March 1942 the company moved to Ranchi to join 23rd Indian Division, then forming up. Equipment was very short. For a time we had no rifles, no water pumps, and no transport except one solitary air-compressor truck. The young officers were Royal Engineers hurriedly sent out from the UK. One of them was a coal mining engineer and ballroom dancing champion of Scotland, another, an Irishman, was a metalliferous mining engineer. Whilst training in Ranchi there were all sorts of alarms and excursions such as Japanese ships

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going up the Hugli to Calcutta, or Japanese landing in Orissa province, and so on; as we still had no weapons the company was somewhat worried.

Finally, in May, we were armed and moved up to Manipur in Assam. The immediate destination by train was Dimapur, sometimes called !Manipur Road. The Ranchi/Dimapur journey by rail took eight days instead of the normal 36 hours. We had to cross the Brahmaputra at Guwahati, where we had our first encounter with a real unheard-of shambles. There were hoards of refugees murdering each other to scrounge things in order to stay alive. Weapons were lying around which had been cast aside, and there was nowhere to build a latrine as the surroundings were flooded. Latrines in the railway carriages were being used with no attention paid to what happened underneath.

We crossed the Brahmaputra in 48 hours which was quite fast going as the river was in flood and the ferry system primitive. We wandered up to Manipur Road, stage by stage, with long halts in between. At some of these halts we would find a goat train beside us with one shepherd in charge of 1000 goats. The goats were dying of thirst and hunger and the smell was absolutely terrible. Some of the troops tried to help the shepherd but really the position was hopeless. On occasion we met trains of cattle trucks evacuating remnants of the Burmese Army and refugees. I met a few prewar friends amongst these with stories to tell of the retreat.

At Dimapur we were taken to a patch of virgin jungle and told to clear it as it was our camp. I had developed malaria on the railway journey but there was no question of going to hospital. It was two weeks before I could get any treatment as priority was going to the Burmese Army. We were told that malarial trouble was due to the infected mosquitoes biting at dawn when troops went to relieve themselves during latrine time.

With the failure of the goat train to provide meat, the supply people had the idea of driving goats into Manipur over the Silchar track. This worked for a short time but as there was little for them to eat on route except dry bamboo leaves, their arrival was not an unqualified success with nothing on them to eat.

During the height of the chaos at Manipur Road, the Governor of Assam took it upon himself to visit. His railway carriage was shunted into the one siding with an end-loading ramp and this prevented incoming units unloading their lorries. It was 48 hours before a senior enough offIcer was found to ask the Governor , if he would be very kind and move on.

We moved up to Imphal in May/June 1942. The place was full of remnants of the Burmese Army, and of one of the Chinese armies that had come out with General Stilwell. Having looted Burmese post offIces and banks on the way, they had vast quantities of!useless money and would 'pay up to 1000 Burmese rupees for a bunch of bananas (an Indian rupee was then worth Is 6d, but the Burmese rupee was practically valueless).

The railway to Manipur'Road remained a bottleneck for a long time until'the Americans took it over and effected some improvement. Fortunately air supply then appeared which further improved the situation.

At Imphal we found 37 Brigade (all Gurkha), to which we were attached, at the end of 14 miles of mud road which was in a terrible condition. We tried to do something about this, laying down rubble, mostly brick from the bombed out Imphal bazaar, but the road-making came to an end when we ran out of petrol. Later, we did a bit more but the end of the monsoon season improved the situation and we went on to build a road up to Sanshak and beyond for 3-ton lorries. Sanshak was where the Paratroop Brigade fought a tough battle when the Japanese were advancing through the hills to Kohima. The battle was fought between "Finoh's Comer" and "Sheldon's Comer". Sheldon was my Subaltern on the road-building job.

The winter of 1942/43 saw the company in Kabaw valley building tracks, boats and bridges. Down Clne of our roads we saw the first Wingate expedition setting out; they "borrowed" the elephants we had working for us. With the arrival of the monsoon, we had to move back to the Shenan Ridge above Imphal. We were asked, by a brigade near Tamu, to build a perimeter of explosives and trip flares round one of their camps as a warning against sudden assault by Japanese from the jungle. Inevitably the trip wires were set off by herds of buffalo grazing round the camp at night. On another occasion we were building a flying ferry across a river and our own Hurricanes started strafing us. I believe their proper target was some 70 miles away but it was very difficult for a pilot in' the air to tell one bit of jungle from another. A IOmm bullet penetrated a tree and stuck out the other side a few inches above the head of a Sapper - I still have it. The pilot was subsequently sent to apologize.

I was recalled from Burma in J\ily1943 to go to the Staff College at Quetta. I then spent a short spell at the Centre in Kirkee, before going to Italy. While there I met again myoid orderly, Babuji More. He was a Konkani (coastal) Mahratta whose village I had visited before the war. When war broke out he was recalled from the reserve and became my orderly again. I trained him, as a driver, on my private car, a Model A Ford, and on the strength of his success in doing this, promoted him to havildar (sergeant) - I was entitled to do this as Commander of the Depot Battalion. T posted him in command of what was called a lines of communication unit (a small transport unit, for engineer purposes, being under the command of a havildar). He told me that he had been a driver, while in the Middle East, to some British generals who went to visit Stalingrad after the battle. When I asked what the country looked like, he replied that it was pretty grim.

I took command of 21 Field Company in March 1944, towards the end of 4th Indian Division's battle at Cassino. We then moved to Lanciano on the Adriatic coast. At Cassino the company's position had been very much in the front line, building Cavendish Road up the back of the "Snake's Head" (see April 1994 Journal, With 4th Indian "Batting With Bradman") Division at Cassino, and into a valley leading right into the middle of the German position and to the back of the monastery. The camp was never peaceful, with constant mortaring and shelling, and there was quite a number of casualties. At Lanciano we relieved 8th Indian Division, the CRE was Pat Kirwan, a prewar friend at Kirkee. 8th Indian moved round to Cassino, to take our place and Pat was killed by a stray shell.

Lanciano had its lighter moments even though we lived in a village in full view of German positions. We had a visit from an ENSA (Entertainments National Service Association) group and the highlight of one turn was a lady contortionist who, in the middle of her act, was hit in the foot by a stray shell splinter which the Germans had thoughtlessly shot in our direction.

11th Brigade of 4th Indian Division, had been captured at Tobruk and was being reformed; after a period, John Hunt came as its brigadier (the John Hunt who later attained world fame as the leader of the fIrst successful Everest expedition). Earlier, in the Maiella mountains, I had found him commanding a scratch force consisting of his battalion, some Household Cavalry, and mountain gunners. The field companies of 4th Indian Division used to move across for a change of occupation, and support John Hunt's force for a couple of weeks or so. Opposite us and higher up in the Maiella was an Austrian division and nothing could be done in the daytime without their seeing. We were asked to build a 40ft bridge in a fold of the ground and moved all the equipment in under darkness so that we would not be disturbed during construction. However, the Household Cavalry turned up in full daylight, marching down the road and taking up a position to defend us, as they said; of course they attracted a lot of attention and suffered casualties.

We did a lot of bridging in Italy as the number of demolitions carried out by the Germans was enormous. I don't remember a single bridge that was a straightforward piece of work. There was usually a steep slope or cramped space or something to make building really awkward. To speed up work, when bridging arrived on vehicles, we used to tie ropes to the bridging materials and then drive the lorry away leaving the rope to pull them all off. Fortunately not all German demolitions were successful, particularly when they improvised with artillery shells - these quite often failed to go off but were a sweat to dig out in a hurry.

Our fIrst advance in May was to Chieti, a beautiful town 10 to 15 miles north of Lanciano. A very warm welcome awaited us from the inhabitants who were glad that the war was now over for them. We had had no sleep for three days but nothing deterred the men of 21 Company who spent the following night sightseeing in the town. The reserves of energy the men had always amazed me; I learnt that I must not judge the availability of effort in them from the way I might feel myself.

Our advance north of Chieti was stopped and we were rerouted across Italy to the upper Tiber Valley, to hand over to a Polish division which continued the advance up the Adriatic coast.

On the upper Tiber, south of Civita Castello, we were working with a bulldozer at night to clear away German demolitions. The Germans the other side of the river could hear and tried to shell us but the area was mountainous and the bulldozer created such a tangled skein of noises, echoes and re-echoes, that they failed to pinpoint our position. Thus in war you can sometimes do what seems a doubtful job and get away with it. Yet the same night one of my Mahrattas, who had been working on the demolition, was walking back through the dark when he was knocked out by a stray shot.

We moved sideways again, when Arezzo was captured, from the Upper Tiber to the Arno

Valley. This involved building a road through cascading vineyards. I do not know what the gradient was but it was very steep and was called Jacobs Ladder. On a visit to the brigade, while in Arezzo, King George VI was driven up Jacobs Ladder and was very surprised by it.

A little incident that is worth mentioning, affecting security and use of wireless, was when a Bengal field company was working on a demolition about a mile away from us and sent an uncoded progress report giving the wrong map reference which happened to be the place where my men were working. Proof that the Germans were listening in to what was going on soon arrived in the shape of a "stonk" of shells.

In the autumn or late summer, the company moved back towards the Adriatic coast for the advance into the Po Valley. This took us to Urbino. Here I saw, on a remaining fragment of a house, a reminder of happier peacetime matters in the form of a direction for the Mile Miglia motor race; a large arrow painted on the wall pointing in the direction the race should go, over a bridge that had now disappeared!

At San Marino we learnt the value of having the sun behind us when working. We built a bridge in the morning, when the sun was rising behind us, in full view of the enemy position but without being disturbed. At sunset the Divisional Commander came into the same area and held a conference with his brigadiers. Their red tabs shining in the evening sun very rapidly attracted attention from the Germans.

The end of our time in Italy consisted of crossing the Rubicon river in the opposite direction to Caesar. We built about eight bridges for 5 Corp before a very short holiday and a move to Greece, which was heading for civil war between communists and non-communists.

In November I went with John Hunt and the advance party to Athens, to sort out what our brigade (11th Brigade) had to do. We were to occupy an area around Patras and see what was going on in the Agrinon area to the north of the Gulf of Corinth. It was about this time that Pant arrived. He was the first Indian officer posted to the field company since Bhagat (who won a VC) had left, though of course Indian commissioned officers had been in our other companies since the beginning of the war. I put him in command of the Sikh Platoon which had become a bit bobbery, and he made a very good. job of it.

down in Patras, or rather on its Settling outskirts, we found ourselves quite near the local Greek andarte headquarters. They, of course, were communist. We sent an invitation to dinner in the mess and they sent us their military adviser who was an ex-Greek army officer coerced into being their military adviser and "general stooge". The night before fighting started in Athens, I was invited by the Greek andarte commander to dinner with him and some of his officers. It was quite a pleasant evening but the theme was how wonderful things had been during the German occupation and how we, the British, must leave them to get on with their affairs in their own way and not intervene.

By December I was posted as CRE of 4th British Division in Athens and had some difficulty in getting there from Patras. In fact I had to catch a boat back to Italy and then fly into Athens. I met 21 Company once after that, when they were bridging the Alikamon River. It was a very fine project on their part, but I was sorry to hear at that time that Pant had been killed when helping some Greeks to clear an old German minefield.

As an addendum I must say something about Tricia, my wife. I met her in Kirkee when I returned from long leave in 1937. She was staying with the Commissioner in Poona and visited the Royal Bombay Sappers and Miners, where her great uncle Colonel B B Russell, had been commandant in 1905. We kept in touch whilst I was in Chitral and got married the first month of the war at Barnston Church. She came with me to India on the P&O ship *Orion* in July/August 1940. We got to Bombay after a voyage of six weeks from Greenock.

In May 1942 I had to leave her in Poona when my newly raised company was moved to Ranchi. She joined me in Ranchi for a short time staying at the Mission, with the help of Elizabeth Ferrar who worked there. I was given leave from Manipur in September, to visit Poona after Philip had been born in the military hospital. On arrival I went straight into hospital with a stone in my salivary gland but, after a quick recovery, was given a little extra leave. In July 1943 I was sent to Staff College, Quetta. It took a month to get there from Burma via Ootacamund where I went to pick up Tricia and Philip. She had moved there after my last visit, and went back in 1944 after I was posted to Italy.

In late 1945 I got posted back to UK and was able to negotiate the return of my family, now including Robert, to England.
Coast Defences: Some Experiences in Peace and War

BRIGADIER M W BIGGS CBE MA CENG MICE

COAST defences to repel invaders must be almost as old as history, and for Sappers especially since Gibraltar. We see them around our coasts, in the form of Martello towers, erected against threat of invasion by Napoleon, and pillboxes from the post-Dunkirk days when we stood alone against Hitler.

Besides the actual construction of such defences, "defence electric lights" (DELs) as they were officially called, or searchlights as they were generally known, were the responsibility of the Royal Engineers before the 1939/45 war, but they were definitely <u>not</u> the favourite choice of right-minded Sapper young officers.

When 26 Young Officer (YO) Batch came down from Cambridge in the summer of 1934, I was happy to be posted to 3rd Divisional Engineers at Bulford, along with my friends Joe Powell (1) and Ken Wylie (2), (whilst my other great friends Tony Dobson (3) and Jim Gavin (4) went to field units at Aldershot). My unit, 17 Field Company, was the first Sapper unit to be mechanized, experimentally; we had lorries for GI098 equipment and Austin 7s for the officers - but we still kept our chargers just in case! One of my tasks that winter was to construct an obstacle course in the Avon valley for trials of sundry "new-fangled" motor vehicles (including the half-tracked Carden-Lloyd carrier) before the Army Council. Unfortunately it rained solidly for a week before the trials and the ground became so boggy that every vehicle got stuck except for a limbered wagon drawn by two great hairy horses - to the unconcealed delight of cavalry-minded officers, who could be seen slapping their field boots and declaring "There'll. always be a place for the horse on the battlefield!"

Alas! to my dismay, for reasons over which it is best to draw a veil, the following spring I was suddenly shifted to 4 Fortress Company, located together with the quaintly named School of Electric Lighting, at Fort Monkton near Gosport, one of the ring of old forts built to protect Portsmouth against the French. The main task here was to train and practice our sappers in the operation and maintenance of coast defence searchlights - not a great challenge. This static and tedious posting, enlivened only by a short return to the Plain to operate the searchlights at the Tidworth Tattoo, was unexpectedly ended by my being drafted with others from 4 Fortress Company to a composite coast defence unit being formed in great secrecy for service overseas.

Our destination was kept secret until after we sailed in a troopship from Southampton, when sealed orders were opened to reveal that we were bound for Egypt, with the target of closing the Suez Canal at both ends against the Italians, as soon as the League of Nations condemned their aggression against Abyssinia and authorized this action. We sailed with darkened ship and minimum lights through the Straits of Gibraltar and along the Mediterranean non-stop to Alexandria. We disembarked, unloaded our guns, searchlights and stores, while our senior officers went off in mufti to recce the sites for the searchlights at Port Said and Suez; they were welcomed by local Egyptians offering bits of land owned, allegedly, by their relatives who would sell them "verry cheap". Meanwhile in camp at Sidi Bishr, on the beach east of Alexandria, we subalterns improved the shining hour by bathing and enjoying the night life at the Phaleron, the Femina and the Excelsior, where we met up with other old friends from 26 YO Batch, Rodney Greenwood (5), Bob Rogers (6) and Gerry Duke (7), who had all come out to Egypt with anti-aircraft (M) units.

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WHENthe League of Nations failed to agree action to stop the Italian aggression, and Anthony Eden stormed out of the Assembly, it was decided to split our unit into two, with Force X being sent to Haifa and Force Y to Port Sudan. In October I moved with Force X to Haifa, where we were quartered temporarily with the Lancashire Fusiliers at Peninsular Barracks whilst new accommodation was being built for us. The Gunners set about emplacing their two 6in guns on the point near the barracks commanding the approaches to the harbour, whilst we Sappers established our pair of searchlights on the beach north of the port, where the brook Kishon (8) runs into the Bay of Acre. It was an unpleasant site, being close to the abbatoir and, isolated from the military area, indefensible against sabotage. The searchlights were housed in wooden emplacements raised on piles driven into the sands, and the power cables were carried back to the engine room in the dunes to the rear, in raised wooden conduits to keep them clear of the sea at spring high tides.

Getting bored with the static and monotonous life of operating searchlights, I volunteered to join the Trans Jordan Frontier Force, and got as far as going for an interview before the outbreak of the Arab rebellion put paid to that initiative. As there were then only two British battalions in Palestine, our unit was called upon to operate in an infantry role in support of the police and civil authorities. We were allocated a sizeable piece of northern Palestine, up to the border with Lebanon at Ras el Naqurah and including the old crusader fortress town of Acre, to control. This involved patrolling and "cordon and search" operations, such as are so familiar to our troops in Northern Ireland today, as well as facing the stones of hostile Arab crowds in the streets, which we found much more exciting than manning DELs. But in June 1936 came a signal out of the blue which completely changed my life.

MOMBASA 1936-1939

"ONE RE offr proceed forthwith KILINDINI" read the signal direct from the War Office. There were only two Sapper officers in our tiny subunit, and the other was a married captain sweating on getting home to his wife and family. Nobody knew where Kilindini was, and we had to borrow an atlas to discover that it was the port of Mombasa in Kenya. So off I went to take passage in a ship from Port Said. On the way, my train was bombed by Arabs at Kalkilyeh station, near Tulkarm, and I fired my revolver (which my father had to buy me when I was commissioned) for the first time in anger. There were 18 Jewish casualties, but the train was able to proceed to Kantara, enabling me to catch my ship.

The approach to Mombasa is dramatic and memorable, as incoming vessels sail through a gap in the foaming coral reefs to the north and south, straight towards the low cliffs on which stands the lighthouse before, almost at the last moment, turning hard to port passing parallel to the nearby cliffs and then turning to starboard through a narrow channel to enter Kilindini harbour, with the expanse of Port Reitz beyond. I sailed in on 28 June 1936 for the first of many times and found that nobody was expecting me or knew why I had come! Eventually I located the local head of the Kenya Public Works Department (PWD), an ex-naval officer, and found that he had already started on the installation of an examination battery of two 6in guns, with associated searchlights and other equipment, to make Mombasa a defended port. I assumed I had been sent to assist in this work and to provide some military expertise.

Mombasa is an island, in many respects similar to Singapore, some nine square miles in extent, and at most 50ft above sea level. It is enclosed by the mainland of Kenya, except on the east where it faces the Indian Ocean. The old town and port is on the north side, whilst the modem harbour of Kilindini, leading into the extensive enclosed waters of Port Reitz, is on the south. Arms of these two harbours meet behind the island on the west side, where Makupa Causeway joins it to the mainland and carries the vital rail, road and water pipeline connections. Being only just south of the equator, its climate is always hot and humid, with heavy rains during the *kuzi*, or southwest monsoon, from April to July, and hotter but drier in the *kaskazi*, or northeast monsoon, from October to February. The months between, with little wind, are even worse.

The site chosen for the new battery was at Ras Serani, on the most eastern point of the island, where the main lighthouse stands, and where the Portuguese once had a fort, St Joseph. It had been approved by the Overseas Defence Committee of the Committee of Imperial Defence on the recommendation of the Barry' Beach Report, written by Lieut Colonel Barry, Royal Artillery, and Captain Beach. Royal Engineers, (9) who had visited Mombasa from Aden the previous year. This site was militarily ideal, as it directly covered not only the main channel leading into Kilindini harbour, but also the channel into the old port. It also gave maximum range offshore to the elderly pieces we had to install, both dating from the turn of the century. However, it was in the most exclusive European residential area, it impinged on the golf course, and the local Indians were accustomed to taking the evening air on the headland itself. Restrictions on the height and location of any new structures which might be built were imposed for fear of interfering with the lines of sight from the lighthouse. A gunner subaltern Lieutenant (local Captain) C F Rouse, who arrived before me to raise and command a new unit to man the battery and had gone up-country, had quite rightly insisted that the African askaris must be quartered near the battery, and not two miles away in the police lines as proposed. The Governor (10) had so ruled, and the news that we were to build "an African village" beside the lighthouse made us most unpopular with the locals. Indeed Rouse had already had such a row with outraged members of the golf club that neither of us subsequently joined it.

The full project on which I then found myself working in conjunction with the PWD comprised, on the operational side, the construction and installation of:

- Two 6in guns in open concrete emplacements, with ammunitionembrasures;
- an underground magazine between the guns, together with ammunition stores and accommodation for duty gun detachments;



Coast battery at Ras Serani, Mombasa, on completion, 1937.

- two 36in high current density searchlights, in concrete emplacements;
- an engine room, with three petrol-driven Crossley engine/generators to provide electric power for the searchlights, and for the guns and their equipment;
- · a three-storey reinforced concrete building to contain:
 - a command post, with a depression rangefinder for the gams;
 - -a directing station for control of the searchlights;
 - a port war signal station for communicating with ships entering or leaving harbour;
 - a 9ft Barr and Stroud rangefinder on the flat roof,

and, on the domestic side, the construction of:

- barracks, initially for 75 African askaris, and for the families of 50 per cent of them;
- · offices, armoury, stores and other administrative buildings.

In addition, officers' and sergeants' messes for the two British officers and three British warrant officers and sergeants on the establishment of the new unit were found by the acquisition of two European houses close to the battery. The larger of these had been the residence of the Resident Magistrate, who was not best pleased at having to relinquish it to us, whilst the smaller, a bungalow had been deemed unfit for white occupancy in consequence of its close proximity to our African lines.

Work was already in progress when I arrived, under the direction of a foreman of works of the PWD, who had been an artificer in the Royal Artillery, assisted by two experienced warrant officers. Mechanist-Sergeant-Major Lawther, RE, and a quartermaster sergeant Royal Army Ordnance Corps. Most of the construction work was being carried out by direct labour, the skilled work by Indian artisans (or fundix) and the unskilled by African labourers, whilst most of the heavy excavation in the hard coral of which the headland was composed was being done by convicts from the prison in the old Portuguese Fort Jesus. A young officer in the administration, Tony Swann (11), later told me that news of the gruelling hard labour the convicts had to endure spread like wildfire among the African population of the coast, and led to queues at the district offices to pay their poll tax rather than do a stint which had previously been looked upon as a restcure in what they called "Kingi Georgei's Hotel".

The detailed plans for all the buildings on the operational side had been sent out from the War Office – presumably the Director of Fortifications and Works – and we regarded them almost like Holy Writ, until we found a few errors. For example, the gun emplacements did not allow the guns to be fired other than out to sea – if for any reason they were needed to fire inland their recoil would have struck the front apron; also, the lack of adequate drainage at the foot of the stairs leading down into the magazine resulted in the latter becoming flooded in the monsoon rains.

The domestic African accommodation was to be of simple local design, the *askaris* quarters being similar to those for the police; single storied construction, with lines of rooms 12ft square, having narrow window openings 8ft above the ground; walls made of coral blocks on concrete foundations, with roofs of Mangalore tiles rather than the then usual corrugated iron (a concession to our "African village" being in the European area). Electric light was laid on to each, with open shelters for cooking, and central concrete slabs

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with taps for washing clothes and showers. Latrine blocks with waterborne sanitation were located a short distance outside the lines. Our simple *askaris* were delighted with these "mod cons", especially the showers with which most were unfamiliar.

As soon as the two guns were mounted and their aprons and ammunition compartments finished and searchlights and their generators had been positioned and connected, it was possible to start training our embryo gunners and sappers on the equipment they had to use.

Over subsequent months the gun and searchlight emplacements were completed, and the guns test-fired successfully on full charge on 21 December 1936. The completion of the magazine however took a long time, the excavation of its deep main compartments being particularly hard; in places the convicts with their hand-tools found it impossible and explosives had to be used. There were also problems with dampness and water, despite adherence to the War Office specifications. The War Office designed shell-hoists did not work properly, but fortunately a local reserve officer, Lieutenant Ryder, redesigned them and made a simple device in the railway workshops where he was normally employed. Eventually the magazine was completed, with a thick heavily reinforced concrete roof, and a deep burster course to absorb the shock of a direct hit. All connecting cables throughout were buried as protection from enemy fire.

The last structure completed, in February 1937, was the command post with its two main inter-connected compartments for control of the guns and searchlights, and the big Barr & Stroud rangefinder on the roof.

Finally the rest of the *askaris* lines and the offices and stores were handed over by the contractor, and the whole installation received the approval of a board of officers in June.

As war became increasingly probable, with the possibility of air raids on Mombasa from Italian Somaliland, I constructed with the aid of an Indian contractor a platform on top of the highest mango tree overlooking Kilindini Docks and Harbour, from which twin AALMGs (anti-aircraft light machine guns) manned by a detachment of our *askaris* might give some protection and deterrence. It became known as "Biggs Tree", and the camp at its foot for the gun crews also took my name. Alas! my hopes of going down to posterity via local maps were dashed when, after the war, an extension of the Docks bulldozed away "Biggs Tree Camp"!

I went home on leave early in 1939, but heard that as soon as war was declared in September the battery was immediately ready for action.

MOMBASA FORTRESS | 1942-1943

I was posted to Mombasa again three years later in July 1942, this time as CRE Mombasa Fortress. Expansion of the East African (EA) Forces since the war broke out, and participation in our victorious campaign in Abyssinia (12) had resulted in my rapid promotion from subaltern to lieut colonel.

The Japanese had entered the war the previous December and had overrun Malaya and Burma; Singapore had fallen and the enemy fleet was threatening Ceylon. It was feared that if Ceylon fell, the Japanese would next attack East Africa. Our own fleet in the Indian Ocean, having suffered heavy losses, had largely withdrawn from Ceylonese waters and its main base at Trincomalee. When I arrived by overnight train from Nairobi, I was amazed to see that Kilindini harbour and Port Reitz were crowded with naval ships of all sorts and sizes from battleships and aircraft-carriers downwards. The island was alive with naval officers and ratings, and no fewer than five admirals were in process of establishing their headquarters ashore, at least temporarily.

I took over from two Commanders RE, one of whom had begun the considerable task of putting Mombasa into a state of all-round defence against the anticipated assault.

The overall strategic concept was of course to defeat any Japanese fleet advancing against the East African coast, by sea and air attack from our fleet based on Mombasa, and by land: based aircraft operating from airfields on the mainland. However, after their shattering series of victories over the British and Allied forces, the Japanese seemed almost invincible, and it was estimated that if they should defeat our fleet again and press on against the weak air opposition which was all that could then be offered, they could either attack Mombasa directly, or more likely would land forces on the coast to the north or south and assault from the land side, as they had at Singapore.

With the lessons of that disaster in mind, the plans for the defence of the fortress had been drawn up not only to strengthen the seaward and air defences against direct assault, but to counter the threat of landings elsewhere on the coast and attack from the mainland. Besides the two infantry battalions and other troops stationed as a garrison on the island itself, an infantry brigade was located at Mariakani, some 30 miles inland, in a position whence it could move rapidly to counterattack any enemy landings north or south of Mombasa, and outflank or take in the rear a land attack on the island.

Mombasa was in a state of feverish activity, with the services competing with each other and the civilian authorities for the limited resources in men and materials available for their priority defence projects. The Navy had heavy demands for buildings for shore headquarters, signal stations, temporary accommodation for ratings, and ammunition and stores of all kinds. Much of this was met by requisitioning public buildings such as schools, hotels and warehouses, but a great deal of modification was needed to meet full requirements. On the mainland to the north a leave camp was established for the thousands, of sailors off the ships, to the south an armament depot in the bush adjoining Port Reitz was being constructed. The air forces (RAP, Royal Naval Air Service, and South African Air Force) were not active on the island itself, but were developing a big new airfield on the mainland west of Port Reitz - which is today Mombasa international airport - where the South African Engineer Corps were using such giant machines as we in East Africa had never seen before.

I assumed responsibility for priority defence projects which included the following major works already started:

- replacement of the old two-gun 6in battery at Ras Serani - which I had installed in 1936/7 - by three modem 6in guns in power-operated turrets capable of 45 degree elevation, and much greater range;
- harbour defences of smaller guns, and searchlights covering both Kilindini harbour and Mombasa old port, and linked to underwater detection loops installed and operated by the Royal Navy;
- the construction of an underground combined operations room and battle headquarters at the west end of the island;
- engineer assistance to the two infantry battalions, and other troops garrisoning the island, in the construction of trenches, pillboxes, covered machine-gun posts and other field defences covering the most likely lines of enemy attack;
- accommodation works of all sorts, by modifications to existing buildings, temporary construction, and the provision of ancillaries for camps;
- development of emergency water supplies and storage facilities, against the possibility of the water pipe from the mainland being cut by enemy action;
- engineer assistance to the mobile brigade at Mariakani, by the provision of camp structures, the development of water supplies by boring, and the improvement of roads and tracks from Mariakani to points on the coast north and south of Mombasa for rapid movement to counter enemy invasion.

I also took over responsibility from the second CRE for engineer works along the East African coast from the border with ex-Italian Somaliland in the north to the Mozambique border in the south; in a previous appointment I had reconnoitred this coast extensively and reported on the most likely beaches for an enemy landing. I also became responsible for the installation of coast batteries at Tanga, Dar-es-Salaam and Zanzibar; for other minor works along the Tanganyika coast and on Zanzibar... Island, and for the chain of coast-watchers up and down the Kenya coast.

My staff included few regular_Sappers. Those who were in East Africa were mostly in the field units of the EA Engineers, a new Corps similar in composition to the King's African Rifles (KAR), with British officers. some British NCOs, and African other ranks, which had formed just before the outbreak of war, and which was expanding to provide engineer units for the EA Division then forming and preparing to move to Burma. I was fortunate in the temporary warrant officers and NCOs of my staff, officers. some of whom were East Africans with local knowledge and experience of the natives, and others from the UK; all of them were qualified in one aspect of engineering or another, and I tried to make the best use of their qualifications. Unfortunately when I arrived my DCRE was under open arrest for allegedly "forcing a sentry" during the blackout. Fortunately I was able to get an able lawyer, then Major Soskice ALS (Army Legal Services) (13) to defend him, and he was acquitted. My first adjutant was highly qualified in the design of reinforced structures, so I transferred him to planning the roof of the underground operations room, and other concrete works, and got in his place a regular_officer, Captain R A Bevan (14) who had been injured in an accident and was temporarily medically downgraded.

My dozen garrison engineers were disposed in charge of various major projects, or groups of similar projects; when a new major project arose they were redistributed to free one to tackle it. For example, soon after I had assumed my appointment, an entire British AA brigade arrived from England without any advance warning. They set about deploying their guns and searchlights on sites on the island and the mainland, mainly to give protection to the fleet in Kilindini and to the new airfield, as well as to the island. Their need for engineer assistance of all kinds to gain access to the often remote hilltop sites they naturally tended to choose, to provide water supplies, and other camp ancillaries, added a considerable extra load to our stretched resources, and required a garrison engineer to oversee the tasks.

The main considerations dominating all these disparate and scattered works was the urgent need for speed, and the dire shortage of resources. When I arrived there seemed little time to transform Mombasa into a state whereby it could defend itself, or be capable of withstanding a Japanese assault for which we had to



The East African Cape Coast in 1942, showing ports with coast defences <u>underlined</u> and points for coast watchers^{co.}

be prepared at comparatively short notice should Ceylon fall. In the event Ceylon did not fall, the Japanese contented themselves with raiding shipping in the Bay of Bengal, and the threat gradually receded.

Japanese submarines prowled around our shores. One night one surfaced in a secluded bay south of Mombasa and launched a seaplane which carried out a reconnaissance over the island and Kilindini; disappointingly the AA brigade was on "guns tight" and the plane flew away unscathed. Another submarine got into Diego Suarez harbour, after we captured it from the French, and torpedoed one of our battleships, *HMS Resolution.*

For a while we continued to labour day and night; we had unlimited unskilled manpower, but skilled men and sophisticated materials were critically short; we made best use of what we had and improvised to make up for deficiencies.

I had only one field company and one field park company EA Engineers under command, plus a company of EA Pioneers whidt provided a uniformed disciplined labour force for defence works. The field company was located with the mobile brigade, their main task being to improve their mobility against the day when the enemy might make a landing somewhere on the coast. Miles of earth roads were improved, bridges strengthened or built anew, and culverts constructed in places liable to flood or become boggy in the rains. As a normal subsidiary task they helped units of the brigade erect camp structures and took part in operations which were constantly rehearsed..

A major problem with the brigade at Mariakani was shortage of water for so many men in one inhospitable place. Several teams were boring for water and more than once struck it in reasonable quantities but, although initially potable; it soon became too saline to drink, remaining useful only as an extra supply for washing and cleaning vehicles.

The field company also prepared defensive positions covering the crossing of water obstacles on the coast road north,of Mombasa at Mtwapa Creek and Kilifi, in accordance with recommendations in a report which I had drawn up before the war, and were ready to immobilize the ferries across them if in danger of falling into enemy hands. The floating bridge across the old harbour from the island to Nyali was also prepared for demolition.

The field park company was located on Mombasa island to support the two battalions and other troops of the garrison. The principle of such engineer support is of course to encourage the infantry to do everything they can possibly do themselves, to give them a leavening of advice and help from a minimum of Sapper NCOs and skilled men, and to concentrate the majority of the skilled Sappers on those tasks which really require their skiUs. Thus the infantry dug and revetted their miles of trenches, erected the barbed wire entanglements and laid the minefields protecting their positions, with some Sapper advice and help. There was a shortage of revetting material to shore up trench sides where the soil was sandy, so we established a central "factory" for the production of brushwood hurdles, from which units drew their requirements. The Sappers, meanwhile, concentrated on the construction of concrete pillboxes and underground shelters for command posts, medical aid posts and-the like, on strengthening houses to turn them into strong points, and on emergency water supplies buried in company positions. The workshops of the field park squadron churned out defence stores for these and other projects, and their plant was kept busy moving from site to site. Compressors were in great demand, since much of the island is of coral with shallow topsoil in which to dig trenches with hand tools.

An interesting and unusual group of specialists also under my command was a dozen European miners, with their native assistants, recruited mainly from the Kakamega gold fields, to carry out tunnelling work connected with the combined operations and battle headquarters. Here a deep rectangular hole had been hacked out of the rock for the operations room itself, a large chamber which was to have a reinforced concrete roof: although the shortage of cement was delaying progress with that. Leading off this some of the miners were engaged in tunnelling a network of smaller chambers for use as offices and stores, with inter-communicating passages and alternative exits by shafts to the surface behind.

Other miners were sinking shafts behind the cliff face overlooking the vital Makupa Causeway linking the island to the mainland, and from these driving galleries forward to end in embrasures for machine guns to cover the causeway and its approaches. Demolition charges, kept under guard in a safe place nearby, were ready to place in chambers under the bridge in the centre of the causeway, and could be connected up in a very short time

to duplicated firing points in the cliff-chambers, through buried cables.

AALMG post. ~

Whilst we had unlimited native labour, we were very short of skilled artisans. These fundis, were drawn almost entirely from the Indian communities, especially the Sikhs. The limited number of these in Mombasa could not meet the heavy extra demand from the services, so my Chief Engineer (15) recruited reinforcements in Nairobi and sent them down. They turned out to be a mixed blessing, as many had little skill in their trades and the incentives they had been offered, to leave the safety of Nairobi and come unaccompanied by their families to potentially dangerous Mombasa, upset my local fundis. When I insisted on the new men being trade-tested I had a strike on my hands, which was only settled after facing down a mass meeting and returning the complete incompetents to where they came from.

Mombasa and its defences, 1942, showing sites of:- 1. Main coast artillery batteries and

seachlights; 2. Underground joint headquarters (under construction); 3. Defences facing

Makupa Causeway; 4. Harbour defences; 5. Headquarters RE; 6."Biggs Tree" OP and

shown'. Infantry defensive positions, and gun sites of AA artillery.

Other main shortages were of the more sophisticated materials such as cement; reinforcing bars, fabricated metal items, and other such imported things. These had to be reserved for the more important projects such as gun emplacements and pillboxes, which could not be constructed with local substitutes. Some of the common local materials could not be produced quickly enough in the quantities needed. For example, common materials used in building construction were coral blocks, cut in nearby quarries, with roofs of mangalore tiles or corrugated iron sheeting. The production of coral blocks could not be stepped up enough to meet demands, and imports of tiles from India and of corrugated iron had dried up. Even the supplies of woven coconut frond mats called makuti (similar to Malayan attap) and mangrove poles (boriti) with

٥D Oil Tanks (3) Kilindini Harbour Dock Area To Mtwapa Nyali Bridge and Malindi Mombasa , Old Harbour Nyali 2 ŝ To Tanga Likoni Fort Jesus, Form Reet TOKIWI Ras Serani Cha-..... v nlle/ h and all and a star and and OCEAN INDIAN



which the Africans of the coast build their huts, were inadequate. We were therefore forced into all kinds of expedients for roofing and cladding, for instance, we had available quantities of hessian which, when coated liberally with bitumen and well lapped, made adequate temporary roofing, whilst hessian again, with a weak cement mixture sprayed or painted on, was used extensively for walls. The Deputy Chief Engineer (16) inspired the setting up of two more "factories"; one made cement-coral. blocks and a second made best use of our semi-skilled carpenters to produce timber frames in a limited variety of shapes and sizes for temporary hutting; these were issued in "do-it-yourself kits" with instructions for erection, together with rolls of "bit-hess", to those of our clients like the AA brigade most able to help themselves.

I was summoned one day to meet the Naval Commander-in-Chief, Admiral Somerville, who had been misinformed that I was building better quarters for our FANYs (First Air Nursing Yeomanry) than were being built for the WRENs (Women's Royal Naval Service). I was able to convince him that mine were equally inferior but that they were the best we and his naval works department could manage in the circumstances: we both had complaints that natives were poking holes through the hessian walls to spy on the girls.

Complaints about the intolerable heat in our hutted hospitals, which had corrugated iron or asbestos roofs, we were able to mollify by putting secondary roofs of *makuti* on top, with an air gap between.

Although my main efforts were directed to pressing on with defensive projects in and around Mombasa, I also took over responsibility for defensive works on the coast of Tanganyika, including installation of 6in guns at Tanga and Dar-es-Salaam, and at Zanzibar, to act as examination batteries for those harbours. Work was proceeding smoothly in all these places, although some difficulty was experienced with landing the guns and their associated equipment and building materials over the beach of the small island off Zanzibar harbour. selected for the battery there. We also erected a girder bridge over a small river south of Mombasa to improve direct road communication with Tanga.

My most pleasant task was visiting the lonely stations of the coast watchers on either side of Mombasa, on headlands chosen for their splendid views over possible enemy landing beaches. Each station had a lookout tower, and accommodation for the European watchers, usually two, and their African assistants; the latter's task 'was, in the absence of radio or telephone lines, to run at speed through the bush to the nearest 'phone to report enemy sightings.

Towards the end of this period, 29 Independent Brigade (17) passed through. Mombasa en route from capturing Diego Suarez to Burma, and the opportunity was taken to have an exercise with them, ostensibly to test our defences. This turned out an utter farce; the "invaders", landed from their troopships in Kilindini harbour_directly onto the island (ie inside our perimeter) and were allowed by the umpires to advance along roads without cover of any sort from the fire of our defending troops. When the umpires also ruled that they had captured Makupa Causeway intact I almost had a seizure!

In March 1943, after nine months in this interesting appointment and when the pressure was off as the situation in the Far East stabilized, our fleet returned to Trincomalee and the waters around Ceylon. I received orders to report as CRE. 11 EA Division, which was under orders to proceed to Ceylon, en route for Burma.

NOTES

- 1. Major J A Powell, who was killed when commanding a field squadron in the Western Desert.
- 2. The late Lieut Colonel K N Wylie DSO.
- 3. The late Major General A H G Dobson CB OBE Me.
- 4. Major General J M L Gavin CB CBE.
- 5. The late Brigadier H R Greenwood CBE.
- 6. The late Major R T Rogers.
- 7. The late Major General Sir Gerald Duke KBE DSO.
- 8. I Kings 18 V40; Where Elisha had the prophets of Baal slain.
- 9. The late Lieut Colonel L G Beach, whom I succeeded as CRE Dortmund in 1952.
- 10. The late Air Chief Marshal Sir Robert Brooke-Popham.
- II. The late Sir Anthony Swann Bt, who ended his career in the colonial service as Minister of Defence and Internal Security in Kenyatta's first government.
- 12. See "The Liberation of Addis Ababa" and 'The End of Mussolini's East African Empire" in the RE *Journals* of Aug 91 and Aug 92.
- Later as Sir Frank Soskice Solicitor General and Attorney General in the postwar labour government, and subsequently Baron Stow-Hill.
- 14. The late Lt Col R A Bevan.
- 15. The late Brigadier Spottiswood.
- 16. The late Colonel Denzil Meares.
- 17. Commanded by Brigadier (later Field Marshal Sir Francis) Festing.

"These Duties May Be Considered as Being Similar to Those of a Fire Brigade"¹

MAJOR J D BEAUMONT



Major Derek Beaumont first joined the Corps in 1971 as a TA Sapper before going up to Sheffield University. Troop Commander appointments in BAOR and UK led to a return to the TA for a spell as Adjutant with 71 Engineer Regiment (V). A staff job in 4 Armoured Brigade and attendance at Camberly were followed by command of 6 Field Support Squadron. A period on the staff at HQ UKLF preceded his present appointment as Second in Command of 33 Engineer Regiment (EOD). He claims the dubious distinction of never having served in a field squadron since being commissioned.

INTRODUCTION

I HAVE a distinct memory from the days of my YO course of being bussed up to Lodge Hill one afternoon, immediately after a splendid lunch, to be introduced to the mysteries of explosive ordnance disposal (EOD). Succumbing to the combined effects of food and alcohol. I was rudely awakened by a piece of blackboard chalk being bounced off my head after a well aimed throw by our lecturer. The sharp words that accompanied this assault did not cause me undue concern because it was well known that you had to be a pretty odd fish to be posted into bomb disposal, and a glittering future of combat engineering awaited me.

Twenty years of commissioned service have brought very little combat engineering in its wake, but I have, presently, the pleasure of serving with 33 Engineer Regiment (EOD). My aim in this article is to try to give something of an insight into the work of the Regiment. I hope to be able to show that EOD is something of which the Corps can be justly proud and therefore, in some small

¹The title of this article is an extract from the War Office Order of May 1940, directing the formation of Bomb Disposal Sections RE. gesture of explation I dedicate this article to that now forgotten lecturer with the accurate right arm.

A BRIEF HISTORY

I CANNOT claim to be an authority on the history of bomb disposal within the Royal Engineers and, within an article of this length, I could not anyway do justice to that story. Anyone who wishes to read a more definite history would be well advised to get hold of a copy of Major Arthur Hogben's excellent book "Designed to Kill" (available from the author at the EOD Technical Information Centre at Lodge Hill). I apologize in advance for any errors spotted by the EOD buffs, and will be happy to be taken to task over a pint in the Mess.²

In November 1938, with an eye to the likely problems in a possible conflict with Nazi Germany, the War Office suggested that unexploded bombs should be dealt with by the Air Raid Precaution (ARP) Organization, which was part of the Home Office. Not surprisingly, the Home Office demurred on the grounds that ARP

²As a precaution against this eventuality, Major Hogben kindly agreed to correct my historical notes, and I am grateful for his help. Any errors still present remain mine of course.

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personnel had no knowledge of aircraft bombs. The debate continued throu: ghout 1939, until agreement was eventuaUy :r.e:ached in October 1939 that the Army would train the Civil Defence Organization, and that this would be undertaken by the Royal Engineers. It was also agreed that the Sappers would form a number of 3-man teams to carry out the task of demolishing (sic) unexploded bombs until such time as the Civil Defence was in a position to assume the role. The Civil Defence was still not too keen on this additional responsibility and so, after further argument, the War Office reluctantly agreed to take on the task of disposing of all enemy bombs, other than those found on naval oraiT force property. On 25 May 1940 the order to form the first 109 bomb disposal sections was issued. By the end of October 1940 the bomb disposal organization had grown to nearly 10,000.

Work carried on right through the war and into the years afterward, though the numbers involved started to decline after hostil~ties ceased. Sapper bomb disposal reduced steadily until, by the late 1960s, the bomb disposal unit comprised a headquarters, a single small squadron, an electrical and mechanical troop, which looked after the specialist equipment, and a Territorial Army Specialist Team Royal Engineers. The total was less than 100 military personnel, but there was a large number of civi.lians involved in the clearance of the then current and previous military training areas all round the country. At that time the unit moved into Lodge Hill Camp near Chattenden Barracks and, because of its small size and largely static peacetime role, it became dependent on the RSME for all its administrative support. In 1973 the unit was retitled 33 Engineer Regiment (EOD).

From this low ebb, the Regiment started to expand. During the 1970s the TA element was increased in size to two EOD squadrons. In 1982 part of the regular EOD squadron accompanied the Falklands Task Force; to help overcome the gap left in the UK, and to provide for the possibility of having to replace or reinforce these troops, a second regular squadron was formed. During the 1980s two more TA squadrons were added as part of the British Army of the Rhine (BAOR) order of battle to provide EOD support along the lines of communication from the Channel ports. An EOD support squadron appeared next, to hold the growing amount of specialist EOD plant and resources. In 1988 the four TA squadrons were hived off under a newly formed TA RHQ to form 101 (London) Engineer Regiment (EOD)(V). Finally, as a result of the Gulf War, a third regular EOD squadron was created to provide for the roulement of the EOD squadron that deployed with 1 (UK) Armoured Division. Although the squadron was not required for that task, it was sent to Kuwait after the end of the war to provide the major part of the British contribution to the postwar clear up. At this stage the unit was approximately 360 military personnel.

Most of these expansions were carried out with changes to establishment and equipment tables lagging far behind the influx in soldiers, so there were often insufficient vehicles or equipment to cope with the increased numbers. In the same vein, the manpower enhancements were all RE cap badge, with no supporting elements such as REME or cooks: for all these the Regiment continued to rely on the RSME. The Options for Change reorganization of the Army was, for 33 Engineer Regiment (EOD), an opportunity to correct the many anomalies and discrepancies that had accumulated over the vears: it was agreed that the unit was to be increased to provide all the administrative functions that are needed in a field force unit. Even before this stage, however, the Regiment had outgrown the limited working space of Lodge Hill Camp, to say nothing of the problems that it was causing to the allocation of single soldiers' accommodation within Chatham Garrison. It was clear that another location would have to be found. In 1993, having had new establishment and equipment tables approved, the Regiment moved to a new home at Carver Barracks, Wimbish, as a fully independent unit with a strength of 530 all ranks.

ORGANIZATION AND WARTIME TASKS No article on a unit would be complete without the wiring diagram, see *Figure* 1. Note that the description of the subunits is now field squadron (EOD) rather than the earlier EOD squadron. This has been changed delib.erately because our squadrons, although small by comparison to a standard field squadron, now have a balanced organization and are capable of acting independently in support of an all-Arms formation, carrying out both the primary role of EOD and, if necessary, combat engineer tasks. The wartime role of the Regiment is to provide EOD support to the NATO ACE Rapid Reaction Corps (ARRC). To fulfil this task in general war we see three distinct types of battlefield EOD whilst operations are ongoing:

Ibe clearance of scatterable mines and submunitions. Army Tactical Doctrine Note 23 clearly sets out the clearance of bomblets and minelets as a task for all Arms. The only time that specialist EOD personnel might be tasked is if an attack has been effected in the divisional or Corps rear area where theaevices constitute a severe disruption to operations and there is no one else to tackle the job.

The clearance of conventional ordnance. This covers what most people think of as unexploded bombs, although these days the NATO term EOD covers all types of aerially delivered munitions including missiles and artillery shells, as well as any form of land service ammunition (LSA) that has failed to function as designed. This can be subdivided into two categories:

- where a high order detonation is acceptable, a munition can be dealt with by combat engineers. The technique is simply to'place a sufficiently large amount of plastic explosive, with initiation set, close to the warhead or the explosive fill (but without disturbing the munition in case it is waiting to catch you out) and demolish in the usuabway.
- in circumstances where it is not acceptaoleto have a high order detonation, it is necessary to call in specialist EOD troops to carry out a render safe procedure (RSP) to defuse or otherwise make the munition safe.

The clearance of chemical or biological munitions. Wherever these are found on the battlefield they require the attention of EOD specialists, as it is deemed unacceptable to have the risk of any chemical or biological agent being released. The Regiment has a biological and chemical decontamination capability exceeding that of most other units in the Army, specifically to deal with some of the "nasties" that could be used by an enemy who was not too particular in his choice of weapons.

In addition to the tasks I have already described, there are two other types of Battlefield EOD that we would expect to be involved in - the disposal of improvised explosive device disposal (IEDD); and battlefield area clearance (BAC).

Battlefield IEDD. It is well known that in peace, the Royal Logistic: Corps (RLC) deals with terrorist "bombs", or IEDs as they are more correctly described, but in Transition to War (TTW) and in General War" these become a RE responsibility. This springs from our involvement with antipersonnel mines and booby traps. Battlefield IEDD work is less



Figure '1.

sophisticated than its peacetime 'counterpart, and is part of the EOD training for RE EOD personnel.

BAC. Experience in both the Falklands Campaign and the Gulf War showed that when an army surrenders and abandons its positions and weapons, there is an awful lot of ammunition and ordnance left, behind in varying states of preparedness, as well as a large number of minefields that may have been poorly marked or not recorded at all. The ammunition that is accessible has to be collected together, rendered safe where necessary and then, disposed of.. This is a task that is not done quickly and/or easily. Some minefields are almost impossible to remove. The fact that after more than ten years, we can'still do no more than "contain" those left by the Argentinians in the Falklands, by maintaining perimeter fencing, is stark witness to the sheer scale, of the problem.

To fulfil our mission, field squadrons (EOD) are nominated to support the different UK formations earmarked for:the ARRC: 21 Field Squadron (EOD) supports 1 (UK) Armoured Division and 49 Field Squadron (EOD), with an airborne troop and a commando-trained troop. supports 3 (UK) Di'Vision. Both of these squadrons couldbegi,ven a "slice" of plant and resources support, both' specifically EOD orientated, from 22 HQ Squadron (EOD). Any non-EOD plant and resources assets needed could be allocated from the divisional field support squadron. RHQ; is structured to provide an EOD tasking and coordination cell (TCC) with divisional HQ which would work with theCRE's staff to provide specialist EOD advice. By drawing the TCC from RHQ rather than the squadron,'the squadron commander can concentrate on commanding his squadron without becoming distracted by having also to act as a part-time staff officer in the divisional HO.

The remainder of RHQ and HQ squadron would deploy if the ARRC HQ deployed: the CO would fulfil the role of EOD adviser to Chief Engineer ARRC, and HQ squadron would



Decontamination after a chemical EOD task (Ex. Scarlet Runner)

be the focus for resupplying EOD manpower or equipment to the deployed squadrons, 58 Field Squadron (EOD) has the task of providing EOD cover in the Corps rear area. Although initial deployment would be in support of UK formations, it is planned that EOD support could be made available to other national divisions of the ARRC should that be deemed appropriate.

PEACETIME TASKS

ONE of the most exhilarating things about 33 Engineer Regiment (EOD) is that there is scarcely time to worry about training for war because it has a large number of peacetime operations in which it is involved. Most of these come under the heading of "Military Aid to the Civil Power" (MACP). At any stage throughout every day, all year round, there are a total of 96 members of the Regiment at 24 hours or less notice to move (NTM) for a wide variety of operations (and this does not include all the normal guards and duties in and around barracks all units are involved in). Some of these tasks are described in general terms below, others I have omitted completely because of their sensitive nature.

Bomb Disposal Officer. The Regiment maintains a bomb disposal officer (BDO) at 30 minutes NTM at all times. Mounted in the distinctive red and white Landrover, he is liable to be called out anywhere in the British Isles (there have been calls to both the Isle of Wight and the Isle of Lewis - though not on the same day!) to investigate reports of unexploded bombs (UXB) left over from World War Two. Reports, routed via the police, may range from workmen finding a strange metal object on a building site, to a hole in the middle of a field where some elderly local can positively confirm being told by his uncle when he was a child that a bomb fell there one night during the war. All calls have to be investigated: we have dealt bravely with many CO2 gas cylinders and, yes, the Isle of Lewis was a false alarm, but there are about half a dozen real incidents a year. In case there is a requirement for engineer work to get at the bomb, we maintain a crash crew of section strength at six hours NTM to follow up with heavier equipment. In addition, we also maintain a standby BDO at three hours NTM and there have been several occasions when both BDOs have been out on different tasks at the same time.

IEDD. Although the lead on IEDD in peace is taken by the RLC, members of the Regiment may volunteer for IEDD training on the RLC Advanced IEDD Operators Course, and gain a "licence" to carry out IEDD work in peace in Great Britain. To this end two IEDD teams are maintained by 33 Engineer Regiment, one at ten minutes NTM and one at three hours NTM, which are tasked to suspect terrorist incidents within an area stretching from Harlow to Thetford, including Stansted Airport.

BAC. As well as BAC in the immediate aftermath of a conflict, there is a continuous requirement for BAC work within Great Britain:

Former Training Areas. During the Second World War many thousands of acres of land were requisitioned by the military, much of it for live firing. When it was returned to its former owners at the end of that conflict, the clearance of unexploded ordnance (UXO) was carried out to the limits of technical ability at the time, but all kinds of ancient ordnance – much of it spent but some not – can still be discovered by the use of the more sophisticated metal detectors of today.

Current Training Areas. Training areas that are still in use need regular clearance to ensure that they

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remain safe: pyrotechnic or ammunition misfires often go unnoticed in the heat of the final section attack. Change in use of parts of the training estate also creates work for us: the recent move of some aspects of the School of Infantry to Sennybridge requires the use of former artillery impact areas, and this land has to be cleared before it can be used for dry training. Alienation of the Military

Estate. Whenever military land that has been used for the storage or firing of any kind of ammunition, pyrotechnic or explosive is alienated, it has to be checked to ensure that there is no residual hazard to the prospective owner.

The outstanding work on BAC is estimated at 40 years' worth, and with the current plans to alienate large parts of

the military estate, that figure is going up rather than down! Much of the routine work is done by some 90 civilian explosive ordnance searchers (EOS) who are formed into two "troops" of three sections each. These sections are commanded by NCOs who identify and dispose of any items of UXO that are found. The EOS were originally recruited from eastern Europe refugees, mainly Ukrainians, who had no wish to return to the Soviet Union at the end of World War Two, but now the sections consist entirely of British nationals. In addition, squadron commanders plan BAC tasks into their squadron training programmes so that the military sections in the field squadrons (EOD) keep their hand in at BAC. These tasks act as excellent vehicles for troop commanders to plan and run a troop or section-size task, lasting a couple of weeks, away from the confines of Carver Barracks.

Search. The Corps has been involved in antiterrorist high risk search (HRS) in Northern Ireland (NI) for many years. In the aftermath of the Grand Hotel bomb in Brighton in 1984, it was recognized that there was also a need for a HRS capability to support the civil police in mainland Great Britain. This role came to the Regiment. In the early days it was very crude and based largely on NI experience – soldiers in green vehicles with a toolkit that came straight off the shelf of the G1098 store. Things



Bomb disposal dummy World War Two - a 1000kg Hermann made safe.

have moved on a great deal since then, both in technique and equipment, enabling searches to be carried out quickly and without the need for floorboards to be taken up or for large holes to be drilled in walls.

Nuclear Accident Response Organization. From 1 December 1993 the Regiment took over the responsibility for Royal Engineer support to the **RAF** Nuclear Accident Response Organization (NARO). This requires the unit to have a recce team on six hours' NTM and an initial response team (IRT) on 12 hours' NTM to deploy to the site of an incident, such as a road traffic accident, that has occurred during the surface movement of nuclear weapon components. The Sapper tasks are: to assist in gaining access to the site so that the weapons can be secured by the RAF and civilian scientific staff, and any contamination can be contained; to provide an emergency vehicle decontamination station (EVDS) to prevent spread of contamination when vehicles move in and out of the cordoned area; and to assist in the removal of any contaminated earth or soil to a safe location.

TRAINING

ONE of the major problems of the Regiment is the amount of additional training required, especially for the officers and senior NCOs. Even

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those who have served with the unit before usually have to be retrained because they are either out-of-date or are returning at a different management level (eg INCa to SNCO) which requires additional qualifications. There are two main types of specialist training that members of the Regiment have to undertake: bomb disposal (BD) and search. In addition, officers and senior ranks can volunteer for IEDD training. Everything else is a combination of one or more of these skills, together with good combat engineer know-how.

BD Training. Officers, warrant officers and senior NCOs who have not served the Regiment before, and who are required to become BDOs, attend the seven-week long Officers and SNCOs Advanced EOD Course at the Defence EOD (DEODS), in Lodge Hill_ Camp, School Chattenden. DEODS is a tri-service organization that trains the EOD components of each of the services, less peacetime IEDD which is run at Kineton by the RLC (IEDD for general war is taught at DEOnS but that establishment cannot award licences for UK peacetime operations); the Sappers and the RAF attend the same courses, as does the occasional naval officer or petty officer, but these latter (drawn from the Navy's clearance divers) also have their own courses which specialize in naval ordnance. For junior ranks the Class 3 BD Engineer qualification is gained from a two-week course at DEODS and, after upgrading to Class 2 within the unit, Class 1 BD Engineer comes from passing a further four-week course at Lodge Hill. Now that the Regiment is properly established there is no longer any need to follow the Regiment's previous practice of making everyone undertake EOD training.

Search Training. Many members of the Corps will have had some contact with search from tours in NI, so I do not intend to describe search training in any detail. Our RE search advisers (RESA) and RE search teams (REST) undergo the same initial training at the Counter Terrorist Search Wing (CTSW) of the RSME as do all the NI teams, but instead of the final NI Part 2 package that has traditionally ___ been run at Training SOT AT (Special Operations and Advisory Team) in Gennany, we have a rest of the world (ROW) Part 2 course which is held in Chatham. Our RES A/REST, therefore, have a ROW qualification and cannot operate in NI without completing the NI Part 2 course;

conversely, NI RESA/REST are not qualified to operate outside the province.

IEDD Training. As already mentioned, the lead agency for IEDD training is the RLC. Although wartime IEDD is covered at DEODS. the for peacetime IEDD works are requirements much more stringent. In order to give our officers and senior ranks a good chance of success we run our own in-house training, which is followed by a special DEODS course, prior to proceeding to the Advanced IEDD Operators Course at the Army School of ammunition at Kineton. The DEODS element is run by an RLC ATO on the teaching staff of DEODS, and is designed to give non-RLC candidates a thorough grounding in all the drills and skills needed, and which RLC personnel have built up through their RLC ATO training. Success at Kineton is rewarded with a licence which lasts for a specified period, normally six months, after which the operator has to re-license on a short test exercise run by 11 EOD Regiment RLC.

DEPLOYMENTS

OUR EOD speciality has the bonus that we also have a reasonable share of overseas detachments.

We still maintain a small EOD detachment in the Falkland Islands, commanded by an officer who would take command of tri-service EOD assets in the event of another conflict. As I have already mentioned, we have long since given up trying to clear the mine fields that were left in 1982 due to some members of the Regiment having lost limbs attempting to do that during the mid-eighties. The main priority now is to maintain the minefield fences and deal with any UXO that turns up in other locations.

The engineer squadron group in the former Yugoslavia also has an EOD detachment of four commanded by a young officer, which is the focus of all EOD/IEDD tasking in theatre. The detachment's role is solely in support of British forces working for the UN, rather than trying to solve the long-term problems that will be the inevitable result of a conflict of this type.

The Regiment has now started to play its part in the normal emergency tour plot (ETP) by sending a reinforced troop to NI as the roulement search troop (RST) based in Antrim. An earlier plan to give this commitment to the Regiment on a permanent basis did not come about. Instead, we will provide the RST occasionally to assist other UKLF RE units.

"THESE DUTIES MAY BE CONSIDERED AS BEING SIMILAR TO THOSE OF A FIRE BRIGADE" 215

I have already mentioned the need for BAC work on the UK ranges and training estate in order to ensure that it is safe for continued use. The same safety criteria apply to some overseas training areas and detachments have been sent to some exotic locations to carry out BAC tasks: Gibraltar and Cyprus have seen one-off tasks, but with the possibility of further work in future; for the past few years we have sent a troop to Belize for up to six weeks, and for the first time this year we are carrying out some work in Kenya, with the prospect of more to come. We would be delighted to help out in Hong Kong before the final withdrawal of British Forces, should we be asked to do so!

CONCLUSION

I HOPE that I have painted the picture of a unit that is extremely busy carrying out a range of unusual but extremely interesting and worthwhile

tasks, and I think that I am on safe ground if I claim that 33 Engineer Regiment (EOD) is the largest unit of the Army that is continuously engaged on operations. It is certainly the case that RE EOD is no longer the strange specialist world it was 20 years ago, thought to be the refuge of the even odder-than-usual Sapper.



Captain Lardner and Lance Corporal Panton dealing with a 1000kg Hermann – Walton on Thames 15 October 1993 Photograph courtexy of Mr M Drewitt of Surrey Fire & Rescue Service.

Though it is a sad fact that EOD is a growth industry, nevertheless it is gratifying that the need for EOD and its allied skills has been recognized by the Army as a whole, and the Regiment can now justly claim to have come of age and can take its proper place in the Corps of Royal Engineers.

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Two Days by the Upper Tiber

CAPTAIN E LIGHTFOOT BSc(Eng) MS(Eng) PhD MA FICE FISTRUCTE



Edgar Lightfoot graduated in civil engineering at King's College, London, in 1941, and was an assistant with McAlpine at Newcastle-upon-Tyne until March 1943, when he entered the Royal Engineers via a Royal Electrical and Mechanical Engineers' interview.

He joined 571 Army Field Company in Italy, in February 1944, at Sessa Aurunca, and left them at Brisighella in March 1945, when he joined 221 Field Company, 56 (London) Division, at Ravenna. He took his platoon up to Trieste but was posted to a works services unit at Mestre in August 1945. In January 1946 he became Garrison Engineer General Headquarters Central Mediterranean Forces at Caserta, until completing his army service in September 1946.

He returned to King's College for research, went on for two years with the City Engineer at York, two years at Huddersfield Technical College, ten at Leeds University and 26 at Oxford University. He is now an Emeritus Fellow of Pembroke College.

In August 1944 I took over a platoon of 571 Army Field Company, though not yet 24 years old and new to my second pip.

Serving as Corps Sappers, we had advanced up the Tiber Valley through Perugia, Umbertide and Città di Castello, but the company now had a new rôle, supporting three armoured car regiments – King's Dragoon Guards, 12 Lancers and 27 Lancers. We were deployed on a wide stretch between the Eighth Army and the US Fifth Army (to the west), the Lancers being required to force back experienced German mountain troops stubbornly defending approaches to the Gothic Line.

On 10 August I went on a reconnaissance with a captain of 12 Lancers, meeting him at their headquarters established in a substantial country palazzo just north of Fighille, a few miles south of the town of Sansepolcro, then enemy-occupied. Our task was to discover whether Road 73, to the northeast of Sansepolcro, could be made usable without the necessity of an excessive amount of Bailey bridging.

This presented quite a problem as it was well nigh impossible to inspect the road on foot, so we studied the map for a good observation post and a point just north of Celalba was chosen; it meant using a jeep to cross the Tiber lower down and then moving forward as inconspicuously as possible. Eventually we proceeded on foot, cautiously approaching a hilltop farm; but, was the place occupied? The final furlong was over open ground, bathed in full sunlight and we had no choice but to break cover and run for it. Clattering into the farmyard we broke rudely into an idyllic scene – old women sitting out and little children playing; the Germans had left that morning. We made a hole in a roof and soon found, through field glasses, that too many bridges had been demolished for the road to be reclaimed easily.

Upon returning to the palazzo I was shown a chalked sign "ab 31/7" on a back garden door; I thought it might mean "abfahren (ie get away) by 31 July". I thought still more about it that evening; how many days' grace would be allowed, and what after that?

Our job the next day was to clear mines from a possible ford over the Tiber on a minor road just north of Gricignano, a village well up towards Sansepolcro. With Sergeant W J Pearson and Corporal C Race, I went ahead of the men and returned to the palazzo to check it through first. Deciding to begin at the lowest level, we started in the basement which included the kitchens and a boiler room for central heating. This latter looked very ordinary, lighted by a window with a grating above. There were steps down from the back door and a passageway to the kitchens. Immediately I noticed the peculiar way coal had been stored – in long 3ft-sided wedges at the base of the walls. The

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Captain E Lightfoot Two days by the Upper Tiber p216 coal was only a surface layer, with soil beneath. In the middle of the floor a number of boards were set in a 5ft square. I felt for wires with a knife blade, then we cautiously lifted a middle board. Underneath, in all its cylindrical brass splendour, stood a J-Feder 504 timing device. Packed explosive glistened below.

I sent Sergeant Pearson to evacuate the palazzo, saying that we were going to tackle the device after 20 minutes. Corporal Race was very excited and said that he had recently been on an explosives course and could dismantle it right away. "No thanks", I said, "strict orders now; we'll follow the handbook to the letter and you're to do absolutely nothing unless I say so!" I read the dismantling instructions through twice. After 20 minutes I checked everyone was clear, then Corporal Race and I carefully removed two more boards. The timer was silent and had apparently come to the end of its run - but was it now more dangerous? - the handbook didn't say. We followed the instructions step by step and got it clear. There were no booby traps. All that remained was to remove the primer charge (about a kilo) and to replace the boards. Race was very keen to have the J-Feder so I let him take it.

I reported to the Lancer colonel that all was safe and his people could return. "Are you <u>entirely</u> sure?" he asked. "Well", I replied, "there's about a ton of explosive there, any decent Sapper with a primer charge, some priming cord and a detonator could set it off!" I suggested that he lock the door and keep the room out of bounds. He didn't look too happy, but invited me for lunch. After seeing my men I joined the Lancer officers in the palazzo. Nobody seemed much interested in the explosive incident now that it was declared safe; instead we talked of a gymkhana they would like to hold once Sansepolcro was taken, and I agreed to help with the fences.

After lunch I joined a dozen or so of my platoon in two White scout cars to go down to the ford. We went slowly through the deserted village, and towards the river found good tree cover for the cars. We then proceeded on foot looking out for *schuh* mines and for any movements ahead, especially near the river and on its far side. All was still and quiet, except for the noise of the water and the birds. With Corporal Roy E Goddard in charge, a squad started sweeping with their mine detectors, paying particular attention to the road edges where concealment is easier. The tank mines were all quite obvious, however, set in the road with bits of broken tarmac above.



Map of area covered in article.

I was well ahead when a loud explosion occurred. My first thoughts were that we'd been spotted and that this was the first of a round of mortars. But an ominous silence ensued. Everyone seemed to have taken cover. I called for them to shout out their names - then, "anybody missing?" We slowly realized that Corporal Goddard had vanished, he'd gone up on the exploded Teller mine he'd been trying to dismantle. This was our first encounter with a newly invented anti-unscrew device built into the detonators of German tank mines. We were dumbfounded. I went back to a scout car to speak to headquarters on the radio; in the circumstances permission was given for us to withdraw as there were no immediate plans for an attack across the ford. (From this time onwards we never tried to dismantle tank mines; instead we always pulled them from a safe distance with signal cable.) The following day another section cleared the rest of the mines but, to my knowledge, this ford was never used as a bridge on a nearby major road was later captured intact.

We returned dispirited to camp. A letter from home was waiting for me to say that my eldest brother* had survived a crash-landing in Burma. But I had a more difficult letter to write.

*Pilot Officer Alfred H Lightfoot was later shot down and killed (actually on 1 August 1944).

Towards Greater Stability in Europe: Reduction of Armaments Under the Terms of the Conventional Armed Forces in Europe Treaty



CAPTAIN D G BOWYER

Captain Daren Bowyer studied philosophy at Bristol before attending the Royal Military Academy, Sandhurst, and 85 Young Officer Course. As a troop commander in 34 Field Squadron, he undertook construction tasks in support of the British Army Equipment Exhibition and deployed with the Squadron on Operation Larchpole in Kenya. There followed an entirely forgettable two years as a troop commander/training officer and squadron 21C at the Army Apprentices College, Chepstow, before a posting to Nienburg as 21C 1 Field Squadron. The highlight of this tour was deployment to the Gulf on Operation Granby.

He has completed a tour of duty in the Ministry of Defence, first as SO3 to Brigadier Arms Control and latterly, following one of many reorganizations, in Military Operations 4. In March he moved to the Royal Military College of Science, Shrivenham, to attend Part 1 of the Army Command and Staff Course.

INTRODUCTION

On 16 November 1993 a milestone was reached in European security that was in many ways as significant, if not so publicly recognized, as the fall of the Berlin Wall. This important yet unheralded event was the end of the first year of the "Reduction Phase" of the Conventional Armed Forces in Europe (CFE) Treaty. There are a further two years of this phase to run.

The significance of this event lies in its being the first major test of commitment for States Party to the CFE Treaty since it entered into force, on a provisional basis at first, on 16 July 1992. For by the end of the first "reduction year" States Party were required to have met 25 per cent of their total liability to destroy or convert to civilian usage Treaty Limited Equipment (TLE). Except for Armenia and Azerbaijan, all States Party achieved this objective." In the course of the year over

⁸There were also some minor discrepancies in Russian and Ukrainan liabilities but these related to agreements made in addition to the CFE Treaty and not to their liabilities under the Treaty itself. 17,000 armoured vehicles, artillery pieces and aircraft were destroyed or converted. If the fall of the Berlin Wall was the symbol of changed Warsaw Pact intentions towards the West, then the CFE Treaty is the cornerstone of ensuring that capability has been reduced accordingly.

THE CFE TREATY

THE CFE Treaty was signed in November 1990 by 22 States Party: the 16 members of NATO, the USSR, Poland, Hungary, Romania, Bulgaria and Czechoslovakia, It sought to create a more stable Europe by establishing parity between the blocks in key armaments, and at a lower level.[#] The disintegration of the Soviet Union led to the rapid adaptation of the Treaty to include the eight successor states to the USSR's obligations under the Treaty: Russia, Belarus, Ukraine, Moldova, Georgia, Armenia, Azerbaijan, and Kazakhstan.

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[&]quot;The CFE Treaty was written as an agreement between two groups of "States Party": NATO and the Warsaw Pact. Despite the disintegration of the latter, the Treaty remains an agreement between groups of States. The term "blocks" is used throughout this article to refer to these Groups.

More recently the split between the Czech Republic and Slovakia has increased the number of States Party to 30.

The Treaty limits the holdings of each of the former blocks in the five categories of TLE: tanks, armoured combat vehicles (ACV), artillery, attack helicopters, and combat aircraft. It was for those blocks to apportion the limits amongst themselves, an exercise that had to be repeated to apportion the limits of the USSR amongst the successor states. It is possible for states within a block to reapportion the limits are sacrosanct. These limits are shown at *figure* 1. Moreover, there are further "zonal" limits imposed to prevent too great a proportion of TLE being deployed in, for example, the central region or the flanks.

In addition to imposing limits on TLE and dictating how these limits were to be achieved (which is discussed below), the Treaty is supported by an intrusive verification regime which was well described by Captain Andy Gladen in his article on the work of JACIG, *Modified Perspectives. Europe, Arms control and the RE,* published in the August 1993 *Journal.* The Treaty also requires an annual exchange of information on military forces.

REDUCTION

REDUCTIONis the formal Treaty term for the process by which States Party must decrease their holdings of TLE to the prescribed limits. Each States Party's reduction liability was set at Entry Into Force, and was calculated as the difference between its Treaty-prescribed limit and either its holdings at Entry Into Force (July 1992) or Treaty Signature (November 1990) whichever was the greater. Calculation of the UK's reduction liability is shown at *figure 2*.

Reduction may only be achieved by a method laid down in the Treaty's protocol on reduction. In brief the methods are: destruction by explosive demolition, destruction by deformation (crushing), destruction by severing, use for static display (limited number), use as hard target (limited number). Reduction activity must be notified in advance and is subject to inspection by other States Party. Again the inspection of reduction activity was well covered in Captain Gladen's article.

OPERATION ABANET

AT an early stage in the Treaty's negotiation the UK began to take decisions on how it should meet

Total holding in each block	
Tanks	20,000
ACVs	30,000
Artillery	20,000
Attack helicopters	6,800
Combat aircraft	2,000

Figure 1. CFE limits.

its reduction obligations. It was decided that the most cost-effective method for tanks and ACVs would be destruction by explosive demolition. This was to be conducted on training areas and ranges so that the resultant hulks could be used as targets. Trials were conducted to determine a method of demolition which would meet the Protocol's requirements and yet leave a usable target. Moreover the operation was to be conducted at minimum cost. Unfortunately, subsequent to that preliminary work, small but significant changes were made to the Protocol which went unnoticed and were to cause enormous last minute problems in the detailed planning of UK reduction operation, which was given the codename Operation Abanet.

When I assumed the appointment of S03 Arms Control, working to Brigadier Arms Control on the General Staff, the foundations of Operation Abanet had been laid. The trials had been completed. the method documented. ranges selected, and Regular Army Assistance Table (RAA T) tasking agreed for Royal Engineers to execute the task in four periods over the first reduction year. In November 1992 there was a degree of turmoil in the Ministry of Defence's Control organization. Arms The post of Brigadier Arms Control was abolished and General and Central Staff arms control functions were brought together in a new branch, Military Operations 4 (M04) within the Directorate of Military Operations (DMO). At this stage I took

Category	Holdings Nov90	Holdings Jul92	Limit	Reduction Liability
Tanks	1198	1159	1015	183
ACVs	3193	3206	3176	30
Artillery	636	534	636	0
Attack				
helicopters	368	389	384	5
Combat				
aircraft	842	757	900	0



Chieftain tanks awaiting destruction at Lulworth.

on responsibility for the detailed planning of Operation Abanet. At a planning meeting with the range commandants and the tasked RE unit for Operation Abanet 1/93, 22 Engineer Regiment, the discrepancies between the proposed demolition method and the requirements of the Protocol on reduction became apparent. It was also clear that the Protocol had not been negotiated by military experts, or at least not those with experience of armoured vehicles or explosives. The protocol laid down both where the charges were to be placed, and what they were to achieve: the two were not entirely compatible.

Never people to make a drama out of a crisis, it was the Corps who saved the day. Conscious not only of the importance of the task but also of its potential training value, 22 Engineer Regiment were extremely flexible and cooperative in meeting much more than their RAAT liability. They agreed to carry out further trials at the Royal Armoured Corps Gunnery School at Lulworth, which was to be the site of the first Operation *Abanet*. They were faced with a number of difficulties. Firstly they had to meet the criteria of the reduction protocol both in terms of charge placing, and in terms of effect.

Area	Tanks	ACVs
Lulworth 1/94	24	+
Castlemartin 2/94	37	12
SPTA 1/95	36	10
Otterburn 2/95	10	-
Warcop	16	

Figure 3. Future Operations Abawer to meet the remaining liability.

This inevitably meant placing several nugatory charges. Secondly, they had to take account of the requirements of the range commandants who, understandably. wanted a usable target and one that could be moved into place with the minimum of environmental damage. Destroying the tanks in their final target locations would have

required that pre-positioning of them was started weeks in advance. There would then have been the danger that they may have been prematurely damaged by over-enthusiastic gunnery students; the Treaty requires that complete assemblies are available for inspection immediately prior to destruction. It is a great credit to their expertise and flexibility of approach that 22 Engineer Regiment produced a demolition plan satisfying all these requirements and I was able to incorporate that into the Ministry of Defence Standing Instructions for the operation. I was also thankful that I was a Sapper!

By this stage it had been decided that, because of the difficulty of fitting in with busy range programmes, the UK reduction liability would be met over the entire three-year period and not, as had originally be planned, condensed into the first year. Operation Abanet 1793 was duly carried out 17-21 May at Lulworth, in the presence of a Russian inspection team. The importance of the event was marked by the presence of both BBC and ITV news teams which carried the story nationally, and most of the national daily papers. All, including the Russians, went away satisfied. Fifty Chieftain main battle tanks (MBT) and 30 Humber 1-tonne armoured personnel carriers were destroyed.

Operation Abanet 2/93, at Middle Wallop, met the UK's liability for helicopter reduction in its entirety; it was a simple operation involving the severing of the tail boom and attracted neither media attention nor an inspection team. Most recently Operation Abanet 3/93, at Stanford Training Area, reduced a further ten MBT. The remainder of the liability is to be met over the next two years as shown in figure 3.

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THE FUTURE

WITH a further two years to run, the reduction phase of the CFE Treaty has a long way to go before its aim of parity at low levels is achieved. However, the magnitude of what has been achieved already should not be underestimated. It has been suggested that the CFE Treaty had become an irrelevance before it was even ratified; that it had been overtaken by events. This is not the case. Threat consists of two parts: capability and inten-



The result of a CD14 hay rick-shaped charge on a Chieftain barrel.

tion. The Cold War was ended by a change in attitude in the Soviet leadership. The Gorbachev Doctrine, the dismantling of the Berlin Wall, Soviet acquiesence at German reunification, all gave evidence to a change in Soviet intentions. However, intentions can change almost overnight and so while the capability existed for a massive surprise attack, the so-called short-warning scenario could not be ruled out. It is the CFE Treaty that has made the biggest contribution to rendering the short-warning scenario obsolete. Without this there could have been no "peacedividend". The elimination of the threat of massive surprise attack, allows us to maintain our guard at lower levels, to be more reliant on reserves and on the provision of essential supplies from production rather than stock.

It should not, though, be assumed that the first CFE reduction year has run an entirely smooth path, nor that the remaining years will be any more free from difficulties. There are signs that the Russian military, if not the political leadership, are uncomfortable with the Treaty's intrusive verification regime: reduction, for the Russians and the successor states in particular, is expensive; the limits on TLE deployment in the flanks is a partiular cause of contention for Russia and Ukraine. This latter point deserves further consideration.

In addition to placing overall limits on each block, the Treaty divides the area of application into a

succession of zones or "doughnuts" and further limits the deployment of TLE in these. The "flanks" zone consists of Norway, Iceland, Greece, Turkey (that part which is within the Area of Application ie European Turkey), Bulgaria, Romania and the old Soviet Military Districts of Leningrad, Odessa, Transcaucasus and North Caucasus. The apportionment of limits between the successor states, established in the Tashkent Agreement, left Russia with restricted scope for deployment in these areas (most of the limit being apportioned to the new republics in the Caucasus: Georgia, Armenia and Azerbaijan). The Russian military now feels it is being unfairly penalized by this, claiming that these are areas in which it has serious and legitimate security concerns. Russia has therefore called for suspension of Article V, in which the zonal limits are enshrined. NATO has resisted this call arguing that apportionment of limits was a matter between the successor states and that it should be, if anything, the Tashkent Agreement that is renegotiated not the internationally legally-binding CFE Treaty. To open up one area for renegotiation would be to open the floodgates.

So the path ahead is not perfectly smooth, but what has been achieved already by CFE is no mean feat. It has been interesting to be part of the process, but even more so it has been good to see the Corps playing a valuable role in the progress towards greater European security.

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Addu Atoll 1993

CAPTAIN S C COWAN

Educated at Campbell College, Belfast, and briefly at Queen's University, Belfast, the author was commissioned into the Corps in December 1984. Having completed 85 Young Officer Course at Chattenden, he served as a troop commander in 21 Engineer Regiment and later in the Junior Leaders' Regiment.

A two-year subbatical in the construction industry followed and he returned to the Corps in November 1991 as a Troop Commander in 42 Survey Engineer Group. After completing 78 Army Survey Course, he was posted as Officer in Charge 2 Section, 512 Specialist Team Royal Engineers in June 1993.

ON 31 August 1993, 2 Section 512 STRE landed in the Maldives, having been tasked with carrying out a geodetic survey of the islands and atolls that constitute the present republic. The task was initiated at the request of the Maldivian government for assistance to establish a network from which the outer limits of their 200km economic exclusion zone could be determined, legally establishing the country's territorial waters. This work was carried out using absolute global positioning system (GPS) techniques. In addition, a gravity survey was carried out throughout the whole of the 170,000sq km of the Maldives, as well as checking the hydrographic office's latest series of charts of the area. As the tasks required the section to travel throughout the entirety of the country, it was only a matter of time before Addu Atoll was visited (the atoll described by Lieut Colonel M D MacLaglan MA in Addu Atoll 1943 published in the Journal in August 1993).

Addu, Foa Mulaku and Huvadu atolls are separated from the rest of the archipelago by the 85km wide One and Half Degree Channel. Addu, in turn, is separated from the other two atolls by the Equatorial Channel and is located in a commanding position at the southern extremity of the Channel. It is through the Equatorial Channel that ships which wish to navigate around southern Asia must pass, as the waters between the Maldives and Sri Lanka are too shallow and the archipelago forms a natural and treacherous barrier from the north to as far south as the Equatorial Channel.

The islands became a British Protectorate on 16 December 1887 with Britain pledging to protect them against foreign enemies in return for sovereignty. It was during the Second World War that the airstrip, described by the former CRE, Lieut Colonel MacLaglan, was built to protect Britain's strategic Indian Ocean interests. When, in 1956, the RAF closed their air base in Ceylon, a new airstrip almost 3000m long was built on the same site as the original in Gan. In 1957, with the country still a sultanate, the premier of the republic revoked a 100-year lease of the air base at Gan to the British. The RAF finally left Gan in 1970 when, as the result of a referendum, the country had adopted a republican constitution and the non-aligned government sought to preserve the Indian Ocean as a zone of peace. Since that date the superpowers have unsuccessfully expressed interest in leasing this strategically valuable piece of real estate.

As it had been decided to work progressively from north to south of the atolls (covering a total distance, north-south, of approximately 720 miles), most of the atolls had already been visited before our short stay on Addu. The islands are all very

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much as described by Lieut Colonel MacLaglan, consisting entirely of a foundation of coral, topped with white coral sand, cotton soil and vegetated with an assortment of coconut palms, banana palms, banyan, bread fruit, mango and lemon trees. Almost all of the islands are located on one end of an oval or circular-shaped coral reef and frequently have a lagoon on the leeward side. Although approximately 50 of the 1196 islands are now converted into tourist resorts, most of the islands are unspoiled and uninhabited with only 202 islands being inhabited by the indigenous Maldivian population. Most of the islands can be traversed on foot in no longer than ten minutes with few exceeding a length of more than a kilometre and a width of a few hundred metres. Foa Mulaku is the largest of the islands, being approximately 6km long and 3km wide.

The inhabited islands have a village which is normally set back from the beach, behind the outermost rows of palm trees and are, therefore, barely visible from the sea before landing. The village normally consists of one long straight road (magu) which runs from the island's main landing place, across the centre of the island to the opposite coast. Off to the sides of the main road, at right angles, are smaller lanes which, like the main road, are surfaced with nothing more than coral sand. The villagers' homes front onto the main road and their homes are almost always built on a plot of land, 15m x 30m, allocated to the family by the government (the only land owner) in order for them to make their homestead. Each living space is surrounded by a coral wall or a coconut palm fence and is shaded by the familiar mixture of banana and coconut palms and papaya, breadfruit trees. In almost all of these homes the inhabitants suspend hammock-like seats (joalis), and hanging from their trees, and can be beds (undhoali), found lounging in them for most of the day.

Homes are built from blocks of coral, mined from the reefs surrounding the island to a depth of approximately 1m, sawn into blocks and bound together by lime mortar which is produced by burning coral very slowly. Most of the roofs are now constructed from corrugated iron as this lasts longer than thatch and provides an excellent method of collecting rainwater for drinking and



Map showing Maldive Islands which lie about 500km to the southwest of the tip of India.

cooking. These age-old construction materials are now officially discouraged as the government becomes more conscious of protecting the environment and the ecological effects of damaging the reefs. Modern blocks and cement are the preferred materials but are extremely expensive as they must be imported. Houses consist mostly of bedrooms which are extremely sparsely furnished (the wooden beds being used as seats during the day). Washing is carried out at the family's well outside the house and toilets either consist of latrines dug deep into the coral near the house or the water's edge on the local beach. Cooking is carried out in a separate palm or coral shack just outside the house.

The streets and compounds are kept immaculately clean with the coral sand being swept clean every morning, by the women of the island sweeping with short brooms *(lloshifathi)* made from bundles of spines from coconut leaves. This causes a dazzling effect as the tropical sun is reflected off white sand streets and white walls everywhere in the village. A dense jungle of vegetation surrounds the village and runs to within a few feet of the water's edge. Unfortunately, the islanders have scant regard for the areas of jungle around the periphery of their living area and these are invariably scattered with domestic waste, old clothes and the ubiquitous rubber flip flop.

For the most part, the islanders seem to consist of children, who form about 50 per cent of the

population of most of the islands. The remainder of the daytime population of the villages consists of women and older men as most of the younger men are either out fishing (leaving the islands in their open topped fishing *dhonis* at 0530hrs and not returning until 1900 or 2000hrs) or are employed away from their islands on shipping lines or in tourist resorts. Separation appears to be an accepted way of life for most of the islands' families, with many of the men working away from home for ten months of the year.

The Maldivian people consist of a mixture of Arabs, Indians, Sri Lankans, Africans and Asians (all originating from sea-going traders travelling the routes from China, Indonesia and the Far East through the Maldives en route for the Red Sea and the Persian Gulf). Perhaps as a result of the diverse origins of the people who settled in the Maldives, the local dialect (*Divehi* - literally meaning "islander") is completely unique, as is their script, and is considered by scholars to belong to the Indo-Iranian language group.

The people are extremely hospitable (always greeting us with green coconuts freshly opened for us to enjoy the milk) and their lives are almost entirely unaffected by modern innovations and appliances - most of the islands only have electricity between 1800 and 2300hrs daily and that is mostly used for lighting and radios! The most significant advance in the last 100 years appears to have been the introduction of the inboard diesel engine which has relegated their lateen sails to second place as a means for powering the majority of *dhonis* (the local fishing vessel, built entirely from coconut wood and up to 20m in length). Almost all cooking is done over wood fires or stoves and much of the lighting kerosene is provided by small oil-burning lamps. Transport on most of the inhabited islands consists of wheelbarrows, with only a few having flat-bed vans, small motor cycles and bicycles. When a heavy load needs to be moved from one part of the island to another, small *dhonis* are frequently loaded up and the cargo is sailed around the coast to a landing place close to the destination. Although this is a painfully slow process (as we discovered to our cost at various points during the course of our work) the people have got all day to carry out such tasks with little else to concern them and, therefore, have little or no sense of urgency. For the most part their life style is so slow and uncomplicated that they seldom have much to do and cannot understand that occasionally, things need to be done

quickly, efficiently and now! Theirs is a beautifully slow, stress-free style of life which only serves to create stress in any hapless westerners who should try to complete tasks with the speed and efficiency to which they are accustomed.

Until very recently fishing for tuna and selling dried fish has been the only industry in the Maldives. Even today this is still carried out by "dolphin friendly" hook and line methods from dhonis crewed by 10-12 fishermen. Whereas in the past most of their catch would be dried for export, now much of it is off-loaded onto strategically placed refrigeration ships (owned by the State Trading Organization) which, in turn, bring the catches (approximately 50 tons per day) to a modern canning plant (managed by a British expatriot). Here, the produce is centrally processed and packaged for well-known brand names such as John West. Occasionally the fishermen still dry their catches for their own consumption or for sale (at increased prices) to the tourist resorts. There is no mistaking an island where a catch is drying as the stench of freshly gutted fish loiters in the air around the village. The fillets of tuna are simply laid out on sheets of corrugated iron and left to sit under the hot tropical sun until sufficiently cured for preservation purposes.

Tourism is becoming increasingly important as a generator of revenue, (even though the majority of resorts are primarily staffed by Sri Lankans and by Italian, German, French managed and Australian companies) and has helped to pay for new schools and health clinics in the more remote islands and atolls. By law, all businesses in the Maldives must have Maldivians forming at least 30 per cent of their labour force. A lasting legacy of the former British presence in Gan is that the majority of Maldivians employed in resorts are from Addu, as they are able to speak much better English than the majority of other islanders.

Although both fixed and rotary wing aircraft were used to complete various parts of the survey, most of the work was based from the Maldives' coastguard patrol vessel *Kuredhi* (a 20m launch built in 1978 by Fairey Marine Ltd on the Hamble) and it was on this vessel that the section arrived in Addu Atoll on 21 December 1993. As Gan is located 00 41 27 south and 0730932 east, approximately 400 nautical miles south of the capital island of Male, we had the privilege of sailing across the equator en route.

A ware of the rapidly changing fortune and history of the island in the last 50 years and having

become very familiar with "normal" Maldivian islands, I was unsure of what I could expect to find on Gan. My first impression on seeing the island from the sea was that it appeared to be like any other Maldivian island surrounded by white coral and a dense jungle of vegetation. There was little indication of any kind of development, let alone there ever having been any sort of British military presence. As we got closer a substantial concrete jetty (and the first clue as to what lay in the interior of the island) came into view. The approach to the jetty was slow as the



Aerial view of Gan with Fedu and part of Maradu in the foreground. Visible are the original two causeways constructed by Lieut Colonel MacLaglan.

waters within this atoll are notoriously shallow.

Once we had moored alongside the jetty, we were able to disembark and start to explore the old barracks as we set about our task there. Having passed through the peripheral ring of coconut palms and jungle we stepped into another world, quite unlike any of the other Maldivian islands visited so far. The first thing which struck me was that all the roads in Gan had metalled surfaces. kerb stones and proper pavements. So far, in almost four months of continuous travel around the islands I had not seen a black-topped road and had almost forgotten what they looked like. This feature alone made us feel that we were suddenly standing on a small part of the UK, just south of the equator.

Running parallel to (but set back from the northern edge of the runway) were lines of postwar, concrete built, single storey billets with long verandas and corrugated roofs of exactly the same pattern as is found in training camps (ie Penhale near Newquay) and barracks all over the UK. The majority of them still even have the old building numbers painted high on the end walls of the buildings, just below the eaves. Having been abandoned by the British military almost 25 years ago, one might expect the buildings to be in an advance state of disrepair. This, however, is not the case as the majority of them are now inhabited by a small army of women, 1200 women (almost 70 per cent of whom are Sri Lankan) are employed on one or two-year contracts by a Hong Kong-owned garment factory which has now been installed in what were previously large corrugated iron store sheds (of a similar type to those found in the former Royal Army Ordnance Corps' depot at Thatcham). Now the sheds echo to the sound of

women's voices and the clatter of hundreds of sewing machines. The company mostly sells American designed clothing for export to the States. The decision to move into its present location is for no better reason than the economic convenience of being able to move into already existing high quality industrial buildings surrounded by purpose built and (certainly by the developing world's standards) extremely comfortable quarters; primarily due to an astute piece of manoeuvring by Hong Kong businessmen. With Hong Kong's quota of exports to the US already having been filled, the Maldives provided a convenient location with, as yet, an unfilled potential for export to the States. In addition, labour is cheap and plentiful. So the businessmen were able to out-manoeuvre America's import laws by producing in the Maldives. When I asked the manager about the small proportion of local Maldivian women working in the factory, he explained to me that the locals are quite uninterested in working and that they would only come to work in the factory if they wanted to save some extra cash for extras or small luxuries.

In front of the former headquarters' building stands a beautifully maintained memorial to the men who lost their lives in Addu Atoll between the years 1939 to 1945. Included amongst the names of the fallen are various members of the Corps of Royal Indian Engineers, the Royal Bombay Sappers and Miners and two noncombatants, G Anthony and H Joseph. The memorial stone is flanked by two guns recovered from a ship scuttled in Addu during the Second World War, and is surrounded by trees and flowers imported by the British during their stay on the island.

Capt S C Cowan Addu Atoll 1993 (p225)

The headquarters' buildings themselves have become administrative offices for the island and include many of the essential services required by modern life, housing a bank, post office, a telecommunications company and even a travel agent. Not even the capital, Male, is so conveniently laid out. This whole area is adorned with real grass lawns (not to be found anywhere else in the Maldives) and has been planted with roses, bougainvillaea, frangipani and even pine trees. The result is a beautiful array of colourful plants which, as a testament to the British, have been carefully tended through the last 20 years.

Perhaps a more adventurous project currently being undertaken, is the conversion of the former officers' and SNCOs' clubs into a small tourist resort. The company undertaking the work has made best possible use of the billets that were already standing. They have stripped out external and internal walls where necessary, fixed new roofing materials and, using the existing foundations, flooring and structural members, have constructed new walls, ceilings and fittings. In place of drab 1960s-style concrete slabs for walls, they have used low-density blocks which are subsequently plastered over and whitewashed. The floors have been retiled and air conditioning fitted. Each room is en suite, being fitted with bath, shower and toilet. Although the rooms are not extremely lavish, they are pleasant and certainly not recognizable as barrack rooms, even in an officers' mess.

On the south side of the airstrip, the company is refurbishing the golf course left by the British airmen and I understand that they also intend to refurbish the now dilapidated tennis courts. Perhaps these courts stand in the same location as the coral surfaced courts built by Lieut Colonel MacLaglan during the war. Even the old "Astoria" cinema now has a new lease of life as an accommodation store for the future resort. The quartermaster's block now contains tourist, factory and duty-free shops.

The two causeways, originally built to join Gan's neighbouring islands, have now been extended to four, allowing the locals to drive for approximately 18km. This makes Addu the only place in the Maldives with a road system, outside the capital, Male, and this is the longest stretch of road in the country. As the roads are there, a few cars (serving as taxis) and vans have appeared over the years and becoming more common, is the motorcycle. Unfortunately the presence of the causeways has affected the natural flow of the water with subsequent silting and weed destroying the once fine beaches. As a result of the loss of such beautiful beaches, this case (amongst others) has provoked the government into some positive action and now extensive studies are carried out before anybody can gain permission to build breakwaters, jetties or causeways anywhere in the republic.

The airport continues to serve as a domestic airport and has recently undergone improvements in the form of a refurbished terminal building and new runway navigation lights; perhaps if the tourist industry succeeds it will_become the Maldives' second international airport.

Of the other islands in the atoll, Huvadu is the largest and is home to 10,000 Maldivians. It is known as the second city of the Maldives but, fortunately, does not suffer the serious overcrowding that Male does. It is a considerably more pleasant place, which still carries on the traditionallife style of the islanders in spite of its size and the presence for so long of the *Arif* (the local name for theRAF).

The people of Addu display considerable pride to have been associated with the servicemen who spent time here and are grateful that the 1200 employed on the base were given educaand health tional care benefits by their employers (to the envy of the remainder of the Maldivian people). Even today they speak of how they had the opportunity to earn respectable amounts of money (compared to their counterparts) when they entered the employ of the RAP. As already mentioned, those who learned to speak English are now able to find work in the tourist resorts of the north. Certainly, I will leave the Maldives with the impression that the people of Addu are just that little bit different, their welcomes just that little bit warmer (particularly to British servicemen) and I know that they are proud of their heritage and association with the British and consider themselves to be different from their island cousins.

Undoubtedly the British military presence in Addu has deeply affected the lives of the islanders who lived and still do live there. The relationship between the Forces and indigenous population was obviously a good one as the people recall only fond memories. Perhaps it is a shame, although understandable, that their memories are dominated by the RAF and not the Royal Engineers, who built the first airstrip and really put Addu on the map.

Memoirs

GENERAL SIR CHARLES RICHARDSON GCB CBE DSO

Born 11 August 1908, died 7 February 1994, aged 85.



WITH the sudden death of General Sir Charles Richardson, the Corps loses one of its most famous and gifted members. His career illustrates in full measure how Royal Engineers of high intelligence and determination can reach the heights of their profession. Because of his wide interests and personal fitness, he continued to enjoy life right up to the moment of his death.

Born in 1908 of Anglo-Irish parentage, his childhood mirrored that of so many sons of regular officers. At a young age he became bilingual while living in French Switzerland with his mother; his father was serving in a non-family overseas station. During World War One, he experienced Zeppelin raids in London while his Gunner father was in France.

His outstanding academic career followed the classic pattern for many of his generation. A scholar on entry to Wellington College, he passed first into the Royal Military Academy, Woolwich, In 1928 he passed out from The Shop as top cadet with the King's medal for military subjects. Again, in a not unfamiliar pattern, he only reached the rank of cadet corporal; like others, a late developer. After young officer training at Chatham, he went up to Clare College Cambridge. Two years later he graduated with a first class honours degree in the mechanical sciences tripos.

In 1931 he received his first posting, to India, where he joined the Royal Bombay Sappers and Miners. Seven years of widely differing experiences followed. He started off with works services jobs at Mhow and Nasirabad, where he learned the vicissitudes of trying to extract water from boreholes that proved to be dry. Then came a posting to Quetta where he served alongside two other eminent Sappers, Captains "Splosh" Jones and John Cowley, in field engineer units supporting an Indian division. After mid tour leave he returned to Kirkee, and at the end of 1935 was sent with 30 Mahratta Sappers to the state of Chitral in the Hindu Kush on the borders of Afghanistan. The Raj maintained an Indian infantry battalion and a mountain battery RA in Chitral. In this Kiplingesque surrounding, Charles found himself entirely horse borne for both business and pleasure. He continued to avail himself here as in earlier garrisons of the wonderfully varied sporting facilities, now extending to skiing. At pigsticking he had been less successful initially, as he had found himself galloping, spear aloft, into a thorn tree on one occasion near Nasirabad. But he did not neglect his study of the darkening world scene by having a wide selection of books sent out to him from home. On return to England in 1938 at the age of 30 he reckoned his apprenticeship was finished and he was ready to play his part in World War Two, then looming on the horizon.

On the outbreak of war, Charles was posted to 1 Corps Troops Engineers as adjutant. For some months he was immersed in organizing mass production of pillboxes that were never used in action. January 1940 found him on a staff course at Camberley. He returned to France just in time to join the staff of 4 Division during its advance into Belgium, followed by its rapid, confused, retreat to Dunkerque. As beach master, Charles evacuated many soldiers before himself being ordered to board a naval sloop.

General Sir Charles Richardson GCB CBE DSO

A posting to be an instructor at the Middle East Staff College at Haifa in Palestine surprised him at a time when England faced an invasion. Yet this step really saw the beginning of his meteoric rise as a general staff officer. He met Freddie de Guingand for the first time, later Chief of Staff to Field Marshal Montgomery from Alamein onwards. He also widened his circle of friends still further amongst those who were to become prominent in the later stages of the war. Nine months later another unexpected assignment found him promoted to Lieutenant Colonel GSOI (Operations) Special Operations Executive for the Middle East. This job gave him wide experience throughout the area for coordinating operations ranging from Long Range Desert Group raids behind Rommel's lines to the demolition of the Gorgopotamos viaduct in Greece, demolished by a fellow Sapper, Brigadier Eddie Myers. He did much to bring about some measure of order amongst chaotic, conflicting interests ranging from the Foreign Office through all three services to the operators of SOE and G(R), the Middle East Services' clandestine organization. He went himself on one secret mission to Turkey to deliver wireless sets to some shady customers, in the course of which the main enemy encountered was bed bugs.

Ten days after the fall of Tobruk, Charles was summoned to be GSOI (Plans) in Eighth Army HO at Alamein. General Auchinleck departed and General Montgomery took over. In no time, Eighth Army was re-energized, and the battle of Alam Halfa won to throw back Rommel's bid for the Delta of Egypt. Planning for the decisive battle of Alamein involved Charles in masterminding the deception plan that led to complete surprise for the initial British assault. Rommel was on leave and his Army expected an attack from the south in early December in consequence of the elaborate use of dummy pipelines, camouflaged stores dumps and vehicles to deceive German air reconnaissance, and communications intercepts.

From that moment onward, Charles' career expanded in line with the advance of the Eighth Army all the way to Tunis. In November he was lucky to transfer across to become GS01(Ops) after the capture of his predecessor. He was awarded the DSO for his conduct at the battle of the Mareth Line, and by the end of the North African campaign had been promoted Brigadier General Staff. In this capacity he took part in the invasion of Sicily; thereafter, at the urgent request of the Americans to Montgomery, he went as British Deputy Chief of Staff to General Mark Clark and landed in both the Salerno and Anzio beachheads during the long slog of the Allied Armies up Italy. At Salerno he met with some hairy experiences including spending a fitful night ashore under a bush with General Mark Clark's Tactical HQ. In March 1944 he was ordered to rejoin "Monty" as Brigadier (Plans) 21 Army Group, then preparing for the landing in Normandy. Monty used him extensively on the difficult task of extracting maximum air support. from contending British and American Air Commands, both before D-Day and during the campaign. As chief planner he was a leading advocate for the strategy of a direct thrust to Berlin on a narrow front in September 1944. Amhem finally put paid to his hopes. He was present at the formal German_surrender.

Soon after the final collapse of Germany, Charles was appointed Chief of the Military Division of the Quadripartite Control Commission in Berlin. His relations with his Russian opposite number, originally a peasant from the Caucasus, seem to have been hysterical. By early 1946 he became restive and returned to London to become a member of the Future Operations Planning Staff in the Cabinet Office. The task set was to forecast British strategy 1946-1961. After a year of high level "hot air", as he described it, he reverted to lieutenant colonel for a year to command an engineer regiment in BAOR. In 1953 he got his allarms command of the Infantry Brigade of 6 Armoured Division. Major, later General Sir Michael Gow, his ADC from Berlin days, joined him in 1954 as Brigade Major, straight from the Staff College.

In 1955 he was promoted Major General as Commandant of the Royal Military College of Science at Shrivenham. Field Marshal Sir John Harding told him he was sending him there to. make science fashionable in the Army. In due course he did just this. After commanding professors, as he put it, for some little while, he submitted to the War Office his conclusions on how to achieve his mission, to be met with a deafening silence. Three years later he was required to establish a new Directorate of Combat Development, the "think tank" of the future Army. A year later, as Director General of Military Training, he was able to introduce changes in staff training to achieve a balance between weapon development studies at Shrivenham and command and staff

duties at Camberley. After 18 months as QMG, in 1967 he was invited to become Master General of the Ordnance for four years, his own recommendation from Shrivenham. So his report from Shrivenham eventually bore bountiful fruit.

Interspersed with these staff jobs came two command appointments, GOC Singapore District and GOC-in-C Northern Command. His ADC in Singapore records how his master initiated a hearts and minds campaign between British units and local Chinese youths, thereby contributing to a peaceful transition to independence. His description of Charles as having a reputation as a hard task master, but in fact being the most human of people with a strong sense of humour that would pop out at unlikely moments, accompanied by a twinkle in his eye, encapsulates the views of many that served under him.

As Master General of the Ordnance, he dominated the Army Board of his day and usually got his way. Having served as QMG previously, his membership of the Board lasted six years, the only officer to have achieved this feat. His reputation was awesome; staff attending conferences in his office called them "going into the pressure cooker." But the results were of great importance to the future of the Army. He initiated many of the key equipments which were used in the Gulf War to such good effect. Amongst these were Challenger, Chobham armour, and tracked Rapier. A longer term legacy of which he was known to be proud was the creation and encouragement he gave to the careers of Technical Staff Officers.

His Military Assistant as MGO, Bill Withall, has recorded his fIrst meeting with Charles, then QMG, in the Radfan, Aden, in 1965. After a successful mortar shoot by the Royal Anglians, his only comment was, "Do you know there is an acute shortage of ammunition?" Turning to his then MA he asked him to make a note, "Too many fireworks' displays." Fifteen months later Bill was invited to present himself for interview for possible selection as MA to the MGO. As he entered the great man's office, Charles looked at him hard and asked, "Haven't we met?"' "Yes sir." Bill replied, "in Aden." There was a pause, a fInger was pointed at him and with a twinkle in his eye the General said, "Guy Fawkes." Bill got the job!

Retirement in 1971 saw no respite to his endeavours. He ceased to be ADC General to the Queen and Colonel Commandant of the Royal Ordnance Corps that year and in 1972 became Chief Royal. Engineer. He devoted much time to the affairs of the Corps, not least in annual visits to units in Germany. He joined International Computers as a consultant for five years, a happy association. Several companies including Maplin invited him to become a director. As chairman of the Foundation Committee of the Gordon Boys' School he was instrumental in many changes to modernize not only the schooling but also the buildings. By much personal drive he succeeded in raising a large sum of money for these causes. Another charity enjoying his support was the Kitchener National Memorial Fund.

His family life had been one of great happiness from the time he married Audrey Jorgensen in 1946. In 1947 they bought The Stables at Betchworth. Over the years they developed from virtually nothing, with great patience, imagination and skill, sometimes from afar when soldiering away from home, a charming house and outstanding garden. Special open days have resulted in hundreds of people sharing the glories of their garden, and generous sums of money have flowed to the Red Cross and to the upkeep of their Parish church. The Stables meant so much to him; he loved being at home with his family. Always understanding of the young, he was a loving and good father and husband and adored by his family. In this milieu he turned his hand to writing books. "Flashback", published in 1985 encapsulated his great career in very readable prose, interspersed with his own inimitable brand of humour. "Send For Freddie" set out the biography of his wartime boss General Sir Francis de Guingand. This was followed in 1991 by the biography of General Sir Ian Jacob, whose career culminated as Director General of the BBC.

The concluding paragraphs of "Flashback" set out the philosophy that sustained him throughout his long military career; "Now at the age of 71 I ask myself what sustained us nearly 50 years ago in those terrible times of impotence and disaster. I believe it was the conviction that the British Army would, in the end, prove superior to the *Wehrmacht*, not because of a greater talent for killing, but for qualities that lay much deeper; its long tradition of civilized duty, of incorruptibility and self-sacrifice ..."

To sum up, Charles Richardson was a man of many parts. He was always a delightful companion on any trip abroad, as a number of those who served with him have testified. He was knowledgeable to a degree. A great raconteur, he would wax eloquently on Alamein, Normandy and his time with the Americans in Italy. Professionally, in his years on the Army Board he had the ability to simplify complex issues to reinforce his views while at the same time understanding what would or would not be acceptable to his colleagues. Personally he instilled not only loyalty but great admiration in all those who came in contact with him. Once his trust was gained, he allowed people to manage their affairs unimpeded. All he asked was to be given warning signals of impending trouble if matters would have to be put right. Above all, his mind was absolutely clear, his determination formidable to achieve the targets that he had set himself, and with all this went a great sense of humour and a warm regard for those who served him. Outside his profession he was a keen sportsman throughout his life, particularly skiing and tennis. Above all he was a dedicated family man. Our sympathy must go to his widow, his son, daughter and stepdaughter for the loss of so brilliant a man, still active as he had continued to be to the end.

DJW, WGFJ, WNJW, OPK

LIEUT COLONEL P M BENNETT OBE Born 20 June 1913, died 13 November 1993, aged 80.



As a younger but subsequently senior officer writes: "Peter Bennett had good old fashioned, enormously high standards in everything he did and thought; one of the most steadfast of that admirable breed of pre World War Two Sapper officers – steel stiffness in their hats and all!" He was an outstanding field company and parachute squadron commander, and field formation CRE.

After nearly a year with 11 Fd Coy in Aldershot, at the end of 1938 he joined 10 Fd Coy, QVO Madras Sappers and Miners, on the NW Frontier, becoming 2IC in 1940 when the company went to Iraq to help protect oil wells from German attack through Turkey. Later in that year he carried out a road reconnaissance of northern Iran, towards the Russian border; but the Russians were uncooperative, although the route was later used for material aid to them from India.

In May 1942 he was promoted to Command 425 Fd Coy in Bangalore, which was being formed with 240 raw recruits from non-traditional soldier recruiting areas in southern India. With an excellent subadar (who remained with him for the next three years) and some newly promoted NCOs, the men were trained in basic and collective skills to become a front line fighting unit. Civil disturbances and the threat of a Japanese invasion of southern India at the end of 1942, provided deployed sectional training. Peter was Mentioned in Despatches for the achievements of the company during the operations. In March 1943 the company joined a brigade group of the 25th Indian Division and was warned to be fit to operate in the jungle within six months. Having already done some jungle training, more emphasis was now placed on self protection against enemy patrols, and "jitter" parties, as well as "sticks and string" engineering and the ability to operate on a man pack basis in virgin jungle. In particular, a very strict regime of anti-malarial precautions was enforced which later gave the Division the lowest percentage of malarial casualties in the 14th Army. Strict discipline in the elimination of noise during exercises was also enforced - not easy in the Indian Army, particularly in some engineer tasks. Much of the training was initiated by Peter who found his own jungle and "living off the country" areas for battle simulation for the company (reflected in 9 Para Sqn training seven years later).

The Division moved to the Arakan in March 1944, just after the Japs had suffered their first defeat in

Lt Col P M Bennett OBE

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failing to take the Ngakyedauk Pass. For the two months prior to the monsoon the brigade, which the company supported, consolidated in the Maungdaw Tunnels area. Much engineer work was needed in the forward areas, the company being deployed in small parties each being responsible for its own protection at night against frequent Jap patrols and "jitter" parties; severely testing their fire discipline which held - unlike some infantry units. The possession of Hill 551, a key feature in the area, was continually being contested with the company being very much engaged in its defence and the maintenance of the exposed routes to it, including the daily clearance of Jap nuisance mines. Grossly overworked, disturbed nightly and suffering battle casualties, there was no malingering and the sickness rate was very low. Under Peter's leadership morale was high - the subadar remarking 'The men know now what war is and they like it." Although the fighting eased off, the maintenance and mine clearing of the brigade tracks and its L of C continued as a major task throughout the monsoon. In early September just before it ended, an attack was mounted down the Mayu range. The company provided assault sections for the leading Gurkha companies. The capture of Hill 1433 (see extract from the history of 425 Fd Coy printed on page 237), a key feature, was largely due to the outstanding actions of one section three members of which were awarded medals, an IDSM, and two MMs.

In December 1944 the company had a new 21C who, as a raw young subaltern, had known Peter in 1942 in Bangalore and been given help and advice by him. Many others learnt and benefited similarly throughout Peter's career. The company, after a short period of preparation, conducted a water borne sampan operation down the Kalapanzin River to take Akyab Island. The company under Peter's direction (from REYC experiences?) had to caulk the many sampans, dried out after road transportation, with oakum and tar. The brigade crossing of the river having been successfully achieved, although only on a manpack basis with a few guns, the 21C remembers the company, now mine breaching and digging in on the far bank, being mortared and taking cover apart; from Peter who strode between sections telling them to keep their heads down! Higher command must have decided not to run any further risk of losing him, as about a week later he left to attend the Quetta Staff College, having been Mentioned once again in Despatches for the company's invaluable contribution to the initial successes of the Arakan advance. The company

went on to support other amphibious operations successfully, down to the coast culminating in the Ruwya battle and the Me Chaung river crossing operation. In March 1945, after exactly one year of intensive operations the company returned with the 25th Division to India to prepare for the Malayan landings (the history of 425 Fd Coy *The RE Journal* September 1949). Meanwhile, Peter having completed the staff course (and some wild fowling) became CRE (temporary Lt Col) Corps Troops for the Malayan landings, which were unopposed as the Japs surrendered just before the assault.

Peter Millard Bennett: was born in Worcester where his father, Lieut Colonel C G Bennett DSO, Worcestershire Regiment, had retired, although later recalled for the Great War. Peter was educated at Blundells and the RMA Woolwich and commissioned into the Corps in 1933. He was one of the more robust, members of White's YO batch, always to the fore in any physically demanding activities including offshore sailing in *[lex.* At Cambridge he rowed, fenced and played rugger for his college, Clare.

On coming down from Cambridge in 1936 he joined a RGS expedition in northern Canada carrying out the first accurate survey of Southampton Island and Repulse Bay (RGS Journal February 1940 and The RE Journal September 1940). A member of the expedition writes, in a Polar Record memoir, that during the winter of 1937 Peter was left to map Wager Bay; living with an Eskimo family and appreciating their good nature and their ability to make the best out of difficulty and discomfort - qualities he fully shared and subsequently taught those he later led. He maintained a life long interest in the Arctic and returned to Canada for a year spanning the winter of 1947/48 with an all arms team developing winter warfare techniques. In 1949 he and three other sapper officers trekked through Norwegian and Finish Lapland in the area of the Russian border. The whole area had been destroyed by the Germans retreating at the end of the war and was starting to be reinhabited and rebuilt. One of the party writes that it was a summer of great enjoyment (The RE Journal March 1951). Others also write of Peter's good company and resourcefulness on expeditions.

On leaving Malaya in early 1946, after eight years overseas, Peter served briefly in HQ 21 Army Group in BAOR and attended the RAF Staff College course at Bracknell. In 1949, after the Canadian assignment, he took command of 9 Indep Para Sqn (9 Sqn) which had just arrived in Aldershot from Hameln, where the squadron had been reformed from the regular sappers who had served in the airbome divisions. The squadron had a wealth of experience and potential, particularly in its NCOs as nearly all had taken part in airborne operations. The squadron had already distinguished itself in BAOR, in competition with major units, in team sports but, like most other units at that time, needed discipline and unit training. Peter was ideally suited to rectify these deficiencies and make the squadron an effective fighting unit fully building on the high quality of the NCOs - several later becoming officers. At that time the SAS was being reformed in Malaya and 9 Sqn had, in addition to its 16 Para Bde role, an independent special forces interdiction role in Europe. Peter's Arctic and jungle survival and his operations experience were invaluable in the squadron's training. Discipline problems were quickly solved after a few fierce admonishments and punishments. His physical and commanding stature was respected and admired as he always made time to talk individually to his soldiers. They liked him and were proud of him. Squadron discipline was also helped by his training regime, with Brigade of Guards help, for the Royal Scroll presentation parade (a major airborne forces event) which the squadron was uniquely awarded for its part in the first British glider-borne brigade operation in the 1943 invasion of Sicily.

In 1951 he went as commandant (Lieut Colonel) to the Army Air Training and Development Centre (AATDC) at Abingdon (later Old Sarurn). It was a period of extensive development and trials in airborne delivery systems; both in adapting to the various types of new transport aircraft and in developing equipments for parachute delivery including the first heavy drop platforms. In 1953, he was posted as CRE 16 Airborne Division TA, becoming CO 131 Airborne Engineer Regiment TA, taking over from a distinguished wartime airborne predecessor. His squadron commanders and many troop commanders were also wartime airborne sappers. However, it was a time of influx of young subalterns completing their national service obligation of a period with the reserve army. It is a significant reflection on Peter's leadership that a number of these younger officers stayed on in the TA and remain enthusiastic members of the Airborne and Commando Association. Peter provided just the right touch of flamboyance to appeal to Territorials

and the annual camps were both demanding and enjoyable. He made good use of his AATDC experience to introduce innovative aspects to airborne exercises. One, in particular, involved the parachute drop of assault boats with superstructure to bridge the River Avon, the first instance of parachute delivery of a bridge.

He helped to ensure that the Regiment became the largest recruited unit in the TA when the national service obligation ended. He was gazetted OBE for his period in command.

Peter was a natural selection for an appointment in the Air Ministry as a GSOI in the Operational Requirements Directorate in 1955. From there he went to Chatham in that most important traditional Corps appointment of Chief Instructor Field Engineer School. He had always kept in touch with the Corps and contributed several professional articles for the *The RE Journal* including a Betrand Stewart Prize essay in 1954. (1955 *The RE Journal*.)

From boyhood he had been a keen fisherman and wild fowler with a long life wish to be a countryman. It prompted him to retire from the Army in 1957; buying a farm in Devon with a leat off the River Exe. Unfortunately a damaging flood ruined the farm and a living had to be found in another occupation in 1964. After a year in Canada he joined the National Coal Board Opencast Executive in Northumberland, retiring as its Deputy Chairman in 1975. From 1973 to 1983 he was an independent councillor on Tynedale District Council becoming chairman in 1977n8 (Silver Jubilee year). He also served on the Northumbrian Water Authority. In final retirement he was a council member and honorary treasurer of Hexham Abbey Heritage and he helped the Royal British Legion locally. He also had more time to fish!

Peter and Rosemary married in 1951. Her father had been in the Sherwood Forester Regiment thus making another union of the Worcesters and Foresters. Rosemary's maternal grandfather was Major General Sir Godfrey Williams KCIE CB, a distinguished sapper. So was her brother Lieut Colonel A J Wheatcroft. Peter and Rosemary (still living in Hexham) had two children, John and Clare, and five grandchildren - one born since Peter's death, who he would dearly like to have seen.

> JHSB ROHC FWJC PdeVP JWLR GR JDW ITCWDABW

COLONEL ADAIR MURRAY Born 5 June 1900, died 2 January 1994, aged 93.



"TORY" Murray (as he was almost always called) got his nickname because he was born on 5 June 1900, the day that Lord Roberts entered Pretoria in the South African war. Tory's father was there at the time.

Educated at Rugby School, where he was in the 1st XV and captain of cricket, he went next to The Shop, and, having first won the Sword of Honour, was commissioned into the Corps in 1919, thus just missing the Great War.

As a young man he served in Egypt and Gibraltar before returning to The Shop as an instructor, followed by a tour as adjutant to Colonel Colbeck, at Aldershot, and then to India on a five-year attachment to the Madras Sappers and Miners. He had orders to return to the UK, slightly early, on 3 September 1939 but, when war in Europe was declared that day, was ordered to stay where he was, not returning to the UK until after the war, in December 1945.

His war service took him to Burma to serve in the 4th Indian Division, including the Irrawaddy crossing where he was CAGRE (Commander Army Group RE), and about which he wrote in the *The RE Journal* in March 1947. He was twice Mentioned in Despatches. After two jobs back in the UK, one of them with the TA in Gateshead, he was appointed Acting Brigadier, to be the Military Attaché in Madrid, remaining there for four years until his retirement in 1953.

He then set out on his second career, as a stamp dealer specializing in the Postal History of the UK and the Commonwealth. He also took an active part in local affairs becoming a Rural District Councillor and later a Hampshire County Councillor. He had the distinction of being the last person to be appointed as an Alderman before the local government reorganization that abolished the post of Alderman. He also founded the Southampton branch of the Burma Star Association.

Tory was a highly intelligent man with an excellent brain. Until a few years ago, he used to do The Times crossword every day and got to the final of their crossword competition in its first year. He and Molly, his wife, were inveterate travellers going on cruises all over the place. including once around the world. He had a lovely twinkle and droll sense of humour, coming out with some amazingly "modern" cracks when he wanted to pull the leg of one or other of his ten grandchildren. In addition to his Spanish, he enjoyed trying to converse in German using the little that he had picked up. A slightly different side of him used to come out when he taunted us that nowadays we "had it much better than he had." This was beautifully exemplified driving around the Commonwealth Brigade camp in Seremban in Malaysia in 1967 when he commented that he did not see why the troops and their families needed all these facilities - "We did not have any of this in our day," However, I could always silence him by pointing out that in his day they never worked after lunch.

He was a very gentle, family man who was devoted to his wife, four daughters and ten grandchildren.

He married, in 1931, Mollie Dowson, daughter of Sir Hubert and Lady Dowson from Nottingham, and is survived by her and two of their four daughters one of whom, Gillian Swinburn, married into the Corps.

DHAS

Col Adair Murray

Born 8 September 1900, died 20 January 1994, aved 93.



COLONEL James Roy Simpson was a well known and respected transportation officer who spent much of his service overseas, in particular in India where he served for many years with North West Railways (NWR). His elder brother, General Sir Frank Simpson GBE KCB DSO, was Chief Royal Engineer from 1961-1967.

Educated at Bedford School and the Royal Military Academy, Woolwich, where he passed out 8th from his course, he was commissioned into the Corps on 16 July 1920. After training at SME Chatham, he embarked for India in January 1923 where he joined the Royal Bombay Sappers and Miners.

Having gained his spurs at Kirkee and Quetta James decided to transfer to the MES, (May 1924) as he wished to join the Indian State Railways to gain greater engineering experience. His first responsibility as a GE, however, was the very large building construction programme which was required for the rapid expansion of the RAF in Quetta.

In May 1925, James was lent to the North West Railways and was to remain with them until April 1940. To all intents and purposes he was a civilian carrying out the duties of an engineering officer of the NWR. During these 15 happy and rewarding years he carried out the survey of the Kangra Valley Railway and was responsible for the construction of 30 miles of it in very hilly and difficult country (1925-29); the erection of the De Montmorency Railway Bridge, a combined rail/road bridge of 15 spans each of 150ft (*The RE Journal* March 1934) and the Kalabagh-Mari Indus Bridge, eight spans of 250ft and four spans of 175ft (1929-31); from 1931-40 he was employed on engineer and administration work on the open line of the NWR including new construction work.

Shortly after the outbreak of the Second World War James returned to the UK where, from 1940-41, he raised and commanded a railway engineer construction company with responsibility for western and southern England. He returned to India in late 1941, where he helped raise three companies and raised and commanded HQ No 4 Indian Railway C&M Group IE, which deployed with 10th Army to Iraq in 1942 and subsequently joined *Paiforce*, having responsibility for the railways in Iraq, south Persia and Nasirah. In July 1944 he and his Group transferred to Italy, where they carried out many high priority railway works. James was Mentioned in Despatches in Italy.

In December 1945 James returned to India and became Chief Instructor No 2 Transportation Training Centre, Jullundur, where his main work was demobilizing the 46,000 transportation Indian troops raised during the Second World War. In 1946 he returned to NWR and remained with them until he retired from the Army in 1951.

James put his experiences to good use on retiring from the Army and from 1951-60 was the Deputy General Manager and London representative of the Nigerian Railways.

After spending most of his working life overseas he settled down in Ferndown, where he became a keen and enthusiastic golfer, playing regularly into his late 80s. He was a popular member of the Ferndown Golf Club where he won many competitions. He twice turned down the offer of Captaincy.

He married Wilhelmina (Mina) Cunningham at Quetta in November 1925, who sadly died in May 1989. He is survived by his two children Anthony and Joan.

Col J R Simpson

BRIGADIER MONTAGU CHAMPION-JONES

Born 3 August 1904, died 23 January 1994, aged 89.



BRIGADIER Monty Champion-Jones will be remembered not only as a "Sapper" but as a talented amateur painter. Some people will remember his paintings and sketches which gave a unique glimpse of life as a prisoner-of-war in the notorious Colditz Castle. The paintings include views of the Courtyard in the Castle, the Chapel, the Clock Tower and a view along the river Mulde, showing the field where the famous glider was supposed to have landed. While in Colditz he produced between thirty and forty water-colours and black and white pictures. Some of these he was able to send home to his wife during the war, but some were returned by the German censor, and these he had to bring home after the US Army had liberated Colditz on 16 April 1945.

Montagu Champion-Jones was the elder son of Lieutenant Colonel Douglas Champion-Jones DSO, Royal Engineers. Educated at Haileybury and the Royal Military Academy Woolwich he was commissioned into the Royal Engineers in 1924 and, two years later in India, joined the Royal Bombay Sappers and Miners. When war was declared in September 1939, he was at the Staff College, Camberley, and was posted as a Staff Major to the Arras area of France.

When the German Army swept through Belgium and France in May 1940, orders were issued to the few troops being overrun in his area that they should endeavour, in small groups, to escape and avoid capture. Luckily, Monty had a map and, with another major and a colonel, spent six days hiding in woods and six nights travelling across country, constantly hampered by the French farmers' barbed wire fences. They were finally captured, in their underclothes in a deserted hut, while trying to dry out their rain-soaked uniforms.

Monty was first imprisoned at Laufen; there one day, while endeavouring to remove excess rainwater from the camp, he inadvertently diverted the water into a tunnel being dug, unknown to him, by fellow prisoners! Though not involved in tunnelling, the Germans soon removed him to Colditz because he was an engineer and therefore a probable menace. There he spent the rest of the war, except for a brief spell at Spangenburg.

After the war, in 1947, by then a lieutenant colonel, Monty was posted to Singapore and in 1949 was Mentioned in Despatches in Malaya. He retired from the Army in 1958.

In retirement Champion-Jones was not idle. He was able to follow his love of painting, but also entered the world of advertising by becoming a photographer's model. He had the instincts of an actor, a good sense of humour and a wonderfully mobile countenance and expression. For some years many of his relations and friends were surprised and delighted to see him in the press promoting all sorts of interesting items!

The two most important things in Monty's life were those of being a Royal Engineer and a painter. It is interesting to note that both these were inherited, for he was a third generation Royal Engineer and a fifth generation painter! His greatuncle Walter Jones was commissioned into the Royal Engineers in 1863 and his father in 1895. Lieutenant John Chard, who won the Victoria Cross when in command at Rorke's Drift, was the Senior Subaltern of Captain Walter Jones 5th Field Company Royal Engineers in the Zulu War.

Monty's love of water colour painting was shared by his brother and more especially by his sister, Hazel, the most professional and prolific painter in the family. This interest and skill they inherited from their father, as he had done from his mother. She was born Charlotte Beechey, one of many grandchildren of Sir William Beechey RA.

Montagu Champion-Jones married in 1932 Betty Pringle, who died in January 1979. He married secondly in May 1980 Doreen Lyon (née Oxlade). He is survived by his widow, a daughter of his first marriage and a stepson and a stepdaughter – the member of Parliament for Rochdale.

Brig Montagu Champion-Jones

COLONEL GAD YOUNG DSO Born 3 December 1902, died 9 December 1993 aged 91.

THE son of a civil engineer, George Alan Dawson Young was born in Rangoon. He was educated at Dollar Academy and Woolwich before gaining his commission into the Royal Engineers in 1923.

During the 1930s he served in Egypt, attended the Staff College, Camberley, and became a Russian interpreter. In 1935 he was posted to Latvia. A keen sportsman he represented the Army at athletics and captained the Staff College at cricket.

In 1940 while working at GHQ, Middle East (ME), Young was invited to form a commando regiment along the lines of those raised in Britain. He raised and commanded the first of three ME Commando units, No 50. In December he was transferred to command the newly raised and trained 52 ME Commando and took them to Abyssinia.

Between December 1940 and March 1941, 52 ME Commando was in the Gallabat sector under operational command of a brigade of the 4th Indian Division. Although 52 ME Commando carried out several deep penetration raids in that sector, they were restricted in scope owing to lack of air reconnaissance information, transport, water and suitable long range wireless sets. However, 52 ME Commando gained experience of operating in very rugged terrain which was to prove invaluable later during the Battle for Crete.

In March 1941,52 ME Commando returned to Geneifa, Egypt to amalgamate with 50 ME Commando then recently returned from Crete where they had been operating in the Dodecanese Islands. Colonel Young remained in command. The amalgamated units were designated "D" Battalion of *Layforce*. Both units had suffered a good many battle casualties, and from malaria, before amalgamation. Their combined strength was now about 650 all ranks.

During March and April 1941, *Layforce* (or the Special Service Brigade, as it was then called) was to have played a leading part in the capture of Rhodes and other Dodecanese Islands, but this was cancelled owing to the turn of events in Greece.

On 20 May 1941 the Germans started their ferocious airborne assault on Crete. "D" Battalion troops of *Layforce* thenin camp at Alexandria were available as reinforcements. Together with "A" Battalion comprising 7 Commando, recently arrived in the Glenships from the UK; "D" Battalion were rushed to Crete early on 27 May 1941. Prior to this between 23-26 May 1941 an unsuccessful attempt had been made to land "D" Battalion on the southwest coast of Crete from destroyers. Colonel Young and his ME Commando men were told almost immediately that they were to be a part of the rearguard for the evacuation of the Island, which had just been decided upon (27 May).

On 27 May "D" Battalion occupied a position astride the Suda Bay-Rhetimo road, where they were incessantly dive-bombed, but sustained few casualties. Although "A" Battalion of *Layforce* and the Spanish company of "D" Battalion were heavily engaged by outflanking German paratroopers, the bulk of Colonel Young's Battalion was extracted with few casualties. During the night they withdrew to a fall back position at Babali_ Hani astride the road Suda Bay to Spahkia, a small fishing village on the south coast of Crete where the main evacuation by the Royal Navy was taking place.

On 28 May 1941 "D" Battalion held the Germans for most of the day, inflicted severe casualties on them and, with the help of an Australian unit, and the remains of "A" Battalion in reserve, prevented the enemy from out-flanking the main position, at Babali Hani.

It should be borne in mind that "D" Battalion, comprising Commando Troops highly trained in assault tactics for which they were lightly armed, found themselves taking part in a difficult infantry rearguard without any of the heavy infantry weapons normally found in an Infantry Battalion Support Company. In addition they lacked, ammunition, tools for digging in, and transport.

The rearguard action at Babali Hani delayed the German advance southwards considerably and undoubtedly enabled many British and Commonwealth troops passing through the rearguard earlier in the day to be evacuated successfully at Spahkia that night. Colonel Young was later awarded the DSO and several officers of "D" Battalion the MC. The successful stand at Babali Hani by Colonel Young's Battalion had given the Germans a bloody nose and had bought time for the evacuation especially for the New Zealanders.

As usually happens in this type of operation, there was little chance of "D" Battalion being
evacuated. The last days of the Battle for Crete them withdrawing to and occupying found perimeter defences covering Spahkia, fully armed and disciplined to the last under Lieut Colonel Young. Predictably a situation arose when the evacuation had to cease owing to severe Naval casualties. A large number of British troops remained - about 15,000.

Before he left by flying boat, Major General Weston, Royal Mairnes, by then in command of all remaining troops in Crete, gave written orders to the senior officer commanding to contact the Germans and arrange a capitulation. This unpleasant task fell to Colonel Young. From this time on (1 June 1941) ME Commandos virtually ceased to exist in the ME Order of Battle. The officers and men became prisoners of war for the next four years during which Young spent a total of three and a half years as a POW in Colditz.

After his release from Colditz, Young served in Germany, where he flew in the Berlin Airlift and commanded the Royal Engineers in Hamburg. This was followed by tours as Military Attache Prague and in Paris with NATO Headquarters.

In retirement he spent 14 years in the Russian Department of the Ministry of Defence.

Young was twice married.

The Capture of Hill 1433, Arakan - September 1944

This item is a summarized extract from the history of 425 Fd Coy (*RE Journal* September 1949). The background to the action is outlined in the memoir of Lieut Colonel P M Bennett. OBE, on page 230.

TOWARDSthe end of the 1944 monsoon, 425 Field Company (Major PM Bennett) QVO Madras Sappers and Miners, supporting the 53rd Brigade of the 25th Indian Division, provided sapper demolition assault sections with each of the Gurkha companies attacking Hill 1433, adjoining peaks and knife ridges of the Mayu coastal range. The Japs were well dug into bunkers on the knife edges on which artillery and air support could have little effect.

The leading Gurkha company attacking hill 1433 scaled the steep hillside by night and broke into the Jap position but was driven out with heavy casualties. The sapper *havildar*, with one sapper, supporting the leading Gurkha platoon, were amongst the few who did not become casualties. The next evening the *havildar*, with a *naik* and a sapper carrying made-up charges, crept through the undergrowth to the rear of the enemy position and placed their charges in an ammunition and grenade store bunker and, although discovered and shot at, managed to get

away in the confusion of the successful initiation of the demolition charges. After a very disturbed "jitter" night in close proximity to the Jap position, the *havildar* and the sapper entered it for a third time and successfully demolished two more bunkers. They again got away despite heavy fire and exploding grenades. The next evening the Gurkha company and sapper section were relieved by another company and section. Before leaving the *havildar* was refused permission to try his luck again inside the damaged Jap position. An IDSM and two MMs were awarded to members of the sapper section for their determined enterprise which has the historical sapper hallmarks of other great breaching operations, particularly in India and in NW Frontier campaigns.

Following these events, the rest of 425 Field Company had the difficult task for the next three days and nights cutting and digging communications to the forward companies, to resupply them and get casualties out, until the Japs abandoned their remaining positions.

BRIGADIER G T E WESTBROOK OBE DL

Born 12 August 1920, died 1 February 1994, aged 73.



GEOFFREY Westbrook had a most successful and wide-ranging military career embracing both staff and regimental service. Although he joined the Army in 1941, it was not until 1949 that he joined the Royal Engineers.

Having completed his education at St Lawrence College, Geoffrey joined the Army in January 1941 serving in the ranks in the RAMC until August 1942, when he was granted an Emergency Commission in the Royal Artillery and joined a light anti-aircraft regiment in the UK. Two years later, in December 1944, he transferred to the Infantry, serving first in the East Yorkshire Regiment, then the DCLI and, shortly afterwards, the 7th Battalion of the Seaforth Highlanders in 21st Army Group in North West Europe, which he served with until wounded in early 1945. On his return to active service in June of the same year, he joined the Beds and Herts and served as a staff captain in the British Military Mission to Ethiopia from November 1945 until July 1946. On returning to the UK, he was granted a short service regular commission in the Dorsets and found himself in the War

Office (SD 4) for the next two years, before he eventually transferred to the Royal Engineers with a regular commission in March 1949 joining 17 Supplementary Course at Chatham.

By now, Geoffrey was a senior captain and, having missed the normal young officer grounding in the Corps, it says a great deal for his drive and tenacity that he achieved such a successful career in the Royal Engineers. However, he had already passed the Staff College entrance examination and he attended the course at Camberley in 1951 passing well enough to fill the post of GSO 2 (Topographical Intelligence) as a temporary major in Headquarters Far East Land Forces and was appointed MBE in appreciation of his efforts there. On returning to the UK he rejoined the Corps and was posted as second in command of 3 Training Regiment for a year where he was able to enhance his knowledge of combat engineering before moving to Long Marston for experience in engineer resources. This was followed in March 1958 by a further tour on the staff, this time as a DAA&QMG in Headquarters Land Forces Persian Gulf.

His opportunity to command a field squadron came in 1959 when he took over 25 Field Squadron in BAOR and his success in this appointment was clearly illustrated, two years later, by his being appointed to command the BAOR Adventure Training Centre in Norway.

Returning to the UK in 1962, he was promoted to lieutenant colonel and took command of 36 Engineer Regiment at Maidstone at a particularly challenging time when the regiment was providing squadrons for 12-month tours in Aden. Only 12 months were available between a squadron returning from one unaccompanied tour and its departure for another in Aden and, because very few soldiers, and even fewer officers, volunteered for a second unaccompanied tour, this period was always one of frantic activity involving not only individual and collective training in works as well as combat skills, as this was a time of build up in South Arabia, but also the almost complete changeover of all personnel.

By 1964, Geoffrey was well established in the Corps and ready for the next staff appointment this time as Deputy Brigade Commander of 28 Commonwealth Brigade and Terendak Garrison in Malaysia. This was another demanding appointment both operationally and administratively which included the control of a large garrison of Australian and New Zealand, as well as British,

Brig G T E Westbrook OBE DL

families. He was promoted to be an OBE on completion of this tour.

When he returned to the UK, two years later, it was on promotion to colonel and as Deputy Commandant of the RSME where he became involved in the reorganization of the Roval Engineers Association from a number of different bodies into the current three-tier system which was established on 19 November 1968 when Her Maiestv the Oueen graciously granted her Patronage to the new association. He was also involved in setting up Westbröok School at Brompton, which bears his name in appreciation of the assistance he gave particularly in smoothing the way with the MOD. His tour at the RSME was followed by a posting to the MOD where he became a colonel GS in ASD in 1968 and was able to use his staff skills to the full.

Geoffrey was promoted to brigadier in 1970 and took command of 29 Engineer Brigade (V), based in Newcastle, with a parish stretching from Aberdeen to London. It was his introduction both to the TA and to the northeast of England and he found the appointment challenging and fulfiling. His nature suited the TA well and he very soon discovered how to motivate the officers and soldiers and, almost more important, how to manipulate the TA system to get things done. It was a period of industrial unrest in the country and, being the only brigadier in Northumberland and Durham, he frequently had to work closely with the police in the region, and the other emergency services there, in the preparation of plans to counter disruption caused by strikes in the ports, coal mines and fire services. His extensive staff experience served him well and he was always a leading member of the emergency planning teams at Headquarters Northern. Command. Serving in the north of England, with such a wide parish, also enabled him to indulge his lifelong interest in ornithology and he was often able to include a little bird watching while visiting units of the brigade.

After two happy years with the TA, Geoffrey returned to London as Deputy Engineer in Chief almost immediately, applied and was but. accepted for the appointment of Secretary of the North of England TAVR Association based in Durham. He resigned from the Army in 1973, at the age of 52, and spent the next ten years as a most effective and popular Secretary as evidence of which he was appointed a Deputy Lieutenant of the County of Durham. As the senior member of the permanent staff of one of the largest TAVRAs in the country, he was responsible for managing a large TA centre building and refurbishment programme as well as coping with the diverse, pressing, requirements of numerous commanding officers of all arms and services.

Geoffrey married Elizabeth Norah (Liza) Scott and they had three children, two sons and a daughter.

FGB

BRIGADIER A G P LEAHY CBE Born 19 December 1908, died 26 February 1994, aged 85.



BRIGADIER Arthur Gordon Poynter Leahy was educated at Cheltenham College and RMA Woolwich (Batch 20YO), being commissioned into the Royal Engineers in August 1928. Concluding three years' training at the SME and Peterhouse College Cambridge (where he attained 2nd class honours in the mechanical sciences tripos), he served in 12 Field Company at Aldershot until the end of 1934, before embarking for India. After two years with the Royal Bombay Sappers and Miners in Kirkee and Quetta, he was appointed to the Engineer-in-Chief's staff at Army Headquarters, India.

Leahy went to the Staff College at Quetta in 1940 and then became SORE II (G), Southern Command India, and was appointed MBE for work in connection with the reorganization of the Sappers and Miners. In 1942 he served as GSO II and GSO I at Headquarters Tenth Army in *Paiforce* for which he was Mentioned in Despatches.

Posted to Headquarters 33 Indian Corps as SORE 1 (G) until the relief of Imphal, he then became CRE 23 Indian Division again being Mentioned in Despatches and promoted to OBE. Appointed GSO1 (SD) at Headquarters, Allied Land Forces, South East Asia in September 1944, he returned to Fourteenth Army as CRE 19 Indian Division, after six months.

From 1946 to 1948 Leahy served as an instructor in the Construction School SME, commanded 131 Airborne Engineer Regiment TA, was AQMG (Ops) HQ BAOR, and in 1952 became Colonel AQ (Plans) involved in the staff planning to set up the British base in Belgium. From November 1954 he was Colonel GS at the SME for three years where, in addition to staffing the training systems of young officers, he become much involved in planning the reorganization of RE field units and the RE field chain of command. Posted to command the Engineer Training Centre at Ripon until 1959, he finally commanded the Training Centre RE at Longmoor before retiring in 1961, and being promoted to CBE.

After leaving the Army, Leahy worked for 12 years as a RO III at the RE Records Office in Brighton, achieving remarkable success. Many commanding officers throughout the Corps valued his fearless, impartial and meticulously fair judgement. Sappers of all ranks owed much to him for making the most of their talents and development of their careers. All who knew him came to respect and admire his rock-like stand for integrity and fairplay.

A keen sportsman, and enthusiastic horseman, Leahy won the Visitor's Race at the Quetta S-C Point to Point in 1934 and reached Corps standard at cricket, rugby, tennis and squash. He was a keen fisherman who also enjoyed reading and writing poetry.

Leahy was firstly influenced and thence indebted in life to two members of his family in particular. He always hoped that the last paragraph of his grandfather's obituary in the The RE Journal of February 1879, could also be said of him " Honest, straightforward and true... The Corps never had a more enthusiastic advocate ... " (Of historical interest: the two cannon balls standing outside the Crimean Arch at Brompton Barracks Chatham were brought home by his grandfather Colonel Arthur Leahy and presented to the Corps by his father Lt Col H G Leahy RA). His wife Ellie, who he married in 1936, was born and educated in America and brought a refreshing if somewhat unconventional ignorance of the accepted British Army conventions to their Army life together. However as he said "she always got away with it". They were devoted for 57 years and she died shortly before him on 26 October 1993. They had three children and are survived by two, along with eight grandchildren and four great grandchildren.

DLGB EAC

Brig A G P Leahy CBE

Memoir in Brief

A brief memoir is published below of a distinguished member of the Institution whose death has been notified recently in the national press and who served in the Royal Engineers for a short period between the wars and recalled to serve during World War Two.

Lieutenant Colonel Sir Edmond Joly de Lotbiniere, who has died aged 90, had a productive career both in the Army and as an entrepreneur, and was president of the Eastern Area of the Conservative Association (CA).

The son of Brig-Gen H G J de Lotbiniere, Edmond Joly de Lotbiniere was born in Egypt on 17 March 1903, and educated at Eton (where he performed well as an oarsman) and at Woolwich.

Commissioned into the Royal Engineers in 1923, he served in India. After matrimonial obligations compelled him to resign in 1928, he joined the Imperial Continental Gas Co.

In 1939 Joly was recalled to the Army and posted to the Aden Protectorate. He then campaigned in Eritrea and Somalia, was involved in a number of skirmishes, and captured the town of Hargeisa with 30 sappers armed only with revolvers. The Italian division, quartered in the town, flocked to surrender and the commander personally handed over his ceremonial sword to Joly, who was only a major at the time: he was Mentioned in Despatches. At the end of the war he was a lieutenant colonel and was appointed Chief Royal Engineer of the Oxfordshire District.

On leaving the Army for the second time he found his old post at Imperial Gas had been assumed by his former assistant. By chance he met the inventor of the Lignacite block-making process and set up a small works at Brandon, mostly manufacturing the building blocks by hand. The business prospered and Joly opened another factory in London.

In 1953 he became chairman of Bury St Edmunds CA, of which he was president from 1972 to 1979. In 1961 he was appointed chairman of the Eastern Provincial Area CA. When he was knighted in 1964 his family dubbed him the "Red Knight".

Joly was a keen gardener, a talented bridge player and an optimistic shot and golfer. He was renowned for his hospitality, style and courage, and was wholly stoical about mental and physical pain.

He married first, in 1928, Elizabeth Joliffe: they had two sons. He married secondly, in 1937, Helen Ferrar, who died in 1953. He married thirdly, in 1954, Evelyn Innes, who died in 1985.



Correspondence

BENT BRIDGE - NEW SOUTH WALES

From: Captain S P Boyd

Sir, – Lt Col Farmbrough's letter in the August 1993 issue of *The RE Journal* described a remarkable wooden bridge, the bent bridge, in New South Wales. Successive floods, most notably in 1986, had gradually increased the curvature of the bridge until the time of Lt Col Farmbrough's visit. In 1993, the local council decided to replace the bridge to ensure access across the river to the neighbouring properties.

Investigations showed that the valley consists of a very thick layer of unconsolidated sand above sandstone bedrock. During flood conditions, which can lead to water depths in excess of 6m above the bent bridge deck, severe scour of the sandy river bed can occur. It is estimated that under worst conditions, when the flooded river's surface is approximately at deck height, the river bed is scoured out to a depth of about 10m below the deck. When this occurs, a further 5m depth of sand in the river bed is fluidized and moves gradually downstream. It is this latter effect which has led to the migration of the bent bridge's piles, particularly in the centre of the river where scour is greatest due to higher water velocity.

The design of the replacement bridge had, therefore, to ensure that piles would be sunk to a depth below the part of the bed that could become fluidized. Additionally, the bridge design included as many pre-formed concrete sections as possible to



The replacement bridge was designed by CMPS & F Pty Ltd, a firm of engineering consultants and project managers, with which the Corps has an agreement to take two officers animally to broaden the officers' engineering experience, and with which the author is presently serving.

reduce the work required at the relatively remote site. The final solution was a bridge of 70m deck length with seven 10m spans each supported at each end by three 25m piles. The piles themselves are interesting as precast sections of this length could not be brought in by road so the piles were specified as off-the-shelf sections with steel end pieces which snap together (rather like the domestic car repair tool kit).

The finished bridge (below left), which was built at a cost of A\$250,000, is shown shortly after construction earlier this year together with the old bent bridge. Unfortunately, the wooden bridge, which was upstream of the new structure, has now been demolished to prevent additional scour of the river bed. Yours faithfully – Steven Boyd

BURMA 1944

From Lieutevant G P Webb Sir, - The following incident from the Burma campaign may provide some amusement.

92 Fd Coy and 32 Brigade, having crossed the Chindwin near Mawlaik in December '44, decided to send an advance party by raft down the Chindwin to Kalewa.

Our raft was made up of two folding boats, decked between the pontoons, driven by a propulsion unit through a flexible drive from a Petters engine. Sappers will appreciate that this arrangement is notoriously difficult to steer, being highly sensitive to the slightest change in the angle of the propulsion unit, developing large swings with delayed response to corrective steering.

The CRE of 20th Division had come to see us off, so as the raft took off for mid stream we saluted smartly and the CRE responded with a salutation that implied good luck and safe journey.

However, not being recently familiar with the awkwardness of such a craft, I over corrected the steering and the raft made a wide circle, returning to pass the CRE and his party again at the landing stage. We saluted again and the CRE responded with an uncertain wave, indicating a somewhat reduced level of confidence in our ability to navigate successfully to Kalewa!

The raft again made an erratic course, seeming to have a mind of its own, but by now the CRE and party were walking away and we were spared any further embarrassment.

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I did get the hang of the steering fairly quickly and we successfully navigated the shift and sand banks of the Chindwin to our destination, spending Christmas Day 1944 in bivouac on a bank of the river, consuming our single bottle of ration beer. Yours sincerely - Geoff Webb

AFFILIATION

From Brigadier John Constant

Sir, - I am writing about the note you included in the latest edition of *The RE Journal* on page 65 referring to the affiliation of the "Amphibious Sappers" to the Company of Watermen and Lightermen of the river Thames.

The point at issue is your use of the adjective "Worshipful", which we do not include with the title of the Company.

This practice does apply to some, but not all, of the City companies, which owe their allegiance to the Lord Mayor of London, whereas our company is under the aegis of the Sovereign, through Parliament. Nevertheless, the Freemen of the Watermen's Company give their respect to the Lord Mayor for two different reasons: Waterman's Hall is in the City itself, and he is the Honorary Admiral of the Port of London.

You may care to have further background information on the company and its links with the Royal Engineers.

On the London River, watermen had plied their trade since time immemorial, both with ferries across the stream and, in the absence of proper safe roads, along it. Their behaviour was not always correct and, indeed, during the Wars of the Roses, it degenerated to a scandalous level.

Henry VII reimposed sovereignty on the nation, and Henry VIII embellished this with a series of decisive actions in various spheres. 1514 was the year in which he turned his mind towards matters maritime; as well as formal decisions about the Royal Navy as a standing force, he confirmed the powers of the Trinity House to mark and light our shores. He also regulated the Thames watermen in no uncertain way, taking strong measures to enforce their professional conduct and decency.

Some 40 years later, during her brief reign, Queen Mary granted the watermen a charter to incorporate them as a company, with a monopoly to carry passengers on the Thames between the limits of Windsor upstream and the "Watermen's Stone" on the shore below Shommead Marshes. In 1700 the "Woodmongers" were permitted to join the company as Lightermen, with the task of moving and storing freight afloat within the same limits.

The appointment of a master did not originate until 1827 and the last relevant Act of Parliament transferred some of the Company's powers to the Port of London AUth011ty in 1908, having earlier brought the upper limit downstream from Windsor to Teddington.

The association with the Corps derives indirectly from the invention of gunpowder and the introduction of mortars and bombards, pieces of ordnance too heavy and awkward to be man-handled across rivers by the infantry and cavalry. This led to the need for watermen, usually from London, to build and operate rafts, when suitable barrels had been found and emptied.

Over the two centuries between the Crecy campaign in the XIV Century and the more sophisticated expeditions sent by Queen Elizabeth to the Low Countries, the English armies were accompanied by some of the 40,000 Thames watermen of that period. When I was commanding the Engineer Support Group, I was told that my predecessor in the XVI Century had enjoyed the title of "Captain of the Tin Boats", having introduced light metal pontoons shaped like big sausages!

Since the Restoration, England, and later Britain, has had a standing army, but whether Marlborough's pontoniers were impressed watermen or uniformed soldiers is not clear.

In the last century, power-driven vessels were used, not just to cross rivers, but to utilize the latter as lines of communication, culminating in the deployment of many hundreds of Royal Engineers in the inland water transport (IWT) units of the two world wars.

In recent decades, with the disbandment of the IWT Sappers, the watermanship role of the Corps has been confined within the art of field engineering; its specialist proponents are the amphibious Sappers, whether operating the present type of equipment, or in "Buffaloes" as at Walcheren in 1944.

You will note the expression of "Amphibious Sappers" has been carefully chosen for the affiliation, since regiments and squadrons may change their role, and it was specifically those in the amphibious units, whether regular or reserve, with which the Company wished to be associated, initially in an informal way, and now after several years, in accordance with the document signed in Waterman's Hall this year. Yours sincerely - Past Master Brigadier John Constant

THE BRENNAN TORPEDO

From Colonel J V Bartlett CBE

Sir, - Lt Col M P Lonnon writes that he still cannot understand how, by itself, a pull can move anything in the opposite direction.

I can lend him a British Seagull outboard engine which will demonstrate the principles convincingly. Yours etc - J V Bartlett

From Brigadier A C S Ross

Sir, - I am not surprised that Colonel Lonnon (*The RE Journal* letters April 1994) and others find the reported propulsion method of the Brennan Torpedo hard to accept. To send something away from you by pulling is unusual, though attractive, and if it weighs a ton and goes at 30 knots it is mind-boggling.

But I can believe it is possible. I think there are two factors involved: levers/gearing and friction. Friction becomes obvious if one thinks of the extremes of an ice-rink and a rack railway. Gearing is harder to illustrate but I think it is critical that the point of attachment to the moving object must move backwards in space when the object moves forward. A normal bicycle pedal at its lowest point still moves forward, even though moving backwards relative to the bike. But on a very low-geared mountain bike it would be possible to have the lower pedal moving backwards. Therefore pulling it hard backwards, with good friction between the tyres and pavement would move the bike forward.

Similarly, the lowest point on the flange of a railway train wheel actually moves backwards in



"Retroactively operated vehicle with elongated rope.""

space as the train goes forwards. On a high speed train the lowest flange point travels constantly in reverse at some IOmph. If one could harness this flange and pull harder in reverse one could make a TGV go with even grander *vitesse*.

If it is of any interest, the sketch (below left) is of a machine that may be pulled away from you. It is called a "retroactively operated vehicle with elongated rope", but I suppose that were it to be built it would be using "backward moving wiretechnik".

With reference to the Brennan torpedo, I can only repeat my December letter; "very efficient propeller design and pretty impressive winding engines" - or, as Colonel Lonnon suggests, there are yet more secrets. Yours etc - Alan Ross

From Major A McLachlan

Sir, - Perhaps I can help Lt Col M P Lonnon (letter April 1994 *Journal*) with his query concerning the Brennan Torpedo, and assure him that there is no need for an onboard source of power.

The essence of the solution is the concept of mechanical advantage (MA), familiar perhaps with respect to levers, but equally applicable to any mechanism. MA is defined as the ratio of the output force to the input force, and it is the duty of most machines to multiply the input force to generate a higher output force (MA> 1).

This concept can be applied to the Brennan Torpedo by considering its internal components - cable drum, gearbox, shaft, and screw - as a single mechanism. The input force is the tension in the cables, and the output force is the thrust of the screws against the water. By selection of suitable parameters within the mechanism such that MA> 1, the thrust from the screws can exceed the tension in the cables. This will result in the torpedo moving forward as the cable is pulled out to the rear:

Lest anyone think that this sounds too good to be true, it is worth pointing out that, as the MA is increased, its inverse, the velocity ratio (VR), decreases. VR is defined as the ratio of the output velocity to the input velocity for the mechanism, and in simplistic terms, ignoring losses and inefficiencies, means that, to achieve an MA=4 (say), VR=0.25. So, using these figures, to move the torpedo forward 1m, 4m of cable would have to be unwound from the drums. As the MA is raised to increase the thrust, so the faster it is necessary to reel in the cable. There's no such thing as a free launch! Yours sincerely-Andrew McLachlan

WATERLOO - NEW PERSPECTIVES-THE GREAT BATTLE REAPPRAISED DAVIDHAMILTON-WILLIAMS

Published by Arms and Armour Press, Villiers House, 41/47 Strand, London WC2N 5JE-Price £20 ISBN 1 85409 156 5

ApPARENTLMost of us have been brought up to a version of the story of Waterloo which is seriously flawed. in many respects actually false. Wellington's strategy may not, after all, have been to bring Napoleon to battle and destroy his Army on ground of his (Wellington's) own choosing; he may actually have had his eye more on his withdrawal route to the ScheIdt regardless of the fate of the Allied armies - it seems the great fight at Hougoumont had no relevance to the battle other than this. As well as the Prussians, the Dutch and Belgian Allies displayed exemplary bravery, a far cry from the dubious behaviour ascribed to them in many contemporary British accounts.

These are just some of the revisions to the normally accepted British story' of Waterloo that result from David Hamilton-Williams' meticulous rereading of the original sources. The villain of the piece is Captain William Sibome, whose version had until now been taken as gospel by all but a few historians. Sibome was not present at the battle but, with the permission of the Commander-in-Chief, he visited the scene a few years later and made two models one of which now forms part of the National Army Museum's "Road to Waterloo" permanent display. These snapshots of the battle were based on personal accounts which Sibome obtained from the participants. Allowing for some pardonable individual gloss to the stories, this would have been satisfactory had not Sibome fallen so badly into debt over his model project that he was obliged to ask his subscribers to purchase shares in the enterprise. The dividend from their investment was to be a favourable version of their own part, both on the model and in Sibome's book published in 1844; and hence a serious distortion of the true story and a grave wrong to many whose contributions to the battle are either ignored or slighted. In 1891 this "crime" was then compounded by Sibome's son, Herbert, who decided to edit and publish the papers collected by

his father under the title "Waterloo Letters". To achieve this without ruining his father's reputation he had to perpetuate the same distortions. (Incidentally, by this time Herbert had become a distinguished Sapper general who might have been expected to behave better. His valuable papers on other matters were recently acquired by the RE Museum.)

Siborne's was not the only contemporary account guilty of this type of misrepresentation. The Frenchman Houssaye, who many historians have relied upon, also stands condemned for his economy with the *verite* in the interests of Napoleon's reputation. But much of Hamilton-Williams' most bitter invective is reserved for the generations of historians, particularly Sir Charles Oman ("an intellectual bigot"), who he maintains have too readily accepted the Sibome version.

To the reader-in-the-street this may all seem a little academic. What matters more to most of us is that the book engages the attention with complete conviction and succeeds in presenting the story on all levels, from the wide political background to the attitudes of the soldier on the ground, in an exciting and graphic manner. The diplomatic preliminaries are clearly explained both the shenanigans between Castlereagh and Metternich, the British and Austrian foreign ministers, which led to so much mistrust between the Allies: and the internal problems in France which were the true cause of Napoleon's eventual downfall. Furthermore it is easy to forget that the British Parliament was by no means united on the desirability of fighting Napoleon and restoring the Bourbon monarchy in France.

The actual events of the campaign will be familiar to most readers. The terrible struggle which took place that long June day is as thrillingly told as in any account. It is the emphasis which is new. Much of this grows out of Hamilton-Williams' skilful handling of the evidence of the various messages passed in the confusion of battle. Thus well-known episodes such as Wellington's "humbugging" by Napoleon's advance despite Colquhoun Grant's perilously won intelligence, the failure of d'Erlon's Corps to take the decisive action at Ligny-Quatre Bras, the battle-saving concentration of the Netherlands' 2nd Division at Quatre Bras against Wellington's orders and Blucher's wholehearted commitment of the

Prussian Army to the Waterloo battle notwithstanding Gneisenau's well-founded mistrust of Wellington, acquire new significance.

It is best to draw a veil over the contribution of the Sappers and the embarrassing failure of the company of Sappers and Miners to carry out Wellington's orders to prepare an entrenchment to his rear. In recording this matter Hamilton-Williams correctly cites Corps History but in his note adds "because of these 350 men having been in the wrong position. La Haye Sainte was not placed in a state of defence, with loopholes, firing platforms or earthworks." This comment is quite unjustified since had the company succeeded in carrying out their orders (they actually lost their way during the night march) they would still have been nowhere near the battle and it was never part of the plan for them to fortify La Haye Sainte. That it should have been is another matter. It might be valid to ask why Carmichael-Smyth, the Commanding Royal Engineer, or some of the ten other Royal Engineers present at the battle had not made it their business to propose such a use for the Sappers and bring the company forward in all haste. Extracts from Napoleon's orders in the book suggest a rather better understanding of Sappers among the French generals.

Although such unwarranted comment by the author does sow a small seed of doubt as to the validity of his other conclusions, what is beyond doubt is the exhaustiveness of his research. The author describes the book as "an attempt to tell the truth about... the Hundred Days", although occasionally he does labour his message to the point of threatening truth-fatigue-in the reader. He claims no chauvinism or bias and certainly the rehabilitation of the honour of the Allied soldiers is most welcome. He does however admit to some partiality, in his contempt for the House of Bourbon, a considerable exception as it indirectly touches those such as the British government (and the Duke?) who supported the royalist cause. There is marked sympathy for Bonaparte in this account. A further book in preparation by the author, "Napoleon: The Final Betrayal" will apparently tell of "his subsequent murder on St Helena through the British Government's connivance". There is scant praise for Wellington, certainly no adulation and his interventions in the actual battle are sparsely mentioned.

One last grumble. This is one of those books where much of the meat is in the end-notes, presumably with the aim of paring down the main text to its bare essentials. It is maddening for the reader to have continually to turn to the end of the book to consult the notes. If these contain information material to the main text, why can they not be either incorporated or placed at the foot of the page? End-notes should be confined to citations of references.

All that said, it is hard to imagine an account of "The Great Battle" where all the elements political, tactical, technical and personal fit so well together into a coherent whole and carry such authenticity and excitement; essential and enjoyable reading for anyone interested in period and an excellent starting point for anyone coming to the story for the first time.

GWAN

SOMETIFING LOST **BEIIIND THE** RANGES JOHNBLASHFORD-SNELL

Publisher - Harper Collins, 77-85 Fulham Palace Road, Hammersmith, Landon W6 8iB -Price £18.00 ISBN 0 00 255034 2

"I SEEfrom the programme that the Mess is to hold a Roman Orgy party. If so, it is to be a proper orgy. I want lions, gladiators, chariot races and vestal virgins. I will provide all but the last!". Thus John Bläshford-Snell gave his first order on day one as CO of the Junior Leaders Regiment. Many who have served with him will recall similar experiences. Life with Bläshers is always anything but dull.

Since his first major expedition descending the White Nile at Emperor Haile Selassie's request, Blashers has led over 60 expeditions to all comers. of the globe. He has even searched for the Loch Ness Monster from an airship! So successful were his early adventures that the Prince of Wales persuaded him to launch Operation Drake, and later, Operation Raleigh. Thousands of young explorers. of all backgrounds and nationalities have gained as a result. Overall his expeditions have raised some £20M. As well as arranging his adventures, Blashers still managed to lead a more or less normal military career, at least until the latter stages. He found time to instruct at Sandhurst, and command both a squadron and a regiment, enjoying active service tours in Dhofar and Northern Ireland.

John Blashford-Snell has now written his autobiography - "Something Lost Behind the Ranges." And a cracking read it is too. Written in rip-roaring,

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ripping yams style you would expect, it is full of humour and one cannot but marvel at what JBS has managed to cram into his life. No wonder he has become the most publicly known Sapper of his generation, not least through countless appearances on TV and his daunting lecture programme. The account of his starring role on "This is Your Life" is hilarious, and surely only Blashers could choose *Jerusalem, Rule Britannia* and *Hurrah for the CRE* on "Desert Island Discs"!

The book covers John's early life in Jersey, his military career from days as an instructor at Sandhurst to operational tours as an OC, and many other experiences including his stewardship of a Government youth programme at Fort George. As you would expect, however, the majority of the book is about his expeditions - the Blue Nile, Darien Gap, Zaire River, Operation *Drake*, Operation *Raleigh*, and Mongolia to name but a few.

"Something Lost Behind the Ranges" should be mandatory reading for all subalterns. It shows what can be achieved with imagination, determination, hard work, a huge zest for life and adventure - and, of course, a wonderfully supportive wife. It also provides a useful insight into how to lead the sorts of self reliant, strong willed, sometimes egotistical characters attracted to expeditioning.

So if it's tales of bandits, crocodiles, yetis, deserts, jungles, seas, cannibals, Mongols, and giant elephants, you want, read the book!

Finally one extract to give you a flavour. On reaching safety after an extremely narrow escape from bandits on the White Nile expedition, Blashers writes "As we staggered up the beach a large lady from Texas turned to her husband and said 'These guys must be crazy'. 'Hush dear', he replied, 'they're British'."'

Buy the book; Blashers is not only British to his core, he's also a Sapper!

PlR-J

D-DAY ONWARDS THE RAILWAY SAPPERS COMPREHENSIVE CONTRIBUTION LIEUTCOLONEH M DANNATERD CENG

Obtained from the author at the following address: Broadfields, Little Leighs, Essex, CM3 IPF - Price £10 inclusive of post & packaging

WffiI the 50th anniversary of D-Day upon us and next year being the 50th anniversary of the end of

the Second World War in Europe (VE Day), it is hardly surprising that authors and editors are marking these occasions by placing on record events about which they had knowledge and which often took place at the most impressionable time of their lives. With the proliferation of such works one could be excused for asking why another war story is needled. There are, of course, as many potential war stories as there are participants, all of whom saw events from their own standpoint; in this instance the author/editor has not only identified a gap but also the need to record the contribution by a number of persons who were essentially carrying out a civilian role under military conditions. The need has been enhanced by the transference of transportation roles from the Corps of Royal Engineers to the Royal Corps of Transport.

The lengthy title belies the brevity of style which holds the reader in progressing through the training, development and operations of a military railway operating service, which, as promised in the title was indeed comprehensive. This worthy publication not only depicts the more obvious activities of a railway operating company but also describes the work of the "backroom boys" who, with their particular skills of boilermaking, welding, turning and fitting, made it possible to get war-damaged and broken down locomotives and rolling stock back on the rails and keep in good running order those in service, without the need to be dependent upon local civilian railway staff.

It is helpful to be made aware of the historical background to military railway transportation and of the realistic and practical training which members of that specialist division underwent. Colonel extensive Dannatt's practical and technical knowledge of not only railway operating, but also of the fundamental principles of the motive power which hauled the trains is apparent, and well qualifies him to produce this book. Those that knew him in the field will happily recall that he was never happier than when in a set of blues of the dungaree sort, (rather than No I blues!) It is his ability not only to teach and command but also to carry out all the functions involved in maintenance and operation of locomotives that earned him respect from his peers and subordinates. It also qualifies him to present this much needed treatise of the contribution made by railway Sappers to the war in Europe. This strength of technical knowledge and detail may make reading a trifle hard for the lay reader who may find it helpful to have to hand a glossary of terms.

Nevertheless it is a factual first-hand account, supported by contributions from other members of the 181 Railway Operating Company, which fills a need and makes most interesting and informative reading aided by a large selection of maps, plates and photographs. KJG

"CHEMICAL SOLDIERS" - BRITISH GAS WARFARE IN WORLD WAR ONE DONALD RIEMER

Published by Leo Cooper - Pen & Sword Books Limited, 47 Church Street, Barnsley; South Yorkshire S70 2AS - Price £15.95 ISBN 085052 3885

IMAGES of gas casualties still have the capacity to shock. But in his book "Chemical Soldiers". Donald Richter explains that in the First World War, contrary to popular myth, they were probably the lucky ones as most of them recovered. Manv Sappers will be interested to read "Chemical Soldiers" because, as the sub-title suggests, it recounts the extraordinary story of British gas warfare in which the Royal Engineers played a leading role. In this remarkable tale of desperate ingenuity and feverish improvisation, the book traces the evolution of one of the Army's most innovative and idiosyncratic units - the "Special Brigade RE" - from Haig's first hurried retaliatory gas attack at Loos through long years of experimentation, trial and error (and there was plenty of that!) to the massed cylinder attacks of 1918.

Donald Richter, an American historian from Ohio University, has mined a rich seam of military records and personal diaries to produce a vivid account of life in the trenches through the eyes of those who actually lived and were gassed there. The result is a lively book full of fascinating detail and contemporary⁻⁻ comment. At the same time, Mr Richter has also attempted the more difficult task of analysing the ethical background and tactical employment of poison gas warfare, as well as taking a critical look at the commander of the Special Brigade, Charles Foulkes.

Somewhere beneath the resulting mass of minutiae and technical detail lies an abundance of forceful lessons waiting to be found; but Mr Richter does not quite manage to unearth them. As a narrative account of life in the First World War the book works well enough: it is painstakingly researched and intensely human. But although it offers a fresh, unsentimental insight into a significant, if somewhat neglected, subject it ultimately proves unsatisfactory as objective military analysis. A yawning gulf seems to lie between Mr Richter's academic perspective from Ohio and the harsh military imperatives of Flanders in 1916. He stumbles in the minefield of peacetime values and wartime necessities. And his stock as a military commentator is not enhanced by making trivial mistakes like confusing Chatham with "The Shop".

Nevertheless, "Chemical Soldiers" is a serious study of an important chapter in military history and as such it deserves to be read. Few will take issue with Mr Richter's assertion that gas was never decisive and seldom really effective. And with the benefit of hindsight, his criticism of its operational command and control is also probably justified. He rightly highlights the controversy over projectors versus cylinders, and he catalogues the extraordinarily "Heath Robinson" manner in which the technology of both was advanced. He goes on to show how frustration and disappointment gradually mounted with the realization that gas could never achieve the tactical breakthrough on which so many had pinned their hopes. The fact that gas became the most effective rat-killer of the war proved insufficient compensation.

Probably the best aspect of this book is its vivid portrayal of the routine boredom, frustration and danger experienced by the chemist corporals of the Special Brigade. Mr Richter introduces an astonishingly rich and varied cast of characters including many well known names such as Livens, Stokes, and Hartley. Yet this reviewer (who is proud to declare a strong personal interest) would take issue with much of the final chapter in which Mr Richter conducts a critical appraisal of Brigadier Charles Foulkes who, unflinchingly and virtually alone, shouldered the formidable responsibility of British gas policy throughout the war. Mr Richter may be surprised that Foulkes felt no sense of guilt or remorse for his part in defeating the Germans; others less remote from military reality will. understand why this was so.

THEF

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