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YOUR Journal depends for its existence on articles and correspondence submitted for publication on historical, professional, technical and, indeed, on any subject of interest to Military Engineers.

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Articles may be of any length, but preferably not more than 6000 words. They should be typed in duplicate on one side of the paper only, double spaced with a one-inch margin. A third copy should be retained by the author for checking with the proofs.

Articles should be accompanied by a photograph of the author, suitable for reduction to two inches width, and a pen picture of his career to introduce the author to our readers.

Photographs to illustrate an article should be black and white prints on glossy paper. The size of the photograph does not matter as the size can be adjusted. Line drawings, maps etc must be in black ink and all lines, lettering etc must be bold and clear to allow for reduction in size when reproduced. Scales must be drawn and not worded.

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Articles may be submitted at any time but the following dates are *normally* the latest for inclusion in the issues shewn:

MARCH ISSUE	1 DECEMBER	SEPTEMBER ISSUE	1 JUNE
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For articles requiring clearance attention is drawn to Military Security Instructions Part 1 Army Code No 60723 Appendix B to Chapter 5.

CORRESPONDENCE

Correspondence is the life blood of the *RE Journal*. Correspondence on published articles is particularly interesting as it provokes further thought and widens the discussions on controversial topics. It is important however that the initial reactions to articles published should be in the NEXT Journal to maintain the interest in the subject. For this reason the submission date for correspondence *referring to articles* is five weeks later than that for articles. On average this will give correspondents about one month to react.

The submission dates for Correspondence on published articles are therefore:

MARCH ISSUE	7 JANUARY	SEPTEMBER ISSUE	7 JULY
JUNE ISSUE	7 APRIL	DECEMBER ISSUE	7 OCTOBER

Editorial

THE 75TH ANNIVERSARY YEAR OF THE TERRITORIAL ARMY

On 1 April 1908 Mr Haldane's great Army reforms caused the Militia to be replaced by the Special Reserve and the Volunteers became the Territorial Force for Home Defence. A little of the background, particularly that which affects the Corps, might be of interest to Members.

The Reserve Army really stemmed from the ancient feudal levies which developed into the Trained Bands of Queen Elizabeth I's time and which were finally disbanded, soon after the Restoration of 1660, when Charles II raised the Standing or Regular Army for permanent defence and the Militia for emergencies.

Volunteers were first authorized in 1757 to make up Militia quotas and not until twenty-one years later were distinct Volunteer units formed as part of the Militia. In 1794 they become a separate Corps of Volunteers. In 1852 the armed forces of the Militia were re-established on a voluntary basis.

There were no Engineer units as such in either the Militia or the Volunteers until 1860 when the 1st Middlesex Volunteer Engineers were raised. The Militia had no Engineer units until 1877 when two of the oldest Infantry Regiments, the Royal Monmouth Light Infantry and the Royal Anglesey Light Infantry were converted to Militia Engineers. In 1896 both achieved the distinction of a second title of "Royal" when Militia Engineers became Royal Engineers. Alas in about 1923 the Anglesey's ceased to exist.

The 1908 Haldane reforms caused units to be organized on a formation basis and the County RE became Divisional Engineers, Army Troops and Fortress Engineers. These included Signal units, Telegraph, Works and Electric Light Companies. (Submarine Mining had been transferred to the Royal Navy in 1907.) The Special Reserve provided Siege, Railway and Depot Companies.

The Engineer and Railway Staff Corps, founded in 1865, remained unaltered. It consisted of Volunteer officers who were managers and engineers of the principal railways, and other distinguished engineers. This Corps still exists today as part of the Territorial Army and advisers to the Ministry of Defence.

In 1921 the Territorial Army for Imperial Defence replaced the Territorial Force which had been raised for Home Defence only. It is to the credit of the Volunteers and the Territorial Force that they were never backward in volunteering for overseas service particularly in the Boer War and World War I. At the same time (1921) the Supplementary Reserve (to complete the Regular Army in emergencies) superseded the Special Reserve.

Although in March 1939 authority was given for the Territorial Army to be doubled, conscription came into force on the outbreak of war and there was considerable interchange between Territorial and Regular units in formations. The honour for successful operations must be shared by all.

Recent years have seen further changes but these are within the living memory of most Members and will not be included in this very brief picture. Suffice it is to say that, as always, special praise is due to all ranks of the Territorial Army who give up so much of their spare time to train themselves so well for war. The Territorial Army remains of enormous potential value in any future emergency.

"Letter From Home—1982"

THE ROYAL ENGINEERS POSTAL AND COURIER SERVICES (PCS)

THE 2 PC Regiment RE Spearhead team was placed on standby on 1 April for possible deployment to the South Atlantic. Initially a team of one Officer and nine ORs was prepared to move at four hours notice, but as the Task Force was formed it became apparent that little could be achieved by including the team on a ship with 3 Commando Brigade where they would be isolated and unable to operate a viable service. In consequence, a proposal was made to C-in-C Fleet to establish a line of communication PC Detachment on Ascension Island.

On 14 April, OC 20 PC Squadron RE travelled as Defence Courier in an effort to obtain permission to operate a BFPO from CBFSU Ascension. On 16 April, the need for a BFPO was finally acknowledged and clearance for three PC Operators to move to Ascension was granted. At 1300hrs on 17 April the BFPO was formally opened.

HMS *Hermes* was designated the mail co-ordinator for Task Unit(TU)1 and the planning of despatches to TU1 was, therefore, based on the mail reaching *Hermes* who would arrange disposal by helicopter to the ships within the unit. Hercules aircraft carried out a limited number of heavy drops using one ton waterproof containers which were dropped into the sea and recovered by helicopter. No mails were lost in the process. After three to four days sailing the unit was outside the operational range of the Hercules and we were forced to rely upon Southbound ships as mail carriers.

Meanwhile the *Canberra,* HMS *Fearless* and the LSLs carrying 3 Cdo Bde and 3 Para had arrived in Ascension and the bulk of mail quadrupled.

On the arrival of HMS *Intrepid,* the *Fearless* group departed on 6 May. The pattern of airdrops and disposal of mail by sea as previously described was repeated.

The PC detachment, being the only operative distribution agency, took over the responsibility for distribution of newspapers, welfare goods and video tapes for the Task Force. In addition, the Warrant Officer IC was also made responsible for the provision of maps and was nominated by Comd Finance UKLF as the Army Pay representative for Ascension.

The taking of South Georgia added a new dimension to the logistic task in that the Task Force split into several separate entities based on South Georgia, the Temporary Repair and Logistic Area (TRALA), the Total Exclusion Zone (TEZ) and Tristan da Cuhna. In addition, a replenishment group was established in the shipping lane to carry out Replenishment at Sea (RAS). It was no longer feasible to send the mail South in bulk and a system had to be formulated to take into account the dispersal of shipping. The South Atlantic was split into four zones: A—The Falklands (TEZ); B—South Georgia and TRALA; C—Ascension; and D—other areas which included the Replenishment Group and submarines. Three ships, HMS *Leeds Castle,* HMS *Dumbarton Castle* and CS *Iris* were designated mail carriers and proceeded to operate a shuttle service from Ascension to Zones A and B, the round trip taking approximately three weeks. Any other vessels going South were also utilized.

The advent of modified C130 aircraft fitted with air-to-air refuelling probes and long range internal tanks, increased the overall capacity for the disposal of mail. Weight restrictions were such that, with the exception of aircraft dedicated to drops to specific ships, only operational classified despatches could be included in their entirety. Airmail was loaded on a fill-up basis to the maximum capacity of the aircraft.

On 11 May, a free aerogramme service was introduced and during the period of hostilities some 1½ million forms were issued to the Task Force. During the three weeks prior to the introduction of Freepost, stamps to the value of £31 949 were

Photo 1. "Look what I've got, Mail"

issued and sold by the FPO.

Two further detachments of 20 PC Sqn were subsequently deployed with the Task Force when it moved south towards the Falkland Islands: one embarked in SS *Canberra* with 3 Cdo Bde and the other in RMS *QE2* with 5 Inf Bde. On arrival in the Falklands, these detachments went ashore and were established in their respective Brigade maintenance areas on San Carlos Water; 3 Cdo Bde at Ajax Bay—Red Beach, and 5 Inf Bde at San Carlos—Blue Beach. A small HQ Cell was set up in HMS *Fearless* with HQ MGRM to co-ordinate the PC operations for both the Land Force and for ships within the TEZ.

The two detachment ashore (one of which operated in the same building as the field surgical team with a 1000lb bomb lodged in the roof) were providing a mail service to forward units and also to the logistic tail by helicopter. The HQ Cell in HMS *Fearless* was serving the ships in San Carlos Water and also co-ordinating mail distribution to the Fleet with Task Groups, the Flagship and also the homebound despatches to the UK via Ascension Island. This system obtained until the ceasefire on 14 June.

After the ceasefire the Postal and Courier effort was concentrated in Port Stanley where, because of damage to the runway, aircraft could not at first land, consequently mail and stores had to be air-dropped. The first air-drop took place on 16 June when most of the mail fell into what subsequently proved to be a minefield; it was recovered without premature opening!

Air-drops became a daily feature until the airfield was re-opened for traffic on 23 June. Between 23 June and 14 August, there were two aircraft scheduled daily, although the failure rate because of bad weather was somewhere in the order of 40%. However, the mail continued to arrive at the rate of about 1800/2000lb a day with transit times of three days for mail and two days for newspapers. These despatches also included mail for the civilian population of the Island.

As soon as practicable a counter service was set up and mail distribution to units ashore reverted to the normal mail orderly system. Mail for ships in the local anchorage was distributed by boat from the duty guard ship and to ships further out in the TEZ by helicopter. Helicopters were also used to get mail to and from the more remote locations both for Task Force Troops and the Falkland Islanders.

A Courier Service to and from the UK for Classified and Cryptographic material was provided for CLF, CTF and the Civil Commissioner.

Letter from home 1982 1

The airfield was closed for repairs and extension on 14 August for a scheduled two weeks. During this closure it was decided to attempt the recovery of mail from the Islands by what had become known as the "snatch method", involving a low flying Hercules snatching up a mail bag from a rigged line by means of a grapnel. The system was widely publicized at the time and worked well. Suffice it is to say that during the period of the airfield closure, mail continued to arrive by air-drop and all the UK bound despatches, which were necessarily restricted to official letters and Forces Air Letter Forms got away. Following the re-opening of the airfield on 28 August, the system reverted to a two aircraft schedule every day, and with the onset of the southern summer the number of flights lost due to bad weather declined.

The following signal was received from HMS *Hermes* on 15 July—"Very many

Photo 2. "A welcome delivery at sea"

Letter from home 1982 2

Photo 3. "Letter from home—1982"

thanks for a superb service provided under extremely difficult circumstances. I believe that *Corporate* mail was one of the outstanding successes of the campaign. Well done."

The original detachments from 2 PC Regt RE were subsequently replaced in early September by the new Falkland Island Postal and Courier Troop as part of the FILOG Battalion and work has continued at a hectic pace despite the reduction to one daily C130 flight. Distribution among the Falkland Islands and to South Georgia for military and civilian mails now operates well using helicopter, air-drop and shipping as necessary. Special flight arrangements had been made to ensure in-time delivery of Christmas mails up to the last possible moment.

Liaison with the local Post Office is first class and the FPO continues to operate from Port Stanley PO; this is likely to continue as the Islanders are enjoying a better service than they ever dreamed possible.

The Tarbard Trophy

THE photograph shows the fifty-six ounce Silver Rose Bowl presented to 36 Engineer Regiment by the family of Sapper Wayne Tarbard, 20 Field Squadron, who was killed in action in the Falkland Islands 8 June 1982.

Sapper Tarbard was an ex-apprentice who had been with the Squadron since November 1981. He was a member of 3 Troop (attached to 9 Para Sqn) who were in support of the Welsh Guards and was listed as missing after the enemy air attack on the RFA *Sir Galahad* at Fitzroy.

The Tarbard Trophy will be held in the Regiment as a permanent Memorial to Sapper Tarbard and will be presented to the top student on each JNCO's Cadre held in the Regiment.

Letter from home 1982 3

Stanley Airport—Airfield Damage Repair

MAJOR D I REID RE, MA, C Eng, MICE

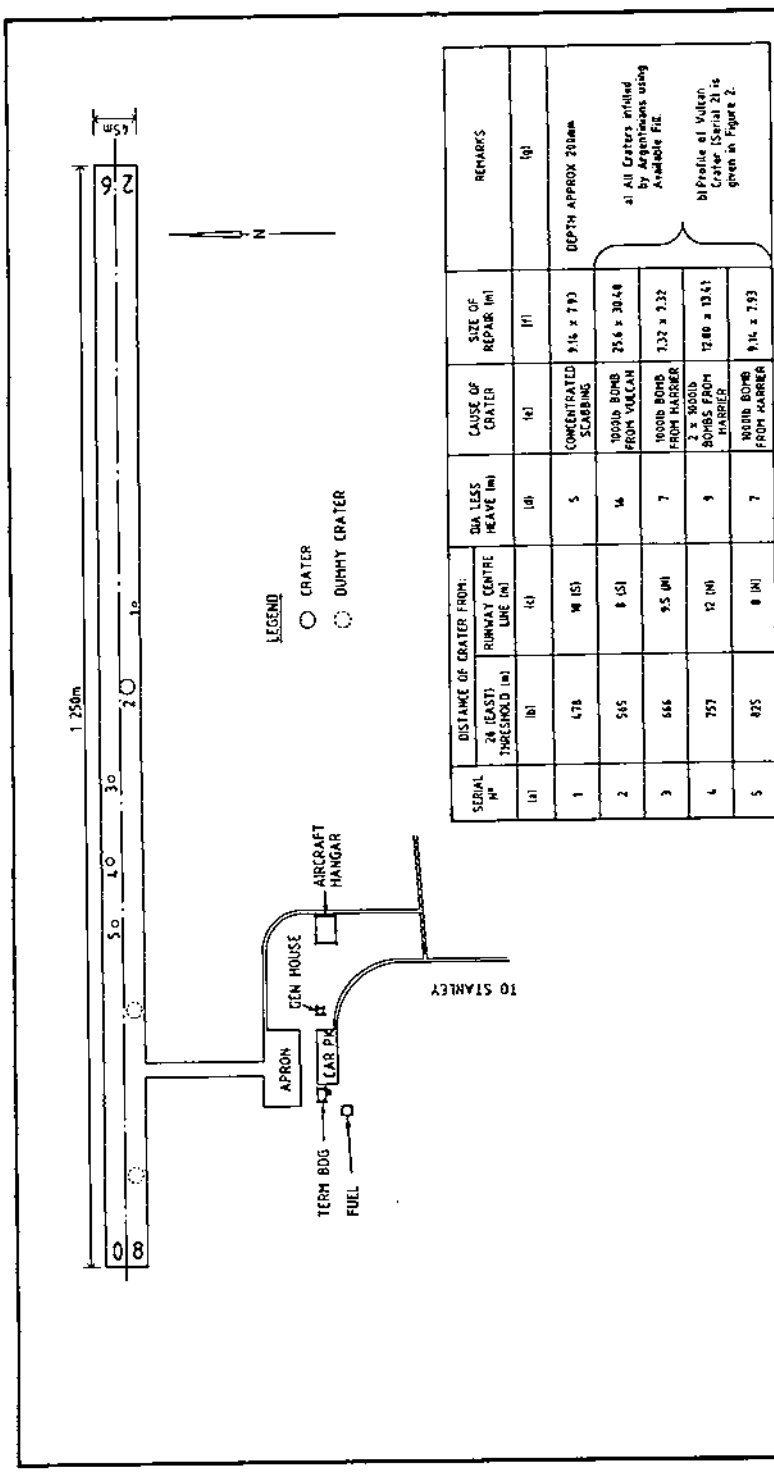
The Author joined the Army in 1965 as a Direct Entrant from Cambridge University. He served as a Tp Comd in BAOR and the Middle East either side of his YO Course. Successive tours as IO of 21 Engr Regt, 2IC of 3 Fd Sqn and AI Fieldworks at RSME were followed by his Long Civils Course and Staff College. From Camberley he was posted as GS02 RE at 4 Armd Div before commanding 51 Fd Sqn (Const) at Ripon during which time his Sqn spent 6 months in Belize. His current posting is as OC 527 STRE (Const) at Barton Stacey but, during Op Corporate, *he joined the advance party of CRE (Works) FI and commanded the Airfield STRE with responsibilities for the repair and development of Stanley Airfield.*

INTRODUCTION

Stanley (Falkland Islands) Airport, which was constructed between 1974 and 1976, is located 8km east of the town of Stanley. The airfield, the plan of which is given at Figure 1, consists of:

(a) A 1250m long by 45m wide runway. Its pavement section has a bituminous concrete wearing course, which was designed to be 32mm thick but is, on average, 55mm thick. This course is laid on top of a 150mm thick layer of wet-bound maca-

Stanley Airport- Airfield Damage Repair Major D J Reid RE MA C Eng MICE



SERIAL No	DISTANCE OF CRATER FROM: 26 (EAST) THRESHOLD (m)	DISTANCE OF CRATER FROM: RUNWAY CENTRE LINE (m)	DIA LESS HEAVE (m)	CAUSE OF CRATER	SIZE OF REPAIR (m)	REMARKS
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	478	14 (S)	5	CONCENTRATED SCABBING	9.14 x 7.93	DEPTH APPROX 20mm
2	565	8 (S)	14	1000lb BOMB FROM VULCAN	25.6 x 30.48	a) All Craters infilled by Argentineans using Available Fill
3	666	9.5 (N)	7	1000lb BOMB FROM HARRIER	7.32 x 7.32	
4	757	12 (N)	9	2 x 1000lb BOMBS FROM HARRIER	12.80 x 13.41	b) Profile of Vulcan Crater (Serial 2) is given in Figure 2.
5	925	8 (N)	7	1000lb BOMB FROM HARRIER	9.14 x 7.93	

Figure 1: Plan of Stanley Airfield, with details of Craters on Runway.

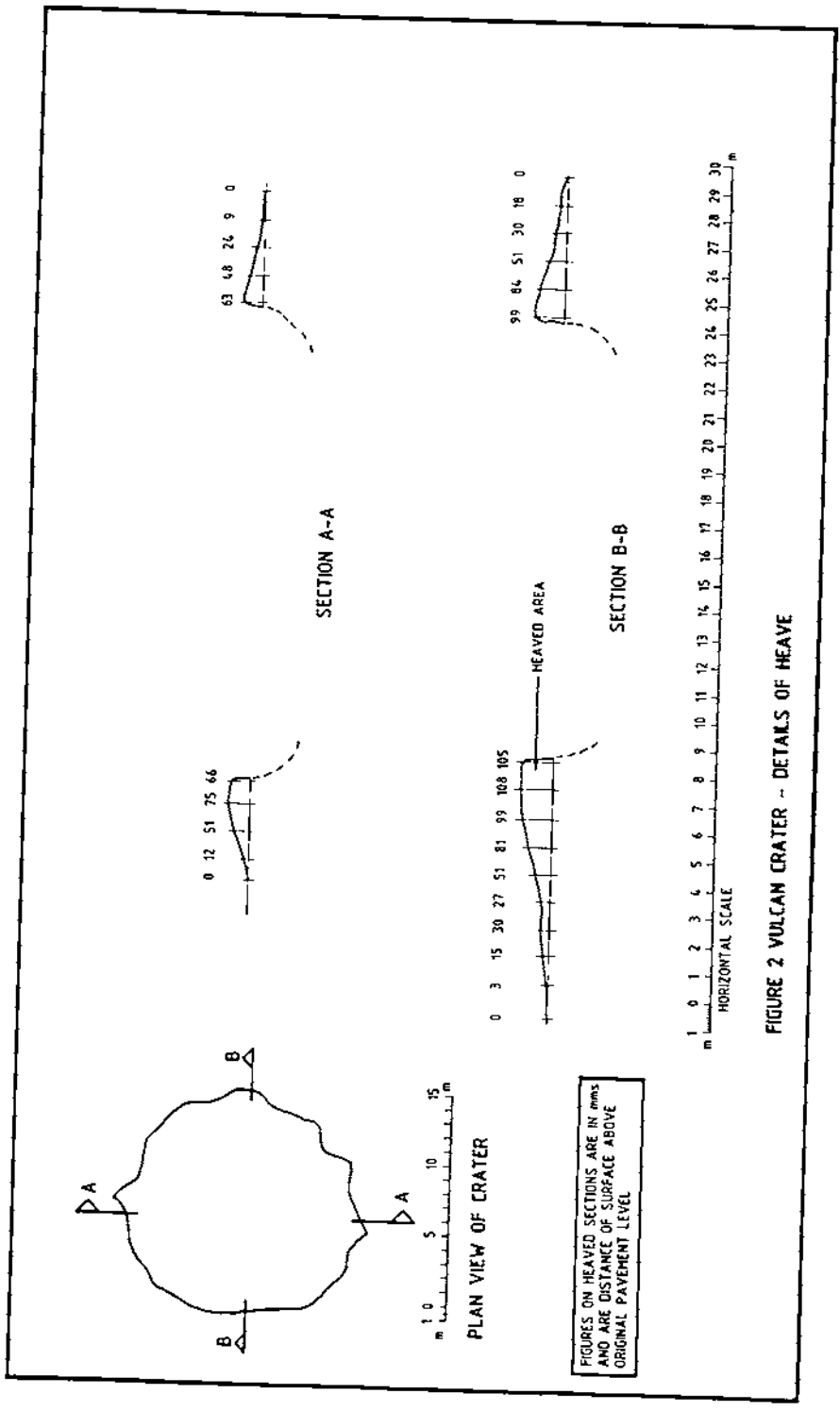


FIGURE 2 VULCAN CRATER – DETAILS OF HEAVE

dam and a further 150mm thick layer of crushed rock, all placed on a compacted subgrade of peaty sand. The runway was designed for a Load Classification Number (LCN) of 16 but this has subsequently been estimated as being up to 30 due to the increased pavement thickness.

(b) An apron, 84m by 40m, connected to the runway by a 15m wide taxiway.
(c) A small terminal building with limited amenities.
(d) A small fuel installation.
(e) A generator Station consisting of two 60kW generators.
(f) A hangar capable of accommodating two Islander Aircraft.
(g) Simple navigation aids.

During the Argentine invasion of the Falkland Islands, the airport became a prime target for the British Task Force. The airfield was attacked three times by Vulcan Bombers and by several sorties of Harriers. Damage to the operating surface and supporting facilities resulted and, before the airfield could become operational again, some of the damage had to be repaired.

DAMAGE TO THE AIRFIELD

The Argentine Forces surrendered on 14 June 1982 and the damage was initially assessed on 17 June 1982. The detailed reconnaissance took place over the next two days amid the several thousand POWs who had been concentrated onto the airfield. The main damage was:

(a) *Craters*. There were five craters on the runway, the details of which are included in Figure 1. Cross section profiles showing the heave around the Vulcan Crater are given in Figure 2. The enemy had also placed earth on the runway to represent craters.

(b) *Scabs*. There were over 1000 scabs, the average size of which was 350mm in diameter and 30mm deep. The scabs had largely been caused by shrapnel, machine-gun fire and debris.

(c) *Aircraft Hangar*. A 1000lb bomb dropped by a Vulcan landed 20m from one corner. Although the hangar frame was structurally sound, the doors were damaged and all the cladding had been holed or stripped off.

(d) *Terminal Building*. This building did not suffer any direct hits and was structurally sound. All the windows were broken, doors damaged and fittings unserviceable, while the walls were battle scarred. The whole building was very dirty.

Photo 1. Crater on edge of runway caused by 1000lb bomb from Vulcan. Also in the photograph is a damaged Islander aircraft, aircraft hangar and terminal building

Stanley Airport- Airfield Damage Repair 1

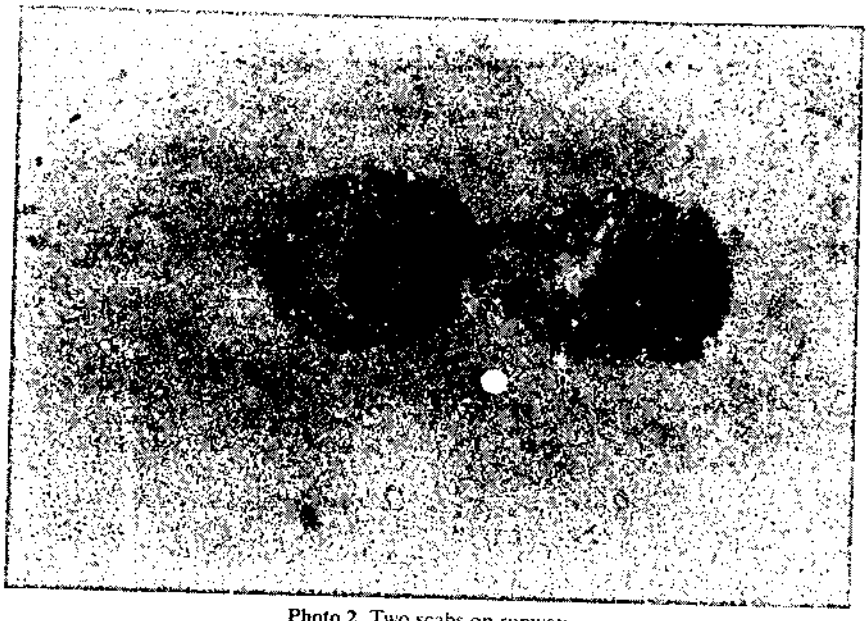


Photo 2. Two scabs on runway

(e) *General Debris.* The runway was covered in debris ranging from damaged aircraft to mud, while the surrounding area was littered with POW debris, craters and further enemy aircraft.

REPAIRS

The plan to re-open the airfield was based on a number of stages with the immediate priority being to carry out sufficient repairs to allow C130 Hercules aircraft to operate. This could be accomplished by 24 June 1982 by repairing the northern half of the runway. Thus, initially three craters and approximately 500 scabs had to be repaired, with the runway and a 15m wide strip either side cleared of all debris. Thereafter, the remainder of the runway and subsequent repairs could

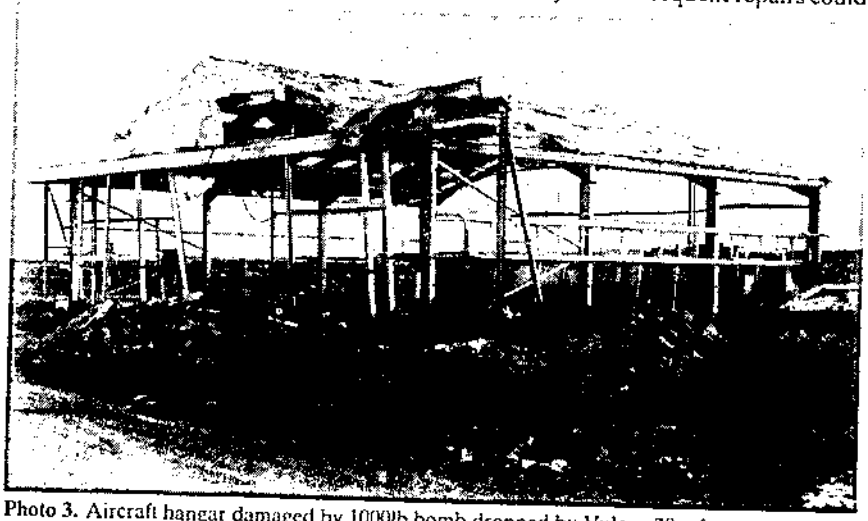


Photo 3. Aircraft hangar damaged by 1000lb bomb dropped by Vulcan 20m from near corner of hangar

Photo 4. Sappers preparing Vulcan crater for repair by cutting back heaved area

be tackled.

To repair the craters, it was decided that some of the stock of approximately 1000 panels of AM2 aluminium airfield matting left on the airfield by the Argentines would be laid on compacted fill flush with the existing surface. The matting would be secured with 4ft long pins, normally used for holding down matting for Harrier operations, driven through the matting. This AM2 matting has an extruded cellular aluminium section 1½ inches thick and good load distribution qualities. Laid on ground with a California Bearing Ratio (CBR) of only 4%, aircraft such as the Phantom with tyre pressures of 250psi and an LCN of 28 can operate off the matting. The matting comes in two sizes (12ft × 2ft and 6ft × 2ft) with the larger panels weighing 144lb. The sides have welded edge pieces for making connections and panels are joined in a brickwork pattern with the short sides being locked by a special bar.

Only a very limited selection of plant was available when 1 Troop, 59 Commando

Photo 5. Edge of AM2 with existing surface. The gap between the matting and existing surface has been infilled with Bostik 276 but this was subsequently replaced with a tar and fine aggregate mix

Stanley Airport- Airfield Damage Repair (4 & 5).

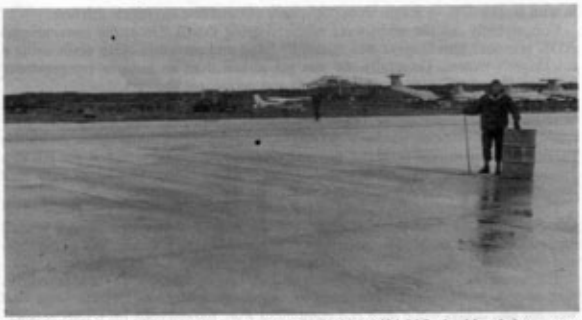


Photo 6. Crater on northern half of runway repaired with AM2 laid flush with existing runway surface

Squadron started the repair work. Instead of heavy wheeled tractors, dump trucks and other items of conventional Airfield Damage Repairs (ADR) plant, one medium wheeled tractor, one wheeled excavator, three 3yd^3 dumpers and two pedestrian rollers were used. These were supplemented by a compressor and tools borrowed from the Stanley Public Works Department, but which had to be collected from the local Cemetery!

The craters were cut back beyond the heaved area of the pavement surface and to a size that would accommodate the AM2 panels. Although the craters had been back-filled by the Argentines, some soft spots were encountered and these had to be dug out before being replaced with available fill. The level of the crater was brought up to 1½ inches below the existing surface with the fill being compacted using a pedestrian roller, which was the heaviest roller available. The matting was laid on a thin bedding of sand and pinned down with the 4ft pickets. The gap between the matting and the existing surface was 20 to 40mm wide. This was filled

Photo 7. Scab being repaired with Bostik 276

Stanley Airport- Airfield Damage Repair (6 & 7).

in with Bostik 276—a magnesium phosphate cement/fine aggregate mixture.

Concurrently, all the scabs were repaired using Bostik 276 in the conventional ADR manner. This cement was mixed by hand and placed in clean scabs using a bricklayer's trowel. Generally the mix set in less than an hour in temperatures between 0° and 5°C with moderate winds and occasional showers.

Meanwhile debris clearance was in hand. Prior to their departure about a thousand POWs lined up on the centre line of the runway and, using what they could, cleaned much debris from the runway and the surrounding areas. As all the POWs had been moved from the airfield before repair works started, it was left to a platoon of Infantry, starting at one end and working along the runway with bass brooms and square mouth shovels, to complete the clearance.

The repairs to the northern half of the strip were completed by the Troop of 59 Cdo Sqn in twenty-four working hours and the first C130 Hercules aircraft landed on 24 June 1982 on schedule. Attention now turned to the southern half of the strip and the apron and, in particular, the large Vulcan Crater.

The repairs to the southern half were undertaken by 3 Troop, 11 Field Squadron with platoons of Infantry again carrying out debris clearance. Despite some bad weather and delays while men and equipment were moved back for C130s to operate, all repairs were completed by 1 July 1982 when the aircraft could use the full width of the runway. The southern repairs took the troop eight days to complete with the Vulcan Crater taking two Field Sections sixty-four hours.

In all, the repaired runway sustained seventy-seven C130 and a few hundred Harrier sorties without showing distress before the runway was closed again for lengthening and strengthening. The scab repairs stood the test of time well with less than fifty failing. The failures were probably caused by the base under the concrete failing and by Harrier down blast. The crater repairs worked well but did require maintenance. An initial problem was that the Bostik placed to seal the junction between the matting and existing surface cracked badly. This was attributed to mat movement as an aircraft passed over it. The problem was solved quickly and successfully by replacing the Bostik with a flexible tar and fine aggregate mixture. Because the resources were not available to seal the surface under the matting, some pumping of mud occurred. Occasionally this was bad enough to warrant a corner or edge of the mat being raised in order to replace fill underneath. Settlement of the Vulcan Crater by up to 50mm did occur, but Hercules C130 operating

Photo 8. The Vulcan crater with most of the debris cleared. To the right of the photograph, repairs to the northern half are being carried out by 1 Troop 59 Commando Squadron

Stanley Airport- Airfield Damage Repair 8

Photo 9. C130 Hercules waiting to take off. Some of the debris around the airfield is shown in the foreground

at 150 000lbs (all up weight) with tyre pressures of 115psi (equivalent to an LCN of 42) encountered no problems with this.

Repairs to the remainder of the facilities continued as plans for the development of the airfield began. The terminal building was cleaned and made habitable with temporary windows and doors while both generators were overhauled and sugar in the working parts removed. The Aircraft Hangar was re-clad with corrugated iron sheeting by the RAF themselves for use as a MT Hangar. Both the RAF and RE EOD squads cleared tons of ammunition, unexploded bombs and aircraft. The existing fuel system was not repaired as it was too small for RAF requirements. Instead, as part of the development of the Harrier complex, a fuel system using Conventional Emergency Fuel Handling Equipment was built. Meanwhile, as the airfield has been developed, further repairs have been accomplished. The development phase will, no doubt, be covered in subsequent issues of the Journal.

CONCLUSION

The initial priority of opening up the airfield was accomplished quickly and successfully using the limited resources available. Within ten days of the cessation of hostilities and three days of the last POW leaving the airfield, a C130 Hercules aircraft landed. As the Defence Correspondent of the *Daily Telegraph* reported: "using unorthodox but very effective techniques, and by initially repairing only half the runway width, the first aircraft was able to land on 24 June 1982."

* * * * * *

The New (Ravelin) Royal Engineers Museum

BRIGADIER D H BOWEN OBE

CHAIRMAN MUSEUMS ETC COMMITTEE

WE must now take the third major decision in the life of the Royal Engineers Museum. One hundred and ten years ago we set up our Museum. Seventy-five years ago we revised the role of the Museum and raised £2000 to provide a suitable home. Now we have the chance, if we can raise the equivalent sum at today's prices, to put the Museum on course for the next century.

The Museum was set up by the then RE Institute, and now the Institution of Royal Engineers, in 1875. The main emphasis was scientific and, accordingly, much of the collection comprised geological specimens. After the Boer War there was a strong feeling that the work of the Corps in that war should be shown; this was extended to include the whole history of the Corps. To do this the Corps raised £2000 in 1908, equivalent to £60 000 in 1983, and established the Museum in the old chapel of Brompton Barracks where it has remained for seventy-five years.

This was an excellent building for the Museum and would have remained so provided the Corps had used nothing much larger than the pick and the shovel! Mechanisation has changed this!! Since the 1930's we have tried to cope, but much interesting equipment has had to be left out and is probably now lost for ever. Recently some items have been acquired; armoured engineer equipment, railway items, a helicopter, bridging equipment; and they are being preserved by various units, but this is far from satisfactory and is not a sensible long-term policy. If we are to keep the Museum as a faithful reflection of the work of the Corps, we must find a way to cope with the larger equipments of the 20th Century.

Over the past fifteen years, several options have been studied in depth. Now a very promising solution has been offered us. The ground floor of the Ravelin Building, better known to many as the old E & M School, is available and would make a superb site for a Corps Museum as the eye-catching building has character and distinction (of a kind). The rooms at the front and side would provide appropriate settings for the contents of the present Museum; the old power station rooms at the rear can take vehicles, tanks, bridges etc. Furthermore there is room for expansion; the quadrangle enclosed by the building could be covered over; adjacent buildings will become available in the near future; there is plenty of space to show such outdoor items as railways. We can also expand to include a well-preserved section of the original defences of Chatham and would thus be able to show, for real, saps, mines and escalading. Another major plus factor is that, although the building is in Brompton Barracks, the public would have direct access from Prince Arthur Road.

An outline plan for expansion has been drawn up which envisages four stages of development; each of which is self-contained. We can, therefore, speed up or slow down the progress from one step to another depending on the support we receive from within the Corps, from the Public, from Industry and from official sources.

Stage 1. Move the present Museum into the Ground Floor of the Ravelin Building.

Stage 2. Expand the Museum into the Ravelin Moat and the Engine Sheds of the RSME.

Stage 3. Roof in the quadrangle of the Ravelin Building.

Stage 4. Expand into the PSA Workshops including the possibility of a short run of railway, together with an engine and coach.

The MOD provides the staff and maintains the building for the present Museum and there is no reason to suppose that the same arrangements will not continue in

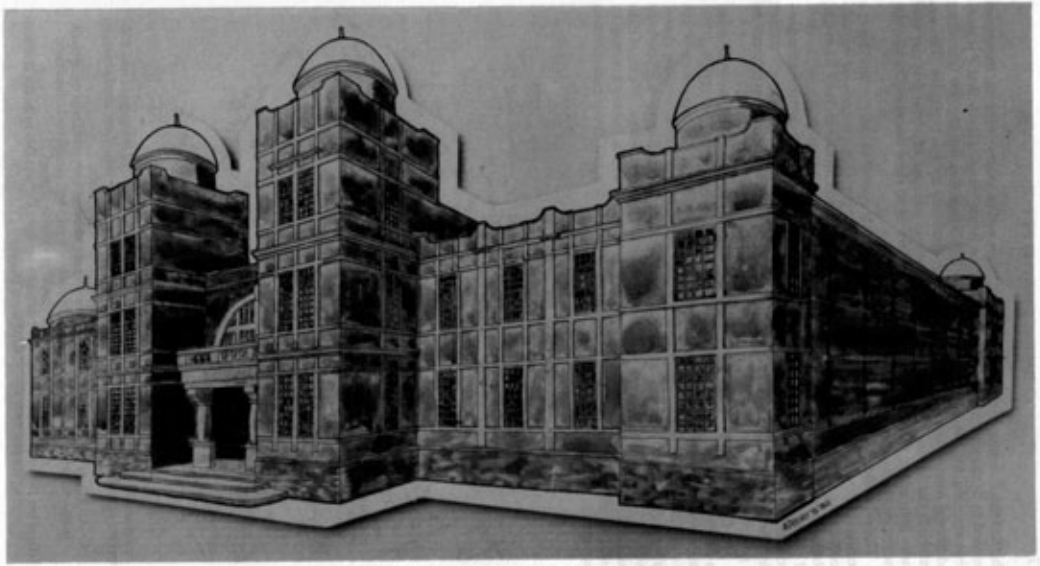


Photo 1. An impression of the Ravelin Building

An Impression of the Ravilen Building

the Ravelin Building. However, no public funds will be available for the alterations needed to fit the existing Museum into its new home. Studies show that a reasonable estimate for the initial move envisaged in Stage 1 is for £50 000 (excluding additional running costs), providing we use as much self-help as is feasible. This will establish the Museum as a going concern with an increase of about fifty per cent more floor space than available now. It will allow us to show many modern equipments, currently scattered around the Corps.

The expanded Museum should have considerable appeal to the public. This is a reasonable expectation as the major roles of the Royal Engineers embrace the subjects of the most popular museums such as the Science Museum, Tank Museum, National Maritime Museum, Railway Museum York, and RAF Museum Hendon. If we set up a successful and popular Museum, we will be able to convince the public and industry that we are worth supporting. There would then be every chance that the expansion into the quadrangle and adjacent buildings could be financed by a public appeal.

The full costs of the establishment and expansion of the Royal Engineer Museum in the Ravelin Building, at 1983 prices, will be in the region of £250 000. To raise this amount we will obviously have to go public. Based on the experience of the Royal Marines, who were faced with a similar problem some years ago, an appeal to the public and to industry is likely to be successful if you can show that you have done all you can to help yourself. It is necessary to prime the pumps. We require to raise £50 000, the estimated costs for Stage 1, together with a further £16 000, to cover running costs. This gives a total of £66 000 which is just about equivalent to the amount raised by our predecessors in 1908.

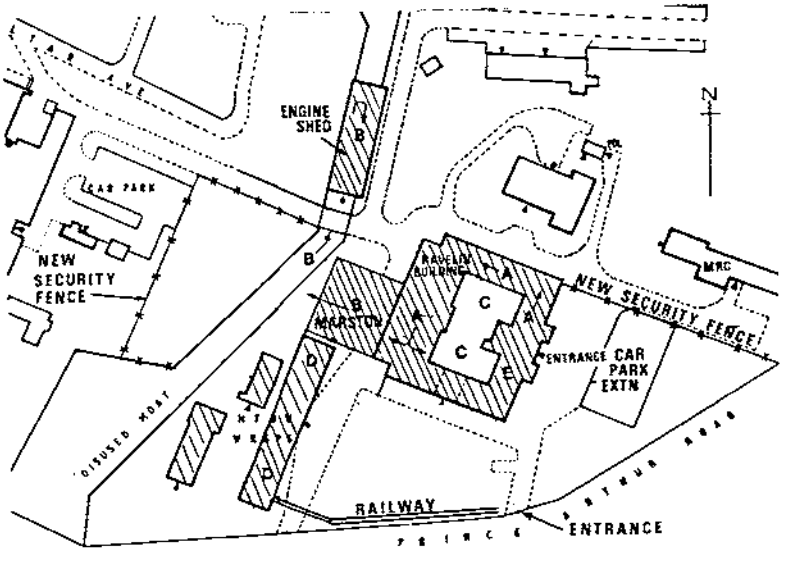


Photo 2. The proposed general layout:
Entrance Off Prince Arthur Road. Outside eyecatchers—Churchill bridgelayer and flail
Entrance to building. Main foyer—professionally designed to include Shop, cloakrooms etc
Displays. Generally anti-clockwise circuits:
AAA—Up to 1945. Mostly exhibits from present Museum with additional equipment
BBB—Separate fortification circuit. Defensive works and assault on fortifications
CC—Post 1945 equipment in suitable settings
DD—Post 1945 equipment. Division of subjects between CC and DD to be decided later
E—Medal Display

We would like to set a target for completion of Stage 1, to re-open the Museum to the public at the RSME Open Day in September 1985. A realistic timescale would be to prepare some exhibits in the power station rooms and to start on the necessary Works Services alterations to the ground floor during 1983 and early 1984; to close the present Museum at the end 1984 and move the present exhibits to the Ravelin during first half of 1985; to add new displays of equipment and complete Stage 1 of the Ravelin Museum by August 1985. If we are to achieve this target we must start raising money this year. We should aim to have collected the first £50 000 by the end of 1984.

Enclosed with this Journal is a letter from the Chief Royal Engineer together with subscription forms including a Deed of Covenant. You will appreciate that the Deed of Covenant will enable us to claim back the Tax you will have already paid on your subscription. We are suggesting an average level of Subscription which will achieve the target if you all support the appeal. Please give more if you can! The suggested average rates for Officers and Ex-Officers are:

(1) Serving Officers—A one-time payment of £20·00 or £5·00 per year for four years, covenanted.

(2) Retired Officers and non-serving members of the Institution—A one-time payment of £10·00 or £2·50 per year for 4 years, covenanted.

We intend opening a Subscription Book into which will be entered the names, but not the amounts donated, of everyone who supports the appeal. In addition to the Officer Subscriptions an appeal for support is being made to former and serving WOs, SNCOs, NCOs and Sappers through the REA, RSMs and "The Sapper".

Appeals for money are unpopular! Our predecessors raised £60 000 (at 1983 prices) to establish the present Museum. Dare we do less? £5·00 a year is less than the price of two bottles of "plonk" or three gallons of petrol. Surely this is not too much to ask to enable the Corps to proclaim its Service to the Country.

The present Royal Engineer Museum is well established but is not suitable for the display of the technical advances of the last fifty years. The immediate need is the acquisition of adequate premises. This is possible with a move to the Ravelin Building. It also offers opportunity for expansion. We will then be able to give better recognition to our Airborne, Armoured, Commando and Bomb Disposal Sappers, to the Indian Army Sappers and Miners, to the other Commonwealth Sappers, to Movement and Transportation, to Survey, to Postal Services and to the Research and Development carried out by Sappers and the "Sapper supported" establishments. With the help of all members of the Corps, serving and retired, officers and soldiers, we can look forward to an even better Royal Engineer Museum. A museum for the year AD 2000, and beyond.

* * * * * *

Lessons from Exercise Red Claymore

LIEUT COLONEL D A GROVE RE, BSc

The author joined the Army as a University Entrant in 1965 and served with units in Germany and the United Kingdom before attending the Staff College in 1974. Since then, and after a tour as DAA & QMG of 24 Airportable Brigade, he has commanded 12 Field Squadron and been a Company Commander at Sandhurst. After a tour as CO 26 Engr Regt he is now an Instructor at the Staff College.

In a year of training cuts and restrictions, 26 Engineer Regiment was fortunate to take part in a Divisional FTX in 1981. We were lucky too that it provided us with excellent opportunities to practise our role and to try some new techniques. Not surprisingly we learned a lot, and on reflection it seems right that those lessons should be shared. What follows is not a detailed description of the exercise but notes and comments on parts of it which may be of general interest.

Let me first explain the outline of the exercise. In the face of track mileage restrictions the Regiment, in common with the rest of 3 Armoured Division, deployed on Exercise *Red Claymore* by rail in late September 1981. Then, while other arms were concentrating for brigade work-up training, the Regiment outloaded stores and prepared to carry out the obstacle plan for the main defensive phase of the exercise.

This plan had been considered and refined over the preceding six months. The obstacle as a whole was designed to disrupt and confuse the enemy rather than stop him on a line: it was a maze rather than a barrier. It included more than forty kilometres of tactical minefield and nearly 250 demolitions. In retrospect it is easy to dismiss the planning phase in a sentence and to overlook the problems. But it was a frustrating undertaking because the Services Liaison Officers required early notice of planned engineering work (plans required in April for an FTX in October) and it was difficult to get battle groups on the ground and thinking in detail for an exercise still six months away. In the event a draft plan was prepared in early May but it was refined and amended until the day the exercise started.

When work began, we were allowed forty-eight hours uninterrupted work on the obstacle plan before we paused and two field squadrons joined 6 and 33 Armoured Brigades for the latter part of their work-up training. After that, when battle groups deployed for the main defensive phase of the exercise, we returned to the obstacle and carried on where we had left off. This sequence, containing as it did a break in the preparation of the obstacle, did not put the Regiment under the pressure we could expect in war. But in a year of track mileage and other restrictions, when most training had been curtailed or limited, it gave us time to learn from our mistakes and put them right. In retrospect I feel there was more overall training value in this than is often gained from exercises which try to reflect worst case prep-

Lieut Colonel D A Grove RE BSc

aration times, and rush us into hasty and often indifferent combat engineering.

The main part of the exercise, a defensive battle, took place in the area of the River Leine from Einbeck north to Gronau. We were hampered by crops, notably sugar beet, but our main problem was the weather. In had been a wet summer and a wet early autumn, and it rained frequently during the exercise. As a result, fields astride the rivers Leine and Weser were very wet and no cross country movement could be taken for granted: in places APCs could not pull a bar minelayer because of soft ground in fields which are normally firm; at one MGB site pallets were flown to site by a Chinook helicopter because of the very wet approaches. Such conditions provided excellent training and in retrospect we would not have had them otherwise, but at the time we felt differently.

After the defensive phase, which lasted nearly a week, the Division advanced. Here, together with 28 Amphibious Engineer Regiment, we bridged the River Weser a total of eight times on three successive nights. The Weser was high and a difficult obstacle and we learned much. The Exercise ended after a 2½ day advance.

This was not an unusual sequence for an FTX in BAOR. It taught, as I have stated, many lessons. Let me briefly consider some of them.

Minefields

What more, you will be saying, can be learned about minefields from a short FTX? Perhaps little, for most of the value lies in practising, over real countryside, the tactical, technical and logistic lessons which are often unrealistically easy when we lay single, small minefields on the sandy soil of a training area. It is far more difficult to lay numerous minefields, some large, in wet fields, some so wet that APCs bog and mines have to be laid by hand. For us, that October, some minefields included annoying strips of sugar beet which APCs had to avoid to prevent crop damage. For this reason too mines had to be laid by hand. A frustrating peacetime restriction you will agree—but there is a lesson here. It often doesn't take much longer to surface lay by hand in crops and the mines are quite invisible; so if there is a track nearby for the mine vehicle, and there often is, perhaps crops can be used to our advantage. Well, there is nothing new in that but you tend only to understand it fully when you notice it for yourself—how many of you make a note of crops and how you might use them when you do your reconnaissance?

Many of you I hope will be congratulating yourselves because of course you do consider crops when you reconnoitre. The line of crops will often dictate the line of mine rows because if you cross the line of the seed rows with a vehicle or minelayer you leave an obvious signature. You are right to consider the line of crops (although you will note that is not the point I make above) but the whole question of hiding minefields and mine rows leads me to make two comments on minefield drills.

Firstly, if the crop patterns do not run in your favour it is not feasible to lay a concealed minefield unless you are prepared to accept a slow laying time. You can of course lay some rows along the edge of fields or tracks, but others will have to cross the crops and the minefields will then be obvious to air recce (Photograph 1). We must therefore accept that there will be occasions when it will not be possible to lay concealed minefields. Indeed it is important that we should advertise some minefields if we are to use phoney minefields to good effect. This leads to the conclusion that in certain cases, and fitted into the divisional or brigade plan, we must accept that a minefield cannot be concealed and we should perhaps cover the area with vehicle tracks before we lay the rows. This in itself is not new, but how many of us discuss with the appropriate commander which minefields we will try to conceal and which we will advertise? The crops will influence our advice to him.

My second comment on minefields springs directly from the conditions on Exercise *Red Claymore* which forced us to lay many rows close to and alongside existing tracks. There are several advantages to doing this, notably:

—Tracks are usually slightly above the surrounding fields and often have a ditch

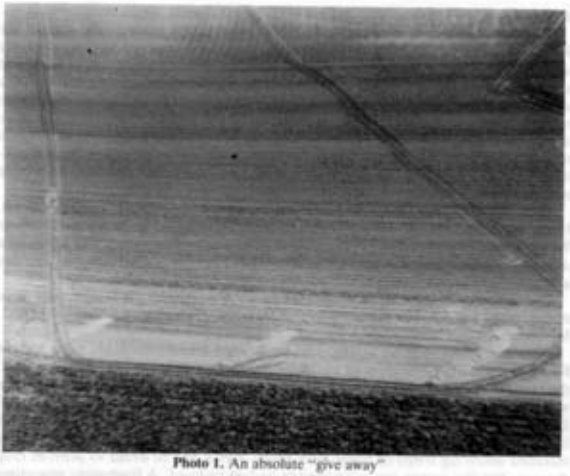


Photo 1. An absolute "give away"

and a small bund running alongside. A plough tank will tend to lift its plough before crossing this combination.

—Vehicle tracks and plough marks are very difficult to see when they run parallel to a track. Alternatively, tilt rows can be hidden effectively in the longer grass of the verges.

—Tracks aid setting out and control when laying the minefield.

Of course convenient tracks will not always be available, but their value if they are should not be overlooked. This may seem a simple point, but both players and observers on the exercise were struck by how extremely difficult it is to spot mine rows which run alongside tracks.

The Anti-Tank Ditch

We were lucky on Exercise *Red Claymore* to be allowed to dig an anti-tank ditch on typical farm land, in this case topsoil over clay. The ditch was 700m long and ran across the bottom of a shallow valley (Photograph 2). It was not raining when the ditch was dug but the ground was wet from rain on previous days and water trickled steadily into the ditch from broken agricultural drains. It would be wrong to draw too many conclusions from one 700m ditch, but the opportunity to dig such a ditch on real farm land, as part of a realistic tactical plan, is so rare that we must learn what we can from it. I offer the following observations and comments.

Combat Engineer Tractors (CET) dug effectively where the ditch remained relatively dry but had little traction in wet clay. They were of limited value in this particular situation. At the time of the exercise 21 Engineer Regiment was carrying out trials on the Earthmill and a Hy-Mac 890 excavator with a large ($2m^3$) bucket. The Earthmill was not available for our ditch but the Hy-Mac performed extremely well and greatly impressed everyone who saw it at work. There was no doubt that any machine that had to go into that ditch would have encountered problems in the clay, but the Hy-Mac, working from above, could manoeuvre at will. If it had been raining, matters would have been worse within the ditch, but tracked vehicles

Lessons From Exercise Red Claymore 1

Two days later much of the ditch was full of water. No-one I spoke to had any doubt that the ditch itself would stop a tank and the water made it an even more impressive obstacle. We laid mines as close to the lip of the ditch as we could and then laid another row eleven paces back and roughly parallel to the first. Both rows were on the enemy side of the ditch and were part of the double impulse panel. The value of this was seen when the ditch and minefield were crossed. The crossing was done simulating giant viper and using armoured bridges but without knowledge of the mine rows. Afterwards tanks and bridges were found stopped on mines which almost certainly lay outside the area cleared by the giant viper.

Our anti-tank ditch was not a particularly difficult obstacle in its own right; but as part of a minefield, and covered by fire, it clearly was.

Movement Light

We were fortunate that during the early part of the exercise we were supported by 873 Movement Light Squadron. The Squadron consists of two troops each of four searchlights. A troop was attached to each brigade for both the work up training and the early stages of the main exercise. The troops are mounted in landrovers which pull the lights. The value of movement light is well summed up in an extract from a report on our experiences written by Major Humphrey, then OC 5 Field Squadron.

"We used three searchlights to assist with the crossing of the River Weser on the night of Wed 7 Oct 81. 5 Squadron, in conjunction with 64 Amphibious Engineer Squadron, built an M2 bridge over the River Weser at last light. 6 Armoured Brigade crossed the bridge from 2300hrs till 0500hrs the following morning. A total of 530 assorted vehicles, including seventy main battle tanks, used the bridge. The lights were positioned about 3km from the bridge site. At last light the lights were switched on to ensure that their direction and trajectory were correctly aligned. As the Brigade was on radio silence this took a long time to accomplish; normally it would take only five minutes if radios were used. The lights were then switched off until 2300hrs when the first vehicle was due to cross. The lights were shone on a low

Photo 2. Tank ditch—end on

Lessons From Exercise Red Claymore 2

trajectory in the indirect mode to cover the actual bridge, the approaches, and some of the exit area.

"The lights were used most successfully and without doubt contributed to the high volume of traffic which used the bridge. Although it was within five nights of a full moon the increased level of ambient light was very noticeable.

"Later, on the night of 14 Oct, a pair of searchlights were used to illuminate, in the direct light mode, the delaunching and stripping out of a MGB over the River Leine. The lights were positioned 1100m from the bridge site and shone directly at the site. The resultant light was very helpful in that it enabled the stripping out and re-palletizing to be carried out much more easily and quickly than would otherwise have been possible. Small parts, carelessly placed on the ground, were easily found.

"The problems were that the lights cast deep shadows and secondly that personnel had to ensure that they averted their eyes from the light source. There was a potential problem in that if the lights had failed or had been switched off for tactical purposes then people would have taken time to regain their night vision.

"Finally, a pair of lights were also used in the indirect light mode to illuminate an area of countryside where field sections were preparing route denial tasks. This too was most successful."

The value of movement light is clear although these examples refer only to support of Sapper operations. We planned to use a troop in support of a battle group operation in the main defensive phase of the exercise but unfortunately other factors prevented it. Movement light has a potential role in support of ambush operations and general surveillance, but will only be useful if brigades and battle groups have trained with it, know its strength and weaknesses, and can build it into their night visibility plans.

I feel there are two problem areas. The first is a matter of education. The G staff are understandably reluctant to agree to the use of movement light where it could compromise a deployment plan. If we are to get full value from this useful battlefield aid we must train with it so that the staff, battle groups, and their associated Sappers fully know its advantages and disadvantages. If movement light is worth having, and I believe it is, we must work to make the maximum use of those few days a year that the Squadron can be deployed in BAOR. The second cautionary word applies to movement. The Squadron is landrover mounted and troops twice missed providing illumination because they were bogged in woods. They should clearly harbour in villages whenever possible and particularly when the ground conditions are as wet as they were that October.

Rapid Delaunching of MGB

While 5 Squadron and 30 Squadron were working up with their brigades at the end of the first week of the exercise, 25 Field Squadron was carrying out trials on rapidly delaunching Medium Girder Bridge.

The concept is simple enough: it takes time to construct MGB and we are vulnerable while we do it; how much better it would be to construct the bridge back from the river, carry it forward with plant, and launch it quickly. With this in mind a paper study had been done by MVEE and special floats built to provide buoyancy at one end of a double storey bridge. The floats strap under the decking between the taper panels and can remain in place while the bridge is trafficked.

25 Squadron were invited to test the concept in a quiet moment on Exercise *Red Claymore*. They approached the problem cautiously and began by delaunching a bridge which had not been trafficked. The OC showed his appreciation at having been selected for the job by calling the trial "Exercise *Careers End*", but happily his pessimism was unfounded! The Squadron delaunched three bridges, two undecked and one fully decked, and the concept was shown to be feasible (Photograph 3). In each case the bridge was winched fully onto the home bank in a little over a minute by two Combat Engineer Tractors (CET). The Squadron also picked up an undecked bridge using Medium Wheeled Tractors (MWT) and CET and showed that it is possible, although difficult, to move such a bridge short distances.

Photo 3. Delaunch of Medium Girder Bridge

This year 25 Squadron is to take the trial further and investigate both rapid launching and the delaunching of a bridge which has been trafficked. The trial will be reported fully when it is complete.

River Crossings

As mentioned earlier, the final phase of Exercise *Red Claymore* involved crossing the Division over the River Weser. We were ordered to do this over a period of three nights by building four bridges on night one and two bridges on each of the following nights.

The Weser was running very high and the bank conditions were poor: certainly anything but a hard site was a real challenge. An extract from a diary on one of the crossings makes the point:

"1930 Launching of the rigs stopped when the outriggers on the 2nd rig malfunctioned. The rig could not enter the water and could not be reversed out of the way because the 3rd rig had turned off the road and stopped two metres behind it. After reversing all the rigs back one vehicle length it was possible to retrieve the situation by towing the 3rd rig onto the hard-standing. The decision was then made to launch the remainder of the rigs downstream at another ferry site. At approximately 2000hrs launching started again downstream of the bridge centreline.

2045 The broken rig was recovered and the 2nd Class 60 mat was laid by the CET.

2145 All defile marking and lighting was complete on both banks.

2215 Bridge open to traffic (75 minutes later than ordered). The first five serials consisting of landrovers and 4-ton Bedfords crossed the bridge with no difficulties.

2315 A difficult serial then arrived without warning from the LOs or the Sector Regulating HQ. It consisted of two AVREs, both with fascine trailers, six Chieftain MBTs, and creeping up quietly behind these were nine Crusaders and semi-trailers. The AVRE and three of the MBT crossed although not without some difficulty and damage to the Class 60 mat. The difficulties were caused by the trackway slipping. This occurred for two reasons:

(a) The trackway had not been anchored as only MLC 30 traffic was expected.

(b) The AVRE and Chieftain could not have a straight approach onto the trackway and bridge centreline without entering a beet field and all cross country movement had been prohibited. The remaining three MBTs were

guided past the entrance in order to reduce damage to the approaches until the end of the operation.

2359 It was now that the nine Crusaders and trailers appeared. The Crusader is MLC 43, has a large turning circle, and very little ground clearance with the trailer. Out of the nine vehicles three were loaded with bridges: the first had a No 8 bridge on, the second a No 9 bridge.

Before any further action could take place the Commanding Officers from both 28 Amphibious Engineer Regiment and 32 Armoured Engineer Regiment appeared at the front of the column. They informed the OC that Crusaders had never crossed M2 Bridges before and just as quickly disappeared into the night, discussing the odds on getting them across.

It was decided to move all nine vehicles past the bridge entrance so that normal traffic could continue. However, the first vehicle loaded with a No 8 bridge slipped on the muddy road, slid into the ditch and gave a recovery problem that was not to be resolved before daylight. This vehicle had been halted and slid off the road only as a result of the camber.

0100 Attempts were made to recover the vehicle so that the other six could be moved out of the way. After nearly an hour of work the Site Commander decided to experiment with one Crusader but took two precautions:

(a) 1st attempt was to be with an unloaded vehicle.

(b) The entrance was to be widened with an extra Class 60 mat.

0135 The entrance was widened using a Class 60 mat laid by CET.

0145 An unloaded Crusader was guided onto and across the bridge. The rear of the trailer scraped the far bank ramps causing very minor damage.

0155 The next Crusader was guided across and that too caused minor damage to the far bank ramps.

The third Crusader, instead of waiting for a guide to take him across, decided to move forward of his own volition and slid into a ditch. This effectively closed the bridge because all attempts at recovery failed.

0240 RMP allowed the next serial towards the Bridge Site. This consisted of sixty vehicles of a Regimental Workshop, many towing heavy trailers. These vehicles ended up nose to tail. Dawn revealed about 100 assorted vehicles in this one mile defile."

This extract highlights the three lessons I wish to draw from our bridging:

—Firstly, the 35-ton semi-trailers which carry spare armoured bridges will not cross an M2 bridge with sloping ramps.

—Secondly, no matter how the bridge build goes the crossing rate will depend on the traffic control organization. It must link closely with the bridge site and react to events on the site. It must also know which vehicles cannot cross and filter them out.

—Thirdly, operations such as this are invaluable training because they underline the importance of coordinating plans and good liaison. Only when you are at the mercy of other people's plans, as well as your own, do you get the maximum training value from exercises. No amount of special to arm Sapper training can make up for a lack of all arms exercises.

Conclusions

Before I conclude may I repeat that I have only referred to those aspects of Exercise *Red Claymore* which had bearing on the lessons I wish to draw. I have omitted many details of the exercise which are not relevant to my purpose. For that reason I have not hitherto referred to 75 Engineer Regiment which took part in the exercise and did excellent work on the divisional obstacle plan at the beginning of the defensive phase. But anyone without experience of BAOR should realize that our Territorial Army Regiments take part in such exercises to our mutual benefit, and 75 Engineer Regiment played a valuable role on Exercise *Red Claymore*.

In conclusion, my lessons are these:

Firstly, that planning for an FTX is affected by the need to agree aspects of the

exercise with German authorities. This means that planning must be done long before some battle groups can be expected to get fully to grips with their plans. We must therefore expect late changes.

Secondly, the early stages of Exercise *Red Claymore* gave the Regiment time to learn from its mistakes. There was greater training value for us in carrying out the obstacle plan in this way than would have been gained from an exercise which practised worst case timings.

Thirdly, we must realize that we will not be able to conceal all the minefields we intend to lay; we must know before we deploy which we should try to hide and which we should not.

Fourthly, we should aim to use tracks in minefields to help conceal rows and to catch plough tanks when their ploughs are raised.

Fifthly, an anti-tank ditch is a very formidable obstacle, particularly in conjunction with a minefield.

Sixthly, movement light can be a great asset and should be better understood. We must take every opportunity to work with 873 Movement Light Squadron.

Seventhly, initial trials on rapidly delaunching MGB have confirmed the feasibility of the concept. We shall now investigate rapid launching.

And lastly, river crossing operations on FTXs are excellent training. They emphasize the importance and difficulty of coordination and liaison, notably between the traffic control organization and the bridge site. Note too that the 35-ton semi-trailers which carry reserve armoured bridges cannot cross an M2 bridge with sloping ramps.

A Piece of Cake

MAJOR B C A LEE RE

The Author was commissioned from the ranks in April 1965, having served in 22 SAS Regt for a period of four years. A variety of Regimental tours includes Construction Tp Comd 51 Fd Sqn (Airfds), Sqn 2IC 60 Fd Sqn, Adjt 25 Engr Regt (BAOR), GSO3 Int HQ 16 Para Bde, OC 16 Fd Sqn and Operations Offr 22 SAS Regt.

This article was written on completion of his recent tour as OC RE Trg Team, The Gambia.

"Come and discuss your future with us", said the DAAG AG7 over the telephone in early 1979. So, quaking in my shoes, I went along on my first ever visit to that feared establishment.

"Can't spare you very long", said the DAAG, "have to go to a meeting in the corridors of power". The coffee was almost as cold as the reception and we quickly got onto the subject of my next appointment.

"The Gambia?" I said, frantically trying to recall African geography. "Yes! it's in Africa, West Africa actually", added DAAG, smugly, hands clasped tightly in front of him, as if in prayer that I would not refuse the posting.

A Piece Of Cake Major BCA Lee RE

Armed with a few facts about The Royal Engineers Training Team (RETT), I drove back to London to break the news to my wife. Crawling through traffic jams all the way back to Putney I couldn't help thinking what a welcome change in tempo The Gambia was certain to be from my last job in Hereford! So faced with little alternative but a second career in civilian life, and with the British winter settling in fast, I quickly accepted the appointment and spent my embarkation leave putting the final touches to my plan to join my new unit, going overland across The Sahara!

It was during this period that I was also able to find out more about RETT, The Gambia. It was formed in 1977 by Major Don Campbell, with two Warrant Officers, a Military Plant Foreman and a Clerk of Works (Construction), to assist him. The Team was to be seconded to the Overseas Development Ministry, on loan to The Gambia Government, to establish and train a 100-man strong detachment of The Gambia Police Field Force.

The aim was to train, as pioneers, in a 1½–2 year period, the nucleus of the unit to be called The Field Force Pioneer Unit (FFPU) as basic construction engineers so that it could eventually execute small construction tasks as part of the 5-Year Development Plan of the Gambian Government. The training was to cover the artisan and the plant operating and maintenance skills required to enable the unit to take on the construction of low cost housing, rural health centres, police stations, schools, jetties, improvized bridges and feeder roads.

All plant, vehicles, tools and workshops equipment were to be provided by The British Government (Overseas Development Ministry), through the Crown Agents. The initial buy was to be in the order of £180 000, the bulk of the equipment to be of UK origin under the terms of the Economic Aid Programme. The manpower for the FFPU was to be provided by the Gambians with a cadre of "potential instructors", all volunteers, to be drawn from the Police Field Force Depot in Banjul, the capital. Subsequently, recruits would be taken from the handful of vocational and technical schools being formed at the time throughout The Gambia.

It was decided after the initial reconnaissance, that all training given by RETT was to be as practical as possible. This was to be achieved by "on the job training" during the construction of the FFPU Depot capable of accommodating 200 men complete with married quarters, offices, stores, workshops and recreational facilities.

With this charter firmly in their minds, the first RETT moved to The Gambia in 1977 to get the project under way. Faced with numerous problems of delays in the shipment of plant and vehicles from UK, shortage of accommodation, vehicles and tools, coupled with the daily chore of commuting by landrover and assault boat from their quarters at Mansa Kanko, on the South Bank of the River Gambia, to Farafenni on the North Bank initial progress was, not surprisingly, very slow. Farafenni is 120 miles from Banjul, where the seat of Government and The British High Commission were located. Banjul is also the commercial centre, not only where all construction materials had to be purchased, but also where most of the unit's administration had to be conducted. (Between 1977 and 1981 it was also the nearest Post Office, telephone and supermarket!)

It has been mentioned previously that the original timescale of the project was 1½–2 years. Within months of his arrival Don Campbell quickly realized that the training problems encountered were so immense that in order to reach an acceptable level of training, an extension of tour for the RETT was inevitable. The main reason was because most of the initial Field Force "volunteers" from the Police Depot, were of the "old and bold school" who volunteered simply because they saw the opportunity of getting into "something new". A high degree of illiteracy amongst this "cadre" gave the Clerk of Works and the Military Plant Foreman many periods of "head scratching" especially during such aspects of the training as levelling exercises! Phase I of the Project, the provision of temporary workshop

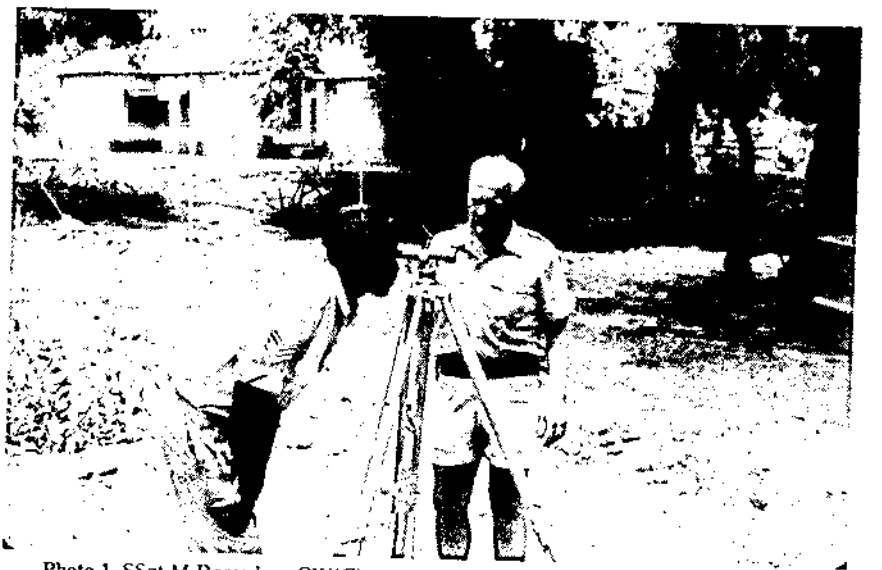


Photo 1. SSgt M Ramsden, CW(C), supervizing setting-out exercises in The Gambia

facilities and married quarters was to be a frustrating period for RETT I.

By the end of 1978 the extension of RETT for a further two years from February 1979 had been agreed. RETT II was formed up and moved individually to The Gambia in February/March 1979.

RETT II was to consist of myself, a Military Plant Foreman (WO2) and Combat Engineer Staff Sergeant, (in lieu of the original Clerk of Works), and a new appointment of a Fitter Sergeant to set up and run the unit Plant and MT Workshops. (Readers may well ask at this juncture how the equipment had been maintained during the first team's tenure!)

In February 1979 forty Gambians, NCOs and Constables, were under training at Farafenni, and one Officer was at the RSME doing a YO course. Construction progress by this time amounted to the completion of a temporary open-fronted artisan workshop, three office/classroom blocks, and two blocks of four family, single bedroom married quarters. Four Government Senior Staff Quarters had been constructed by a combination of civilian contractors (who went bankrupt), PWD (who ran out of skilled labour), and RETT/FFPU.

RETT II, excused the teething problems of the first team, were faced with the formidable task of building up the unit to its full strength, with a proper Establishment and Command structure. It was also required to complete the planned building programme for the Depot, to implement the training in project planning, resources and stores handling, and to oversee the formation of the unit Plant and Vehicle Workshops.

Over the next two years the transformation was very apparent. A collection of keen, willing, but educationally limited Gambians, were turned into a physically fit, efficient and well disciplined construction unit, organized on the same lines as an RE Squadron. Progress accelerated steadily as the FFPU tradesmen gained confidence and experience. By April 1981, 65% of the Depot had been completed to a standard envied by all local organizations. The Workshops was now properly established and housed in its new building with stores, offices and a wide range of equipment and tools. In an attempt to provide a variety of training, to provide an opportunity for minor project planning training at Section Commander level, and to create an awareness of the FFPU/RETT existence in the country, several MACC tasks were undertaken. All this was designed to prepare for a RETT withdrawal in April

1981. But this was not to be!

Late in 1980 the Gambian OC (designate) of the FFPU, trained at the RSME, was tragically crippled in a landrover accident. With him was the Gambian Sergeant destined to take command of the unit workshops, he was injured and died a few days later. It was now obvious that RETT could not leave until replacements were found and trained to take over these two key appointments. Whilst a further extension of tour by nine months to December 1981 was agreed for RETT, another young Officer was selected and rushed to RSME for a "short" YO Course. A replacement Sergeant Fitter was "borrowed" from the Police HQ Workshops and work continued as before.

A few isolated incidents of civil unrest in early 1981 prompted OC RETT to implement a limited military training programme for the FFPU much to the concern of the British High Commissioner. A shortage of SLRs led to Soviet and Chinese Kalashnikov rifles (AK 47) and Tokavev pistols being supplied to the unit from the considerable stocks of these weapons held at the Field Force Depot in Banjul. From now on, The FFPU, by this time up to strength, combined their trade training with occasional weapon and tactics training at Farafenni.

With the General Elections due at the beginning of 1982 many residents of The Gambia expected an increase in minor incidents as electioneering got under way. For OC RETT it was also a difficult time. Working directly to the Inspector General of Police of The Gambia, with the British High Commissioner being ultimately responsible for RETT activities, a conflict of priorities became apparent and a head-on clash was inevitable. This came at the end of July 1981 with a seven day armed rebellion by the Field Force in Banjul, which resulted in an estimated 1000 deaths and an "invasion" by the neighbouring Senegalese Army.

The events of the period were well documented by the world's media and no attempt to enlarge on them will be made in this article. Suffice to say that members of the RETT, with their families, sitting in the midst of a large, well armed unit of the rebellious Field Force, at Farafenni, were theoretically in a somewhat difficult situation. Cut off from the outside world and with no contact with the British High Commission, OC RETT evacuated the rest of the Team with their families to Dakar, the capital of Senegal.

With the families gone, the keys of the Armoury safely on his RE lanyard, OC

Photo 2. Sgt I. Simpson, "Hands on" instruction, Primary Health Care Project

A Piece of Cake

RETT had little option but to wait and see if "the rebellion" was to sprout in Farafenni. It was at this trying and hectic stage that the words of DAAG AG7 suddenly sprung to mind that the job was "a piece of cake". The next few days were to be the most frustrating and hectic in the long and chequered career of the Author!

The aftermath of "the coup" had a dramatic effect on RETT/FFPU. With fifteen of the men killed, six detained for their participation/cooperation with the rebels and the balance of the unit employed on Security duties, RETT became intimately involved in the extensive emergency rehabilitation of essential services, vehicle repair (reinforced by six REME fitters from UK), and arms/ammo recovery coordination. Little construction was to take place other than security projects for the next few months.

Because of this tremendous upheaval and disruption of the country, and following a "post rebellion" visit by the Colonel GS, HQ E-in-C, a further extension of RETT to July 1982 was very quickly approved and eventually training was restarted.

A noticeable shortage of imports of materials, a reduction of shipping and an increase in political indecisiveness during the period of Confederation between The Gambia and Senegal, led to many delays. Nevertheless, the unit was later to plan and start a major development project constructing the first Divisional Primary Health Care HQ funded by the World Health Organisation, (estimated at half a million dollars).

Regrettably it was not possible for RETT to supervise this project to its conclusion despite temporary reinforcement of five additional RE instructors, and the team was withdrawn on 1 July 1982. This left the FFPU to continue the projects and to provide the nucleus of the proposed "Gambia Army" which was being formed as a result of the Confederation. Several requests for RETT to stay and continue its advisory role fell on deaf ears in London.

It was no longer "A PIECE OF CAKE"!

Computers for the Combat Engineer

CAPTAIN D C BOWEN RE

"Computers will never replace the combat engineer's cigarette packet!" A bold statement and, I hope, one which has gained the interest of readers. The computer is acknowledged to be an accurate, rapid and reliable means of processing information. These three qualities are envisaged to be the prime requirements of combat engineering reconnaissance and planning; how, then, can computers assist the combat engineer?

The Operational Working Group of the RE Computer and Microform Steering Committee is currently examining the application of ADP technology to the control and deployment of engineer resources, the dissemination of terrain information and execution of combat engineering tasks. The first two subjects are currently provoking a great deal of thought and discussion on the direction in which the Corps should proceed. The third subject, that of combat engineer skills, is of immediate interest to the practising combat engineer.

What would your reaction be if presented with computer programmes which could:

(1) Plot any laid minefield, accurately, within 5 minutes and also includes the following information on the print-out:

(a) The number and type of mine in each leg of each row.

(b) The distance and bearing of each leg of each row.

(c) The distance and bearing of the start and end of each row, from the landmarks/previous row.

(2) Provide an accurate stores list for any minefield, in 3 minutes.
(3) Design an MGB (currently up to 12 bay DS MGB).
(4) Calculate the quantities of explosive required, whether PE3A, PE4 or CE/TNT, slab or cartridge, for any number of cutting charges.

In fact, these are the practical results so far achieved by the Field Engineer Wing, RSME in its study of the application of ADP equipment to the execution of combat engineer tasks. As the study has progressed, it has become evident that computers can be used beneficially in most areas of combat engineering. Indeed, it is quite likely that future generations of RE MCVs, even at troop level, will have micro-computers as an integral part of their internal fittings.

Before Squadron 2ICs start throwing away their graph paper, protractors, rulers and combat engineer pamphlets in anticipation of the arrival of their desk-top computer and programmes, allow me to introduce a note of caution. The combat engineer has a wide variety of tools at his disposal which assist him in his task. The computer would merely be another such tool, as its advantages of accuracy, reliability and speed are offset by its inability to make command decisions or create new concepts. In other words, it is impossible to replace the human qualities of initiative and original thought.

Technology may have provided us with the high speed train but how many of you own bicycles? Combat engineers—use the tools provided by technology but keep your cigarette packets handy!

The Penguin Chemical Energy Underwater Demolition Charge

CAPTAIN A P SOWERBY RE, MCIOB

The Author was commissioned in 1976 from the CW(C) Roster. His first appointment was for three years as Resources Tp Comd and Diving Officer with 21 Engr Regt in BAOR. This was followed by a period of two years with the Queens Gurkha Engineers, Hong Kong, as Design Tp Comd and Diving Officer. He is currently with 62 CRE (Const) as a GE with 524 STRE.

Introduction

The rapid growth of the North Sea oil and gas fields has, in turn, produced an ever expanding requirement for larger and improved port facilities. Tanker terminals, marine works, and ship to shore pipelines . . . all these requirements demanding safer and speedier methods of underwater excavation. This is particularly relevant to submarine trenching, where operations are confined to narrow, deep excavations, and a greater, more precise explosive shearing action is needed—compared to say general surface stripping of the sea bed by the "plaster" or "lay-on" method.

The traditional methods of underwater excavation, by dredging, or by drilling and blasting from a drill barge, are often limited in their practical applications because of dense rock formations, or rough sea conditions. To overcome these

Captain A P Sowerby RE MCIOB

problems Nobel's Explosives Company (NEC) has evolved a system for underwater excavation based on the use of shaped charges. These charges, called *Penguins*, are filled with a liquid high explosive composed of two essentially non-explosive components.

Aim

The aim of this paper is twofold—first, it is intended to define the working regulations, and the regulating instructions of the system when used as an underwater trenching charge, and second, to exemplify the versatility of the system against other targets, for example, as a cutting charge on steel and concrete. To illustrate the latter, an account will be given of a demolition task undertaken by divers of the Queen's Gurkha Engineers for Shell Company Brunei.

Liquid Components

The charge is composed of two liquid chemicals which are individually non-detonatable, but when mixed together they become a powerful explosive capable of being detonated at high velocity. The two liquid components consist of base chemical "PAC A", and a sensitizor "PAC B". Table 1 give the commercial details of each "PAC".

Although NEC are not at liberty to divulge the chemical composition of either "PAC A" or "PAC B", they do lay claim to significant advantages when using their system. Based on successful field operations carried out in various parts of the world, it has been found that the chemical components are both safe and reliable in storage and transit. The resulting mix is very stable and is not affected by sea water, and the detonation velocity will not deteriorate with age.

Details of the explosive mixture, which is termed "Offshore Pac", are given in Table 2. While both liquids are accepted by the International Air Transport Authority (IATA) as being reliable and stable air cargo, the rules regarding accessories such as detonators, primers and detonating cord, must still be observed.

TRADE NAME	"PAC A"	"PAC B"
Description	YELLOW LIQUID	RED LIQUID
Density	1.13 gm / ml.	0.98 gm / ml.
Flash point	35 °C	72 °C
Solubility in water	10 %	100 %
Packaging	Heavy duty navy blue steel drums :- 200 Litres (188kg net) 50 Litres (47 kg net)	Heavy duty pale blue steel drums :- 50 Litres (47kg net) 25 Litres (23.5kg net) Plastic containers 5 Litres (4.7 kg net)
Customs classification	BNT No 2903 0333	BNT No 2922 1865
European transport reg. ADR Classification	Class III (a) 3°	Class IV (a) (b) II°
IATA Classification	ORA Group A Article 1292	ORA Group A Article 1330

Table 1. COMMERCIAL DETAILS

	"PAC A"	"PAC B"
Composition	94 °/o	6°/o by weight
Per 10kg (nominal) "PENGUIN"	9.4 kg.	0.6 kg.
Approximate volume equivalent	8.30 Litres	0.6 Litres
	MIXTURE	
Density	1.12 gm/ml.	
Minimum initiator	No 3 ASA Detonator	
VOD (38mm Diameter)	6,300 mtr/sec.	
Strength	75 °/o BG	
0.5 kg Fall hammer	>200 cm	
1 kg. Torpedo friction	>80 cm	
Glancing blow		
Steel : Steel. Steel : Concrete	0/60	
Friction wheel	0/100	
410gm. Flat impact hammer	>45 cm	
Thin film initiation	1-2 mm	
Narrow tube initiation	2.5mm metal : 5.5mm plastic	
Static hazard	Below 35 °C unlikely	

Table 2. "OFFSHORE PAC" EXPLOSIVE MIXTURE

Transportation and storage of these items must conform to the internationally established standards for safety and security.

One very important point to observe when using this explosive is that neither the components nor "Offshore Pac" should be allowed to come into contact with mercury metal, or any alkali. In this respect, it should be remembered that both Nitroglycerine and Pentaerythrital Tetranitrate (PETN) explosives are alkalis.

The "Penguin" Shaped Charge

The containers are fabricated from a heavy gauge steel to resist both rough handling on site, and to withstand the pressures encountered in deep water. All containers are pressure tested at the factory—normally to 6895kN/m^2 (1000psi).

The shaped charge is designed to make full use of the "Munroe Principle" to focus the explosive energy and obtain maximum results. The cone shaped cavity in the bottom half of the charge produces a shock wave concentrated on the axis of the cone which gives the charge directional breaking impact. On detonation, this strong directional force shatters the rock beneath the charge, and the high volume of gas produced ejects the rock fragments.

The physical characteristics of the Penguin shaped charge are shown at Figure 1.

Working Regulations

Protective Equipment:

To protect personnel against burns when handling the two components, or the explosive mixture, rubber gloves and anti-splash goggles should be worn. There must also be a supply of fresh or sea water readily available on site, to dilute and

disperse any spillage of components and explosive mixture, and for washing splashes off the skin. As a further safeguard it is advisable to have a supply of eye-wash on hand.

After use, all equipment that has been in contact with either of the components or the explosive mixture must always be thoroughly washed-off with fresh or sea water.

Component and Mixture Transfer:

When opening drums and containers holding "Offshore Pac", or either of the components, non-spark tools of either Berryllium-copper, or alternatively Phosphor-bronze should be used. Because of the volatile nature of the components and the explosive mixture there is a consequent risk of pressure building up. To reduce the danger of spraying caused by this condition a water-wet towel or similar cover should be placed over the container cap as it is being unscrewed.

Whenever the mixture or components are being transferred from one container to another the receiving vessel must always be standing in a suitable spill tray. Transfer can be effected either by plastic syphon pump, funnel, or through a plastic

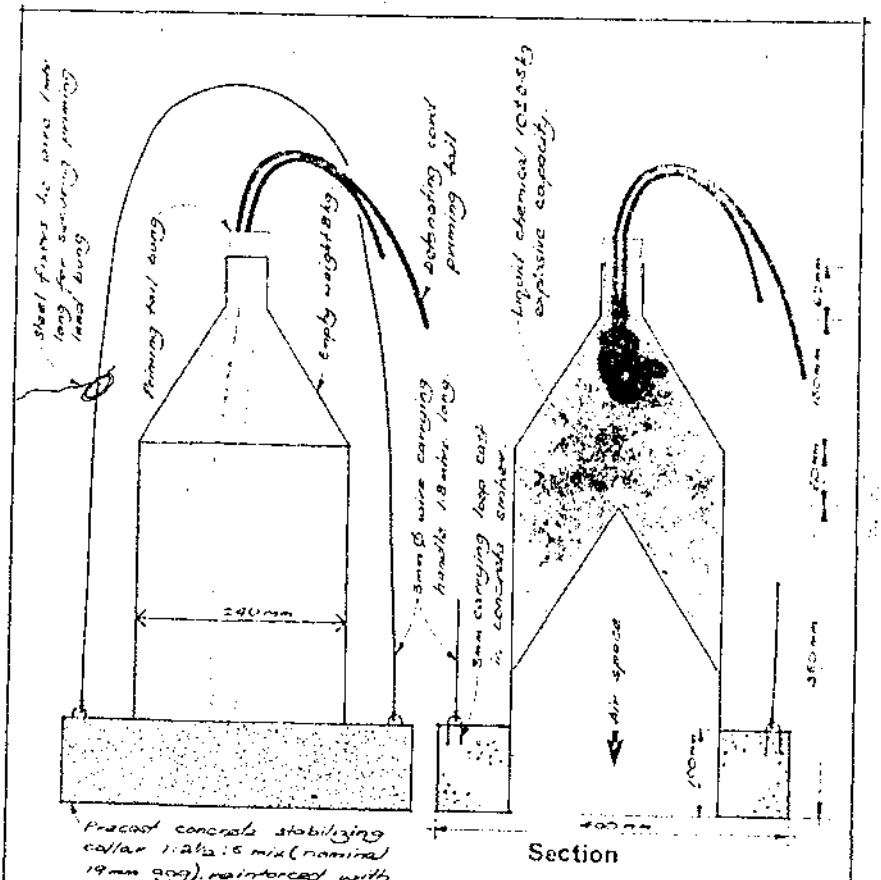


Fig 1 Penguin shaped charge

tap screwed into an adequately supported drum. If taps are used all tap threads must be sealed with "PFTE" tape to prevent leakage.

Drums and Containers:

Ideal containers to use in the transference and transporting of components and mixture are twenty-five litre transparent plastic Jerricans with a leak-proof, screw-top cap, and secure bottom tap. Alternatively, plastic wash bottles of 500ml/1000ml size as used in laboratories can be utilized. The firm of Powell & Company, Dyfed, South Wales supply a 2in Flo King Jumbo Tap which will fit the openings of the component drums currently supplied by NEC. A suitable pump would be the "Gallenkamp" Carboy Syphon No CC-942, which has a rated flow of four litre/minute.

Operating Instructions

The air space in the shaped charge makes it inherently buoyant in water, and even when it contains the explosive liquid the Penguin may up-end itself. In order to ensure that the canisters will remain in the desired position on the sea bed, a concrete sinker must be attached.

This can be done by one of two methods:-

(a) By casting-in-situ a 400mm × 400mm × 100mm block of concrete around the canister as shown in Figure 1 or,

(b) By pre-casting a concrete collar of the same overall dimensions (Figure 1), but which has a 250mm diameter central void to enable the collar to be slipped over the canister after it has been filled.

Figure 1 also illustrates the method of priming each charge. Because the filling orifice is not of a standard diameter, it may be found necessary to pad-out the rubber bung with electricians tape or similar material. The lengths of the free ends of the priming leads will be determined by the pattern of the charges to be fixed, but should not be less than one metre. This allows the divers sufficient scope when placing the charges to make a good connection to the ring main.

All exposed ends of the detonating cord must be sealed against the ingress of water. This can be achieved by inserting the cord into a vaseline-filled aluminium or plastic end cap, which is then securely taped down. A room temperature curing silicone rubber such as "Silcoset" is a suitable alternative.

Prior to mixing the two components the correct weight of "PAC B" should be calculated for the weight of explosive required, ie 6% by weight. Although not strictly accurate, this weight may be converted to a volume, and a plastic Jerrican marked off to indicate this volume. Thus for a normal 200 litre "PAC A" drum containing 188kg of liquid component, the appropriate volume of "PAC B" is then added to the appropriate weight of "PAC A", either directly, or via a previously measured and marked plastic Jerrican. The 200 litre "PAC A" drum can accommodate the 12·2 litre of "PAC B", and therefore serves as a useful mixing vessel.

The two components must be thoroughly mixed together. When mixing is carried out in the "PAC A" drum, the components must be stirred for at least fifteen minutes using a wooden paddle which is free from grit, nails and contamination by oil or grease.

If the mixed "Offshore Pac" is not to be used immediately its preparation vessel must be securely closed, and clearly marked "Danger Explosives" with the date of mixing. Usually the explosive mixture will have been prepared for immediate use, and can therefore be dispensed directly into the Penguin containers or holding vessels, ie Jerricans.

After filling the Penguin containers the knotted end of the priming lead is inserted into the container, and the bung gently pushed into position and secured by the tie wire attached to the carrying handle. When inserting the bung there is a danger of spray especially if the container has been overfilled. A wet towel or cloth placed over the bung will avoid this happening.

The primed charge now has any spillage washed off, and is ready for transporting

to the blasting site. Whether the charges are moved by hand, or by mechanical means, care should be taken to ensure that they are not subjected to friction or impact hazards. When temporary stocking is necessary, such as while a boat is proceeding to the blasting site, all charges must be shaded from direct sunlight, and covered with a wet canvas sheet so as to reduce temperature expansion of the explosive liquid (35°C maximum).

Placing the Charges

In shallow water the charges can be positioned from small boats or rafts, but in deeper water they must be placed by divers. Where surf conditions are encountered suitable skid mounted rigs and templates can be designed, and the charges either fired from the sea surface, or from the shore.

It is not intended that this paper teach the rules of underwater demolitions—these are adequately covered in the RE Diving Establishment precis on that subject. The following is therefore written as a general guide only, and circumstances will in fact dictate the particular techniques adopted.

It is normal practice to mark the site of operations by bouy. After positioning the Penguin Charges, a ring main is laid on the sea bed and the charges connected to it in the conventional manner. Detonating cord connections can be made by clove hitch knot, junction clip, or light gauge binding wire.

After connecting the charges to the ring main a trunk line is led from the ring main, via the buoy line, to the initiation set at the surface. To allow for movement of the buoy by current and wind action, sufficient slack should be allowed in the trunk line when tying it to the buoy line, with at least 2m spare end left at the surface for connection to the initiation set.

Initiation of the charges can be either electrical (L2A1 Detonator), or by Safety Fuze (L1A1 Detonator). For reliability and safety, both methods of initiation should be provided per firing circuit—the electrical providing a back-up in case of misfire.

Blasting Pattern

The blasting pattern will be determined by the site engineer and this will obviously vary from site to site. As with the plaster blasting method the sea bed should ideally be free of overburden when using these shaped charges, so that the full force of the directional shock wave produced can be utilized to crush the rock beneath the "excavator".

Normal practice when trenching is to position these charges on the sea bed on a burden and spacing of one to two metres, depending on the rock type and the depth of trench required[1]. The high volume of gas produced on detonation helps to eject the rock fragments leaving a clean cut trench 800mm in width, and up to three metres in depth. Wider excavations can be made by placing lines of charges in parallel, in which case the distance between each line of charges should not exceed 650mm. This minimizes the possibility of stumps being left, and thus avoids secondary operations.

As a general guide, the charge weight of explosive required to excavate a trench 800mm wide and three metres deep in soft ground, eg Sandstone/Red Marl, would be 1·6kg/m^3. For a similar result in hard ground, eg Granite/Quartzite, the charge weight would be 3·5kg/m^3. In each case the lineal spacing of the charges would be two metres and one metre respectively.

By way of comparison using the plaster or lay-on method, a charge weight of 15kg would only remove 1m^3 of similar soft ground. A minimum head of 7·5m of water would be required above the charge otherwise much of the explosive energy would be expended in producing nothing more than a gigantic water spout[2]. In any case the hydraulic shock produced by an uncontained charge of this size might well prove unacceptable. Only by containing the charge in drilled holes—in itself a time consuming job, would similar results be obtained for the same charge weights as

used in the NEC system.

Before full-scale operations commence it is advisable to have trial digs every fifty metres or so[3], not only to determine the suitability of the blasting pattern, but also to measure the water-borne shock wave level in order to allow a suitable scale of blasting to be formulated.

Controlled Blasting

When using these charges the majority of the shock energy will appear as water-borne shock with little ground vibration. In areas where only water-borne shock has to be considered a bubble curtain, comprising a sparge pipe through which compressed air is blown, will suffice to reduce the shock wave[4]. But if work is carried out close to structures, or in urban areas where ground vibration, noise and air blast do present problems, a delayed method of firing will also have to be adopted. The average layman tends to associate loud bangs with large and possibly damaging explosions.

Many criterion have been used for assessing damage to structures due to explosively generated ground vibrations, but the criteria most widely accepted, at present, is the peak particle velocity concept which combines both the "amplitude of motion" and the "frequency of the seismic event".

It has been found that minor damage occurs when a peak particle velocity of 100mm/s has been reached, while major damage is reached at 175mm/s. The United States Bureau of Mines have adopted a peak particle velocity of 50mm/s as a safe level, but in the United Kingdom considerably lower levels are used. These vary from 12·5mm/s for high pressure water mains, to 25mm/s for normal dwellings. Only where isolated blasts are planned is the figure of 50mm/s used[5].

NEC have recently introduced a non-electric delayed firing system using a pressure actuated detonator called a "Domino"[6]. The system requires only one charge to be primed by conventional methods and a single underwater explosion to be created; the shock wave from this actuates the successive detonation of other "Domino" detonators set in line or pattern. Using this system there is a considerable saving in divers working time spent on linking charges, and it has the additional advantage of being safe against electrical currents from radar stations and ships radios, and in areas prone to electrical storms.

Alternative Applications

The mild steel tubing used in the construction of oil drilling platforms, or oil and gas pipelines, is very difficult to cut with a straight forward explosives charge. One of two methods, or a combination of both, is normally employed. The one, by wrapping a flexible charge of explosive around the pipe at the point at which the cut is required—the other, by inserting a charge inside the pipe again at the point of cut. In both cases very large charge weights are necessary. If however, a shaped charge is used, based on the "Munroe Effect", the results are quite different, and a much reduced charge weight is required to cut through the equivalent thickness of mild steel[7].

Adapting this technique, and using "Offshore Pac" as the explosive agent, a team of divers from the Queen's Gurkha Engineers recently carried out an underwater cutting operation off the coast of Brunei. The targets, two redundant mooring piles, were located a mile offshore at the end of a tanker terminal. Due to the increased size of tankers using the terminal—and their consequent increase in draught, these piles were considered a hazard to navigation, and the requirement was to crop each pile to one metre below the level of the sea bed.

Having first located and marked the position of the piles with buoys. the targets were then exposed by water-jetting and air-lifting, until a sufficiently large crater was formed around each one to enable the divers to place the charges. Figure 2a shows details of the preparation work required prior to placing the charges. This part of the operation took two days to complete, due mainly to the fact that under

the top crust of the sea bed a thick glutinous mud was encountered which made water-jetting a slow and dirty business. On completion of the excavation work the liquid components were measured and mixed together to form the charge. This was dispensed into the charge containers, and after insertion of the detonating cord leads the filling orifices were sealed tight.

All the preceeding preparation work was carried out from the well-deck of a

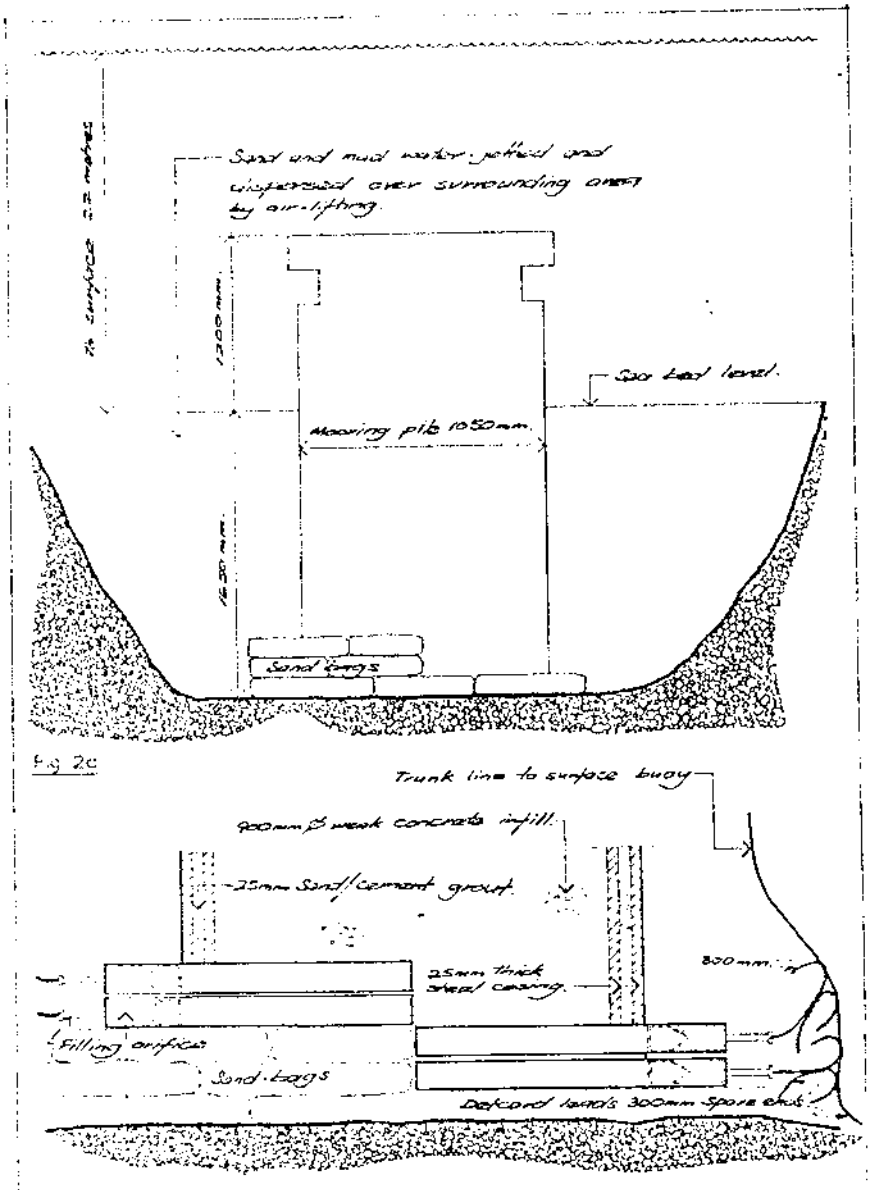


Fig 2 ALTERNATIVE APPLICATION

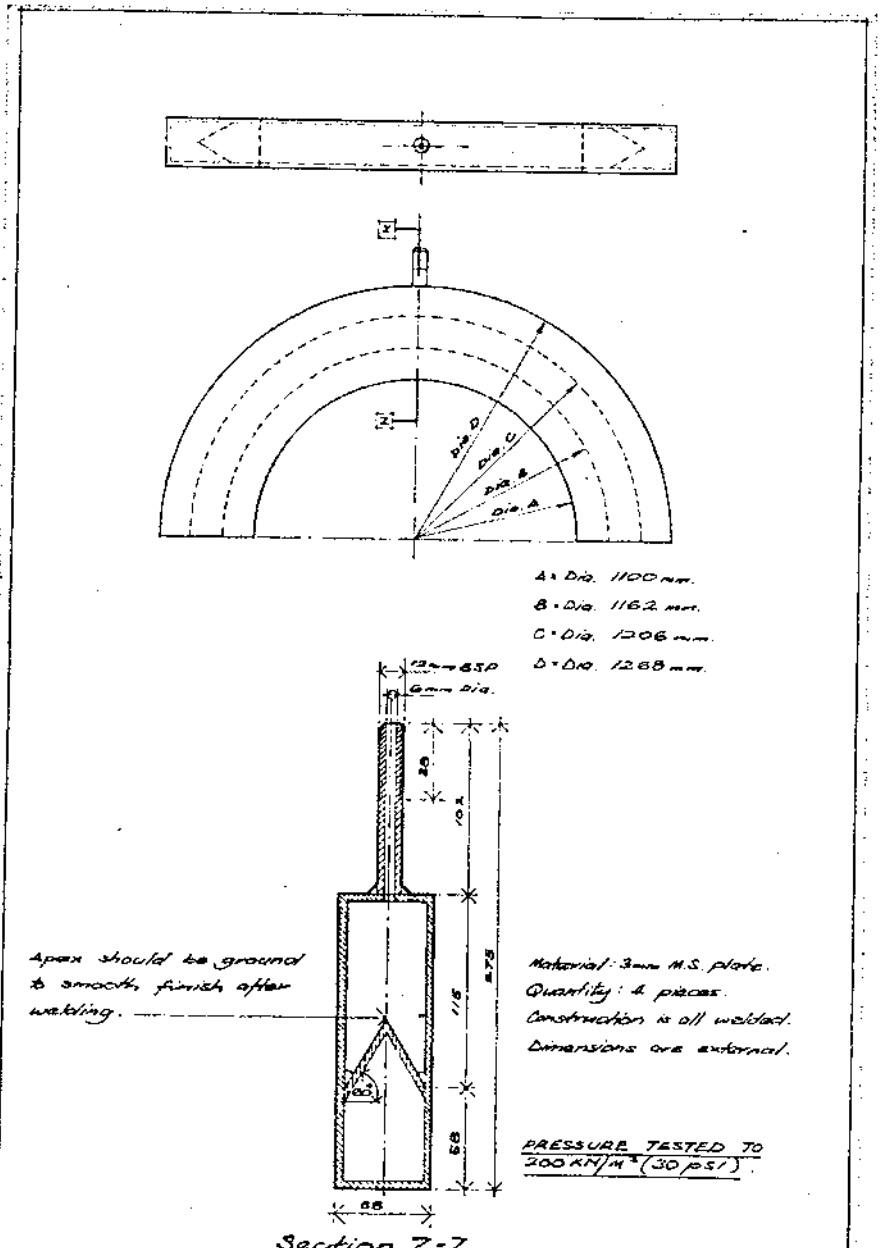


Fig. 3 SHAPED CHARGE CASING

Shell Company tug which had been allocated for the duration of the task. The firm of XPL-TECHNOLOGY Singapore, were the demolition consultants for this particular job, and both the shaped charge containers and charge weights were made-up to their specifications. Figure 3 shows details of the containers which were produced in the local Shell Company Workshops.

The divers then placed the charges in position from a small powered boat moored

to the buoy line at each pile. Figure 2b shows the charges in position and connection of detonation leads to the trunk line. On return of the divers to the tug the shot firer commenced to make up his initiation sets—in this case electrical only. At this point the ships radio was shut down—all other shipping in the area having previously been warned to keep clear.

An initiation set was taken by the shot firer to the first pile and connected to the buoyed trunk line. The firing cable was paid out to a distance of 150 metres and the charge was fired. This procedure was repeated for the second pile, and after a pause of thirty minutes, both targets were inspected by the divers. It was found that the piles in each case had been cut at 1·5m below the level of the sea bed, and a crater formed approximately two metres deep and six metres in diameter.

Conclusion

Explosives for underwater use should have high bulk strength, good water resistance, and they should also retain their sensitivity when subject to hydrostatic pressure and detonate reliably[8]. At the present time there are no special military explosives or accessories issued for underwater tasks, and while the current issue of demolition items may be used, there is always the problem of water penetrating the explosive and rendering it impotent. This can happen if a charge is left submerged for more than one hour.

In addition to the problem of waterproofing, underwater charges must be strong enough to overcome the hydrostatic head of water to allow the rock to break out—so higher charge weights are required. The use of shaped charges on the other hand minimizes the amount of explosive needed, both for trenching and cutting operations, and the method is reliable and quick. Various configurations of shaped charge can be assembled, and in conjunction with "Offshore Pac", even the most difficult underwater targets can be attacked.

The significant advance then of the NEC system is the availability of a technique for preparing shaped charges on site, which not only overcomes many of the storage and distribution problems, but also provides waterproof, reliable and reduced charge weights.

ACKNOWLEDGEMENTS

The author wishes to thank the Technical Service Department of Nobel's Company, and Shell Company Brunei for their assistance with this paper.

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Ex Bezonian Venture—Leg 2: Gibraltar to Cyprus

LIEUTENANT J R WHITE RE, BSc

After leaving Ampleforth in 1975, the Author spent a short time "resting" before being welcomed into the Army. On commissioning from Sandhurst he commanded a Troop in 73 Indep Fd Sqn. Having completed his final year at the Royal Military College of Science he is now serving with QGE in Hong Kong.

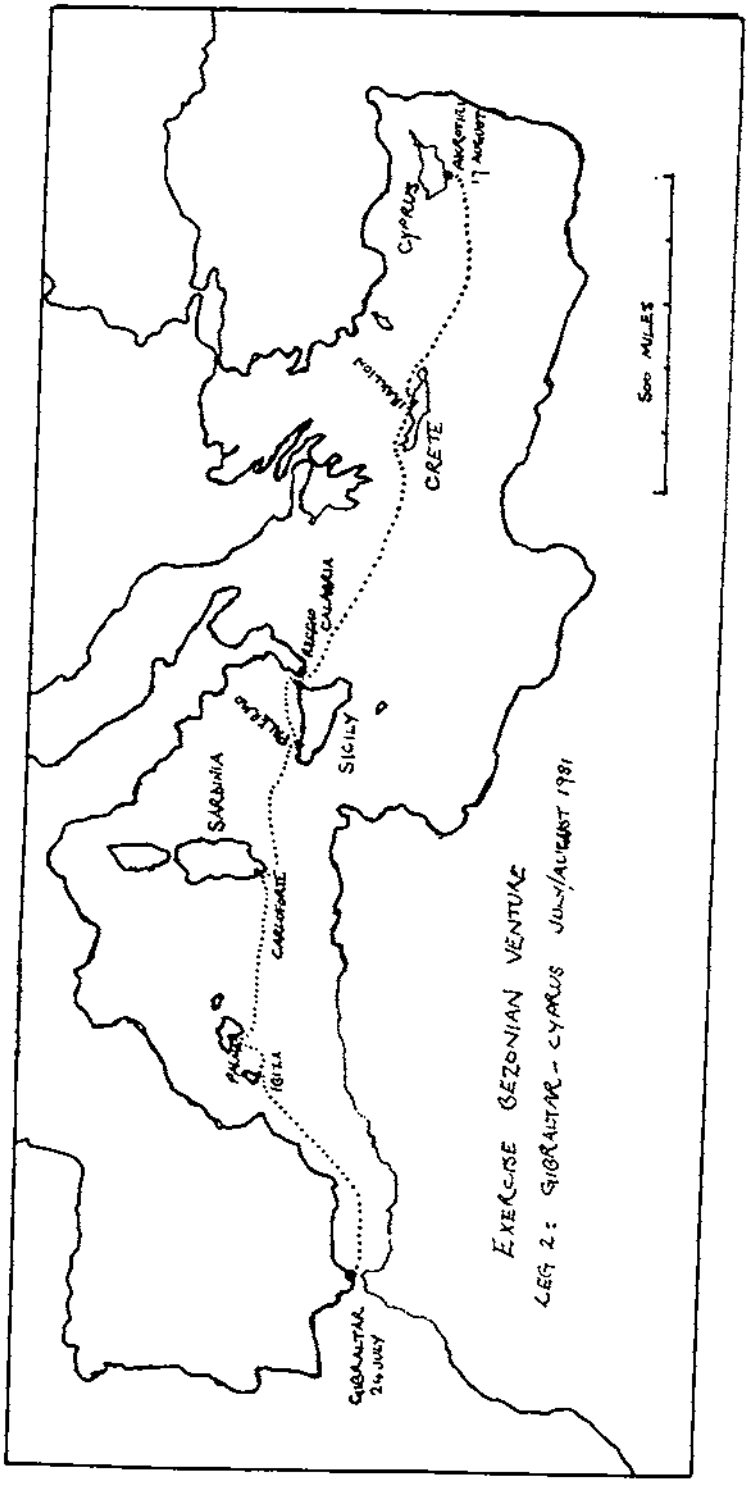
THERE cannot be many who for sometime in the year do not wish to escape the harsh reality of Army life, to drop what they are doing and sail away to a timeless paradise where the frenetic cries of an hysterical Sergeant Major are replaced by the gentle singing of nymphs and where everything can wait until tomorrow. Although *Exercise Bezonian Venture* could not provide the nymphs it did provide the means of transport to this paradise in the form of a 40-foot Swan, loaned to the Army by a shrewd Australian banker who calculated that financially it was well worth the risk of having his prize brought to Sydney by a motley collection of soldiers rather than pay the exorbitant fees charged by a professional delivery crew.

The yacht, christened *Byzance* by a previous owner, had been left in a sorry state before being "discovered" by Colonel Tommy Tucker, Royal Artillery, who had her taken to Marchwood where she underwent an extensive overhaul in preparation for the epic voyage across over 17 000 miles of hostile ocean. It was Colonel Tucker's idea to christen the venture "Bezonian", for finding no reference to "Byzance" in works by any English writer, remembered that a Bezonian was a rascal recruited by an army in time of need. It was a most appropriate label for an expedition whose members came from a wide variety of backgrounds and whose experience ranged from nil to that of the Leviathans who would actually skipper the yacht in the six legs from Marchwood to Sydney.

Preparations for the voyage had been going on for almost a year when *Byzance* finally slipped her moorings on 8 July 1981 and headed for Gibraltar. Though two Clansman PRC 320 sets had been fitted, communications were lost with Blandford after only four days and the yacht was not heard of again until almost two weeks later when she arrived, unannounced, in Gibraltar.

It had been realized very early on in the planning stages that only the very best crew could be chosen for the difficult second leg across the Mediterranean to Cyprus, a voyage which could normally be done in under three weeks but which eventually took almost four; a voyage not without its perils, for calls would have to be made at the particularly tricky ports of the Balearic Islands and transactions made in four different currencies if the standard of cuisine aboard the yacht was to be maintained at that to which the crew was accustomed. Thus, with all this in mind,

Lieutenant J R White RE BSc


EXERCISE BEZONIAN VENTURE
LEG 2: GIBRALTAR - CYPRUS JULY/AUGUST 1981
GIBRALTAR
26 JULY
IBIZA
PALMA
CARTAGENA
SARDINIA
SICILY
CRETE
CYPRUS
500 MILES

Colonel Tommy Tucker (whose brainchild the expedition was) was selected as Skipper and had almost no hesitation in choosing John White as his Mate. To manage the other watch and keep an avuncular eye on the Volvo diesel engine, the Royal Tank Regiment loaned Sergeant "Zip" Nolan. A delightful duet of singing Welsh Corporals from the Queen's Dragoon Guards lent tone to what might have otherwise been an unruly mob and additional muscle was amply provided for by a brace of Jocks from the Highland Division whose dialectal convolutions kept the remainder of the crew bewildered for hours. The only other Sapper to take part in the expedition was LCpl "Buzz" Barry who at that time was serving with the Fortress Squadron and whose knowledge of electricity was second only to his knowledge of the Rock.

Beneath a hot sun and to the cheers of the crowds that thronged the Coaling Island Dock, *Byzance* put to sea once again on 24 July. None of the crew expected what was about to happen over the next few days for it was estimated that within 72 hours they would be over 400 miles away in Ibiza; but one of those rare storms erupted and the crew battled against tempestuous winds for six days before finally reaching the relatively safe haven of the Balearic Islands.

Barely two days were spent effecting repairs in the ports of Ibiza and Palma before once again putting to sea. As Mallorca dipped below the horizon, the wind dropped and *Byzance* was becalmed. For two days there was almost no wind at all and she averaged less than forty miles a day. Furthermore, there were no other vessels to be seen until late in the second day when the yacht was buzzed by two American aircraft returning to their carrier. After an overnight stop in Carloforte on the Ile di san Pietro off the coast of Sardinia, the voyage continued to Sicily but once more the wind was light and progress slow. It was not until the beginning of the third week that *Byzance* at last met fair winds and as she left Reggio Calabria, in the Straits of Messina, there was a stiff following breeze that allowed one of the three spinnakers to be raised. Over the next four days the yacht averaged more than 120 miles a day.

What was of more significance probably to the anxious signallers at Blandford, was that one particularly sharp crew member finally made radio contact after almost a month of being incommunicado. However, the *Byzance* transmitters were not powerful enough to send long messages over 2000 miles to Southern England so the hapless messenger had to send all his signals in morse, while the men at Blandford had the unenviable task of differentiating between dots, dashes and DT's.

Though time was getting short, it was necessary to "fly the flag" in one last port before Cyprus in order to stock up on nice things. Crete was chosen as the island most likely to provide such commodities but it is open to conjecture as to what criteria were considered in selecting the harbour. During the four days between Italy and Crete, Colonel Tucker was mostly concerned with his poker school while the Mate was transported to another world of knights and heroes, engrossed in the works of Sir Walter Scott. However, be that as it may, *Byzance* arrived very early one morning in the ancient harbour of Iraklion and the crew scattered for about four hours, each man to practise his own dialect of the English language on the inhabitants. Upon their return, it was discovered that they had all bought the same revolting postcards of Satyrs to send to their loved ones which tended to show that the mentality of a Bezonian was on a par with that of a grubby schoolboy.

In the words of W C Fields, the next four days were "fraught with eminent peril". Those with a classical education may recall that it was in these very waters that another great soldier, Ulysses, had had more than his share of excitement on his way home from Troy. And so it was with *Byzance*. The spinnaker ripped in a sudden gust which drastically reduced speed; the Mate reached the end of his list of "Twenty-one Banquets fit for a King" and did not know what to serve next; and, for some inexplicable reason, the two Celts stopped swearing and an uneasy silence hung over the rest of the crew who wondered what oaths the pair were thinking of for the moment when this period of restraint ended. As a result of the cut in speed,

the authorities in Cyprus had an extra half day in which to alert "Rent-a-Crowd" and prepare for the yacht's arrival.

Words cannot describe the sight from *Byzance* as she rounded the mole at Akrotiri on 17 August. The quayside heaved with people cheering, clapping, singing and welcoming the men who in three and a half weeks had sailed almost 2500 miles with only a forty-foot hull beneath them, had communicated in three languages and had done all this on a basic diet of "compo". As they left the yacht for the last time, while the band of the Royal Marines played *Rule Britannia*, perhaps they paused for a moment and thought of the new crew which was to take *Byzance* through Suez, out into the Red Sea and on to India; but more probably they were thinking of the hot baths awaiting them, of feather beds freshly made up with clean white linen and of England, "where men with Splendid Hearts may go".

Should Civil Engineering Die at RMCS Shrivenham?

PROFESSOR W G WOOD B Sc. Ph D, C Eng, MI Mech E

THE Army Board will shortly be asked to make a decision on whether the Civil Engineering degree course should continue at RMCS after the 1983 intake of students. The whole operation of technical training in the Army is, of course, under examination in the Groom and Tri-Service studies as also is the possibility of contracting the academic teaching at RMCS to an outside Institution. Apart from these global issues, but to some extent hidden by them, is the firm proposal in the *Killick Report* (1) that the undergraduate degree course in Civil Engineering at RMCS should cease. This may be a matter of concern to the hundreds of Sappers who regard RMCS as their Alma Mater and to those who wish to preserve a single Staff and a balanced College, able and willing to respond to the whole needs of the Army. It takes many years to create a good degree course, as it does a good school or a regiment, so it should not lightly be thrown away. It may be useful therefore to obtain a wider discussion of this issue and to couple it with consideration of the sort of undergraduate training the Army needs and to look at some of the advantages and penalties that follow from the alternatives.

On the whole, this Journal has been remarkably free of articles on education. A quick look through the last five years issues yielded only two which touched on the subject; "Gentlemen—The Corps" by Colonel P L Newth (2) and "Dai Morgan's Education" by Brigadier Sir Mark Henniker Bt(3). I hope this article may redress the balance.

I propose, then, to direct attention first to the Killick proposal to end the Civil Engineering degree course at RMCS and then to a consideration of the design of degree courses to meet the needs of the Sappers.

THE KILLICK PROPOSAL TO ABANDON THE CE DEGREE COURSE AT RMCS

The Killick report appeared in 1981; it covers about 100 pages and has about half as many again as Annexes. Briefly, the grounds for recommending the abandonment of the CE degree are:

(a) An anticipated fall in the numbers of CE graduates required by the Corps.

(b) The present ease with which suitable graduates may be recruited either on university cadetship and bursaries or by direct entry.

(c) The high cost of all Shrivenham degrees compared with those at outside Universities.

These grounds themselves are contentious. However it is probably best to consider first what the Sappers would both gain and lose if this proposal were carried.

Possible Gains

(1) With the closure of CE Department, the Sappers would be given some extra places at outside Universities to compensate them for their losses here. Places at Bristol, Southampton and Imperial would be more attractive to Sandhurst graduates than the corresponding places at Shrivenham and the Sappers would be well placed to attract the best students into the Corps.

(2) It is difficult to be precise on the savings that would be made by the Army as a whole because most of the RMCS facilities and rather less than half the total CE staff would have to be preserved to service degree courses given to other Departments and to Staff and other specialist courses. However a saving of £250 000 is likely to be obtained by abandoning the RMCS degree, of which about £100 000 would then have to be paid to outside universities to maintain the extra students there. For comparison, the total cost of RMCS is of the order eight to ten million pounds per annum.

Possible Losses

(1) There would be a loss of goodwill with other Corps if the Sappers were to have a privileged position in recruitment.

(2) With the closure of CE Department the Sappers would effectively lose their stake in RMCS, but the costs of the College, which would not be affected significantly, would remain to be borne by the Army as a whole, including the Sappers.

(3) In the present economic climate, men recruited from outside Universities may join the Army for the wrong reasons, simply to get a job. Those who come via the RMCS route have clearly put the Army first.

(4) The present economic climate may lift. Given an upturn in the economy and some national recovery, we can expect industry to exert a massive demand on new graduates. If we couple this with the inevitable result of cutbacks in university places which are presently being made it is likely that there will be a shortage of good men and that the Army will not be able to sustain its intake of Sappers at the necessary levels if the only sources are outside RMCS.

(5) A good degree course is not created overnight. The present course has taken about ten years to develop into its present excellent condition. It immediately won CNAA approval and has been accepted by ICE, I Struct E and I Mun E as satisfying their requirements.

(6) There is a group of young men with plenty of initiative and enthusiasm who put a great deal of effort into sport and therefore attain lower pre-university qualifications but who, nevertheless, make first class officers. An institution like RMCS can cope with these men who might not otherwise obtain university places, given stiff competition. Some very successful Sappers have belonged to this group.

(7) The Sappers would lose a source of commercially unbaised, expert advice. We get a number of enquiries for opinion, information, ideas and general expertise each year from all over the world.

Degree Courses for Sappers

Whatever happens at RMCS, if we continue, we are almost certain to have to rethink our philosophy of degree teaching and so it may be useful to review my own ideas of degree training, how these have led to the present degree course, and the sort of alternative and more economical course that could be designed.

Education is like any industry; it is a prey to vested interests. Those in charge of it are knowledgeable in certain fields and find life easiest when teaching the same material from year to year. Nor is it only those in charge of teaching who have a vested interest. All those already trained feel themselves knowledgeable on training and, human nature being what it is, feel that their training is the one that should be duplicated henceforth. These attitudes, when sustained, lead to tragedies like the Comet disaster and the failure of steel box-girder bridges. It was not that the appropriate technology was lacking in these and similar cases, it was simply that the people doing the designing didn't know it! There was an extensive knowledge of

metal fatigue before it caused aircraft failures and the aircraft industry itself had been designing stiffened plate structures which worked above the elastic buckling limit of the plate for twenty years before civil engineers started on steel box girder bridges. The new technology simply hadn't rubbed off. In the past fifty years, the academic standard of degree courses has advanced at about one year of level attained per fifteen or twenty years in time. For example, some of the material which I had in my final year I am now teaching to my own students in the first term of their second year.

My first message, therefore is, that we, both academics and practicing engineers, should approach the subject of what goes into a degree course with a becoming amount of humility; the academic because he should realize the vast store of knowledge from which he has to select only enough to fit into a three-year course and the practising engineer because he is likely to be ignorant of the major advances in all but the field of his own particular practice.

The second message is that one does have to *select* a course. Many of the developments and applications of the theory of elasticity which I struggled to assimilate over the years are now museum knowledge as far as degree teaching goes, the rise and triumph of the digital computer has seen to that, and these must be left to gather dust in the archives while I lead my students to do their structural analysis by developing finite element computer programmes.

The first sentence in the previous paragraph could now have its emphasis changed—one *does* have to select. In a very real sense, because we know this vast store of knowledge exists, and that it is utterly impossible to even review it in three years, never mind learn it, it doesn't much matter what you select, at any rate in the final year. It is terribly easy to fall into the trap of saying that one knows what students will need, whereas, if each of us looks back to gauge what proportion of our course we actually used I'd be surprised if it were more than 10%, and for many RE officers it is likely to be zero. In that case, you may retort, why bother with degree training at all—it is not necessary to the Sapper in the field and it takes three years out of his Army career. And so we're back to the beginning again.

The Present Degree Course

It is probably best to start with a statement of what we do not do. The Sappers needs for military engineering in the field are met at RSME Chatham, and we do not try to duplicate these. Our brief in the Civil Engineering Department at RMCS has been to provide the best education for the profession of Civil Engineering that we can devise. Our starting point is to note that the two desirable features of an educated man, breadth and depth, tend to be mutually exclusive and that we must consciously aim to preserve both of these. We try to present our men with a broad view of the present day state-of-the-art in Civil Engineering and we also demand that they follow some studies from the shallow to the deep water, because it is only by doing this that one comes to get a measure of and a feel for coping with the weight of the immense store of knowledge that is available. Another essential of a good education is that it should be linked to life—it should illuminate the real world—and so we try to include applications that are appropriate to our, largely Sapper, student body. This is an aspect of education that most concerned the authors of the Finniston report (4).

In the present degree course there are ten modules in the first year, nine and a half in the second year and six, with an experimental project and a design project in the final year, Table 1. All Civil Engineering students take the same course in first and second years. In their final year all students take the Management and Design modules and then choose extra modules from the list given. An honours man would take four extra modules, three at honours level, an ordinary degree man three extra modules all at ordinary level. The difference in level is made by terminating the honours module early for an ordinary degree man so there is no duplication of courses. The whole arrangement is flexible (a man may opt to take the ordinary course at any stage), it covers a very wide range of interests, and it is very cost effec-

tive. Civil Engineering Department have led the College in getting computing into the degree courses and into use as a design tool, it is introduced into the course in the first week of the first year and in continued use thereafter. We are particularly proud of our design course. This runs through all three years, culminating in a final year design which the students take from an initial scenario through site selection, conceptual design, structural design and planning stages to the construction of a scale model, which, with the drawings and calculations is exhibited at an "Open Day" in the early summer when a number of distinguished visitors, both academic and military come along to inspect the work. The course is fully described, elsewhere (5), (6). I am very proud of the whole course—over the past thirty years I've taught at Leeds, Bristol and Imperial College and in the USA and our present course is as good as anything I've seen elsewhere.

Alternative Courses

If it becomes important to cut the cost of all courses and if there is a demand for a greater commoning of teaching for REME, R Sigs and RE students, and a stronger demand for military relevance then a course along the lines of that shown in Table 2 could be constructed. This has a common first year for all engineers, a higher electrical content, a final year without choice and an academic level in Civil Engineering subjects which might cause concern in a validating body like CNAA and to the

TABLE 1—PRESENT CIVIL ENGINEERING DEGREE COURSE

FIRST YEAR (10 Modules)

(2) Mathematics
(1) Stress Analysis and Structures
(1) Hydraulics I
(1) Mechanics/Thermodynamics
(1) Electricity
(1) Surveying
(1) Engineering Materials
(1) Drawing and Design
(1) Liberal Studies

SECOND YEAR (9½ Modules)

(2) Mathematics
(1) Stress Analysis
(1) Structures
(1) Soil Mechanics
(1) Hydraulics II
(½) Geology
(½) Vibrations
(1½) CE Design & Construction
(1) Liberal Studies

THIRD YEAR

Mandatory (Whole Modules)

Site Management
CE Design & Construction

Options (Whole Modules)

Mathematics
Structures
Hydraulics
Stability and Vibrations
Rock and Soil Mechanics
Electrical Power Systems
Stress Analysis

(Half Modules)

Surveying
Geology
Transport Engineering
Hydrology
Heat Transfer
Rock Mechanics
Metallurgy
Prime Movers

Honours men choose 4 options, 3 at Advanced Level
Ordinary degree men choose 3 options, all at standard level.
In addition, there are the following commitments:

(1) An 8-week attachment to a Contractor in the first summer vacation.
(2) A Geology Field Course in the Easter vacation, second year.
(3) A 3-week Field Survey Course at Sennybridge followed by a 3-week course in photogrammetry at the School of Military Survey, Hermitage.

moderators of degrees in the ICE. One of the problems of general degrees is that they are not given professional recognition. The exceptions are, of course, Oxford and Cambridge, but their entry standards are such as to ensure a high quality graduate and the Institutions are quite clear that in other cases it is not possible, in one three-year course, to satisfy the IEE, I Mech E and ICE requirements simultaneously. It might be possible to satisfy any two, but, like the well known breakfast food, three is too many! A degree course without professional recognition would not be attractive to recruits and would be liable to get more and more out of touch with the mainstream of professional thought.

So far I've confined my comment to the requirements we have to meet in the UK. Here a balance has to be struck between a good education in engineering, the needs of the Army, professional recognition, and the need to economize. However, there is an equally insistent pressure from what is almost "the rest of the world" to refuse professional engineer status to our three-year degree courses. This trend was noted at a recent meeting of Moderators of degrees in Civil Engineering at the ICE. The pressure from abroad, and especially from the EEC countries, who have had it for many years, is towards a longer degree course for chartered engineers and it is unlikely that we shall be able, in the long term, to resist that trend.

At this moment, the important issue is in the short term. Should the Killick recommendation to abandon the Sapper degree at RMCS be adopted? The decision is, of course, that of the Army Board, upon whom Sappers may have as much influence as anyone else. For myself, I retire in October 1983, so that the decision to be made is not one in which I have a vested interest. Gentlemen, I wish you well.

TABLE 2—POSSIBLE MILITARY ENGINEERING COURSE—CIVIL OPTION

FIRST YEAR (10 Modules—largely common to Civil, Mechanical and Electrical students)

(2) Mathematics	(1) Engineering Materials
(1) Stress Analysis and Structures	(½) Workshop Technology
(1) Fluids and Thermodynamics	(1) Drawing and Design
(2½) Electricity and Electronics	(1) Liberal Studies

SECOND YEAR (10 Modules)

(2) Stress Analysis and Structures	(1) Numerical Methods and Computing
(1) Soil Mechanics	(1) Electrical Technology and Control
(1) Fluid Mechanics	(½) Geology
(1) Mathematics	(½) Surveying
(1) CE Design	(1) Liberal Studies

THIRD YEAR (6 Modules + Project)

(2) CE Design	(1) Prime Movers and Power Generation
(1) CE Management	
(½) Mobility and Soils	(½) Roads and Airfields
(½) Military Structures	(½) Water and Sewage

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74 (Antrim Artillery) Engineer Regiment (Volunteers)

COLONEL I B GAILEY TD, O St J, (V)

The Author enlisted into Queens University Belfast OTC in 1952; from 1954–69 he rose to become 21C of 6RUR and after 2 years on RARO he became a Coy Comd in 5 R Irish and subsequently its 21C. Appointed Brevet Lt Col in 1975 he joined the Staff of HQNI. In 1978 he was appointed Cadet Comdt (ACF) for Antrim and Belfast in the rank of Colonel, a post he still holds. He joined the RE in 1981 and is at present serving as PSAO of 112 (Antrim Fortress) Fd Sqn in Bangor, Co Down.

He has many interests including Military History, Architectural History and Conservation. He is an active appeals organizer for both SSAFA and the Order of St John of Jerusalem. He was joint Author of "An Account of the Territorials in Northern Ireland 1947–1978".

INTRODUCTION

Although the association of this Regiment with the Corps of Royal Engineers is comparatively short, their history as a unit of the Auxiliary Forces is longer than most of the present seven Volunteer Engineer Regiments. The main components of the Unit have strong Gunner links, and this is reflected in pictures and silverware displayed in our TA Centres.

HISTORICAL BACKGROUND

Prior to the Seventeenth Century, Ireland was largely a tribal society with little centralized authority outside the Pale. Therefore the development of auxiliary military forces was rather different from Great Britain. For centuries the Irish lords had produced the great bulk of their fighting men by calling out the "freemen" of their own "lordships". They came armed and equipped to the summons, fought and returned to their peaceful occupations: for this reason warfare could never be protracted.

In 1608 one condition of the Plantation of Ulster was that the "Undertakers" who received grants of land were required to "have ready in their houses at all times a convenient store of arms, wherewith they may furnish a competent number of able men for their defence, which may be viewed and mustered every half-year, according to the manner of England".

No Militia in name existed before 1660 and then only in the area of the Pale. During the Williamite War there was Militia in the service of both James II and William III, though they differed somewhat in complexion. The first Militia Regulating Statute in Ireland was in 1715 and there is evidence of an array of the Force in 1745 and again in 1756, at the time of the Seven Years' War between Great Britain and France.

Companies of Volunteers in their various brilliant uniforms were raised locally by private subscription. They were well armed—partly, though with some misgivings, by the Government—and were even in possession of Artillery. By the end of

Colonel I B Gailey TD O St J

1778 the Volunteers numbered some forty thousand men. They were a Protestant body, but some Companies admitted a few Roman Catholics surreptitiously though the laws forbidding "Papists" to possess arms were still in force. Military organization gave the Irish Protestants a new sense of unity and strength which they now exploited to their advantage. Instead of simply being there to defend the coastline, the Volunteers became a fashionable and extremely effective expression of Protestant political aspirations.

Events in Europe in 1792 lead to a considerable revival of interest in "volunteering", but the Government was anxious that control of the Irish Auxiliary Forces should be restored to the executive, as the Volunteers had been tardy in quelling disturbances and it had proved impossible to bring them into subordination. The Militia Bill of 1793, introduced to meet internal and external threat, consolidated the existing Militia Laws and fixed the quotas of men to be furnished by each County. The Militia embodied under this Act differed in major aspects from earlier formations, whose existence tended to be intermittent. Firstly, the Corps almost never served, and were rarely stationed, in the County of their formation. Secondly, Catholics were officially admitted to membership for the first time. The Colonel of each Regiment was appointed by the Government. He was responsible for finding the Officers who apart from the Adjutant, Surgeon and Mate, were required to have certain property qualifications. The men were selected by ballot held on a parish basis, resistance to which in some areas led to disturbances. It was possible to insure against selection and volunteers willing to offer themselves as substitutes could generally be found.

Suspicion and doubts about the loyalties of the Militiamen, because of the religious opinions of the majority of soldiers, led to demands from the establishment for an additional force for the "Preservation and security of the lives and properties of His Majesty's subjects". The role of these "District Corps", as they were originally known in 1796, was local defence whereas the prime role of the Regiments of Militia was that of a counter-invasion force. Both Cavalry and Infantry units were raised almost entirely from the Protestant population and members were exempt from the ballot for the Militia, which proved a great inducement for enlistment. The name Yeomanry was later applied to the Cavalry, and the Infantry Corps were frequently called Volunteer Infantry. The force was actively employed during the Rebellion of 1798 and continued as a permanent military body throughout the war, but, except when called out for regular service, was not subject to the Articles of War. Some Corps survived with a small Permanent Staff until they were finally disbanded about 1840.

During the years of the war with France the units of Irish Militia moved about Ireland from station to station, with a retinue of wives and children. Despite the doubts of some regarding the loyalty of the force, most Regiments served with distinction during the Rebellion of 1798 and also supplied numerous recruits for the Regiments of the Line. From 1811 many units served in England, until the Militia was disembodied in 1816.

THE CRIMEAN WAR

On the outbreak of the Crimean War in 1854 a re-Organized Militia was raised in Ireland, and Artillery units were formed as well as Infantry. The Royal Antrim Artillery was embodied in December with Headquarters at Carrickfergus. The Lieut Colonel Commandant was the Viscount Massereene and Ferrard, DL; the Officer Establishment was one Major, six Captains, five First Lieutenants, six Second Lieutenants, an Adjutant, Surgeon, Assistant Surgeon and a Paymaster. The Regiment was disembodied on 5 April 1859, being stood down on 28 February 1861. The Militia was now on an entirely voluntary basis, the soldiers serving for seventy-six continuous days recruit training on enlistment and then coming up for a months embodied service each year.

Due to the disturbed state in Ireland the Militia was not assembled during the years 1866 to 1870 and again on various years during the eighteen-eighties.

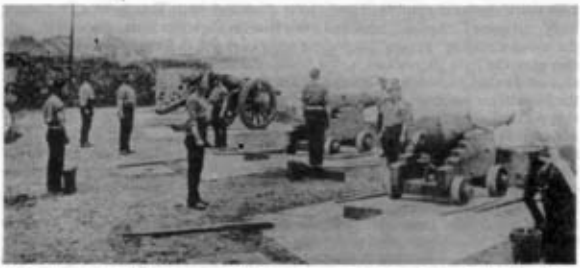


Photo 1. Gunners of The Antrim Artillery at firing practice during Annual Training at Carrickfergus. (*From The Navy and Army Illustrated 26 November 1897*)

An article in *The Navy and Army Illustrated* in 1897 describes the Antrim Artillery as consisting of eight Companies recruited "principally from the ship building workers and peasantry of the North of Ireland. The unit is not only numerically the strongest, but for efficiency and smartness is not excelled and not often equalled by any other Artillery Militia Corps in the United Kingdom". Training took place for the usual twenty-seven days at Carrickfergus and the Regiment possessed an excellent Band and was popular in the district in which it trained.

SOUTH AFRICAN WAR, 1899–1902

On the outbreak of the South African War, five Officers and 153 NCOs and Gunners, under the command of Major G E Elmitt, the Secretary of Portrush Golf Club, volunteered for foreign service. The Company along with a similar sub-unit of the Donegal Artillery embarked at Queenstown, Co Cork on 26 March 1900. The two Service Companies formed an Artillery Brigade commanded by Colonel E T Pottinger, the Antrim's Commanding Officer.

On arrival at Table Bay the Force was encamped at Maltland, before being employed on escort duty guarding a large number of Boer Prisoners being taken to the Island of St Helena. On return to South Africa the two Companies took over the Artillery defences of the Cape Peninsula, prior to spending nine months guarding lines of communication in Orange River Colony. During this time "Fort Antrim" was constructed by the Brigade, for which it received much commendation.

The Brigade returned home and the Antrims were disembodied at the Old Courthouse, Carrickfergus on 10 July 1901.

COAST DEFENCES

In 1905 the "Report of the Committee on Armaments of Home Ports" approved the armament of the Batteries at Grey Point and Kilroot on Belfast Lough to have each two 6-inch Mk VII guns, adequate against attack by unarmoured cruisers.

FORMATION OF THE TERRITORIAL FORCE, 1908

On formation of the Territorial Force all Militia Artillery was disbanded except in Ireland and the Channel Islands. "The Antrim Artillery" and "The Cork Artillery" were retained as units of the Special Reserve to assist in the manning of the North and South Irish Coast Defences.

FIRST WORLD WAR, 1914–18

In 1914, No 15 Company Antrim Royal Garrison Artillery (SR) was deployed to man the guns at the defended ports of Lough Swilly and Belfast. The unit remained in these stations for the duration of hostilities without experiencing any action. On conclusion of the War the Regiment was not revived though never formally disbanded.

THE TERRITORIAL ARMY, 1920

The Territorial Army was reconstituted in 1920, but the relevant Act did not apply to Northern Ireland. The Province had always wanted Territorials, but the circumstances were peculiar because the Government was in treaty bound with the Irish Free State not to raise an Army in Northern Ireland and was fearful of misunderstandings. These were removed on condition that the parentage of the new force was accepted entirely by the War Office, and the object of the Territorial units in Northern Ireland was for Imperial defences only.

Recruiting opened in August 1937 for the 188th (Antrim) Heavy Battery RA with an Establishment of six Officers and 179 Other Ranks, which was regarded as a revival of the Antrim Artillery. The role of the Battery was to protect the approaches to Belfast Lough, while in addition the Engineers of the new Antrim Fortress Company, Royal Engineers, were to provide technical services. Enthusiasm was unbounded and there were large queues of prospective recruits at the Drill Hall, a converted warehouse in central Belfast. The units were soon up to Establishment, and the first camp was held at Grey Point on Belfast Lough in June 1938 and they were later mobilized during the Munich crisis.

THE SECOND WORLD WAR, 1939–45

By April 1939 the units were at full strength, and when the following August precautionary measures were ordered, the Batteries at Grey Point and Kilroot were quickly manned. 188 (Antrim) Heavy Battery claims to be one of the first units to fire in the Second World War, having fired across the bows of an incoming vessel on the morning of 3 September 1939, some three hours before war was declared, in order to prevent the vessel entering harbour as it had not carried out the approved recognition procedure. Shortly afterwards the Royal Artillery took over the tasks of the Fortress Company, and each unit went its separate way. 188 (Antrim) Heavy Battery was expanded to form 525 (Antrim) Coast Artillery Regiment RA in 1940 and manned the defences at Orlock Point, Musgrave Channel, Greypoint, Kilroot, Larne and Magilligan. It was equipped with both anti-aircraft and 6-inch naval guns. Throughout the war the Regiment served in Northern Ireland until it was placed in a state of suspended animation in August, 1945.

In contrast to the rather static role of the Artillery, the Antrim Fortress Company RE had a much more mobile life. In December 1940, it was converted to

Photo 2. Original members of 188 (Antrim) Heavy Battery RA (TA) and Antrim (Fortress) Company RE (TA) at camp in Grey Point, Co Down, 1938

become 591 (Antrim) Field Company RE. As part of II Corps it moved to Halifax in January 1941, and then to Ely. It then went to Woodbridge and became part of 54 (East Anglian) Infantry Division. In May, 1943 the Company converted to a parachute role and joined 6 Airborne Division as 591 (Antrim) Parachute Squadron RE. The unit was one of the first to land in France in 1944. Shortly after midnight on 6 June, 1 and 3 Troops were dropped east of the Orne bridge to clear an area for gliders of 6 Airborne Division due to land at 0330. This task was successfully completed and the troops cleared mines, reconnoitred routes and laid a minefield to strengthen the Ranville position.

Meanwhile 2 Troop formed part of the force that was dropped on the heavy gun Battery at Merville. Although few Sappers reached the target due to inaccurate dropping, the guns were eventually neutralized by the force. The remaining Sappers joined and fought with other units until they could rejoin their Squadron. The Squadron stayed in France until August 1944, and then returned to Bulford. In December the Squadron moved back to France to help counter the German offensive in the Ardennes. By February, 1945, the Squadron was back in England having spent a short period in Holland on the way. Their stay in England was short-lived. On 24 March, as part of *Operation Varsity*, they took part in the Rhine Crossing followed by a rapid advance to Wirmar on the Baltic Coast, which they reached on 2 May 1945. During May they moved to Norway via England to clear mines, assisted by a German labour force. The Squadron finally returned to England in early 1946 being demobilized and placed in suspended animation on 15 March 1946.

THE NEW TERRITORIALS, 1947

429 (Antrim) Coast Regiment RA (TA) was formed in 1947 with its Headquarters in Great Victoria Street. Its task was to man the Northern Ireland coastal defences. A Battery of the Regiment was formed at Windmill Camp, Carrickfergus in 1949, and in 1950 the Regiment, less this Battery, moved to a converted centre at "Firmount" on the Antrim Road. The Carrickfergus Battery also moved to a new centre in the Old Town Jail.

591 Independent Field Squadron was re-constituted in 1947 in two Nissen Huts in Girdwood Park, Belfast. It formed part of 107 (Ulster) Infantry Brigade (TA) and in 1950 "Antrim" was added to its title in recognition of its past connections. This Squadron moved to Victoria Barracks, Belfast, adjacent to Brigade HQ in 1949.

With the abolition of Coast Artillery, 429 (Antrim) Coast Regiment RA (TA) was re-badged and converted to Royal Engineers on 31 August 1956 and became 146 (Antrim Artillery) Field Engineer Regiment RE (TA). Headquarters, 255, 256 and 259 Field Squadrons were based at Firmount, and 260 Field Park Squadron at Carrickfergus. In 1961 the Regiment was redesignated 146 Corps Engineer Regiment. It had a Home Defence role with the emphasis on Military Aid to the Civil Community following a nuclear attack. One Squadron, the "Bowheads" had a role in Germany and this was undertaken in rotation by each Field Squadron. The uniform worn has followed the standard pattern of the parent Regiment or Corps, except that the Militia Gunners wore a helmet badged with the Royal Coat of Arms surmounting a Royal Artillery gun with a crest "Antrim Artillery" underneath. On the formation of the TA in 1947, all ranks wore "Royal Artillery" shoulder titles later with "Antrim" (red lettering on a blue background) underneath. In addition Officers wore gilt "Antrim Artillery" collar badges on the lapels of their battledress. Shoulder titles and collar badges continued to be worn until battledress was phased out in 1967. 591 Field Squadron wore the title "The Antrims" (blue lettering on a red background) under their Royal Engineer shoulder titles.

Pipes and Drums were first formed in 429 (Antrim) Coast Regiment in 1950, but were not established as a Band. Their uniform consisted of battledress jackets and tartan kilts. The Honorary Colonel of the time, the Earl of Antrim, granted to the pipers the right to wear the family tartan, the MacDonald of the Isles tartan, for kilt and plaid, and his personal retainers' badge. This badge consisted of the family

crest, a dexter arm embowed fesseways, couped at the shoulder, vested and cuffed, holding in the hand proper a cross crosslet fitched, surrounded by a belt, bearing the motto "Toujours Pret". Since then the Band has been established and its uniform and equipment are provided by the Crown. However, the Bandsmen are Sappers and must carry out their duties in addition to normal training.

THE FORMATION OF THE TAVR, 1967

Major re-organization occurred once again when the Territorial Army and Volunteer Reserve was formed on 1 April, 1967. The Regiment amalgamated with 591 (Antrim) Independent Field Squadron RE (TA) to form 74 (Antrim Artillery) Engineer Regiment (V) which consisted of two Squadrons. 112 (Antrim Fortress) Field Squadron RE (V) was formed from 591 Field Squadron, and 260 Field Park Squadron. Regimental Headquarters and 114 (Antrim Artillery) Field Squadron RE (V) were formed from the personnel at Firmount. So the Artillery Regiment and the Engineer Company which had parted in 1940 came together once again. The newly formed Regiment moved to Girdwood Park, Antrim Road from the previous centres at Firmount and Carrickfergus. Since then it has spread to include a number of other centres. In late 1968 114 Field Squadron formed a Troop in Ballymena, and 112 Field Squadron followed this with a Troop at Bangor in August 1971. In 1972 the Regiment exercised the right of the Royal Engineers to march through the City of Ripon with pipes and drums playing and bayonets fixed and the Regiment participated in a parade of Royal Engineer Regiments when the Freedom of the City of Hameln was conferred on the Corps in 1977. On this occasion the Regiment was the only volunteer Regiment and its Pipes and Drums were the only Pipes and Drums on parade. During 1976 further Field Troops were formed in vacated Ulster Defence Regiment premises in Carrickfergus (112 Field Squadron) and Antrim (114 Field Squadron). Expanding even further afield, 272 (West Riding Artillery) Field Support Squadron RE (V) which is based at Bradford, became part of the Regiment on 1 May 1977.

272 (WEST RIDING ARTILLERY) FIELD SUPPORT SQUADRON (VOLUNTEERS)

In 1977, 272 (West Riding Artillery) Field Support Squadron, Royal Engineers (Volunteers) based at Bradford, West Yorkshire, became part of the Regiment. This Squadron has also a long complex history, its origins dating back to the formation of the Volunteers in 1859, when the 5th and 6th Companies The Yorkshire Volunteer Corps were raised, and in the following year the 2nd (Bradford) Corps Yorkshire (West Riding) Artillery Volunteers. The two Infantry Companies became the 3rd West Riding of Yorkshire Rifle Volunteer Corps, and in 1887 the 2nd Volunteer Battalion, The Prince of Wales' Own (West Yorkshire Regiment). A number of soldiers from this Battalion served during the South African War in the Service Company of the Regiment.

On formation of the Territorial Force in 1908 the Infantry became the 6th Battalion, The Prince of Wales' Own (West Yorkshire Regiment) with Headquarters at Belle Vue Barracks, Bradford, while the Artillery became the 2nd West Riding Brigade, Royal Field Artillery, based at Valley Parade Drill Hall, Bradford. Both units were part of the 49th (West Riding) Division, with which they served on the Western Front from April 1915, until the Armistice. Among the principal actions were Aubers Ridge, 1915; Somme, Thiepval, 1916; Ypres, Poelcapelle, 1917; Lys, and Bailleul, 1918.

When the Territorial Army was reconstituted in 1920 both units were re-formed. The Artillery being re-designated the 70th (West Riding) Field Brigade, Royal Artillery (TA) in the following year.

As part of the expansion of Anti-Aircraft Command in 1937 the 6th Battalion The West Yorkshire Regiments (The Prince of Wales' Own) (TA) was converted to a Searchlight unit designated the 49th (West Yorkshire) Anti-Aircraft Battalion Royal Engineers (TA).

During the Second World War the Anti-Aircraft Battalion became Royal Artil-

lery and served in the United Kingdom, while the 70th (West Riding) Field Regiment, RA (TA) served briefly in France in 1940, as part of the 52nd (Lowland) Infantry Division, subsequently being transferred to the 46th (North Midlands) Infantry Division, and serving in the campaigns in North Africa and Italy.

On the reconstitution of the Territorial Army in 1947 the two units were reformed as 270 (West Riding) Field Regiment, RA (TA) and 584 (MOB) Heavy Anti-Aircraft Regiment (6th Battalion West Yorkshire Regiment), RA (TA), the latter unit was converted to a light anti-aircraft role with the relevant change in designation.

In 1955 the two Regiments were amalgamated and entitled 370 (West Riding) Field Regiment, RA (TA), the number being altered to 270 in 1960. In the next year the Regiment and 269 (West Riding) Field Regiment, RA (TA) at Leeds were amalgamated to form 249 (West Riding) Field Regiment, RA (TA).

When the Territorial Army was re-organized in 1967 the Field Regiment was re-designated The West Riding Regiment RA (Territorials) with a home service role, subsequently it was reduced to a Cadre in 1969. The Cadre was later absorbed by 272 (West Riding Artillery) Field Support Squadron, Royal Engineers (Volunteers) which formed part of 73 Engineer Regiment (V).

RECENT HISTORY

Since formation, 74 (Antrim Artillery) Engineer Regiment has been committed to a European role. Up until 1 May 1977 it formed part of 30 Engineer Brigade (V) with a reinforcement role for 1st British Corps. Then it transferred to 29 Engineer Brigade (V), with the same role. On 1 April 1978, the Regiment became part of 6 Field Force, with a reinforcement role under the Supreme Allied Commander Europe. This new role places the Regiment in the Combat Zone alongside its Regular counterpart. On 1 January 1982, 6 Field Force became 1 Infantry Brigade and moved from Aldershot to Tidworth where it took 22 Engineer Regiment under command as its regular Engineer support. On 1 January 1983 the Regiment again changed its Engineer Brigade affiliation and reverted to 30 Engineer Brigade but it retains its role as the only TA Engineer Regiment in the frontline. The Regiment,

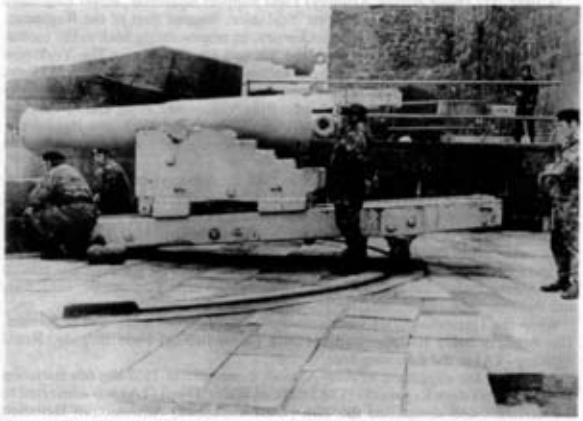


Photo 3. The Old and the New Sappers of the Carrickfergus Troop of 112 (Antrim Fortress) Field Squadron RE (V), with 68-pdr RML gun on carriage and slide at Carrickfergus Castle

which formed originally in Carrickfergus, has maintained connections with the town except for the period 1967 to 76.

CONCLUSION

In common with many Territorial Army units the Regiment has changed titles, roles, moved location and even rebadged over the years, but the TA is a robust beast and the Regiment as 74 (Antrim Artillery) Engineer Regiment (Volunteers) continues to flourish, with recent camps in Schlesswig-Holstein and Denmark. Its unique and challenging operational role with 1st Infantry Brigade has caught the imagination of the unit, demanding a high standard of training and a heavy commitment to exercises. In January 1983, it came under peacetime command 30 Engineer Brigade. Where to 1984?

The Renovation of the Merville Battery

CAPTAIN THE HONOURABLE S W LUCAS RE, B Sc

The Author joined the Army in 1976 under the Short Service Limited Commission Scheme. He spent nine months with 42 Fd Sqn RE in Hameln before attending Leicester University for three years as a University Cadet. He obtained an Upper Second Class Honours Degree in Geology and Geophysics. More recently he has been serving as Fd Tp Comd in 10 Fd Sqn RE providing support to Harrier Force in BAOR. He is now serving on a Regular Commission.

Introduction

In April and May 1982 a composite Troop from 10 Field Squadron worked in Normandy, France, on the renovation of the Merville Battery. This article will first explain why the Battery is of interest before going on to describe the background of the Sapper involvement, culminating in the work carried out by the Squadron. The reader may also wish to refer to the article by Brigadier Lowman which appeared in the June 1982 issue of the *RE Journal* where he refers to the capture of the Battery and the efforts of the Sappers in support of 6 Airborne Division on D-Day.

Le Batterie de Merville

The Merville Battery consists of four reinforced concrete gun emplacements built in 1944 as part of Hitler's Atlantic Wall. The four guns were believed to be 150mm capable of firing a 96lb shell over a range of 14 600 yards. From the sketch map showing the location of Merville it can be seen that this posed a serious threat to *Sword* Beach. The strength of the concrete (over 2m thick) meant that bombing or Naval gun-fire could not ensure destruction. In all the air raids only two hits were scored on a casemate and these caused no real damage. 9 Parachute Battalion of 6 Airborne Division were tasked with the destruction of the guns.

The Renovation Of The Merville Battery Captain the honourable S W Lucas RE B Sc

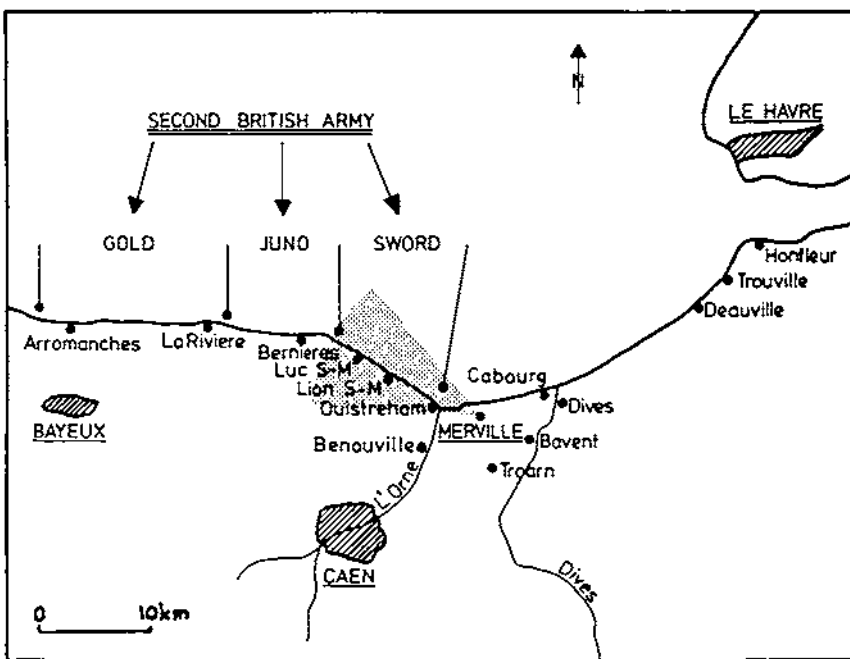
The layout of the Battery is shown on the diagramatic map. There was an inner barbed wire fence 3m wide and separated from an outer cattle wire fence by a minefield. In addition a 4m wide anti-tank ditch lay to the north and northwest. These static defences were covered by fire from a number of machine gun and rifle positions. A strong point and a light anti-aircraft position lay to the south west. The defences were manned by 120 men during alerts, and they could be accommodated in the four casemates or the additional four underground bunkers. When not on duty the soldiers were billeted in Merville village, where other anti-aircraft positions and concrete shelters could be found.

The Attack on the Battery

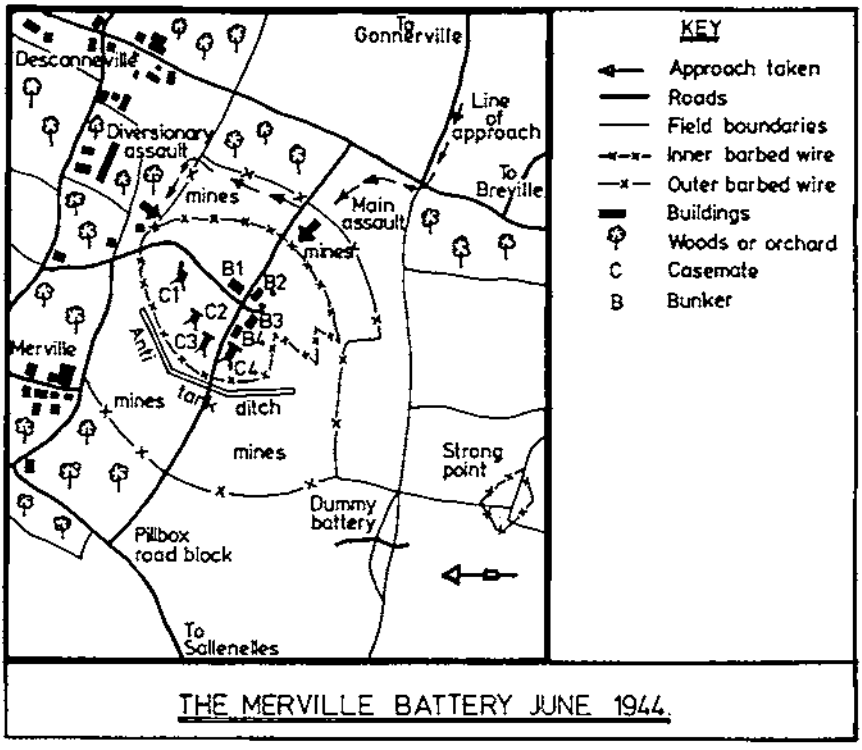
The plan of attack was elaborate and involved eleven separate parties. Included in this were Sappers from 591 Parachute Squadron RE who were to destroy the guns. The 700 men of the Battalion spent two months training for the operation. Time and again they rehearsed the attack on a mock-up of the Battery built at West Woodhay near Newbury so that as they climbed aboard their aircraft on 5 June every man knew exactly what he was supposed to do.

Four minutes from the Drop Zone moderate anti-aircraft fire meant evasive action was required and the resulting confusion over which river was the Dives and which the Orne caused the Battalion to be dropped over fifty square miles of Normandy. Only the Reconnaissance and Rendezvous parties were dropped correctly and they were very nearly killed when the RAF bombed the Battery off-target.

The result of this was that one and three-quarter hours after the drop only 120 men had arrived at the RV. This number swelled to 160 but none of the mortars, anti-tank guns, mine detectors, footbridges and few Bangalore torpedoes had arrived. The decision was taken to press on. On reaching the Battery they met the Recce Party who reported they had penetrated the minefield and had found many gaps in the barbed wire. A path through the minefield had been "cleared" by feeling by hand and had been marked with heel scuffs!



THE IMPORTANCE OF THE MERVILLE BATTERY
(The supposed range of the battery is shown shaded)



The new plan was now simple—four parties (one for each casemate) in the Assault Group and a diversionary group to give them cover. At this stage two of the three gliders carrying the *"Coup de Main"* party appeared. As there were now no mortars to illuminate the Battery one glider missed it altogether and landed four miles away. The second nearly landed in the minefield but eventually crashed just to the east where its occupants engaged German reinforcements moving to the Battery. The signal to attack was given. The men pressed on through the wire, mines and bomb craters under heavy machine-gun fire. The casemates were reached and hand to hand fighting ensued. The Germans eventually surrendered and the Paras entered the casemates not to find the expected 150mm guns, but World War One Vintage 75mm field pieces. Three of the guns were destroyed by Gammon bombs and one by the simultaneous firing of two shells. The remnants of 9 Battalion then withdrew to avoid the scheduled shelling of the Battery by HMS *Arethusa*. They had planned three separate ways to signal for this not to happen, but none of these worked. Fortunately in the event HMS *Arethusa* did not fire anyway! When the Paras arrived back at the firm base there were thirty wounded and sixty-six dead.

Development of the Site

"Le Debarquement" (The Invasion) is a subject of great interest to the French. The *Conservatoire de L'Espace du Littoral* (equivalant to the National Trust) purchased the Merville site a few years ago with the aim of turning it into a tourist attraction. They fenced the site off and provided a car park while the commune of Merville Francille put in an access road. A British Trust called the Airborne Assault Normandy (AAN) was keen to restore a sector of the Battery and turn the largest casemate into a Museum.

An initial reconnaissance was carried out in 1978 by Captain C P Bouwens RE. However due to lack of funds there was no progress until late in 1981 when Lieuten-

ant H M Dodds RE carried out the detailed reconnaissance with the client, General Sir Nigel Poett KCB DSO, Chairman of the AAN. The feasibility of the project was confirmed and 10 Field Squadron RE tasked.

In December 1981 a meeting was convened at MOD to enable the Project Officer, Captain S W Lucas RE, to be fully briefed by the client. Following this they travelled over to France to meet a Recce Party from 10 Field Squadron with the aim of investigating the task, confirming requirements and gathering data for planning. Although the time authorized for this recce was too short to gather detailed data some striking discoveries were made. Most importantly it was obvious that the scope of the project would have to be changed; when the Detailed Reconnaissance and Planning Report (DRPR) was written the casemate was dry—it now had 60cm of water in it! Also at this time the client had not yet defined all his requirements (in particular for lighting and interior fittings). However in spite of the fact that the project had only received informal approval, planning could now start.

The Project

Scope

The client's overall requirement was: "To restore the, currently waterlogged, Eastern Casemate to a clean dry and safe condition suitable for use a Museum to be opened on 5 June 1982".

This involved a variety of tasks, however I will discuss only the major ones which can be grouped as follows:

(a) Drainage.
(b) Electrical Installation.
(c) Provision of external doors, walls and windows.
(d) Cleaning, decorating and fitting out the interior.

It is worth stressing that as there were three "controlling" bodies involved in the project, the Commune, the Conservatoire and the AAN, work had to be agreed between them. However as the project was being mounted at short notice our client (AAN) had not obtained agreement on the detail of the work, nor had indeed decided on it all. This final agreement was not reached until five days before the start of work and the client's final requirements were not received until half-way through the project. A flexible approach was required!

Planning

The recce in December 1981 had shown where the problems lay and what would be required. This was followed by a Site Investigation in February 1982 to gather soil samples to enable the drainage system to be designed. Preliminary administrative arrangements were made and these were confirmed on 30 March 1982 at a meeting in Merville.

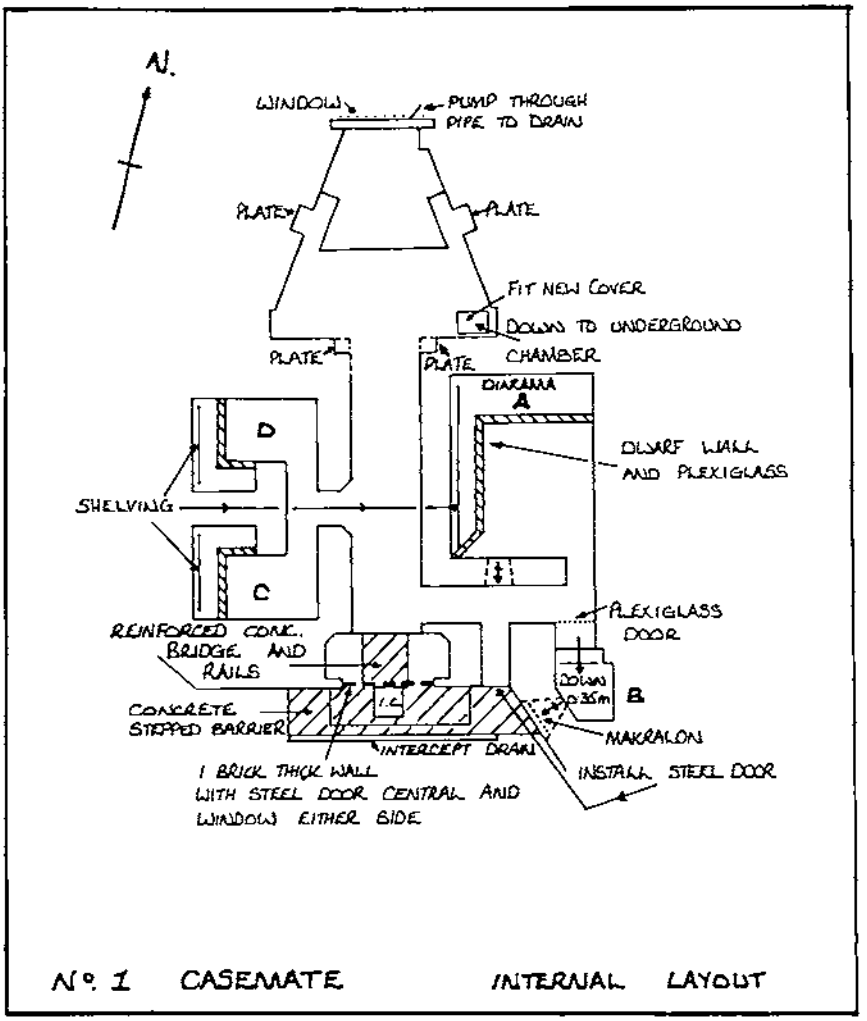
This meeting was called to get agreement by all parties on the detail of the work so that planning permission could be sought (at the time of writing the project is completed and it still has not been obtained!) The resulting compromise enabled work to proceed although the designs that had been produced had once again to be changed. Unfortunately at this stage 10 Field Squadron was in the middle of its ARU and the Clerk of Works from 522 STRE was working on other tasks!

Throughout the planning stage 522 STRE provided assistance in design by the loan of a Clerk of Works (C) when he was available. It was not until the project was mounted that he was able to go on to the job full time.

Mounting

The composite Troop from 10 Field Squadron RE was supplemented by two drivers from 45 Squadron RCT, a Plant Operator Mechanic and a Welder from 73 Independent Field Squadron RE, a Medic from 3 Armoured Division Field Ambulance and a Postal NCO from 3 Postal & Courier Regiment.

Movement was by both road and rail. An Advance Party moved down by road to take over accommodation in buildings being loaned by the Commune. Simul-



taneously the rail party with all the heavy equipment was speeding through France to arrive in three days instead of the seven that had been estimated by the RCT Movement Staff! They then had to sit and wait for the main body to arrive by road before they could unload. Throughout it was a pleasure to move in convoy as the French Police escorts sped around stopping all traffic for us to pass. Meanwhile the Troop Commander had travelled down independently from Hohne, where he had been carrying out a recce for another exercise, to arrive ahead of everyone else. The poor work output from his men when they arrived betrayed the excellent night of hospitality they had spent with the French Army at Compiegne on their journey down in what had been a trouble-free move.

Execution

Wet weather, combined with clay, caused great problems moving on to site but with the stores unloaded the pressure was on to get the job done in the four weeks available before returning to Germany for a Harrier Exercise. The weather improved and a 6-day week, 10-hour working day produced dramatic changes in the casemate.

The first problem was pumping out the casemate and removing forty years rub-

Photo 1. Casemate No 1 at start of project

bish, mud and *explosives*. The local French EOD team were used to WW2 Vintage munitions and went away with their finds muttering (in French) "If you drop it it will go bang"! This seemed of little concern to the Sappers who had been merrily shovelling away at the mud in which they made their finds. As the work continued further discoveries were made. A large hole at the South Entrance; gun rails set in the floor; and a German drainage sump—that jetted water out! Once again designs were revised or was it the principle in reverse—The problem arises . . . you provide a solution . . . you design the solution! Certainly the project was nearer a Combat Engineer task than a Construction one.

Photo 2. Casemate No 1 at completion of project. Note the "Ring Drain" and the hinged Grill at the N Entrance

The Renovation Of The Merville Battery 1,2

lery and served in the United Kingdom, while the 70th (West Riding) Field Regiment, RA (TA) served briefly in France in 1940, as part of the 52nd (Lowland) Infantry Division, subsequently being transferred to the 46th (North Midlands) Infantry Division, and serving in the campaigns in North Africa and Italy.

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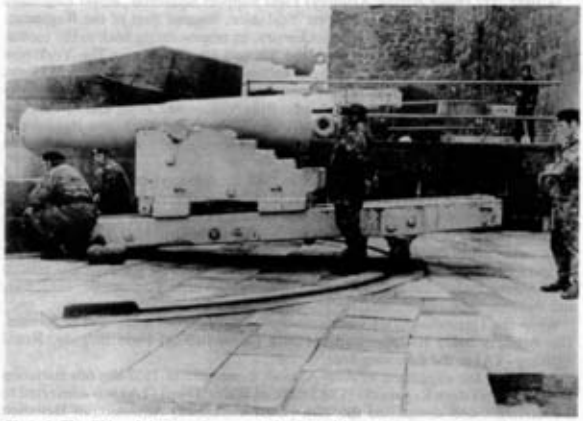

Photo 3. The Old and the New Sappers of the Carrickfergus Troop of 112 (Antrim Fortress) Field Squadron RE (V), with 68-pdr RML gun on carriage and slide at Carrickfergus Castle

ground level and installing a window in the gun aperture. This 2m square window was to have been "makralon" but the appearance of the finished product was so bad it was changed to glass. A lockable hinged steel grill was fitted outside this and provision made to fit a wooden shutter for additional protection.

The fitting of all internal "electrics" was undertaken with a *melange* of German, French and British parts. This work was undertaken totally by a Class 1 Electrician and was done most successfully. The provision of the external supply was a source of much discussion and confusion over who was to do the work and who was to pay for it, with every possible combination of the AAN, the Commune, the Conservatoire and ourselves paying for and/or doing some of the work. This changed four times between April, when a local French Contractor installed half the cable, and the end of May, when the French Electricity Board installed the rest—but only after special authority had been sought from Paris to obtain the necessary safety clearance at short notice!

The cleaning up of the interior was a long dirty job and involved the grinding (using excellent local purchased angle grinders) down of the rust-covered ceiling and the fungus covered wall prior to application of fungicide, sealant, primer and paint. A large amount of rendering had also to be done. Once this was complete the internal walls, metal fittings, plexiglass screens and shelving for exhibits could be installed.

A host of other minor jobs were also executed but of particular importance was the site investigation and survey. This was really contemporary archaeology. The old German drainage system was uncovered, power and communication cables discovered and the four underground bunkers opened up and pumped out. Unfortunately time permitted only a cursory examination prior to reclosure but the entrances are now uncovered ready for further exploration.

The final point in this section concerns a job that was not done but is worth highlighting as it is all too often glossed over. Originally the client was told it would be quite easy to knock a 2m × 1m doorway in 2m thick reinforced concrete. We believed otherwise and the requirement was dropped. However we were required to remove approximately $0{\cdot}3m^3$ of reinforced concrete uncovered in a shallow trench outside the N Entrance when laying the main power cable. This took five man-days and neither the Hi-Cycle Medium Breaker, Light Breaker and Rock Drill nor the Kango Hammer could make any significant impression. Indeed throughout the project the Hi-Cycle tools proved inadequate. The drill was too slow and weak (a civilian roto-percussion drill was purchased), the saw was too inaccurate and dangerous (a civilian one was borrowed) and the generators were unreliable. We had considered the use of compressor tools but these posed problems working sideways into a doorway. Furthermore they were not readily available although they would have been the solution for the trenching. This does highlight the inadequacy of our present Hi-Cycle power tools for heavy work.

Life at Merville

Although Merville is a holiday town, the local people were extremely friendly and helpful—even if we did beat them 8–2 at football! Throughout the project they did all they could to help both officially and unofficially. Showers were provided at the local camp site, accommodation was in buildings owned by the town and a great deal of assistance was given in local purchase arrangements (for stores, food, laundry, etc.) Wherever we went we became a local attraction as it appeared the French had not seen British troops for forty years! The reaction from civilians was, without exception, one of great interest and enthusiasm for our presence and is something we will miss on return to BAOR.

A BFPO mail delivery service was set up for the main body as was an HF radio link. The radio link was superceded by a telephone which was both a blessing and a curse—it was soon used as the local Forces Holiday Booking Centre!

Recovery

The main body and rail party left with the bulk of the equipment on 5 May 1982.

Photo 4. Putting finishing touches to gun chamber. Note the plate glass window at N Entrance

They left behind a nine man Rear Party whose principle tasks were:

(a) The installation of electrical circuits.
(b) Finishing the painting.
(c) Installation of internal fittings.
(d) Assistance with exhibits.

These tasks had always been intended for the month prior to opening and it says much for the hard work of the Sappers on site that the main body had achieved all it set out to do in the planned time.

Conclusions

The project generated a great deal of interest and goodwill both from the French and the Veterans of the Second World War. It provided excellent training for both management and artisan trades and produced a solid worthwhile achievement. Although it would have been desirable to have had more recce and planning time with a more clearly defined requirement, this did not prove to be an insurmountable problem due to the back up from BAOR and the "Combat Engineer" approach adopted. Had we worked in greater isolation a much greater time would have been required in planning and preparation.

A Canadian Exchange Officer's Viewpoint

MAJOR P F HOWE RCE

Unlike my friend Captain Ted Dobbie, the Exchange Officer at RSME, who has Australians, Americans and other foreigners to protect him, I have spent two years thrust into the middle of "Little Britain", which itself is in a foreign community in the famous Rat Catcher's city on the River Weser. My tour is almost up, so I

A Canadian Exchange Officer Viewpoint 4

thought that a few observations might enlighten you British as to what "outsiders" think about you and your way of doing things.

Having arrived the week before *Exercise Crusader* started, and finishing now in the flush of the South Atlantic Campaign, I have seen the British Army and the Sappers in one of their most active periods. My impressions have certainly been favourable, so if I *critique* anything below, it is in the manner of an Instructor who is impressed overall with his student's performance, but nonetheless must ensure that his faults are clearly known, lest he becomes complacent.

My biggest complaint is that for all your claim to being the standard-setters of the English language, your pronunciations leave a lot to be desired. For example, whenever I asked for the Chief Clerk, or the Clerk of Works, or any other clerk, somebody always corrected me—telling me "Clark". I detected a conspiracy in this, for even your dictionaries have mispronounced it, though the spelling is correct.

Next to the problem of pronunciation, your vocabulary is only a minor problem. I once asked for a bag of chips in the Mess; fifteen minutes later a paper bag of *pommes frites* appeared. When I pointed out the cellophane wrapped variety, the poor barman was nonplussed. "Crisps" he said, shaking his head. Add such quaint terms as rubber for eraser, butties for sandwich, wellie for boot, boot for trunk etc, and it is little wonder that McEnroe has such trouble at Wimbledon. He along with the rest of North America cannot understand you.

In matters of dress, I found that my wardrobe was reduced significantly when I was not allowed to wear my blue denim jeans and sneakers (pumps) outside my yard (garden). I had to throw away my "cut offs" because, living next to the CO, I could not even wear them cutting the lawn. The greatest problems, though, occurred in the evenings when I attended functions that allowed casual dress. Of course I should have known that "casual" just meant not having to wear my dinner jacket, and not open neck shirts.

My Canadian Forces green uniform, with unification rank insignia, was always a source of derisory comment. Some people were perceptive enough to call me "Admiral" at Mess dinners, perhaps in jest, I don't know. But when a TA Subaltern quite seriously (and naïvely) asked me if I was in the Navy I gave him five extras. The other problem with my uniform was that I had a green beret, which apparently was attractive to those who wear a blue one. Fortunately, a Royal Green Jacket Battalion was just down the road and I was able to replace it (twice).

Your sporting programme is a very good one—morning runs, Wednesday team sports and the like. But you must accept that people from other countries can play your games also. When I first arrived, I had spent the two previous years coaching a British Columbia rugby team. It was six months before anyone would accept that I might have a point or two to make. On the other hand, because I was from North America, it was assumed that I was a qualified Harlem Globetrotter. I unwillingly began to coach what was undoubtedly the worst basketball team in Hameln. But by careful grooming I taught them how to punch, shove, trip and generally play basketball as it is played in Canada. Fortunately they were poor learners, for in the first tournament we entered I fouled myself out of three out of four games, which the rest of the team managed to avoid. Your referees obviously leave a lot to be desired, but I won't go into that here.

The class system, for which the British seem to be famous or notorious depending on your viewpoint, keeps a very low profile, certainly in the Engineers. I have been on exercise with the Life Guards though, and led a very merry existence for three days: vintage wine at meals, Bendicks Sporting chocolate, fine cigars and port, and this was after every meal in a field mess. My Mess Bill for the three days was as much as my monthly one in Hameln.

Planning was usually well done, except when it came to preparing for the *Medicine Man* exercises that are held in Canada. In my first summer I went as Squadron OC (with the Life Guards Battle Group), because my own OC was going as well,

later in the year. The improbability of being in the only Squadron that sent two Troops to Canada in one summer is too great for coincidence. To top that, I was destined to go again in 1982, but a short-notice posting instruction sent me back to Canada to prevent this.

No, life with the British Army has generally been very good for me and my family. My wife is English and so her parents were able to visit us regularly, and my children have learned to speak with a funny accent which will take time to correct. But, in spite of these small problems, your community and family life, in which we tried to participate fully, is to be commended. It was certainly the most enjoyable two years of my Army Career and I end it with a touch of remorse.

I will close with a short note of appreciation to the three officers in my Regiment who allowed me to gain a small measure of revenge against the British language. All were named Clarke and all took umbrage every time I called them Clerk. Many thanks for biting!

Correspondence

Squadron Leader P T Baker MBE, RAF
RAF Laarbruch
BFPO 43

Operation Corporate—Sappers on Ascension

Sir,—Please excuse this intrusion into your professional publication by a stranger from another Service and a non-engineer at that. However, having read Major Hill's offering (Dec 1982 issue) on *Operation Corporate* and his sojourn on Ascension, I feel bound to write and comment on a most interesting article.

During my two months' stay on the Island, life was extremely hectic right from the beginning. Within twenty-four hours of arrival, the Victor detachment had erected its own working and domestic accommodation and flown the first long sortie south using a stream of aircraft. The pace did not slacken from that day until the end of hostilities. In such conditions, it is hardly surprising that the efforts of others, although noticed, passed without comment, and it is only through articles like Major Hill's, that one can begin to understand the enormity of the Sappers' tasks and their successful completion on Ascension.

Leaving aside the zealous RN Captain who even wanted to send aircrew back to UK, the conditions and demands of Ascension made life far from easy. We knew that there were problems with fresh water, aviation fuel and power, but the size of the problems and possible solutions were something of a mystery. Not until the fuel pipeline appeared alongside the Georgetown to Wideawake road did we fully appreciate the scale of effort required to provide aviation fuel in sufficient quantities for the thirsty aircraft.

As for air-conditioned accommodation for aircrew briefing, to my certain knowledge the only air-conditioned briefing facility was a tiny room titled "Nimrod Ops"—this room was part of the American side and had been used by Nimrod crews for some time before the main airborne thrust arrived. The briefing facility for everyone else was tented accommodation in the middle of the airfield. Such was the noise level from aircraft and generators that briefing officers had to use megaphones to ensure being heard by crews. I mention this small point because I would not like your readers to add unjustified fact to any feelings they might already have about "Prima Donna" aircrew. The air-conditioned Portacabins were, in fact, used by Staff Officers of all three services!

Overall, we were in debt to the Sappers for their excellent work. Thank you.—Yours faithfully, P T Baker

Colonel J B Wilks
Regimental Headquarters Royal Engineers
Brompton Barracks,
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As a Bystander

Sir,—As a bystander in the Falklands Operations I have read the articles in the December Journal with great interest. I read on to General Tony Jones' letter and see at page 279 reference to the casualty figures at Arnhem, 8000 out of 10 000 in nine days fighting, and of some battalions in XXX Corps having received 400% reinforcements in the periods of operations from Normandy to the Rhine (five months?).

In the Falklands Operations the Corps only deployed some 800 men during the operational phase and our total casualties were thirty-three. We were indeed fortunate, particularly in these days of weapons with greater accuracy and lethality. If we had sustained casualties on the same scale as at Arnhem or in France in 1945 how would we have coped with finding and training reinforcements particularly for the specialist units? When we were involved in Korea there was a Battle School and a Reinforcement Holding Unit. I note that 3 Cdo Bde had a Reinforcement Company but this did not include any Sappers. Surely we need to have trained manpower earmarked to reinforce our units?

Although Major Davies believes that the Orbat of a Field Squadron is about right, I wonder if it is strong enough to take casualties on the scale of 1939–45 War, or the loss of twenty men, as with the loss of the SAS helicopter, and still remain viable. When I was first in a Troop it was two officers and sixty-four strong. Should we not go to war with our first reinforcements with the Squadron where they can provide additional working numbers and acquire rapidly additional skills and retraining.—Yours sincerely, John Wilks.

Major C M Davies MBE, RE, B Eng
9 Parchute Squadron RE
Rhine Barracks, Aldershot
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Battle Casualty Replacements

Sir,—Colonel Wilks' letter on Battle Casualty Replacements (BCR) raises an important issue which, regrettably, has been ignored in recent "peacetime" years.

It is a relatively simple matter to replace Infantry casualties. To be blunt an infantryman's basic skills are fairly simple and the first encounter with the enemy is quite the most "rapid results" learning I have ever come across. (For those who survive!) The same cannot be said for Sappers. While being shot at or shelled certainly enhances the desire to get the job done, it does not teach Sappers how to perform their skills.

There are allowances made for individual BCRs in many units' War Establishments (though not for the Parachute or Commando Squadrons—are we to be whittled away to destruction?). However individual replacements would be of little value. I believe a troop can cope with two or three casualties of any rank and continue to function. If, (as happened to one of my troops in the Falklands,) there are ten or more casualties it is likely that the whole troop will be a write off. Therefore, I would prefer to see BCRs considered in units of whole troops. Quite apart from anything else this would allow soldiers to go to war under the direct command of those Officers and SNCOs who trained them: this is vital. Such block replacement/reinforcement would also allow remnants of troops to be withdrawn and reformed in "Reinforcement Holding Centres" before they, too, became casualties through

battle weariness.

I take Colonel Wilks' point on reinforcement from within but I believe a troop of two Officers and sixty-four is too unwieldy for most purposes. I would prefer to see troops of one and (say) thirty-five and to have four of them in the Squadron. Perhaps I am pre-empting my next article!—Yours faithfully, C M Davies

Major R J Wade B Sc(Eng), FCIT
9 Catherine Close
Shrivenham, Swindon, Wilts

Re-Inventing the Balloon

Sir,—In today's *The Times*, I see that the new RAF Tornado is to fly blind at a height of 200 feet. It is well known that low-flying aircraft plagued us in the Falklands Campaign.

Is it not time that we re-invented balloons, which could both deter low-fliers over land or ships, and could also perhaps act as decoys to attract the unwelcome attentions of missiles such as Exocets?

No longer our business? If not barrage balloons, surely we can still sponsor camouflage and deception, and deceive, electronically-guided missiles.—Yours sincerely, James Wade

Brigadier E C W Myers CBE, DSO, BA, C Eng, MICE
Wheatsheaf House, Broadwell,
Moreton-in-Marsh, Glos

At Arnhem—September 1944

Sir,—My article in the *RE Journal* of last September has resulted in some criticisms by General Sir Victor Balfour and some constructive comments by Major General A G C Jones, which you published in your December issue. I respect most of the criticisms and all of the comments. But personal reminiscences, to be of any value, must be honest. I do not feel able to retract from the general picture I gave of what I saw and felt, now many years ago. My mistake may have been to allow my article to be published and reopen old sores.—Yours sincerely, Eddie Myers.

M J McBride Esq
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Sapper Reservists

Dear Sir,—I read with interest the article "Sapper Reservists" in Volume 96/4 of the *RE Journal*. Being directly involved with Royal Engineers Reservists I am frequently reminded of the extent of interest displayed by ex-members of the Corps such as Captain Lynch—long may it continue to be so.

However, I feel that Captain Lynch's experience of the Individual Reinforcement Plan may be exceptional because a compulsory period of "refresher" training is already included in the Annual Reporting Centre package. At the beginning of 1982 the number of Annual Reporting Centres was reduced from 360 to 60; in my view this has proved to be a far more effective system so perhaps such anomalies will not occur in future.

It may also be of interest that several schemes are currently being evaluated to enhance the training given. Captain Lynch's "stepped" commitment is not interesting, but I feel that it could prove administratively expensive. Yours faithfully, M J McBride.

Memoirs

BRIGADIER G R MCMEEKAN CB, DSO, OBE

Born 22 June 1900, died 25 August 1982, aged 82

GILBERT READER MCMEEKAN was commissioned into the Corps in 1919. He was a Senior Under Officer at The Shop and his first posting was to the Experimental Bridging Company RE at Christchurch, largely because of his prowess on the Rugby field (he played for the Army later) and the ambition of Major G le Q Martel to win the Army Cup with a minor unit against the might of the famous Regimental teams of the time. It is of interest to note that nearly thirty years later he returned to Christchurch as Chief Superintendent, Military Engineering Experimental Establishment (MEXE).

He spent seven years in the Sudan, attached to the Sudan Defence Force, where he played polo and shot game, but soon found he preferred shooting animals with a camera and not a gun.

In the early thirties he was one of the Adjutants in Aldershot where horses took over from the Rugby field. He rode with the Drag, hunted and rode in point-to-points, winning the George Master horn one year. Even in those days his complete dependability and cheerfulness stood out. His friends are convinced that these basic traits were largely responsible for his later successes, particularly during the siege of Malta and at El Alamein.

During the Malta siege he was OC Fortress RE, dealing with Bomb Disposal (and captaining the Army Polo Team which for once beat the Navy!), before being appointed CRE 10th Armoured Division in the Western Desert. He arrived in the desert a few weeks before the Battle of Alamein, stories of his sterling work in Malta having already trickled through. He was soon to prove again that he was everything one could wish for in a Commander in war. He made crystal clear what he wanted done; he never breathed down the necks of his Squadron OCs but was always in the right place at the right time. Cheerful, resourceful, imperturbable—everyone felt the better for seeing him. He was a natural leader and by the eve of the Battle every Sapper in the Division was confident of victory. On the first night he personally led the mine-clearing Sappers. This was typical of his courage and it inspired the men. It nearly cost him his life when a bursting shell punctured one of his eardrums. Despite the intense pain he carried on for two more days before being ordered out of the line for treatment. He never recovered his hearing in that ear.

The port of Benghazi had to be reopened; it was vital. In November 1942 a hastily organized Works CRE under Gilbert was put in. With a series of brilliant improvizations by 5 December the port was discharging 1500 tons per day and by the end of the month this had been doubled. This success was largely instrumental in enabling Eighth Army's advance to maintain its momentum.

He was posted as British Engineer Liaison Officer at Fort Belvoir where he is still spoken of with much affection by the then young US Engineers who knew him. His

Brigadier G R McMeekan CB DSO OBE

Legion of Merit bears witness to this.

He returned to Christchurch where he was one of the architects of the expansion of the Experimental Bridging Establishment to become MEXE with its much wider range of activities. He was the first Brigadier Director with Sir Donald Bailey as his Deputy. It was not an easy command with a mixture of highly individualistic Sapper Officers and civilian experts. He welded them into a team which worked together in friendship and understanding of each others problems. One of his great strengths was his ability to organize demonstrations of which there were many—a true test of character when things go awry, as is not unknown!

After a tour as Commander 25 Engineer Group TA he was appointed Commander HQ RE Ripon—his last Active List appointment. He was so successful in this post, particularly in relations with the local community, that he was awarded the CB, not usual in the Army at that time for anyone below the rank of Major General.

When he retired he became a Director of Stroud Brewery until it was amalgamated with Whitbreads. He became a JP, Chairman of the Gloucester County Bench and was actively involved with many local organizations. He lived at Painswick for twenty-eight years and it can be truly said that he was a pillar of the local community respected and liked by all.

In a Memoir which is a compilation of many contributions certain phrases stand out and are repeated time and again; "Self importance and pretence were not in his nature"; "Cleverness never deceived him"; "We owe much to his indomitable spirit"; "We could always count on him". It was this last characteristic, above all, combined with cheerfulness, which endeared this gallant soldier to all who served with him as well as to his many friends.

In later years he was badly crippled in both legs but he never let this get him down and he always remained cheerful; never more so than when he returned to MEXE for the farewell lunch of his former Personal Assistant and, a few weeks before he died, at his Golden Wedding anniversary celebrations.

To his wife Marion and the family we extend our deepest sympathy.

JMLG, HAT J-K, AM, JFM-P, PNMM, CDS, SRGS, SAS

BRIGADIER W A FITZG KERRICH DSO MC

Born 13 May 1890, died 11 April 1982, aged 91

THOSE who served with Walter Allan Fitzgerald Kerrich when he was CRE 1 Division in the mid-thirties probably learnt more about Field Companies than at any other time in their peace-time careers. He had served almost throughout WW1 in them, and his two decorations were awarded before he was twenty-eight.

Always receptive to new ideas, he was the ideal man to help us through the problems of long overdue mechanization, from horses to lorries, and shovels to bulldozers—though no one actualy saw the latter for years to come.

A quiet, apparently *laissez-faire* attitude, concealed a policy of decentralization which allowed everyone a loose rein, the length of which was shrewdly adjusted to the abilities of the individual. He welcomed the Belisha reforms which gave the soldiers more comfortable quarters, but spoke out against what he felt was a softening up of the Army as a prelude to the war he could see coming—a view which was not popular in high places.

GRM

Book Reviews

BRITISH INFANTRY UNIFORMS SINCE 1660

MICHAEL BARTHORP

(Published by Blandford Press, Poole, Dorset. Price £10.95)

BRITISH Infantry Uniforms since 1660 traces the development of uniforms, equipment and weapons of the Infantryman from the time of the Restoration to the present day. Although containing only 160 pages there is a wealth of detail not only of uniforms worn at home but of the modifications adopted when campaigning in various parts of the world. The Author, a former British Infantry Officer, has a feel for his subject and does not disguise his satisfaction at the steps taken in the last decade to improve the appearance of the British Soldier after the twenty-five years of the Battle Dress era.

Also demonstrated is the evolution of the infantryman's equipment, from the knapsack of the early 18th century to the 1958 pattern web equipment and there is a useful Appendix on the weapons used over the period.

With five appendices, a full bibliography and index, and supported with over a hundred contemporary pictures in black and white and ninety-six coloured illustrations, this is a book which should appeal to the serious student as well as to the general reader.

LEF

BATTLE OF THE FALKLANDS (1): LAND FORCES

WILLIAM FOWLER

(Published by Osprey Publishing Ltd in their Men-at-Arms Series, Price £3·50)

THIS is one of several books, by various publishers, that have been hastily put together to cover the operations in the South Atlantic. Your Reviewer suggests that readers should keep their money in their pockets and await publication of the more detailed and better researched books that will no doubt be produced in a year or two.

The Press Release, that accompanied our review copy of this book, makes much of the fact that "unlike many of the other books published or announced on this subject, the Men-at-Arms Falklands Specials offer the reader the hard, specific facts. They are written and illustrated by experienced specialists . . .". In the list of units that took part in *Op Corporate*, they include 49 Explosive Ordnance "Device" Sqn, 2 Port Control Unit "RE" and Mil Works Force "RPC"; these errors hardly inspire confidence in the care taken in the preparation of this book or the overall knowledge of the Author.

Despite this criticism, this 40-page book contains an excellent selection of photographs, the text is well written and it does give a concise account of events. However there are only four passing references to Sappers and their equipment, and no mention is made of their work in minefield recce etc on patrols or in the attack.

JTH