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Editorial

PREFABRICATION is the theme of two articles in the *Journal*, interesting because of their separation in time by nearly one hundred years. Both tell how engineers met a particularly urgent demand in wartime for accommodation and how the problems were solved. The article *"The British Hospital at Renkioi"*, of which Part 2 will appear in the March 1986 issue, has some particularly apt messages on the need to give engineers a free hand as a precondition for success in such an emergency. The manner in which Brunel and Brunton defeated bureaucracy, which will be particularly clear in Part 2, has many messages for us today. The March 1986 issue will also contain an account of arguably the greatest feat of military engineering prefabrication ever, Mulberry Harbour. This is a more personal account, by Brigadier A E M Walter, who commanded B Port Construction Force at Arromanches.

Potential contributors to the *Journal* will also be interested in a further glimpse into the future, the prospect in 1986 of substantial increases in the value of awards for *Journal* articles. The scale of these must await Council approval but I confidently predict that it will be worthwhile sharpening both your wits and pencils now with a view to taking advantage of the opportunity when it is announced.

Bomb Defuzing Equipment

DUCK ISLAND ST JAMES' PARK

THE RE MUSEUM was recently given the opportunity of dismantling some remarkable equipment which has lain in a hut on Duck Island, St James' Park for nearly a century. In July this year a team from the RSME E&M Wing under Captain K T Harris RE recovered the equipment and brought it back to Chatham. Some idea of the task can be obtained from the photographs. The operator of the equipment shown in *Photo 2* would have worked by a system of remote control protected by three screens, two steel and one wooden and would have observed the work in a series of five mirrors suspended above and to the side of it and controlled by a series of pulleys and counterweights.

The origins of the equipment have been researched by Major A S Hogben QGM RE (retd). It appears that a case was made in 1894 by the Chief Inspector of Explosives, Colonel V D Majendie, for the construction of the hut where "bombs and infernal machines can be deposited, examined and if necessary destroyed with the least possible risk". Accordingly Colonel Wheatley RE, Bailiff of the Parks, drew up the plans for the Duck Island installation.

There is evidence that the equipment was resuscitated for use in both World Wars but no detail of such use has yet been established.

The equipment is being renovated at Chatham and will eventually form part of a bomb disposal display in the Museum. Because of the state of the equipment there is some difficulty in working out its precise mode of operation. It would be much appreciated if anyone with further knowledge of the equipment, particularly of any actual use, could get in touch with the Curator, RE Museum, Brompton Barracks, Chatham, ME4 4UG.

Photo 1. The site on Duck Island

Photo 2. The main equipment

Bomb Defuzing Equipment 1 & 2

Cuneo painting of the Falkland Islands Campaign

ACCEPTANCE ADDRESS BY THE ENGINEER-IN-CHIEF

ON 16 JULY 1985 AT THE CARISBROOKE GALLERIES

"TODAY is yet another landmark in the long associaton between the Corps of Royal Engineers and Terence Cuneo who himself served as a Royal Engineer during the last war. This will be the twelfth Cuneo painting about the Royal Engineers to come into our possession. The first, in 1951, was our famous war memorial painting of *Sappers Breaching the Minefields at El Alamein.* Others have included the *Amazon Bridge Over the Rapido* in 1970; *The Hook (Korea)*, in 1973 and *Sappers in Northern Ireland*, in 1984. The activities of the Postal Branch of the Corps have been recorded in six Cuneos ranging from *The First Airmail*, in 1978 to *Her Majesty The Queen Visiting Mill Hill* in 1982. All are superb and much admired and this, our latest painting, is clearly no exception.

"Terence, it gives me much pleasure to accept this Falkland Islands Campaign painting from you on behalf of the Royal Engineers, and to express our deep gratitude to you for using your exceptional talent to record some of the multifarious activities of our great Corps, which will be treasured and appreciated by many generations of Royal Engineers to come."

Cuneo Painting of the Falkland Islands Campaign

My War in Royal Engineer Works Services

MAJOR L C KITCHING MBE FICE FRTPI

This is an extract from the talk given by Major Laurence Kitching to the RE Historical Society on 11 April 1985. Major Kitching was a Senior Assistant to the County Surveyor of East Sussex in 1938 when he was commissioned in the Supplementary Reserve. After a brief military training and a year building fixed defences on the South Coast of England he found himself in Egypt in May 1941 when this part of his story begins.

Cairo Defences

At Suez, when we arrived, it was 110° in the shade and it is a strange sensation sweating at the top and having cold feet at the bottom! However, I was posted as Garrison Engineer to DCRE Cairo Defence (Major J E O'Brian Echlin) under HQ British Troops, Egypt (BTE) then known as "The Army of the Nile". Echlin had been a departmental head in the Egyptian Irrigation Service and it was upon their canal system that the defences were based. There was a great rush to defend Cairo and much of the constructional work was done by contract at this time, in what I will call Phase 1. I will come back to it and to Phase 2 at Alamein time, when I was myself DCRE. But perhaps I could first mention a few jobs I did in and around the

Photo 1. The Santa Bridge

My War in RE works service,
Major L C Kitching MBE FICE

Photo 2. The mix-in-place road under compaction

Delta in the intervening period. The first was the Santa Bridge on the Treaty Road from Suez Canal to the W Desert. The abutments and the central pier had been completed but the swing bridge itself was being fabricated in Belgium when that country was overrun. Chief Engineer BTE had located a bascule opening kit and a supply of mild steel angles in the Delta, so his department designed a Warren girder and my job was to supervise construction by an Egyptian firm under contract. The Egyptian Government insisted that feluccas, the local rivercraft, must be able to pass through, so the bascule bridge was built into it. Another job was the Trans-Desert "Mix in Place" road an early experiment in soil stabilisation which was then a new idea but hardly a science. The road was to run from Khatatba camp, some 15 miles north of Cairo, to Wadi Natrun on the Cairo—Alexandria road and, including a small branch road, the length was 17 miles. The intention was to stabilise the desert soils with bitumen produced at the Shell refinery at Suez and I had to find out how to do it! It had to be a mixture which would compact and set in temperatures of over 100°F in the shade (of which of course there was none). Experiment convinced me that one needed a mixture of 50% topsoil from formation work and 50% sharpish sand quarried at some 5ft below surface. This gave a 10% clay content and was mixed with F80 bitumen at 80 litres per m^3 to give a dead black mix. A coffee coloured mix wouldn't compact, while a blue-black mix would not set in summer heat. The system seemed to work and the road was built in three months (nearly three miles a month) by local labour gangs with very little plant. The road became an important link at Alamein time and in the subsequent advance. I never saw it again, but was told that it had stood up well.

Chief Engineer BTE became worried about hutting and sent round a signal asking for suggestions for methods of building camp structures using a minimum of imported materials—because of the lack of shipping space. Egypt produced cement and was reasonably placed for sand so I designed a semi-circular hut built of pre-cast blocks which formed a ribbed arch structure when set in cement mortar over timber centering—which was struck after three days. The photograph shows one of a group erected for use as an anti-tank mine filling factory.

Then for a period of three months I was Garrison Engineer to GHQ Middle East looking after alterations and repairs GHQ buildings in Cairo, until on 14 May 1942

I was posted to 62 CRE under command 8th Army. I was sent to Mersa Matruh as DCRE works and given my majority. Unfortunately Rommel's last push almost immediately overran Mersa Matruh and we had to retreat to Alamein. After a few days there guiding new units to their allotted locations in the line, I was recalled to take over as DCRE Cairo Defences.

In practice I was Engineer Adviser to Major General Rees (the same Rees I believe who made his name in Burma) who was at first concerned with the whole Cairo Defence plan and later was in command of "Rees Force" covering the Nile bridgeheads. The peak was reached at the time of Alam Halfa when the lines were occupied by 51 Highland Division, the Guards Motor Brigade, "Fletcher-Force" and "Rees-Force".

Monty's orders were that, if the Alam Halfa battle was lost, all recently landed reinforcements and all headquarters troops in Egypt were to cross the Nile. There was then to be a fight to a finish, "each man defending the ground on which he stood". All previous ideas of forming guerilla groups to continue the war by retreating up the Nile were quashed. On all fronts morale soared immediately.

Our total strength was equivalent to two divisions plus one machine-gun battalion manning suicide positions in front of our lines. They were Free French Foreign Legion, but when I spoke to them I found they were nearly all Germans but certainly not Nazis! They had fought at Bir Hachem. The Royal Engineers order-of-battle included 274, 275 and 276 Field Companies and 239 Field Park, 66 Field Company Bengal Sappers and Miners (out with the Guards Brigade), 2 Corps Workshops Company and 552 Army Troops Company.

Cairo is 130 miles from Alam Halfa. Rommel's intentions, from captured Rommel maps, were that given a break through at Alamein, the German panzer divisions would head for Cairo and Alexandria while the Italians, using my mix-in-place road and the Treaty road and Santa bridge (perhaps they didn't know it was only Class 18), fanned out between. Rommel's interest in Cairo was not solely because it was the capital but also because it was where most of the Nile bridges were, and therefore the key to a drive on Suez and Syria to join up with the Vichy French and encircle the Russians.

The Cairo defences covered a front of twenty-four miles comprising the whole of the irrigated land lying to the west of the Nile opposite Cairo and averaging about six miles in depth. The scheme was based on the irrigation system, embracing a number of "canals" running roughly North/South and paralleled by "drains" running

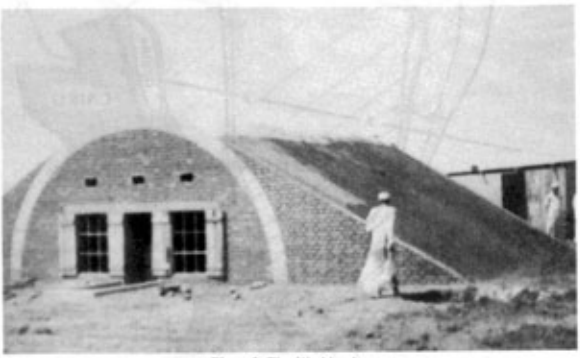
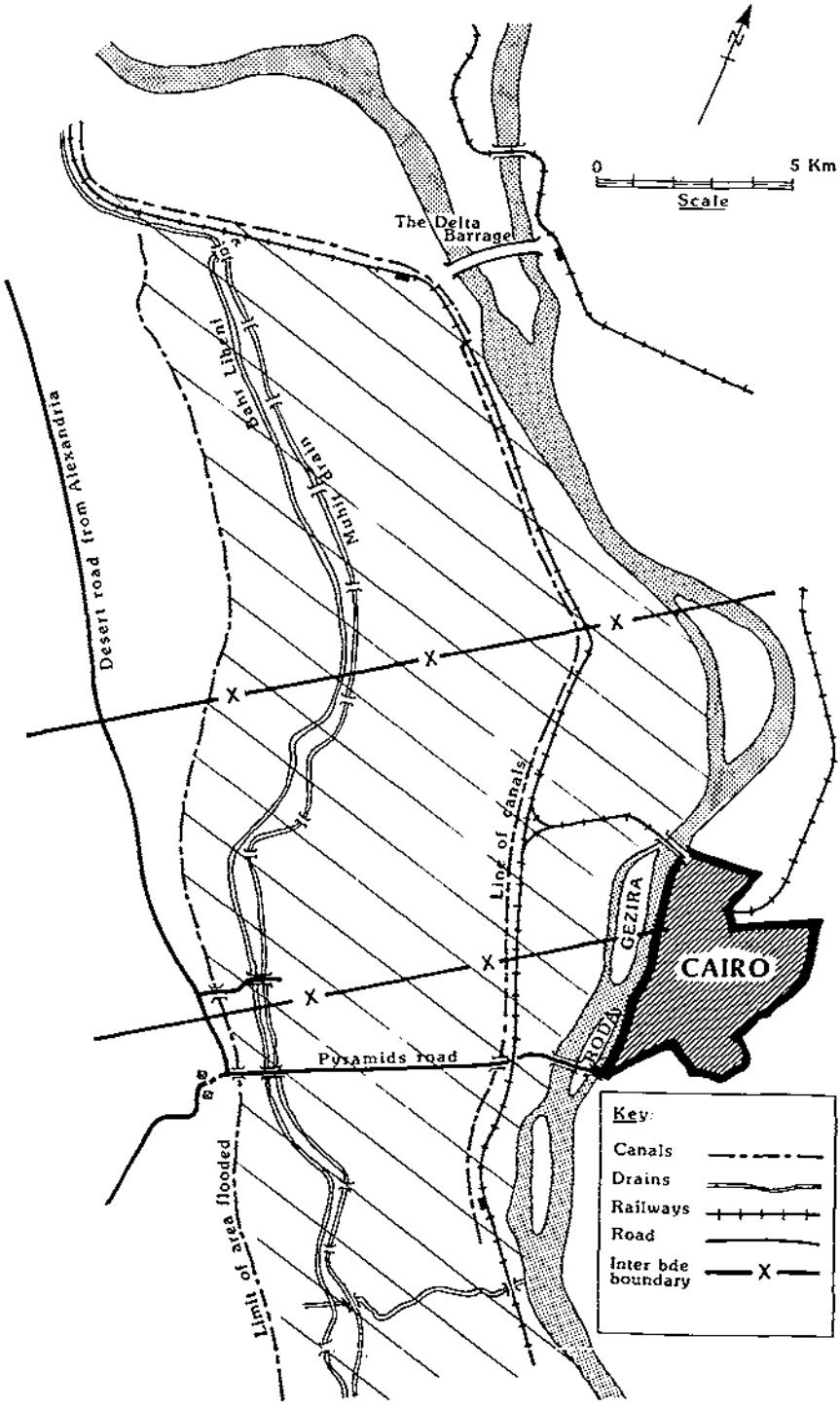


Photo 3. The Kitching hut

CAIRO DEFENCE AREA



at a slightly lower level. Nile water was fed into the canals, from which it was taken to irrigate the fields. It then passed to the "drains", which were in fact canals at a lower level and falling to the Nile below the Delta barrage. Two of these, the "Bahr Libeni" and the "Muhit Drain" ran close to the desert boundary and the Muhit Drain was made the basis of our fortified front line. There were two inner lines, based on other canals covering the eight Nile bridgeheads and the Delta barrage North of Cairo. North of this barrage the Nile divides into two branches and bridges are few and far between, so the rivers became an effective obstacle.

The inundation timetable was, from order to commence:

a. In 3 days—2m of water in all channels forming the principal water obstacles.

b. In 10 days—the whole area transformed into thick slimy mud, except for roads on embankments which formed our communications network.

c. In 15 days—roughly 2m of water over the whole area except for the embanked roads.

(*Note: The shaded area on the map shows the total expected area of inundation*)

When the battle of Alam Halfa started we were seven days into this process and it worked beautifully. This may sound simple but in practice it was extremely complicated and success was largely due to Echlin who had been brought back to organise it using the Egyptian staff. 522 AT Company was trained in operating the twenty-three Nile regulators in case this should be necessary under fire.

At the same time some 3500 tons of stores for road blocks, minefields and other works were moved. Road blocks were built on roads over bridges unsuitable for demolition because of the massiveness of the structures and 45000 anti-tank mines were laid—some in places with historic associations—and 75 Flame Fougasse Batteries were installed and manned by Sappers. Demolition charges were laid to 167 canal bridges and prepared but not placed for certain others. 153 Infantry and machine gun posts had been constructed in the banks of the canals with the lower parts of the trenches concreted to keep out canal water-carrying bilhartzia disease. 106 RC Pillboxes with 3ft 6in reinforced concrete walls had also been built. Most of these posts had been built by civilian contract and camouflaged to match local mud

Photo 4. Minefield outside Cairo. (Author on left)

My War in RE Works Service (4)

Photo 5. Camouflaged reinforced concrete pill-box

brick structures. (*Five files of operational instructions, demolition plans and so on, prepared by a small staff of eight were exhibited at the meeting*). I was much encouraged by a report from CRE 51st Highland Division approving our defence plan and agreeing to work to it!

The day after the break through at Alamein I was instructed to close the defence office and to go to Mena camp to form up 109 Works Section RE and await orders to proceed to Benghazi. A works section had an establishment of four officers, fourteen NCOs and five sappers or drivers. Further personnel could be attached if the unit became overstretched and indeed by the time I left Benghazi we had an additional two officers and fourteen other ranks.

Benghazi

Benghazi was retaken on 20 November 1942 and we arrived on 1 December, reported to CRE 35 and were put in charge of the reconstruction and maintenance of the harbour and all town installations. Once again we came under 8th Army.

Originally Benghazi was a sophisticated town of around 65000 population built in the attractive style of the Italian colonial architecture of that period. The destruction was incredible; it had been taken and re-taken three times in the "Benghazi Stakes", bombed continuously and comprehensively demolished by the Germans before their recent withdrawal. All quay faces had been blown with camouflet charges and gaps had blown in the outer and inner moles so that strong tidal currents flowed along the demolished quay faces leaving them as washed out beaches. Wrecks were all over the harbour and the outer mole had been weakened by bombing and lack of maintenance. No ship could get alongside a quay and all off-loading was by lighter. Barely 1000 tons per day were being unloaded against a minimum requirement of 2000 tons and a real need 3000 tons to maintain 8th Army's advance on Tripoli.

A work force of some 1100 Engineers and a company of Pioneers was quickly available including 588 (Monmouth) Army Troops Company, 19th Army Troops Company RNZE, 234 Field Company Field Company RE, A Field Park Company and a Mauritian Artizan Works Company. In Mussolini's regime only Italians were allowed any form of works skill and these had been withdrawn, so only unskilled Arabs were left. There was one valuable exception, an Arab who could make injectors for diesel engines. There was a lot of small Italian plant lying around, but in every case the injector had been removed and we had little plant of our own.

We worked day and night building up quay faces with oil drums filled with concrete and topped with about 18in of mass concrete. We tackled the gap in the outer mole by building up a wall of sandbags filled with dry concrete mix across each end of the gap, done at low tide, and filling it up to high tide level with ½-ton concrete blocks, chunks of rock and more bags of dry concrete handled by a small crane we had salvaged. Over this we placed mass concrete (I would guess about 12ft thick to deck level) reinforced with old rails. This was the best we could do with the equipment available and was agreed by Chief Engineer 8th Army who had taken time off to recce it with me. After a week the off-loading rate went up to 2000 tons a day and by the end of December we were up to our 3000 tons a day because we could then get a proportion of the ships alongside quays.

While this was going on the New Zealanders surveyed underwater wrecks in the harbour and spotted a sunken pontoon derrick. They raised it, but found that the bottom of each leg of the derrick had been blown off. In the sabotaged powerhouse of the brewery which the CRE had thoughtfully taken for his headquarters (he never got it working) I remembered there were some very large compressed air bottles used to start an enormous old diesel engine. They had half round ends which might fit the cups on the pontoon. In fact they did, so the ends were cut off and welded to the derrick legs and the whole re-erected. We derated it from 120 tons to 80 tons lift and with it cleared a mass of obstructions and debris from the water.

Then nature dealt us a blow which exceeded most of the enemy's efforts. The bay of Sirte is noted for its storms and from 4 to 6 January it excelled itself. A weakened length of the outer mole was breached and our repaired section had all the concrete blocks washed out leaving the concrete deck as a bridge. One of three huge concrete blocks (roughly 10ft × 10ft × 30ft) left by the Italians, and which we had placed outside the gap with the help of a cable-laying ship having a crane on its bow, had been picked up by the waves and washed straight through under this 'bridge', coming to rest some 100ft inside the harbour. It must have weighed over 100 tons. All our quay face repairs were scoured out again and the quays returned to beaches, if anything worse than before. Four ships sank in the storm, two in the harbour, one trying to get out and another trying to get in!

At 0100hrs on the second day, Navy House called me to say three more ships had broken their moorings and were clanging together in mid-harbour and indeed one could hear them from a mile off. The navy explained that the bollards on the washed out quays had gone, or were likely to; could we produce a holdfast on the shore to

Photo 6. Quay faces as left by the Germans

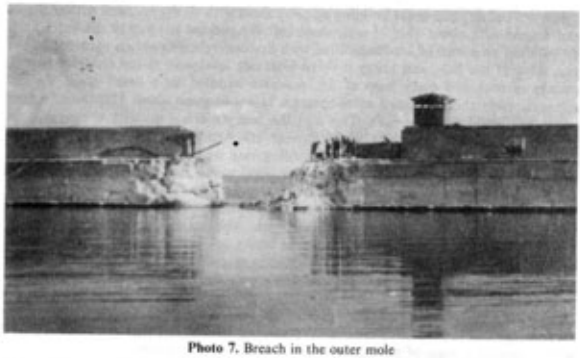


Photo 7. Breach in the outer mole

take lines from the ships which they could then triangulate with other lines onto remaining bollards on the inner and outer moles? I turned out the only two officers and four senior NCOs available and remembered the "RE Holdfast" in the 1936 Handbook of Field Engineering. The desert did not provide quite the size of log necessary, but there were two very heavy RC beams left by the Italians nearby which we managed to move, dig in and connect with thin steel hawser to a block. By the time we had done so we were up to our waists from the incoming tide and having great difficulty in keeping our feet. The Navy performed incredible feats in getting lines from the ships ashore—and the ships and their cargoes were saved.

Next morning the ships were quite a sight. One could see the positions of all decks and bulkheads starkly outlined because the plating of the hulls was concave in between them. Inevitably, our intake of stores dropped to 1000 tons a day again. We got it back to 2500 or thereabouts fairly quickly, but never quite regained our 3000 tons a day.

Monty was so concerned that he came to see and he mentions our efforts in his book *Alamein to the Sangro*. He was planning the battle for Buerat and needed all the stores he could get. He decided to keep 10 Corps camped around Benghazi and to take all its transport to ferry stores from Tobruk, so achieving another 800 tons per day. We, of course, had to start all over again and we also had to supply 10 Corps. This second time we succeeded in dumping far more of the 100 ton blocks outside the gap in the outer mole so greatly reducing tidal flow. The New Zealanders repaired the corresponding breach blown in the inner mole covering the old harbour, which, in spite of the relatively shallow depth, we decided to develop for use by smaller vessels.

Within this old harbour we build a wooden jetty, an entirely new quay (using three Italian concrete caissons—a sort of miniature Mulberry) and a slipway for Fairmile and similar mosquito craft which operated from Benghazi against submarines in the central Mediterranean. To improve communications to it we salvaged and rebuilt an Italian wooden floating bridge across one end of the inner harbour.

Outside Benghazi there were three airfields, Berka I, Berka II and Benina used first by the RAF for their operations during the advance and by coastal command for attacks on enemy shipping. Later the American 8th Bomber Command moved in, for the softening up of Sicily and Southern Italy, with, from memory, twenty-nine squadrons of Liberators (they carried out the ill-fated Rumanian Ploesti Oilfield raid). Petrol supplies for these, and for Army MT were a tremendous problem.

In a quarry some 4¼ miles west of the harbour, the Italians had commenced building two reinforced concrete tanks, each to hold 5200 tons of petrol. One tank was about 75% complete and the other had foundation work only. They were to be lined with mild steel plates welded together to prevent leakage and were to be roofed in reinforced concrete and buried. An 8in diameter steel main connecting with the inner mole of the harbour was largely in place. There were on site all the steel plates and ample supplies of 8in flanged steel pipe and some 8in and 5in armoured flexible hose. Only cement and reinforcing rod had to be shipped from Alexandria.

We received orders to complete this scheme for aviation fuel and to add a further tank for 200 tons of MT spirit. New provision had to be made for a road tanker, drum and jerry can filling station; a 4 gallon flimsy factory and filling station and 4¼ miles of 3in galvanised screw-jointed mains to Berka I and Berka II airfields and supply points at each. 588 Army Troops Company, were allotted this work, including the design of the filling station.

The first problem was how to get the fuel from a 4000 ton tanker standing out in the harbour, there being no deep water quay available. We first tried tying the ship up to a remaining section of the outer mole and taking an 8in submarine pipeline to it across the harbour. This we did by floating it out full of water supported by empty oil drums. Sappers were stationed on each flange to release the oil drums at a given signal. It worked more or less, although the pipe did not go down straight and, it being winter, the Sappers got near to hypothermia before they were rescued. Unfortunately, only a fortnight later, and in spite of strict Navy House orders, a cargo ship dropped its anchor too soon and tore up the whole pipeline.

We then decided to moor the tanker to one side of the harbour and to take a submarine pipeline to a buoy carrying a length of our flexible hose, to which the ship would connect. This time we dispensed with flanges and welded the joints and had a motor launch pulling the pipe out as the welding was done. The end was plugged and the pipeline floated under its own buoyancy, until, with the full length afloat, the plug was taken out by the launch party and the end suspended just below the surface, so the pipe filled continuously from that end, the shore end being out of water. This worked perfectly and the pipe went down straight. We had no more trouble so long as the tanker dropped the end and ceased pumping as soon as a storm blew up, which it could do from a flat calm within an hour.

The Italians made no provision for a booster station on the pipeline, evidently relying on the power of the ship's pumps, but those on our tankers were inadequate and a booster station was essential to pump the 4¼ miles uphill to the 10400 ton storage. We were supplied with two 99HP Caterpillar diesels with rotary pumps, but they were water pumps and no matter how we packed the glands, petrol leaked out all over the site which quite literally was awash with it. I stopped the intended roofing in of the station and decided the pumps should stay in the open without any type of shelter, I also ordered that guards would be placed on the approaches to prevent any one coming near unless searched for cigarettes, lighters and matches, and that rubber plimsols would be worn at all times. Nevertheless our hearts were in our mouths all the time the pumps were running. We got away with it, but I still take my hat off to the brave men who volunteered to run those pumps.

There were a dozen or more of the 100ton concrete blocks lining one of the principal roads serving the docks, and the Navy wanted them removed. The Italians had an elaborate overhead gantry system for lifting them but had destroyed it so I arranged for the New Zealanders to bore a hole in the middle of each with a cone charge, pack as much explosive as they could get into the hole and blow them. There was to be a sentry with a red flag at each end to stop all traffic when demolition was about to happen, and it was also in every units orders.

All went well until, one afternoon when the red flags were out, a staff car with two flags fluttering came rapidly down the road, passed the frantically gesticulating sentry and drove on without check. Just as it was opposite the block to be blown, the charge went off. The car was blown across the road, its screen and side windows crazed, and

more than a few dents put in its side. The lieutenant in charge could hardly stand for fright, but out got the GOCinC, General Alexander, dapper as ever, and laughing all over his face. He said it was all his own bloody fault and they were not to worry, and where could he borrow another car? . . .

Another of my projects, the attempted salvage of the Free French light Cruiser *Cavour*. It had been at station on the portside of a convoy from Alex to Tripoli in thick fog. Its radar had picked up the sand dunes on the shoreline but not the wide gently shelving sandy shore in front of them and it had run well and truly aground some 30 miles east of Benghazi. The Navy, with two tugs, could not tow it off and we were asked to help. The only solution seemed to come down to constructing a shallow draught dredger to move the sand which had built up around the Cruiser and to cut a channel to get it into deep water with the aid of the tugs.

In the Suez Canal zone the Royal Engineers had built some light tank Landing Craft known as "Z" craft and, although not all suitable as sea-going vessels, two of these had been brought up to Benghazi to help off-load stores from ships. I asked for one of these and went into a huddle with the Officer Commanding 19 Company Army Troops RNZE.

Outside Benghazi was a large plant for making salt by pumping sea water into evaporation pans. Three large rotary pumps were still there although the engines had been removed. We assembled these on the deck of the "Z" craft and drove them from our own portable engines. It was intended to suck the sand on one side and discharge it as far away as we could on the far side of the "Z" craft. V-shaped suction ends were fabricated in mild steel and connected to lengths of 8in flexible hose, which could be positioned by a pole derrick. The discharge was by 8in diameter pipe across the deck to the other side. After a little experimentation with suction nozzle shapes we got the system going extremely well. We quickly dredged a channel out into deep water and were working round the cruiser when another Bay of Sirte storm blew up; the "Z" craft was only saved by getting it into the lee of the cruiser. The storm raged all night and all next day and piled more sand around the cruiser which finally lifted onto it and broke its back. I shall never forget the faces of the Free French Officers when I visited them, via Breeches Buoy, the next morning. There was no other ship for them and they had lost even their home—and we had got so close!

Another, but successful, effort was a 1000ton fuel oil installation and pumphouse we built for the Navy. An interesting problem was how to make our reinforced concrete, made with porous local lime-stone, sufficiently oilproof. I consulted DWME in Cairo and got the answer of eight coats of Isinglass to be applied to the interior. It took some time to do, but the result was a glasslike surface which proved totally oilproof.

I am sure similar stories could be told by the Sappers at Tobruk and Tripoli. We never had much plant, except that left by the enemy and rebuilt, and materials had largely to be what could be found on site. It was by such improvisation that 8th Army was supplied and maintained for close on 2000 miles through extremely inhospitable country from Alamein to Tunis.

Subsequently Major Kitching became OC 306 RE Works Services, spending the last year of the war in Italy rebuilding bridges in permanent form across the Volturno and its tributaries—in order to release Bailey forward for the crossing of the River Po.

THE BRITISH HOSPITAL AT RENKIOI—Part 1

Professor DAVID TOPPIN, BSc Tech,
MSIA, AA Dipl, RIBA, FFB, FIOC

David Toppin is Principal of "David Toppin and Associates: Architects and Engineers", a private practice in North London. He is also a founder Director of the Institute of Constructors whose objective is to work for unity in the construction profession. His widely varied career over twenty-five years in construction includes that of author, building contractor, fashion designer illustrator, infant teacher, lecturer and photographer. He is a Fellow of the Faculty of Building. Permission to publish this serialised article has been granted by Ove Arup Partnership and is gratefully acknowledged. The original article appeared in The Arup Journal, July 1981. Our thanks are also due to Captain A R M Wilson RE who brought the article to our attention and arranged the permission to publish.

Overall Introduction by Peter Dunican

At Maxwell Fry's 80th birthday party in August 1979 the publisher and editor of *Architectural Design*, Dr Andreas Papadakis, arranged with me to review for him *Pioneers of Prefabrication. The British Contribution in the Nineteenth Century* by Gilbert Herbert. My review was published in the November issue of *Architectural Design* and in it I said, *inter alia*:

"In detail the examples which are given cover particularly the middle period of the 19th century, but go back to 1787. And, in fact, to a prefabricated hospital arriving in Sydney in 1790. Perhaps 1830–40 was the real beginning of the export in earnest of prefabricated buildings from Britain, although the Crystal Palace in 1851 marked the ultimate achievement in construction, with one million square feet of exhibition space being completed in less than a year from the start of the design. A most remarkable achievement, still unequalled.

"Following Paxton's Crystal Palace achievement—which unfortunately was not repeated in its transfer to Sydenham, mainly because of the client's interference—Brunel completed in 1855 a 1000-bed prefabricated hospital in the Crimea in ten months from the date of the initial instruction, which emanated from the direct involvement of Florence Nightingale. This outstanding work was erected by a team of thirteen carpenters, one pipelayer, three plumbers and a smith, with some assistance from Greek carpenters. It was a most remarkable achievement which has not been repeated anywhere since."

Subsequently, and most unexpectedly, I received an approving letter from an *AD* reader which made particular reference to my brief observations about Brunel's Crimea hospital and referred to a private, unpublished and detailed monograph on the subject.

Naturally I was so intrigued by this that I asked to see it. Having seen it I was absolutely convinced that this was a work of historical importance, which should be widely published, preferably in *The Arup Journal*; and here it is. I consider it to be a most distinguished contribution to the history of our construction industry and a significant challenge to our future performance. I think that we are priviliged to publish David Toppin's monograph and I trust that we have done it justice. I wish I had the ability and tenacity to produce such a work.

Introduction

Over 125 years ago two buildings were both designed and constructed in an incredibly short space of time: the Crystal Palace, and a hospital for the Crimean War which was "designed, constructed, crated, shipped to the Dardanelles and opened for use in six months in 1855"[1]. Whilst the former building was designed by a head gardener and the latter by a civil engineer, Isambard Kingdom Brunel, both are paradigmatic,

and, in their contrast, illustrative of the range of early industrialized building. The former is a bravura display and symbol of Victorian daring, ingenuity and technological skill, the latter, perhaps unspectacular and of no momentous single breakthrough, is of courageous common sense, modest in its simple disciplined modularity and honest response to functional, climatic and logistical problems, yet still significant in concept. Both exhibit examples of an architectural planning principle that has come to be known as indeterminacy.

Interest in the hospital lies as much in the concept of indeterminacy as in how this speed was achieved and what the hospital was like. Unlike the Crystal Palace, the British Hospital is a considerably under-exposed topic and commands only relatively brief mention in readily accessible literature[2], and at the same time it has been surrounded in rumour and conflicting claims. Reasons for this must include the bias of writers in ways of interpreting available facts, linked with the shortage and difficulty of access to information on the hospital, coupled with the inevitable overshadowing effect of other works by Brunel of greater magnitude, complexity and contemporary controversy; and the fact that the hospital was conceived as a temporary structure erected outside England and in use for little over a year.

It has been said that all history becomes subjective; that properly there is no history, only biography. In this account of technical and related social history, revolving therefore around the sheer force of individual personalities, Brunel's multi-faceted achievement, with its genesis in a critical political situation, is remarkable. The hospital is notable for the speed and methods of its design, its linear organizational principle, and its wide sense of energy consciousness in terms of materials usage, environmental management, servicing and assembly process, as well as being an illustration of an early example of prefabrication.

What follows does not, in relation to any history of construction, seek to claim primacy of inventions, and is less about firsts and rather more about mosts[3], and it is in their cumulation that the significance of the building lies. Yet the outstanding point that emerges is that, whilst none of the constituent parts were totally original inventions, it was Brunel's conception of their total functioning together as a coordinated plan of action that was in a sense the great invention.

There is no work, to the author's knowledge, which fully describes or does justice to Brunel's achievement, and the wider import of it has still to be satisfactorily interpreted. The significance of his building lies in the fact that the fundamentals that Brunel grappled with, successfully, are still relevant today.

The Crimean War

For various motives, England, in the mid 1850s, slid into the Crimean War without real object or occasion, contrary to the policy of her peace-loving Premier, Lord Aberdeen. She sided with the French and war was declared in March 1854[4]. The capture of Sebastopol, (*Photo 1*) the Russian arsenal and naval base, was chosen as the allied objective. Sebastopol could have been taken within a few days of the landing of the French and English in the Crimea, had they chosen to march into it at once from the North. However, deficiencies of leadership resulted in a march round the fortress to the south to begin a slow siege. The enemy were thus given time for defence works and the reinforcement of the field armies. The besiegers were soon put on the defensive and, as a result of the breakdown or organized supply and transport, the little British Army nearly disappeared in the Crimean winter[5].

It seems incredible that the British nation, which then led the world in new methods of industrial production and organization, should be unable to provide for 20,000 soldiers half a dozen miles from her fleet in the port of Balaclava, yet the breath of reform, which was transmuting commerce, Parliament, Municipalities, Church and Education, had left the Army untouched.

The deficiencies in military preparation led to such a disastrous situation that in the five months from September 1854 to January 1855 only 22,000 of the 56,000 troops sent to the East by the British Government still survived. Of the 22,000, at least;

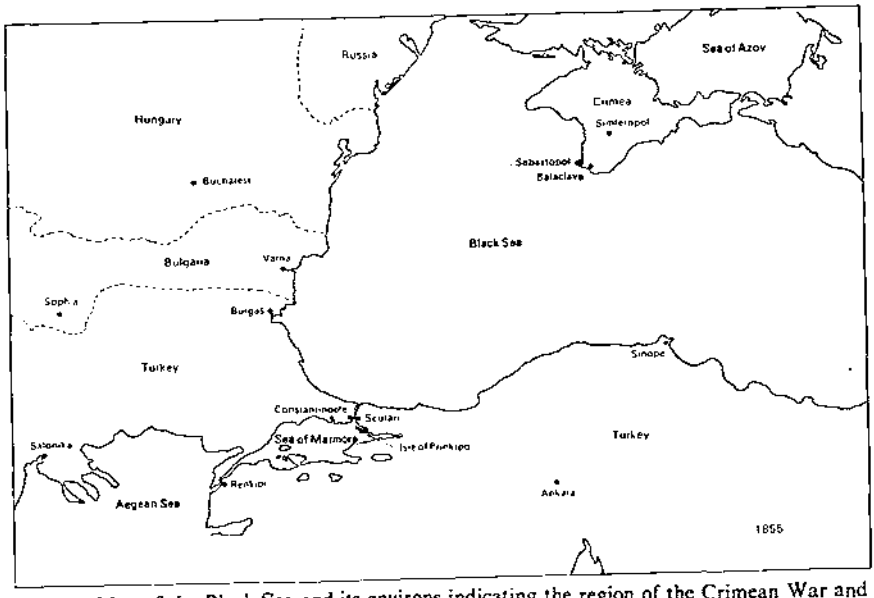


Photo 1 Map of the Black Sea and its environs indicating the region of the Crimean War and the site of the Hospital. (*Drawn by David Toppin*).

10,000 were in hospitals. The small remainder of men were completely demoralized, their officers no longer having the ability to command. The sick and wounded were dying in hundreds in deficient hospital buildings which lacked sanitary provisions, were overcrowded and understaffed. There was no heating in the building the severe winter in January, bedclothes and boots froze on the patients; the moisture of their breath turned to ice. Men suffered frostbite and chilblains, some freezing to death in the exposed wards during the night[6]. Disease spread: dysentery was the largest killer; cholera and typhoid also spread rapidly amongst the weakened troops who had little or no resistance to these diseases. The losses of men from disease far outnumbered those lost from battle.

The organization, strategy and supply services were totally unsuited to waging long-range warfare. At the base hospital at Scutari (now called Uskudar), (*Photo 2*) a huge quadrangular building, formerly a disused barracks, with a grave natural disadvantage as a hospital since it stood over old sewers, there was a complete lack of facilities. There were no arrangements for landing the sick and wounded brought to sea, there was no proper water supply or drainage system, an inadequate number of open privies without any means of flushing or cleaning stood beside the main storage tank—whose supply was eventually found to be polluted. Very often the supplies of warm clothing, medicine, tents and building materials, shipped from England to the Crimea, got no further than their ports of destination, where they were stolen or left to rot because of the inadequacy of communication and transport systems[6].

Developments

But for two developments, the diminished British Army might have finally perished for want of shelter, clothes, food and medicine. The first of these was the arrival of Florence Nightingale in Scutari, despatched from England in January 1855 by Sydney Herbert. A woman of administrative genius, inexhaustible energy and a withering contempt for red tape, she saved the sick and wounded of the British Army, in spite of its medical chiefs, by creating at Scutari a modern base hospital with trained women nurses and necessary material. The second development was the emergence

of the newspaper correspondent, an unknown person in Sebastopol or Scutari; for this was the first war to be covered by the newspaper correspondent. The daily reporting of the grim facts of the appalling conditions of the troops during that winter gave rise to a growing public awareness in England of the 42% death rate[4].

The emotional indulgence in the celebration of war gradually turned to disillusionment and challenged the statements by the Minister of State, that conditions were improving daily and that the Government was doing everything within its capacity. In January 1855, John Roebuck, the radical Member for Sheffield, angered by the Government's inability to recognize the true situation and the need for immediate action, moved a vote of censure on the Government, and proposed a Committee of Enquiry[4]. The Government of Lord Aberdeen fell and was succeeded by Lord Palmerston's in February; a determined effort was made to better the situation and improve the conditions of the troops. A sanitary commission was sent to Scutari and the reports of Florence Nightingale clearly indicated that the problems of the hospitalization of the troops were the poor quality of medical care and the inefficient supply services available within the military structure, together with the unsuitability of using accommodation not designed or adequate for the purpose.

The request for a hospital

It was against this background that the newly-formed Government asked for a hospital system to be designed, made in England and sent out ready for erection. Quite obviously, the reasons for prefabrication lay in the difficulties of building to a satisfactory standard and rate with local materials, labour and processes. It is perhaps not surprising that the request should have been for an engineer. The massive social changes and technological developments in new materials and techniques were of little concern to the majority of architects at the time. Their preoccupations, impeded by an architectural tradition unable to discard its cultural load, lay more with the derivation of styles, and the conscious art of creating massive enduring structures, than the performance and construction of buildings. Sir George Gilbert Scott held that the great principle or architecture was to decorate construction, and in 1853 Ruskin stated that ornamentation was the principal part of architecture. The problems and potentialities of the first half of the century were left to be recognized and grappled with by others.

Photo 2 A contemporary observer's view of Scutari Barracks in use as the British Hospital. *(The Illustrated London News Picture Library).*

Isambard Kingdom Brunel

Isambard Kingdom Brunel was born at Portsmouth on 9 April 1806, the third child and only son of Sir Marc Isambard Brunel, civil engineer. Sir Marc was an unselfconscious man of simplicity, unworldliness and natural dignity; from French stock he was self-taught and a born craftsman with a flair for invention[2]. Records indicate that the son showed a brilliant intelligence from the outset. He displayed a talent for drawing from the age of four and had mastered Euclid by the time he was six. Sir Marc was one of the first in England to have mastered the system of mechanical drawing evolved by Gaspard Monge, upon which modern engineering drawing is based, and, under paternal direction, Isambard started the habit of measuring and drawing on the insistence that the habit was as important to an engineer as a knowledge of the alphabet, and which undoubtedly contributed to his extraordinarily acute powers of observation.[1].

By the time Isambard had reached adolescence his father had already achieved honour and distinction as an engineer and was able, despite financial vicissitudes, to give his son a good education and training. His childhood was spent at a boarding school in Hove, and holidays at the family home by the river in Lindsey Row, Chelsea. At the age of fourteen Brunel went to the College of Caen in Normandy and later to the Lycee Henri Quatre in Paris famous at that time for its mathematical teachers, and, after finishing there, took an apprenticeship under Louis Breguet, maker of chronometers, watches and scientific instruments[2].

The incredible number and variety of projects that Brunel undertook in his life, included tunnels, bridges, railways, trains, ships, harbours and ports; his understanding of timber, for example, stemmed from a line of development of its structural potential in railway bridges. For whilst the 19th Century could look back on a long tradition of centuries of timber bridge truss construction, no serious attempt was made before that century at scientific design. The impetus was provided by the needs of the railways, whose construction in 1821; the railway train is incapable of negotiating steep gradients up or down hill, nor can it operate until the permanent way is complete, thus posing a new problem requiring new solutions prompting original thinking, not least in terms of size and number required in a short space of time.

Experiments with timber

His first major project, which in 1841 established him at the age of thirty-five as second only to the engineer Robert Stephenson, was the original main line London to Bristol Great Western Railway which used a timber bridge[2]. By the late 1840s he had acquired considerable experience of timber bridge building and carried out experiments to determine the strength of timber beams and methods of preservation. In the later extension of the Great Western Railway into Devon and Cornwall, where Brunel faced the problem of crossing many deep and narrow valleys, he developed a standardized design of timber viaduct of considerable simplicity with spans of 50 and 60ft. From piers, four diagonal members sprang, supporting the main longitudinal members carrying the platform. The members could be replaced without interruption of traffic and the whole design was based on the repetition of standard units of timber.

As a man, Brunel, short in stature and of no great physical strength, had immense reserves of nervous energy and unlimited capacity for hard work which, coupled with a dogged persistence, could, once unleashed upon a particular project, perform feats of endurance and work output out of all proportion to ordinary physical powers. By temperament, he was complex in character, privately acutely sef-conscious; yet cold, proud and self-confident *in* public[2]. Brunel earned high reputation in the profession for his evidence given before Parliamentary Committees on schemes of which he was an engineer[8]. But he was restive under restraint of any law, rule or regulation which interfered—even in the age of individualism—with individual responsibility or initiative, and a persistent and outspoken opponent of the patent laws, reserving special scorn for Government departments and their officials.

The Commission for the Hospital

Sir Benjamin Hawes, who was Under Secretary of State for War, had married Brunel's eldest sister and was, perhaps, instrumental in Brunel's appointment for the design of the hospital. The state of war must have been a topic of conversation between them and the project might well have been discussed and developed in private. At any rate Brunel must have been forewarned, and with his usual zeal for new tasks, he had explored his first ideas for the design of the hospital by 16 February 1855, for, when he received the official request from the Government through Sydney Herbert, Secretary at War, to undertake the work, he replied on the same day[7]; "This is a matter in which I think I ought to be able to be useful and therefore I need hardly say that my time and best exertions without any limitations are entirely at the service of the Government."

Definition of problem

This was not the moment to embark on the prolonged development of an elaborate and original design idea. What was required was an exercise in rapidly identifying all the factors essential to the success of the project and proceeding with haste. Brunel was fortunate indeed in having the problem so sharply focused and critically defined by the circumstances of its inception. Obviously the solution had to be conceived on terms of the following essentials:

(1) The environmental needs and provision of facilities for the care of the sick and wounded.

(2) A building complex based on a planning principle capable of adapting itself to unknown site conditions and accommodating an unknown number of patients.

(3) A form of construction utilizing an assembly technique appropriate to the possible available labour force.

(4) A speedy manufacture of the component parts, with an ease of their means of transportation.

Any answer, however ingenious and carefully conceived, could be rendered useless through a lack of anticipation of contingencies. What emerges is a uniquely appropriate solution judged both from Brunel's own description, and the observation of others on the performance of the hospital in use.

Method

Once committed to the undertaking, Brunel moved with remarkable speed, showing considerable initiative and the beginnings of his design method. Within six days he had placed the contract for the supply of buildings for a hospital with 1,000 beds, and had written to Hawes at the War Office outlining desirable conditions, and asking for sketches of contoured maps of suggested sites. To have placed the contract, even by this early stage, he must have been fairly clear about the eventual form of his solution. An outraged squeak from the War Office Contracts Department at this unorthodox and precipitous behaviour produced the following retort[8]: "Such a course may possibly be unusual in the execution of government work, but it involves only an amount of responsibility which men in my profession are accustomed to take . . . It is only by the prompt and independent actions of a single individual entrusted with such powers that expedition can be secured and vexatious and mischievous delays avoided . . . These buildings, *if wanted at all*, must be wanted before they can possibly arrive."

Most probably in writing to Hawes, Brunel was trying to establish a more complete brief, yet we can be sure that he did not get contoured maps, for his later explanation of the idea behind the design of the hospital acknowledged that the actual site was unknown. In a further two weeks on 5 March, Brunel reported on his design to the War Office. He recorded[9]; "It is most gratifying to be able to state that from everybody I have received the most zealous and cordial assistance, and found it sufficient to mention the object of my enquiries to obtain immediately every assistance I could possibly require."

Brunel's explanation of the idea behind his hospital was[10] "That the aggregate of the building should consist of such parts as might be conveniently united with one

whole under great variations of conditions of the form and nature of the site. That the several parts must be capable of being formed into a whole united by covered passages, and that it should be capable of extension by the addition of parts to any size."

It would be interesting to know who Brunel saw and what advice he sought during this time. Yet there seem to be no records of his contact with advisers—whether medical, constructional or manufacturers of equipment. However, his choice of principal material, wood, has genuine virtues: in terms of performance in use—visually undemanding, acoustically quiet, thermally comfortable because it has a thermal conductivity which places it among the range of more than moderately good heat insulating materials, and also a low thermal capacity enabling its vegetable fibre surfaces to warm quickly; in terms of construction—freely available and easily workable. Certainly we can assume that the evolution of the organizational principle and the decision on the enclosure system was made early on for him to have placed the contract for the buildings.

As will be seen later, the basic concept of Brunel's design was based on timber pavilions, and it is known that from pioneer beginnings in the 1830s, British industry had, by the time of the Crimean War, developed a significant technical competence and production capability for the manufacture of prefabricated buildings, ranging from modest wooden or corrugated iron huts to the most elaborate iron villas, churches and commercial buildings. Considerable experience had been gained in manufacturing large quantities of prefabricated huts quickly for export to Australia and elsewhere, and a system of coding of the parts had been developed[6]. Thus for the enclosure system Brunel drew on existing resources.

A person of Brunel's varied experience would often have been involved in the design activity of forming assemblages through the combining or repetitive elements. But even so, the idea behind the hospital is remarkable; not least for its portending of the idea of indeterminate buildings—*ie* those buildings in which not all aspects are fully determined at the time of their design, and are characterized by a linear organizational planning principle which accommodates an incomplete brief and at the same time contains built-in potential to meet unknown growth[1]. Shortly after Brunel reported to the War Office, a prototype ward was erected on the premises of the Great Western Railway at Paddington. The size of the ward was considerably larger than existing huts, and one of the objects of the prototype must surely have been a number of tests which included the lightness and strength of the structure, and the performance of heating and ventilating systems to see if further economies and improvements could be made.

A report on the hospital dated March 1855, written by Brunel to satisfy his friends' curiosity, appears to be the only instance in which he printed an account of his works. It shows an elastic and efficient plan of action, capable of adapting to unknown conditions and anticipating possible contingencies. It gives considerable insight into his design method, and reads almost like a primer. He outlines his strategy and sets down his definition of requirements[10]. "The conditions that it was considered necessary to lay down in designing these buildings were:

"First, that they should be capable of adapting themselves to any plot of ground that might be selected, whatever its form, level, or inclination, within reasonable limits.

"Secondly, that each set of buildings should be capable of being easily extended from one holding 500 patients to one of 1,000 or 1,500 patients or whatever might be the limit which sanitary or other conditions might prescribe.

"Thirdly, that when erected they might be sure to contain every comfort which it would be possible under the circumstances to afford.

"Fourthly, that they should be very portable and of the cheapest construction."

Proceeding, Brunel then explains: "The mode in which it has been sought to comply with these conditions is as follows: The whole hospital will consist of a number of separate buildings each sufficiently large to admit of the most economical construction, but otherwise small and compact enough to be easily placed on ground with a

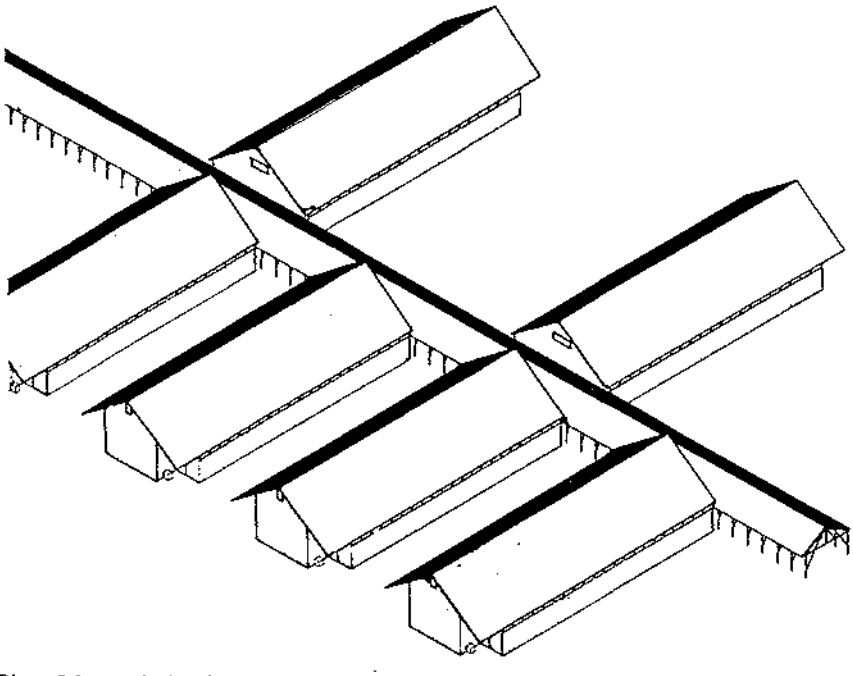


Photo 3 Isometric drawing illustrating the linear organization of Brunel's standard ward units: pavilions either side of a connecting corridor, characteristic of indeterminate buildings. (*Drawn by David Toppin*).

considerable slope, without the necessity of placing the floor of any part below the level of the ground. These separate buildings have been made all of the same size and shape; so that with an indefinite length of open corridor to connect the various parts, they may be arranged in any form, to suit the levels and shape of the ground . . . so that by lengthening of the corridors and the addition of any number of these buildings, the hospital may be extended to any degree."(*Photo 3*)

WHAT this amounts to is a very subtle definition of the size of a basic unit based on a trade-off between its increasing economy of construction and decreasing ability to adjust itself to unknown site conditions; as well as the elucidation of a coherent repetitive principle of organization of the units, and a system of extension to accommodate an unknown patient load. He continues[10]:

"Each building, except those designed for stores and general purposes is made to contain in itself all that is absolutely essential for an independent hospital ward room; . . .

"To ensure the necessary comforts, and particularly to provide against the contingency of any cargo of materials not arriving on the spot in time, each building contains within itself two ward rooms, one nurses room, small store room, bath room, surgery, water-closets, lavatories, and ventilating apparatus.

"The ward room, . . . intended for 26 beds each, which is found in practice to be a size of room admitting of proper control and supervision, . . . is made wide enough and high enough to ensure a good space of air to each bed, even if these should be unduly crowded." Here, Brunel is juggling with the size and composition of the unit for self-containment, and trading off variously the size of the unit for effective control and supervision, economy of provision of self-contained facilities, and contingency of supplies.

Turning to the provision of sanitary facilities he continues[10]: "With respect to closets and lavatories, after examining and considering everything that has been done, both in hospitals of the best description and poor houses of the cheapest construction, it was found that the requisite security for cleanliness and the greatest amount of economy of labour and on consumption of water, could be obtained by a cheap description of water-closet designed for the purpose; and with the same object of diminishing the amount of labour and waste of water, and securing cleanliness without depending upon the constant attention of assistants, fixed basins for lavatories and mechanical appliances for supplying and drawing off water were adopted."

From the report it is clear that Brunel gave considerable thought to the anticipation of the climatic conditions under which the hospital might have to operate, and the means of attaining environmental control in the wards. The systems for the protection against heat and cold, supply of air by natural and mechanical means, control of humidity and artificial and natural lighting were all carefully worked out[10]. "As a protection against heat, experience in hot climates and experiments made expressly for the purpose satisfactorily proved that a covering of extremely thin and highly polished tin, which reflects all direct rays of heat, was the cheapest, lightest, and most effective protection, and every piece of woodwork not covered with tin is to be whitewashed externally."(*Photo 4*)

In the provision of heating and in the event of the buildings still being in use in the winter—"The framework is adapted to receive an internal lining of boarding and the interstices can be fitted with a non-conductor." As all the buildings except the kitchens and wash houses were constructed entirely of wood, Brunel considered it essential that stoves or fire places should not be used: "... each ward building is provided with a small boiler, heated by candles, which by experiment have been found amply sufficient for all that can be required."

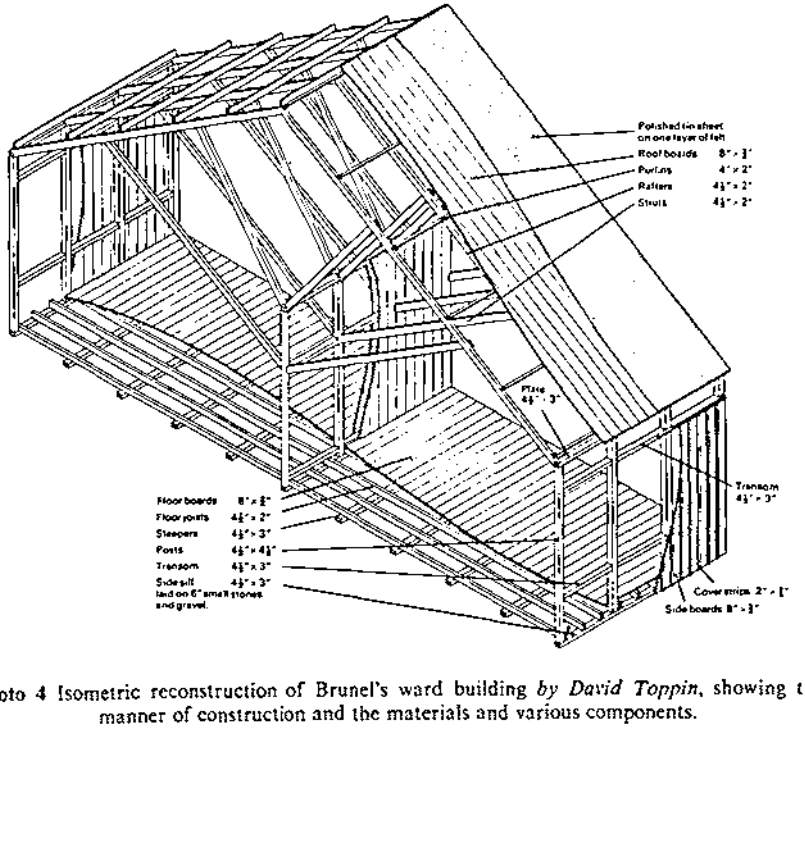


Photo 4 Isometric reconstruction of Brunel's ward building *by David Toppin*, showing the manner of construction and the materials and various components.

Ventilation

"To secure ventilation in a hot climate with low buildings extending over a large area, and therefore incapable of being connected with any general system of ventilation, it was considered that *forcing in* fresh air by a small mechanical apparatus attached to each building would be the only effective means. (*Photo 5*). Each ward-room is therefore furnished with a small fan or rotary air pump, which, easily worked by one man, is found capable of supplying 1,000 to 1,500 cubic feet of air per minute, or 20 to 30 feet for each patient. This air is conveyed along the centre of the floors of each ward-room, and rising up under foot boards placed under the tables, is found to flow over the floor to every part of the room .... By forcing the air into the room, instead of drawing it out, the entrance of bad air from the closets, drains or any other nuisances, is prevented. The fan is placed at the opposite end to the closets and drains; and all the fans being in the open corridor, the workmen can be seen by a single sentry and kept to their work.

"Besides this mechanical supply of air, opening windows are provided along the whole length of the eaves, and spaces left immediately beneath the roof at the two gables, amply sufficient together to ventilate the rooms thoroughly if any breezes are stirring, without the help of the fan.

"*Humidity*

"There is a very simple provision made for passing the air over a considerable extent of water surface; which would not only cool it, but diminish the effect of excessive dryness, which is said to be occasionally in this climate more oppressive than even the temperature."

Lighting

"The light is admitted by a long range of narrow windows, immediately under the eaves, which protect them from the direct rays of the sun. These windows open, and are provided with shutters inside, which exclude the light, but admit the air ... Internally the lime wash has a slight tint of colour to take off the glare ... Candles are to be used exclusively for lighting, and lamps and the lanterns have been constructed for the purpose."

Fire protection

"A proper supply of fire engines is provided and other precautionary measures are adopted against fire."

Drainage and water supply services

"With each set of buildings is sent a pumping apparatus, a small general reservoir, and a sufficient length of main, with all its branches, to supply water to every detached building; and all the pipes and branches are of such construction to admit of being put together without any soldering or cement. A system of drains is provided, formed of wooden trunks properly prepared, and of sufficient extent to form a complete and perfect system of drainage from every building to a safe distance from the general hospital."

Construction portability and cost

"The construction of each building has been studied with very great care, so as to secure the minimum amount of material, the least possible amount of work in construction or erection, and the means of arranging all the parts in separate packages capable each of being carried by two men; and the result is that each building is the cheapest and lightest that has yet been constructed in proportion to the area covered."

Transport

"For the transport of the materials to the spot selected, two sailing vessels and three steamboats, capable of carrying one hospital for 1,000 men which is the first about to be sent out, have been secured. In each vessel is sent a certain number of complete buildings, with every detail, including their proportion of water pipes and drains, closets, lavatories, baths, etc. and a small amount of surplus material and tools; and in each of two separate vessels are sent a set of pumps and mains and a kitchen and washhouse. So that by no accident, mistake or confusion short of the loss

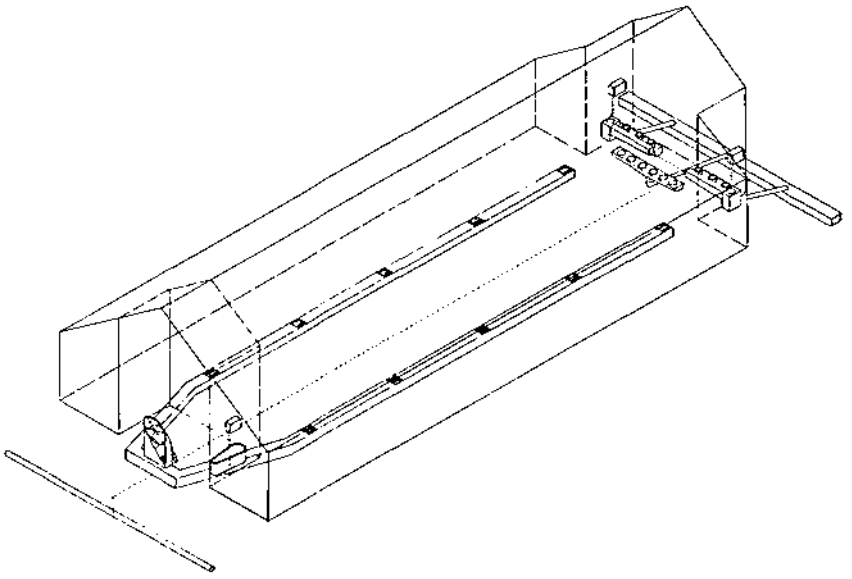


Photo 5 Isometric drawing illustrating servicing systems in a standard ward unit. (*Drawn by David Toppin*).

of several of the ships, can there fail to be a certain amount of hospital accommodation provided with every comfort and essential.

"The cargo space-required for their conveyance is about a ton and a half to a ton and three quarters measurement per bed."

Equipment

"As the space in the wards is very liable to be encroached upon, and the beds crowded, portable baths have been designed, into which the more helpless patients can be lifted, and lowered, on a frame or sack, without requiring space for assistants to stand around, or with the bath placed only at the foot of the bed.

"The kitchen and laundry have each required many special contrivances."

Other space

"A number of small buildings, intended to be detached from the main body, are provided for residences for the officers and servants of the establishment, and for a small detachment of soldiers. A slaughter house and a store yard and some other appurtenances are also provided, the extent of which depends on the circumstances of each case."

Flexibility of accommodation demand

"The ward room is made wide enough and high enough to ensure a yard space of air to each bed, even if this should be unduly crowded . .. if pressing emergency should lead to the beds being placed closer, and fifty per cent more patients introduced, it is believed that the perfect system of ventilation which is secured would render these hospitals very superior to any now in use for the army."

REFERENCES AND NOTES

(1) WEEKS, John. *Indeterminate Architecture*; Transactions of the Bartlett Society, vol 2, p 6. University College, London, 1964. Weeks is incorrect in his assertion that the hospital "was designed to open with 300 patients and be extendable to accommodate 1500". Brunel's original contract was for 1000 beds, and it was always envisaged, according to Dr Parkes, that the eventual size of the hospital would be 2500 to 3000.

(2) ROLT, Lionel T C. *Isambard Kingdom Brunel*; a Biography. Longmans Green, 1957. In the few cases where I found the sources relating to Brunel or the hospital to conflict in fact or original quotation, the version by Rolt has been accepted. He had access to earlier works on Brunel[7, 10], as well as to original, hitherto unpublished, documents belonging to the Brunel family. Although Rolt refers to Dr Parkes, it would appear that he has not read his report[11], which is further confirmed by his not mentioning it in his bibliography, as is also the case with Professor Clapham's book[12].
(3) BANHAM, Reyner. *The Architecture of the Well-Tempered Environment*; Architectural Press, 1969.
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(7) NOBLE, Lady Celia Brunel. *The Brunels, Father and Son*; Cobden Sanderson, 1938.
(8)HARRISON, Robert. *Essay on Brunel*; Dictionary of National Biography, vol 3 (Earliest times to 1900), p 143. Oxford University Press, 1967–1968 (reprint of 1921–1922 edition).
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Hutting the Militia 1939

LIEUT COLONEL G G S CLARKE DSO, OBE

The author was commissioned into the Corps at the RMA Woolwich in 1921 and, after his Chatham courses, spent eight years in India, initially with RE Works Service and later with the Bengal Sappers and Miners. He returned to England in 1932 and on the outbreak of war was posted to BEF France as Brigade Major X Construction Force (Civilian Contractors) for extending the existing Maginot Line. After Dunkirk, subsequent postings were to 3 Division as OC 253 Field Company, 53 Welsh Division as CRE, 9 Training Regiment as CO (while recovering from a wound received in Holland) and thence to Egypt and Palestine as CRE 3 Division. His final appointment was to HQ Middle East at Fayid as GI(E). This article arises from his tour (1936–39) in the Directorate of Works in the War Office.

THE separate Hutting Section, of the then QMG10 at the War Office, was formed in 1938. One RE officer (DADFW), with two civilian Assistant Architects, were given the task of preparing a synopsis of scales for hutted accommodation, and a book of standard designs, based on this synopsis, as finally approved by all the War Office Departments concerned. These were to be confined to a selection of four spans, 19ft, 24ft 6in, 28ft 6in and 36ft to be used with a 'Meccano' set of steel parts for the hutting frame work of these spans, designs for which had previously been produced by QMG10. For some reason it had not been considered necessary to produce designs for timber frameworks. The synopsis, and a volume of standard plans, were ready and issued to Commands early in 1939.

On 26 April 1939, the Prime Minister, then Mr Neville Chamberlain, announced in Parliament the introduction of compulsory Military Training for a period of three years, extended, if necessary, by a year at a time. Some two weeks earlier, QMG10 had been informed that hutted accommodation, for the first call-up of 120,000 personnel, would be required for occupation by 15 July 1939; less than four months ahead! Additional accommodation for a further 80,000 would be required before the end of the year. Instructions were given to prepare copies of contract documents to accompany the existing book of standard plans referred to above. These were to be ready immediately after the Easter break, which, in that year, was from 7–10 April. A conference was then to be held by the Engineer-in-Chief, Major General Collins, to be attended by the Chief Engineers from each Command, and by representatives of a selected number of the largest building contractor firms. As there was no time to adopt the normal procedure for WD contracts, an agreed share of the required work was to be allocated to each contractor on a 'cost-plus' basis. A delay immediately arose, because the then Secretary of State, Mr Hore Belisha, refused to accept the stove heating, as provided in the book of approved plans. He insisted that all hutted living accommodation was to be centrally heated. There was no time to revise the plans in the book already prepared, and lean-to boiler house annexes, of local design, had to be provided by each Command. For the living huts, separate combined bath and boiler rooms were designed by QMG10, for each group of six huts. These were

Lieut Colonel G G S Clarke DSO OBE

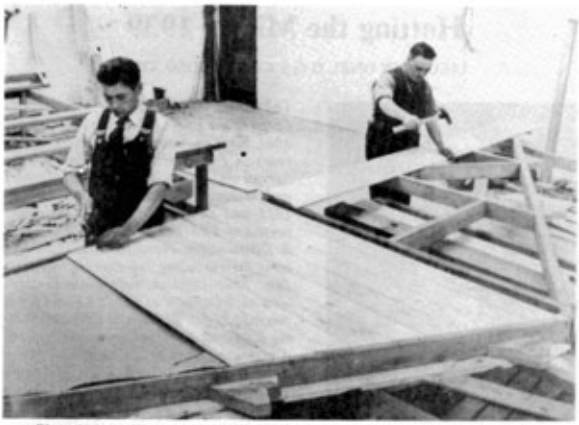

Photo 1. Assembling a gabled end section. (Courtesy of the Red Cedar Supply Co)

placed at three each side of the central bathroom, and were connected by covered ways. The groups became known as 'the Spider' layout. Another Works Department, QMG9, had to work overtime on the necessary calculations and circuit plans for the central heating. It was certainly fortuitous that in my previous job, I had spent two winters living in the Boer War design of corrugated sheet hutting at Longmoor Camp. These were not windproof, and were extremely cold in severe winter weather. In the light of this experience, I therefore specified that, to make them windproof for the militia project, an internal lining of hessian reinforced bituminous paper, was to be inserted between the framework, and it's outside cladding, of all external panels. This insulation considerably reduced, for QMG9, the calculated size and required output of the central heating boilers. The next problem was that the contract documents, specifications and instructions etc, required for the EinC's conference, could not be produced before the Easter break, when the whole civilian staff of QM9 and 10, would depart on holiday. Authority had to be obtained, direct from the Finance Chief at the War Office, for the required typing, duplicating etc, to be carried out by a civilian firm during the Easter break. Messrs Pitmans undertook the task, and produced an excellent job, at a very reasonable cost for the overtime work involved. The next urgent requirement was to produce timber framework designs for the four standard spans, as referred to above. The existing 'Meccano' steel design was found to be too costly to produce and too slow to erect, althought the 36ft span was used for some larger hutments, such as workshops, when overhead cranes were required.

Contact was therefore made with the Timber Development Association, which proved to be very helpful. They produced a timber hutting designer, Mr F J Leather, who did a most commendable job of work. He quickly prepared the designs for the 18ft 6in, 24ft and 28ft spans, comprising side wall and gable end panels, floor panels and roofs, and later, for the 36ft span. The Association also contacted the commercial hutting manufacturing firms, and arranged for them temporarily to drop the production of such items as garden sheds and chicken houses and to concentrate on the mass production of WD hutting, as soon as they had been supplied with plans and orders. One firm, Messrs Thorne Brothers of Erith, most helpfully undertook the erection of

Hutting The Militia (1).

one complete gable-end section of each of the three smaller spans, to ensure that any errors in drawings were corrected before the supplying firms jigged up for mass production.

It was, later, an inspiring sight to see ships, loaded with timber from Scandinavia, discharging their cargoes at Thorne Brothers' wharf at Erith. The scantlings were immediately cut into the required lengths on a multiple saw bench, and then fed on to jigs in their factory. The outer cladding, and the insulating lining, were laid on each completed frame and then nailed to the frame with one blow of a multiple hydraulic hammer. Each panel was then turned over, and the inside lining fixed in the same way. At the other end of the factory, completed panels were pouring out, and being loaded into waiting lorries, for despatch to Commands. Owing to the different arrangements of windows and doors, it was not possible to produce one design of wall panel, but the alternatives were reduced to the minimum.

Pending the arrival of completed hut sections, Commands were busy preparing camp layouts, purchasing the land required, and proceeding with the external services, roads, drains and electric power lines. To save time at Commands, to facilitate the purchase of the land required, and the preparation of estimates of costs, a number of typical hutted camp layouts for different establishments, were prepared by QMG10. The whole project was an example of the co-operative teamwork which could be produced at short notice by the Works Services of our great Corps.

Hutting sections were designed to be bolted together for speed of erection and ease of dismantlement, the minimum of nailing being necessary. At a visit with Brigadier G B O Taylor, the then Director of Works Services, to one of the camp sites where construction was in progress, the noise of excessive hammering was very evident, adding appreciably to the costs, and therefore the contractor's "percentage plus". The Director pointed this out to the building contractor, who was there to meet him. It was noticed, at a later visit to the same site, that the contractor's foreman had been replaced!

The original estimate for the hutted accommodation, for the first 120,000 'call-up', was in the nature of £10 million. This was under-estimated, largely due to the short time available for the initial estimating, and the tendency of cost-plus contract work to increase expenditure. At the early stages of the project, due to changes in the

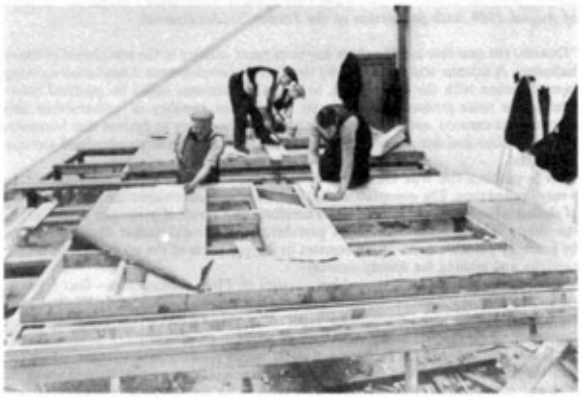

Photo 2. A windowed section being assembled. (Courtesy of the Red Cedar Supply Co)

Hutting The Militia (2).

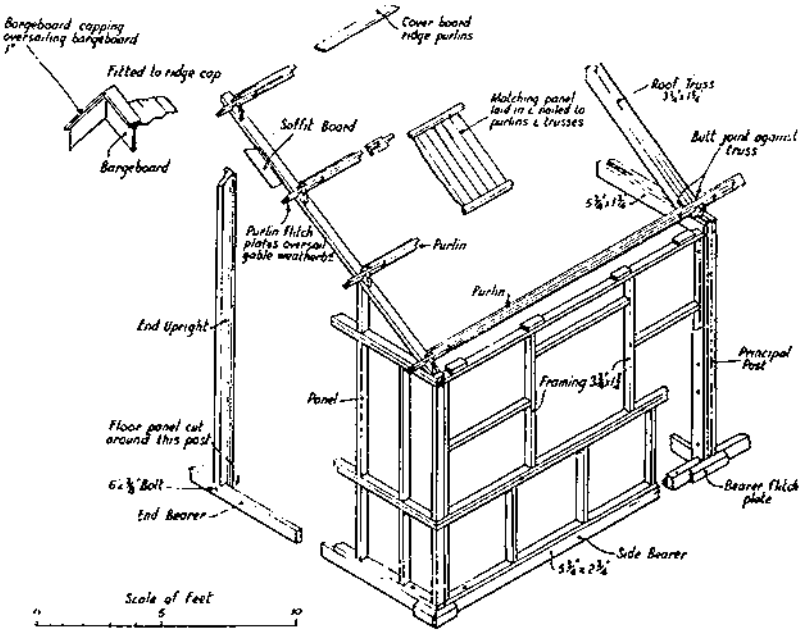

Photo 3. Isometric drawing showing the method of assembling a complete hut

establishments of the various camps, some alterations to the initial designs had to be made, and many new designs were called for. Special financial approval was therefore obtained to bind the plans in loose leaf covers. Obsolete plans were easily removed and revised, or new plans, quickly inserted.

Extract from the Timber Research and Development Association's Magazine 'WOOD' of August 1939, with permission of the Timber Trades Journal:

"DURING the past few months there has been great activity in the erection of military hutments. A scheme was developed by the Timber Development Association working in conjunction with the War Office, so that the hutments could be made of interchangeable mass-produced sections. By this means rapidity of construction and erection was ensured, and at the same time the sections were so devised that hutments of various sizes and designs could be assembled from a range of standardised sections and parts.

"The problem the War Office had to solve was to provide accommodation within a very limited time. The essentials were speed, simplicity of construction, and minimum of skilled labour required in erection. Therefore, as a result of proposals by the TDA, the War Office decided to employ a prefabricated sectional timber design of hut to be made by portable building contractors in various parts of the country, thus saving carriage and making for speedy delivery.

"Briefly, the design for a typical hut consists of: Floor substructure—four types of parts; Floor—one type of panel; Principals and posts—two types of parts; Walls—12ft. bays, two panels high; Ends—two types of parts; Gables—two types of parts; Purlins—one type; Roof lining—one type of panel.—*see Photo 1.*

"It was realised that the sections and parts would possibly have to stand out in the weather before erection, and that one manufacturer's products would have to assemble with any other, and ample clearances were allowed for any swelling or slight variation in manufacture.

"The huts are constructed with a timber framing, covered externally with shiplap section weatherboard, internally with matchboard, and a building paper interlining to floors, walls, and roof.

"The whole scheme thus enabled the TDA to organize the portable building trade—some 135 firms—to supply these huts in lieu of buildings erected in situ by the comparatively few firms employed at the sites. The design was made and a trial hut fabricated and approved within six days, and delivery started within three weeks.

"In this article the illustrations deal chiefly with the construction of one of the smaller hutments, but it will be seen how the sections and details can be applied to the larger buildings."

Extract from 'The TIMES' of 1 August 1939, with permission:

"DURING a week's tour of various Territorial units in the West Country the present writer saw nothing that impressed him more than this empty shell of a camp—to become in a few weeks' time a living body. The camp is a magnificent tribute to the work of the War Office, of the contractors, the Western Engineering Company, Limited, and of the gangs of workmen who, on occasion, have numbered over 2,000.

"On May 20 of this year the site was a bare field with a foot of soil on solid rock. Within a little more than two months it has become a small self-contained city in working order; in a fortnight's time its street lamps will be disturbing the hitherto eternal solitudes of Hay Tor.

"An inspection of this camp revealed neither waste in design nor extravagance in detail. The whole place is perfectly fitted for its purpose. When one reflects that the wealth of thought and material and labour that has gone to the making of this one camp will serve no more than 1,000 of the 30,000 militiamen who are now under training, the problem of handling and accommodating this small army can be examined in perspective."

Early Days

M L C

As is to be expected, the 1885 *Journals* were dominated by two themes. The advance of the relieving force by boat and camel along the Nile towards Khartoum, and the news of Gordon's murder and the national reaction to it. By late January, the head of the camel-based column was well on its way, albeit still about six weeks from Khartoum, and a party aboard a steamer had even come *within* sight of the city. But they were too late. Gordon had been murdered on 26 January 1885.

As far as the Corps were concerned, the column based on the Nile, making its laborious way up the river using large numbers of whalers, absorbed the main engineer effort. The Sapper units were there to supply watermanship skills (in this they were assisted by numbers of specially enlisted Canadian backwoodsmen) and to keep the whalers in action. Stove planks and fractured pintails needed an enormous repair effort, as the whalers were dragged through the cataracts. The news that Gordon was dead was received on 1 February, but the order to "go back" was not given until 28 February 1885. This news was a "woeful disappointment"—but presumably since the object of the expedition, to rescue Gordon, could no longer be achieved, *it must have* been expected. The RE diarist (Capt J E Blackburn) who reported regularly back to the Journal, admitted that the knowledge that no more would it be "take in the slack" and "haul away", leavened the disappointment. The expedition proved, if nothing else, that whalers could both go up and down the cataracts when no other boats could. The Sappers were the "hardest worked lot in the column, earning golden opinions all round."

Many extracts from reports and diaries, including from Gordon himself, were published in the*Journal*, describing the final days in Khartoum. From all accounts

Gordon was killed in the street, some distance from the Palace. The well known picture of him confronting his attackers from the entrance steps of the Palace is well worthy of the subject, but, it seems, it is imaginative (see also the *Sapper* of February 1985)

The *Journal* records what must have been one of the more memorable occasions to have taken place in Rochester Cathedral. A Funeral (sic) Service for Gordon was held on 13 March 1885 in the Cathedral. The musical accompaniment, by the RE Band, including an elegy composed by the Bandmaster, was much praised. The denial of self, the sense of duty and consciousness of the Divine Will, were the themes of this and other memorial occasions for the General. "Gordon was one of those of whom the world was not worthy and so God took him away." Whatever intention the Almighty may have had for Gordon, and with whatever intention the Government may have originally had in dispatching him (to evacuate the garrison as quickly as possible), at the end Gordon himself seems to have been in no doubt. His last dispatches record that "he would not, and could not, leave the people and garrison in the lurch."

There was much controversy in the Corps over the form a tangible memorial should take. Its discussion formed a large part of the proceedings of the Corps AGM in July 1885. Suggestions included a full-sized statue in marble to be placed in the main dining room of the HQ Mess, a statue in London, a recumbent effigy in Rochester Cathedral, a memorial garrison Church in Chatham, an institution (or to fund endownments at existing institutions such as Wellington College) for sons of officers and/or other ranks, and a ward in a hospital. Much feeling was displayed: "Not one shilling should be spent on a statue with the amount of destitution and want around them. It would not be profitable to expend any money on useless marble and bronze." In the event, the Lord Mayor's Mansion House fund decided to erect a statue in London and to endow an existing institution (then at Portsmouth) for the education of the sons of other ranks, known now as the Gordon Boys School. It is interesting to note that officers of the Royal Artillery undertook to augment the funds raised by the Corps, for whatever purpose the Corps chose. The Sub-Committee set up by the AGM to make recommendations had not come to a conclusion by the end of 1885, although it favoured erecting a statue in Rochester Cathedral with a replica in Brompton Barracks. The Committee thought that about £2,700 would be raised—a sum far insufficient properly to endow an educational institution or to build a garrison church.

Despite the competition for funds—such as the Gordon appeal—another appeal featured in the *Journal* and did not lack for support. This was for the final completion, at a cost of £196, of a porch in memory of those killed in south west France under Wellington between October 1813 and April 1814, as part of the English Church in Biarritz. This appeal was, of course, Army wide. Individual officers donated £5 to which £5 was added from Corps funds. The names of three Royal Engineer officers were inscribed in the porch.

Railway construction figured prominently in the *Journal* of a hundred years ago. 8 Railway Company was concerned with advancing the existing railway which ran south up the Nile Valley from Wady Halfa, by-passing the first cataract. They operated this stretch (about thirty-three miles) using very indifferent rolling stock and engines, and up to the time of the recall of the Column had added a further fifty-three miles across waterless desert, thereby circumventing the second and worst cataract. The engineering work was frustrating, but comparatively simple. Labour for earth works, mostly involving fairly shallow cuttings and embankments, was chiefly supplied by Egyptian infantry battalions, which considerably eased the administrative problems.

At the same time an expedition, again under Major-General Sir Gerald Graham (late RE), had been sent to Suakin on the Red Sea Littoral, to improve the port and to construct a railway to Berber—on the Nile. 17 Field Company were concerned with the port, water supply, etc, and 10 Railway Company with the railway. The latter construction was organised with a curious mixture of a UK civilian railway contractor on a cost plus (2½%) basis, together with civilian labour and an RE

element, which included a company of the Madras Sappers and Miners. When the latter left Bangalore and had to say goodbye to their families, an officer commented in a letter to his father, published in the *Journal*, that he had not realised that "the natives had so much feeling." One is reminded of the alleged comment by a cabinet minister made after visiting base installations, including bath houses, on the Western Front, that he had never thought the working classes had such white skins. But the officer also relates to his father that "at the taking of the Taku Forts a British Regiment failed, at which one of our Sappers rushed out shouting "who will follow a black Sapper?" The regiment followed him." As to the railway construction, from all accounts the contractor, however experienced in railway work in the U.K, was sadly ineffective and the burden seems to have fallen on the RE and Sapper and Miner contingents.

THE real challenge in railway construction at that time had been in India. Both the *Professional Papers* and the *Journal* of 1885 figure railways on the North West Frontier very prominently. The threatened war with Russia in March and April 1885 meant that the work was treated with extreme urgency. In 1885 the final extension of the Bombay—Sind line from Sibi, to link the Indian plains with Quetta and thence right up to the frontier itself towards Kandahar, was the vital priority. The difficulties to be overcome almost defeat the imagination. A completely wild and mountainous country with deep ravines. No natural resouces or shelter whatever, with extreme heat and cholera in the summer and sub-zero temperatures in the winter. The 224 mile stretch was entirely an RE responsibility (as opposed to the PWD which had been responsible for railways elsewhere on the Frontier.) The ruling gradient was restricted to 1 in 50 and the mimimum radius for curves to 1000 feet. There were many tunnels, including one which enabled the line to corkscrew over itself—no mean feat of survey and construction. A CRE was in charge—referred to as the 'EinC'. The backbone of the construction force was provided by five companies of Bengal Sappers and Miners plus Madras and Punjab Pioneer battalions. A large civilian work force ebbed and flowed according to disease and weather conditions. There were many difficulties in getting the work started. At first the only directing officer with any railway experience was the CRE himself (Col J Brown RE). A batch of YOs fresh from Chatham were drafted in, and gradually other officers arrived from the PWD and elsewhere in India.

The country was "absolutely barren". The line presented more difficulty than any other of the frontier railways eg that to Peshawar and towards the Khyber Pass. The bridge work was "exceptionally difficult". The larger bridges, many of 150 feet span and more, were of rivetted or bolted plate girders designed in England. The Nari Gorge had to be bridged six times in fifteen miles. Much credit was due to the Sappers and Miners, many of whom were miners in civil life. "They accepted the extreme difficulties of terrain and climate in a proper soldier-like spirit, as a complement to their skill and aptitude." No nonsense, it seems, as to being a soldier first and tradesman second. Both, very properly, went forward together! When reading such accounts one often wonders how the Corps managed to produce sufficient engineering knowledge and know-how. There were indeed civilian engineers on the CRE staff (Mr Molesworth was one of them), but as reported by Capt Scott-Moncrieff in the *Professional Papers*, officers sent up may have had experience in barracks or roads but not on railways, in circumstances which even the most experienced railway engineer would have found daunting.

However, Capt Scott-Moncrieff clearly thought highly of the Chatham training. He writes that a Chatham trained officer, able to take levels and to lay out a curve, with a knowledge of pumps (for foundation work) and with an ability to manipulate heavy weights (for girder erection) " as in such exercises that are taught at Woolwich and Shoeburyness, with the accompanying instruction on the use of ropes, chains, blocks and tackle", would find the training of greatest value and, by implication, quite

sufficient. And so it must have been. The line was built. Then, as now, even the non-PQ officer should have complete confidence in his engineering abilities!

The Survey and choice of route did of course demand extreme skill and care. The *Professional Papers* relate that when making a military road to Quetta on a more southerly trace than the railway, the route had not been surveyed from end to end, but only bit by bit, and many months of work were wasted as the road got into unsurmountable difficulties. A considerable stretch had to be abandoned and a new route chosen. Luckily for the surveyors the original route had been persisted on by the Staff, despite the written protest of the senior RE officer!

In 1885 strategic worries loomed large—especially in lectures at the RUSI, which were reported at length in *the Journal*. The message, as ever, was deterrence. The Government was reminded that there was a need "to restore to the Country that sense of security, and to foreign nations that proper regard for us, which there was reason to fear was at present greatly wanting." Maj Gen Sir W D Jervois (late RE), as Governor of New Zealand, assumed that the very existence of Empire depended on Naval supremacy and that the danger of "lone raiders and landing parties" was always present. The speaker of the first quotation above had France in mind, but sensibly went on to say that in looking to her own strength this country should not deny to France her own right to a strong navy—it was just a matter of keeping ahead!

But it was Russia who was seen as the real menace. "Russian Generals have declared that, with her Asiatic hordes, she will sweep through Persia and Afghanistan into India." In another lecture the warning was given, however, that we should not occupy Afghanistan for strategic reasons, "The cost would be enormous. But Russia has even her apologists who would have her pose as the harbinger of civilisation and messenger of peace and uniter of divided nationalities. But not so—the role of angel of death and darkness is more congenial to her." In the meantime, strategic occupation or not, the Government pressed on with the building of railways and roads up and into the Afghan borders—as noted above.

Various suggestions were made to create strength, but at least cost. One was to build small fast torpedo boats by public subscription. Another, to save money by extending the period of ship construction from three to six years, was condemned as sheer waste: A suggestion in the *Revue Militaire* that the Navy should be substantially laid up during the winter to save 'winter wear and tear' was not well received! Less money should be spent on coastal fortifications and more on ships. To speed things up the Royal Dockyards should confine themselves to repairs and new construction should be privatised! In other ways too it was then, as today, the same story. "We had lived on Trafalgar and victory. The French were spurred on by defeat and the need to retrieve lost reputation." This latter point did not quite square with an account of a French attack on Tamsu in China in October 1884, when a powerful squadron landed a large force of blue jackets and marines. These were ignominiously driven back to their boats with heavy loss.

The RUSI lecturers found some support in the *Revue Militaire Italiana* The UK is criticized for inadequate coastal fortifications and for having prematurely dismantled the Martello Towers, but at least we "had sensibly refused to build a Channel tunnel"! We should, as a priority, create a strongly defended port at Dover, so forcing a possible combined German, French and Russian fleet to approach the UK via the Orkneys. (No doubt with Spanish pilots!) Finally, despite a "climate calculated to develop physical strength" in her people, the UK was advised to be well armed! In a Russian study, as reported in the *Journal*, of how England managed to supply her troops at the end of a long and difficult L of C—such as on the Nile and in Afghanistan—the English were judged to be excellent at the front but hopeless administratively. This due to the absence of a well-trained transport during peace. The only favourable comment was that "the English administration is distinguished by its honesty"!

The usual prominence was given to the Annual Inspection of the Engineer Volunteer

Corps. It was not only in 1985 that people as in Durham, have been advised to keep an eye on the activities of the Almighty. The Inspecting Officer (the local CRE) of the Buckley Volunteers in Lancashire, after congratulating the unit on its demonstration fieldworks, etc, added that they "owed a duty to a higher tribune than an earthly one". The CO in his reply said that they hoped to do better next year—that is "if they were spared." Presumably they were, unless the 1886 Journals report otherwise! Their field works might have been enlivened by a tip on the construction of cavalry obstacles, printed in the *Journal*. If the obstacle depends on flooded ground in the wet season, marshall your transport elephants and march them through and through, while the ground is still marshy. The dried bed, honeycombed with holes a foot in diameter and two or so feet deep, is, it seems, a better protection than the water had ever been!

The *Journal* reported with some sorrow that in 1885 there was a shortage of candidates for admission to the RMA—the attractions of the two 'Ordnance Corps' being insufficient. Sandhurst, be it noted, was then being many times oversubscribed. Factors against Woolwich were that the course was double the length of that for Sandhurst, involving parents in double the cost, and that conditions of service for the RA and RE compared unfavourably with those of the line. "Young men will not be found willing to elect those Corps which require infinitely higher attainments, but are less liberally dealt with, particularly as regards promotion and retirement." The mistake, it seems, was to have remedied the complaints of serving senior officers but not to have bothered about the views of the more junior, which naturally more influenced aspiring cadets.

If the RMA was unpopular, the Royal Tournament was not. A notice in the *Journal* stated, this time with some pride, that the Tournament at the Agricultural Hall, Islington, had proved most popular. The most applauded turn had been that staged by the Corps—the bridging of a river before attacking a fortress. This had been performed in a "wonderful, smart manner."

At the AGM. the RE Widows decided to continue the handsome £30 per annum pension with a bonus of £25. Much criticism was directed at the policy of investing funds almost entirely in land mortgages. Agricultural prices at this time were very depressed and there were national rumours of wholesale defaults. The Trust Deed limited the investments to Government Stocks (which gave a very small return) and to mortgages. There was a move to change the deed to allow also for freehold ground rents, but any change required the agreement of each and every member of the Society—a daunting prospect which was resisted by the Committee!

FOOTNOTE

Since writing the above, the author has read *Karari*. The Sudanese Account of the Battle of Omdurman by E H Zulfo, a major in the Sudanese Army. This, to quote the publisher, is the story of the battle as seen through the eyes of the enemy! It was first published in Arabic in 1973. In recounting the events which finally led up to the battle, Major Zulfo naturally covers the siege of Khartoum and Gordon's death. He states that Gordon was killed, despite the strict orders of the Mahdi that he should be taken alive, and he firmly supports the authenticity of Gordon having met his death on an upper floor of the Palace. "Mursel (a standard bearer) shot a man and he fell on the staircase". It seems that his assailants did not realise that they had hit Gordon, until Gordon, mortally wounded, was found a few moments later; they then cut off his head. The scene portrayed in the "Death of Gordon" may be reasonably accurate after all.

Exercise Longshot—The Berlin 600m Range

CAPTAIN M A TOOGOOD RE

The author is an ex MPF and was commissioned in May 1982. After a tour as AO of 39 Field Squadron he joined 43 Field Support Squadron in February 1983 and became Project Officer for the earthworks connected with the new Berlin 600m range. He is at present serving as a Troop Commander with 43 Plant Squadron in Osnabruck and takes up the post of OC 40 Army Engineer Support Group in October 1985.

Background

In recent years the Corps has not been involved in very many projects that involve major earthworks. Perhaps notable exceptions are works undertaken by the Mobile Civilian Groups based at Krefeld and Hannover. But they are almost totally dependent on German civilian plant operators. With the formation of 43 Plant Squadron, in June 1983, there is now the potential within BAOR for Sappers to undertake major earthmoving tasks.

Exercise *LONGSHOT* presented the newly formed Plant Squadron with an ideal opportunity to display its capabilities. The aim of the project was to complete the basic earthworks in the construction of a 600m Small Arms Range at RAF Gatow, Berlin. This involved the movement of over half a million cubic metres of earth in preparing the range bed and associated bunds. The range lies within 50m of the Berlin Wall. When completed the fully baffled range will provide Berlin based troops with an essential training facility. The full range of small arms can be fired including the AFV mounted machine gun. The idea of the range was first conceived in the late 1970s, when the Commander Berlin Brigade, Brigadier CR Grey, (late RE) was keen to have the range built by Sappers. 65 Corps Support Squadron was asked to produce a initial report covering the earthworks. Subsequent site investigation revealed the need to evolve a new design and in February 1983 25 Engineer Regiment sent a team to carry out a detailed reconnaissance. One month later the advance party from 43 Field Support Squadron (re-designated 43 Plant Squadron in June 1983) deployed to Berlin.

During the project the Area Works Officer in the Berlin Property Services Agency (PSA) was Lieut Colonel John Leivers RE. It was largely as a result of his confidence in Corps tradesmen that the earthworks were finally placed in Sappers' hands rather than that of a civilian contractor. Throughout the project the PSA in Berlin gave full support to the Sappers working on the project and a considerable mutual understanding and respect developed.

Mounting the Project

The range was designed by PSA Berlin in conjunction with the School of Infantry Warminster. The designers were conscious from the beginning of the need to minimise the effect of noise on the local inhabitants. Other design problems included the high level of the local water table and the effect of the concrete baffles on the nearby radars at RAF Gatow. It was planned to complete the earthworks in two phases with civilian contractors erecting the stop butts and concrete baffles in the intervening period.

Phase 1 (March to December 1983)

(a) Remove and stockpile 35000m^3 of topsoil from range area.
(b) Excavate the range bed to formation level.
(c) Construct a protective earth embankment around the perimeter of the range bed. (Excluding the bullet catcher).
(d) Construct a car park and an access road around the embankment.

Photo 1. A general view of the range nearing completion. The Berlin wall can be seen on the left.

(e) Work in conjunction with civilian contractors on the construction of roads and tunnels.
(f) Replace top soil over the embankment.

Phase 2 (August to December 1984):

(a) Completing the embankment around the bullet catcher.
(b) The construction of a further access road.
(c) Filling the bullet catcher with sand.
(d) Grading the first 200m of the range bed to final level.
(e) Constructing the first two firing points.

Deployment for the project involved the movement of a large quantity of equipment from 43 Plant Squadron's base in Osnabruck, via Helmstedt and the corridor, to Berlin. Several machines could not pass the rail guage so all movement was by road. There are fifty-four bridges along the actual corridor and there is a 4m height restriction on all loads. It is not possible to meet this limitation without extensive dismantling of some plant equipment, the worst example being the Terex Medium Wheeled Tractor (MWT) on a transporter, which had a height of 4.25m even with deflated tyres. A light wooden frame was mounted on a transporter at 4.35m, and driven in both directions along the corridor to test the "actual" clearance. It went under all bridges, so trusting that the DDR would not resurface their roads that summer, the plant was dispatched in two convoys. All vehicles were driven under a 4.30m height guage before setting off, and both convoys arrived without mishap. Over the two year period the Squadron became experts at movements to Berlin and an excellent relationship developed with the RMP detachments controlling the corridor. A complete list of the Plant and vehicles used during the project is at Annex A.

Construction

PHASE 1

The works were set out from PSA drawings by 43 Plant Squadron surveyors using equipment loaned from the PSA. this included automatic levels and an Electronic Distance Measurer. During the project surveyors were attached from other BAOR squadrons to gain experience. Great care was taken during the setting out of the site to avoid the need for double handling of material.

Exercise Longshot (1)

Photo 2. Medium Motor Scraper back-filling over access tunnel.

Excavation began with the removal of top soil using six motorised scrapers, two TS14s and four TS8s, all being pushloaded by compatible dozers. The highest daily output was achieved in this early stage. This was due to the short hauls and high service ability. Dumping areas were carefully chosen to facilitate subsequent replacement of the top soil. Scrapers were again used to excavate soil from the range bed and to build the surrounding bund. The estimate of earth to be moved, 500,000 m³, proved to be accurate within ten per cent. The average output target for material excavated each day was 3,000m³. As the embankment grew in height, so the danger of equipment sliding over the edge increased. Extreme care had to be taken when dumping on top of the bund which narrowed to 4m at its peak. This highlighted a lack of "recovery awareness" by section corporals and operators alike. A little more training in recovery techniques on POM II courses might be appropriate.

The top soil was relaid on the embankment after it had reached its final height. TS8 motor scrapers hauled the top soil to the top of the bund from where it was spread down the sides with Medium Crawler Tractors (MCT).

Most of the range bed and bund area was constructed on good quality sand but this did not apply to the road and carpark area. In this area the previous occupiers were sand quarriers. They had removed the sand down to the water table, about 1m below ground level and back-filled with many types of industrial refuse. This meant that all the unsuitable material had to be removed, and the void back-filled with sand before any construction could take place. This proved to be a laborious and unpleasant task.

There are three access tunnels to the range bed area. These were precast units and assembled from interlocking sections, rather like a giant 'Lego' set. A civilian contractor was responsible for tunnel erection while the Plant Squadron prepared the base and compacted around completed tunnels. The tolerance given for the tunnel bases was plus or minus 1cm. To achieve the required compaction the sand was watered and a Pedestrian Bomag roller used to compact close up to the wall. A 5.8 tonne roller, towed by a D6, completed the job. When back filling, care had to be taken not to 'dump' too thickly or the required compaction could not be achieved. Only clean sand was deposited within 1m of the tunnel walls to prevent contamination of the concrete structure with phosphates. Construction of the access road and carpark involved the removal of all unsuitable material which was dumped in the centre of the embankment. Sand was then laid and graded to formation level. A civilian road contractor cement stabilized the sand and laid an asphalt base course.

Exercise Longshot (2)

PHASE 2

The main tasks of the second phase were to complete the bund around the bullet catcher, and to construct the final level of the first 200m of range bed including the firing points. An interesting problem was posed by the need to fill the bullet catcher with sieved sand. It was not possible to drive a tractor directly up to the bullet catcher as this meant driving over the unreinforced concrete roof of the butts. 38 Field Squadron helped out by providing a MGB which allowed the wheel loader to take the bulk of the sand in. The final height was achieved by the use of a conveyor, loaded through an improvised mesh grill.

An active safety policy was pursued throughout the project. Anyone adopting unsafe procedures, including being on the site without a site helmet, was invited to contribute to the project social fund. This encouraged a high level of awareness and the project was completed without serious accident occuring.

MANPOWER AND CONTROL

AT the height of the project in the summer of 1983, 54 men were employed. During Phase 2, in 1984, the maximum on site was 31. An invitation was issued to all BAOR RE Sqns to send plant operators and surveyors to Berlin to gain practical experience. This opportunity was taken up by 27 men. 38 (Berlin) Field Squadron were particularly helpful. In addition to lending men they gave assistance with minor repairs, helped clear the top soil prior to setting out, and frequently put their plant at the Project Officer's disposal.

Three MPFs were employed during the two year project. WO2 P Clorley was responsible for mounting the project and planning its early stages. He was relieved by WO2 I Horsburgh, who completed Phase 1 in 1983 and SSgt C Anley completed the 2nd Phase in December 1984.

Considerable effort was put into ensuring that every member of the team understood the overall plan of work. The various tasks were allocated to sections. Corporals were encouraged to arrange their own working shift and estimate task completion times, so long as these conformed to the overall plan. They responded magnificently and their standing within the Squadron grew tremendously as they gained confidence. Weekend working was quite common and many sections returned after the evening meal to finish off their self-imposed work quota. The Junior NCOs clearly showed that they are capable of handling far more responsibility than they are normally given.

Photo 3. Shaping the range bund July 1983.

Exercise Longshot (3)

Equipment Management and Performance

Refuelling was carried out by bulk delivery to site every other day. Pods then filled up the plant at cease works daily. The total diesel fuel used for Phase 1 of the exercise was 348,629 litres, this was within 5% of the original estimate. The fuel estimate was based on consumption figures taken from the AB74 of the machines used on the project. This method of estimating fuel requirements is strongly recommended.

Servicing and maintenance was given a very high priority. The PSA purchased a portable servicing trailer for use on the project and this proved invaluable. Several methods of allocating servicing time were tried. The most successful was the formation of a three man servicing team which worked a late shift (1600 hrs until approximately 0100 hrs). It was essential that there was an overlap period between production and maintenance shifts when operators could discuss machine problems with the servicing team before leaving the site. The Repair Team consisted of 1 RE Fitter Sergeant, 1 RE Corporal and 4 RE Fitters. 12 RSME Regiment were kind enough to send a civilian plant instructor for two weeks at the start of the project, to familiarize the fitters with the then new Terex TS14 and TS8 scrapers. Some of the fitters remained in the team throughout the project. This provided continuity and increased the fitters skill level which in turn reduced time lost due to equipment failure. A Base Repair facility was supplied by 14 Field Workshop REME (Berlin).

Because the project was carried out in support of the PSA, and given special conditions pertaining in Berlin, it was possible for the Squadron to develop a direct relationship with the local agents for the various equipments being used. The ability to deal direct removed much of the frustration normally associated with the plant spares supply system and contributed to the success of the project. An overall equipment availability figure of 72% was achieved. Detailed comments on the equipments used are given below.

Heavy Crawler Tractor. The Terex 8230Bs were all brand new at the start of the project. Overall they performed adequately, being very good in "Ponderosa" type sand and conditions. When required to work in the "rubble" area, however, they suffered from broken windows, cracked welds and the general effects of vibration.

Medium Motor Scraper. The TS8 scrapers all worked well, they were pushloaded by a Caterpillar MCT and after a very short time most operators could gain 9m³ in load. Even in the light sandy conditions it was not possible to gain a full bowl by self loading.

Heavy Motor Scraper. Both TS14 scrapers worked superbly. They were push-loaded by a Terex 82-30B HCT and frequently exceeded an output of 1500m³ per day. However as the bund appraoched its final height they could not be used due to the narrowness of the embankment at the top.

Medium Crawler Tractor. The sides of the embankment were shaped by the Caterpillar D6C. In some cases these machines were 15 years old, but they gave excellent service and spares were still readily available. For the second phase of the project the D6D replaced the older model and proved even more reliable.

Motor Grader. The main fault experienced with the Super MGH was jamming of the mould board due to sand clogging the slide. Most operators seemed a little wary of the grader at first, probably due to the lack of practice.

Medium Wheeled Tractor. The Terex 7251 proved unreliable and had difficulty gaining any traction in the sand. A bucket loader had to be hired by the PSA for both phases of the project.

Dump Trucks. Like the MWT the Haulamatic Dump Truck had little traction away from hard surfaces. Lowering the tyre pressure helped, but rubble haul roads had to be constructed before they became economical to use. The need for an all wheel drive dump truck was very clear.

Bomag Rollers. The motorised scraper provided enough compaction on the embankment. The Bomag 4¾ tonne towed by a MCT was used along the access and haul roads. The ¾ tonne pedestrian controlled roller was used for compaction around the tunnels and the firing points. Both machines gave little trouble and performed well.

Photo 4. A recovery problem.

However the ability to use the MWT as a towing vehicle would have been an asset.

Lessons Learned

Recovery. As the embankment grew in height the recovery problems increased. Extreme care had to be taken when dumping on top of the bund which narrowed to 4m at its peak. Plant Section corporals and operators need to be very "recovery aware" and trained thoroughly in recovery techniques.

Fitters. It is important to maintain continuity amongst the fitter section, at best in the management, as similar problems often recurred.

Local Purchase. On a project of this size it is essential to be able to locally purchase vehicle and equipment spares to avoid delay.

Servicing Team. It was found very effective to have a servicing team who systematically worked on all plant during non-operating hours. This eliminated peak pressures on tools and equipment whilst saving daylight operating time.

Scrapers. The medium motorised scrapers were found to be uneconomical over these short haul distances. They needed push loading to get a full load or self-loaded with half a bowl.

Dump Trucks. The in-service dump trucks proved to be unsuitable to work in sandy, off-road conditions; hence haul roads had to be constructed for them.

Topsoil. Relaying topsoil on the constructed embankments progressively was found to be more effective than leaving it until the bund was finished.

HGV for POMs. It would have been a great asset to have POMs with HGV 2 licences to enable them to drive dump trucks off site.

Conclusion

Exercise *LONGSHOT* was a clear demonstration of the Corps ability to carry out major earthworks to civilian standards. The project was an excellent proving ground for both men and equipment of the newly formed 43 Plant Squadron. Many other units and individuals not mentioned in this short article also contributed to the project and this opportunity is taken to thank them for their part in bringing it to a successful completion.

Exercise Longshot (4)

Annex A

Plant and Vehicles used during the Project

	Phase 1	*Phase 2*
TS 14 Motorised Scraper	2	Nil
TS 8 Motorised Scraper	4	4
Grader Motorised Super MGH	2	1
Heavy Crawler Tractor Terex 82/30B	4	2
Medium Crawler Tractor Caterpillar D6C	6	Nil
Medium Crawler Tractor Caterpillar D6D	Nil	4
Medium Wheeled Tractor Terex 7251	2	1
Medium Wheeled Tractor Caterpillar 966 (hired)	1	1
Dump Truck Haulamatic	4	5
Bomag Towed Roller 5.8 tonne	1	1
Bomag Pedestrian Controlled Roller ¼ tonne	1	1
Landrover ¾ tonne	3	2
Bedford GS	2	1
POD UBRE	2	1

Pom Senior

CAPTAIN S G TENISON BSc

Since leaving Sandhurst the author has served with 52 Field Squadron (Construction), with whom he frequently travelled on overseas projects. He then spent three years at the RMCS Shrivenham devoting himself to the pursuit of pleasure and studying civil engineering in his spare time, thereby earning a gentleman's degree. He returned to the real world in August 1982 to serve as a troop commander with 32 Armoured Engineer Regiment. This turned out to be a globe-trotting tour, so PB7 have temporarily pinned him to a desk as Operations Officer at 39 Engineer Regiment since January 1985.

AFTER a two and a half year tour with 32 Armoured Engineer Regiment, as a troop commander, I am a firm supporter of 'the tracked Mafia'. Many people bump start the lungs on a cigarette each morning, an armoured engineer cocks an ear to the sound of the Chieftain and inhales deeply. Another reason for waxing lyrical about a tour with 32 Armoured Engineer Regiment is the variety of the life. Besides taking part in innumerable Battle Group exercises and autumn Field Troop Exercises (FTX), I have seen many parts of the world during my tour; Norway on the Unit Expedition Leaders Course (UEL), Austria with the ski team, Canada on exercise and adventure training, and finally New Zealand on Exercise *LONG LOOK*.

I first wrote an article for the *Journal* at the end of my first tour as a troop commander, under instructions from my Commanding Officer. It was probably designed as a test of my ability to write, before going to RMCS Shrivenham. Again I am putting pen to paper, having finished a tour as troop commander, under instructions from my Commanding Officer. The reason on this occasion was definitely "the pound of flesh" for going on *LONG LOOK* (as I had previously demonstrated my ability to write by submitting a written application for *LONG LOOK*).

Captain S G Tenison

My application slipped through, and I understand that the first my Commanding Officer knew of the application was when it was accepted in May. I settled back in comfortable contemplation of a few quiet months in the South Seas. Two letters arrived on my desk in the early summer which effectively put an end to this smugness. The first was a list of Public Information articles to be written for the Regiment. One serial was "Ex *LONG LOOK*", Captain Tenison to write an article for the *RE Journal*". The second letter, from New Zealand, invited me to prepare a one hour lecture on the role of the Royal Engineers on Op *CORPORATE*. I began to feel that *LONG LOOK* might not be such a good idea, with the work arriving before deployment.

Third Class to New Zealand

After all preparations had been made, inoculations up to date and suitcases overfilled, I was despatched to RAF Gutersloh for the outward flight. I say despatched because I was wheeled on my way following an excellent champagne breakfast provided by friends in the mess. Day One of our 'all stops to New Zealand journey' did not begin well. The plane was to start from RAF Brize Norton, and depart from RAF Gutersloh at 1130. We were finally airborne at 1730. In addition we were flying third class in a RNZAF C130. The drawbacks of this mode of travel were overshadowed by the itinerary and accommodation; Gander, Washington, Travis, Hawaii, crossing the

Photo 1. Waikiki Beach, Hawaii

international dateline to Fiji and finally New Zealand with some very nice hotels on the way (all AA recommended).

On arrival it was rumoured that watches should be put back twenty five years, but this was proved false. They should only go back ten years. Despite such a pleasant journey, and the rigours of a Hawaiian beach, we were not sad to leave the aircraft. The throb of the engines rang in the ears for many days after landing. So at last we were on New Zealand soil, having landed at Whenuipai, Auckland. There was much excitement all round as we embarked on the second stage of our adventure.

First Impressions

My base for the next three and a half months was to be Papakura Camp, twenty five miles south of Auckland. The camp houses 1 Task Force (TF) and so has a mixture of units. In the one camp is the headquarters, two signals squadrons, an engineer squadron, a transport squadron, New Zealand SAS group, a gunner regiment and a

Photo 2. Officers Mess Annex, Papakura Camp

workshops (and probably some organisations which I did not see). The camp seemed fairly friction free compared with mixed unit garrisons in UK. There were about 600–800 regular soldiers, male and female, on camp.

The integration of the New Zealand Army is very different from ours. Firstly women serve as far forward as brigades and are recruited into a unit such as signals, rather than as WRAC serving with signals. Secondly many regular units are at half strength, the other half being territorial troops. The two, regular and part-time, exist side by side extremely efficiently. Some of the units within the TF are entirely Territorial, such as the infantry battalions. (The TF had no regular infantry).

The way forward for this narrative will probably be a ramble through the occurrences and impressions of three and a half months in New Zealand. There is much to say and a good deal will have to be omitted.

"So You Want to be OC"

On reporting to the Officer Commanding 1 Field Squadron RNZE, I was asked when I wanted to take my leave. This seemed an excellent way to start, and certainly my photograph albums show the results of treating this question with the seriousness which it deserved. Out of some 300 photographs only about ten are of military subjects.

I was eager to get to grips with my job in New Zealand and wanted to know what I was to do, besides taking leave. I had *expected to command a troop of tradesmen*. The OC quite casually asked me if I would mind being Second-in-Command for a while and if I could fit in a couple of weeks as OC. The two incumbents were deserving their posts, one for a diving holiday in Raratonga (*Journal* Sep 85) (called a military task, or so he said) the other for a course in Australia. I made the most of being OC because squadrons are not given to troop commanders every day. I did not manage to press a claim for pay of higher rank, despite the awesome responsibilities of the task.

Jazzajetics

Having reported for duty I fell in with the squadron routine. Much time is devoted to physical training and with less threat than that facing 1st British Corps it is easily fitted into the programme. The first Thursday morning session was Jazzajetics (I think that is the correct spelling). To inhabitants of the Northern hemisphere aerobics

would be a more common name. Full of scorn I went to the gymnasium not expecting to get out of breath. How wrong I was. It is an extremely effective and enjoyable form of physical training, not for the faint hearted. Imagine two hundred male and female soldiers moaning and groaning through fifty minutes of painful exercise to music, while an incredible body performs incredible contortions on stage. I believe that the APTC should brighten their image and recruit Jane Fonda for physical training. No coercion would be needed to attend.

I spent part of my time doing routine squadron administration. The squadron has a strength of about sixty regular soldiers and fifty territorial soldiers. The Second-in-Command and training wing are responsible for the training of the territorial soldiers, with the administration done by one of the clerks. The territorial soldiers have weekend and evening training and take part in the annual camp with the regular soldiers.

The role of 1 Field Squadron is to provide Engineer support to 1 TF and an airborne troop for the Rapid Deployment Force. During the year they spend seven months on construction jobs and five months on combat engineering. They do many jobs which are done by the Property Services Agency in England and the standard of work of the artisan tradesmen is extremely high.

Troops Running in All Directions

My major occupations were writing a section competition exercise and planning the squadron's involvement in the Australia, New Zealand and United States (ANZUS) CPX called Ex *TRIAD*. The irreverent named the exercise 'TROOPS RUNNING IN ALL DIRECTIONS'. *TRIAD* is a biennial event to exercise the three brigades (1 AS, 1 NZ, 2 US) of 4 (ANZUS) Division. The memorable parts of this exercise were spent skiing. We worked shifts of six hours on, twelve hours off. With skifields on a nearby volcano we took every opportunity to get away from the exercise.

The section exercise took place at the end of October, in glorious spring weather. We deployed to a pair of islands in the Hauraki Gulf. The islands are separated by ten feet of water at high tide, but there is a causeway between Rangitoto (a volcanic island) and Motutapu (a sedimentary island). The two islands provided a great range of terrain and going for the exercise. The aims were to practice leadership, various military skills and some improvised field engineering. Motutapu is an area of rolling

Photo 3. Improvised Cattle Bridge. On Motutapu Island

Pom Sendor 3

Photo 4. View from Cullens Point, South Island

grassland with some steep sided valleys but nothing higher than about eight hundred feet. This island was used for most of the exercise. Besides the usual weapon tests, patrolling and mines and booby traps the major task was the construction of two cattle bridges. The field section appeared on site to find a large box frame girder, with timber for decks and abutments. Carry on! The two bridges were excellent and should give good service for many years.

The Rangitoto part of the exercise was considerably tougher. The sections moved up to the summit of Rangitoto to do a map reading and signals exercise. The map reading was particularly well located with a view for miles over the Gulf and Auckland. From this stand the sections moved on down to the coast and patrolled along the north coast and back onto Motutapu. A round trip of some twelve hours hard slog, walking on razor sharp volcanic rock. The vegetation on this island is dense bush so the sections could take no short cuts across the island. This phase of the exercise caused a number of names to be coined for the 'Pom' who wrote the exercise. With a corporal from 9 (Parachute) Field Squadron also attached to 1 Field Squadron, I was once referred to, on the radio, as 'Pom Senior'. Standing by the set I was able to pick up the handset and reply "Pom Senior speaking". Apparently this caused quite a stir at the other end. The finale of the exercise was a night ambush which lit up the sky and disturbed the sheep. The exercise was most enjoyable, not just for Squadron Headquarters who were not under pressure. Even the soldiers enjoyed it (in parts), felt it to be worthwhile and worked extremely hard.

"Where's the Falklands?"

My last major effort on work was the lecture for the Corps Conference. I was ignorant of much of the sapper involvement in the Falkland Islands and wondered how I would be able to keep going for half an hour, let alone one hour. By sending a begging letter before departure I received help from many quarters and naturally ended up with more material than necessary. The lecture and slides were extremely educational for both the audience and lecturer. It was a marvellous opportunity to sing the praises of the versatile Sappers. I even managed a joke on the obscurity of the Falkland Islands; just like Australia, everyone knows it's down there but nobody cares much. This was said to an audience of New Zealanders who like saying such things about the Australians. The Australian Chief Engineer Colonel J A Crocker RAE was also in the audience.

Pom Sendor 4

All work and no play is not the phrase to describe Ex *LONG LOOK*. I was allowed plenty of time for travelling; Rotorua, Tauranga and visiting relatives at Wellington, Ngaruawahia and Havelock in the South Island. I spent most time in the Marlborough Sounds in the South Island, an area noted for scenery, sea food, gold mining and forestry among other things. I spent four days trekking in Mt Richmond State Park in beautiful but dry countryside; one day on the mail run in the Sounds and some time just walking in the valley and on a farm.

Journeying north following Exercise *TRIAD* I spent twenty four hours at Rotorua with another Long Looker and a Māori driver who showed us around. It appears to be *the* tourist spot in New Zealand appearing in all the guide books. It was certainly popular with the Americans and Japanese, and like many tourist spots it was commercialised . . . catering to American tastes anyway. The profligate use of the natural steam for heating hotels has reduced the pressure to the extent that the thermal area, which everyone comes to see, is virtually extinct.

Return of Hercules

At last after sad farewells the time for departure drew near. We left Whenuipai on a Hercules for another seven day island hopping holiday. This time travelling via Raratonga, Hawaii, Los Angeles, Washington, Azores and then Gutersloh.

We were all sad to leave New Zealand, a beautiful country with friendly people and a pleasant lifestyle. The journey home was for many a time for looking forward. For myself a week with the Regiment in Germany, a place where I made many good friends, before more farewells and a move to 39 Engineer Regiment.

Three months later I look back on my time in New Zealand as a most interesting and worthwhile time. With over three hundred photographs in my album I can easily picture myself in New Zealand. I was made to promise to return there, and I really need no persuading. Fortunately, no-one in the Army is indispensible, so I am on my way to ask the Commanding Officer if I may have my six weeks annual leave in one block next Christmas, (or maybe I will apply for *LONG LOOK* again).

A Sentimental Connection

MAJOR-GENERAL D M GRAY, B Sc (CE), M Eng, P Eng, CD

Major-General Donald M Gray is the Senior Military Engineer in the Canadian Forces and currently holds the appointment of Chief of Construction and Properties at National Defence Headquarters. General Gray is a 1956 graduate of the Royal Military College and holds both a Bachelor's and Master's degree in Engineering. He is a former commanding officer of 3 Field Squadron RCE. He has commanded 1 Construction Engineering Unit and was Base Commander at CFB Chilliwack, the location of the Canadian Forces School of Military Engineering. He is a corresponding member of the Institution of Royal Engineers.

On the 26 May 1874, Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada assented to an Act which established an institution

Major-General D M Gray B Sc M Eng

for the purpose of imparting a complete education in all branches of military tactics, fortifications, engineering and general scientific knowledge..... Following this Act on 1 July 1876, the Royal Military College at Kingston opened not only its doors, but also a long association with the Royal Engineers.

The first Commandant of RMC was Colonel E O Hewett, CMG, RE, and his appointment lasted eleven years. He is remembered for having established RMC on a firm military and educational footing which contributed to the development of RMC into a national institution.

The Royal Engineers (as well as other Arms) offered commissions to selected ex-cadets from the earliest days and these commissions were eagerly sought. While this practice ceased during the first days of World War Two a number of firsts occurred by RMC ex-cadets serving with the Royal Engineers.

The first ex-cadet to enter the Royal Engineers was Arthur Hope Van Straubenzee who was commissioned in 1880 and had the distinction of instructing at both Kingston and Chatham. Huntley Brodie Mackay, who was commissioned in the Royal Engineers served in Bechuanaland 1884–5 and as CRE in West Africa 1887–9 and won the first ex-Cadet DSO fighting tribes near Sierra Leone. The first ex-cadet killed in action was William Henry Robinson (CRE west coast of Africa 1889–92) who died while attempting to blow up the gate of a stockade at Tambi near Sierra Leone.

These foregoing historical notes serve only to provide a glimpse of the RMC/RE connection. My real purpose was simply to write a short introduction to cover an event that took place at the RMC on 30 September 1984 in the presence of Brigadier-General Frank Norman, Commandant. The following words, which need no further explanation, were spoken by Major-General George Spencer, OBE, CD, who prior to his retirement had a long and distinguished career in the Royal Canadian Engineers. After his retirement, all Canadian Military Engineers were delighted and honoured that he served as our Colonel Commandant.

"This story is largely about Commandants of the College and about Sappers so it is fitting that it should be told in the Office of the Commandant and in the presence of Colonel Sutherland-Brown, Colonel Commandant of the Canadian Military Engineers.

"Mindful of the debt the College owes to its founding Commandant, Colonel EO Hewett who concluded a distinguished career in the Royal Engineers in the rank of Lieutenant-General; proud of the fact that his successors included five Canadian Sapper Commandants; recalling with pleasure the close ties which existed between the Royal Engineers and the Royal Canadian Engineers, ties which were fostered by the fact that until 1940 many ex-cadets accepted commissions in the Royal Engineers; the acquisition of a military memento belonging to Colonel Hewett was a logical target for the five successor Commandants.

"Our two distinguished senior Sapper Commandants are represented by their families, the late Lieutenant-General KG Stuart by his son Group-Captain VCH Stuart; the late Major-General HFH Hertzberg by his daughter Mrs Dagmar Nation, and also involved but unable to be here today his daughter Mrs Théa Gray and his nephew Captain PA Hertzberg RCE. Regrettably Major-General JA Stewart was unable to be here today. The other former Commandants concerned, Brigadier-General WK Lye and I, are pleased to be here in person.

"So it is with the greatest pleasure that by, or on behalf of, five Canadian Engineer Commandants we present to the Museum of the Royal Military College of Canada this Royal Engineers badge which belonged to our distinguished predecessor Colonel E O Hewett, Commandant 1875–1886."

Our ties with the Royal Engineers continue to this day, as five young officers from the Canadian Military Engineers are presently serving with Royal Engineer Field Squadrons. The presentation of the Hewett Badge to RMC by our former engineer commandants expresses a sentiment which I hope will enhance the spark of professional kinship.

Photo 1. The front and back of the Hewett Badge, now in the possession of the Royal Military College of Canada.

A Sentimental Connecting (1)

Exercise Sixth Shot

CAPTAIN T W WYE RE ENG TECH MHTTA

The author enlisted in 1960. He was trained as a Plant Operator and served in BAOR, Aden, PRA Wing, Hong Kong and Canada. In 1975 he was trained as a Military Plant Foreman and completed tours in Cyprus, Nepal, the Training Regiments and again the PRA Wing. Commissioned in 1984 he is currently serving as Resources Troop Commander in 60 Field Support Squadron.

THE "Shot" exercises are a series of minor engineer projects designed to practice the artisan trades and are conducted annually in Gibraltar. In 1985 Exercise *SIXTH SHOT* was completed by the Resources Troop of 60 Field Support Squadron. The exercise consisted of four entirely separate projects that were to be completed for three independent customers. The subject matter was diverse and certainly could not be described as routine. The allotted tasks were as follows:

1. *Indoor Range*. This involved completely renovating an existing 25yd indoor range situated in the galleries inside the southern end of the "Rock". The work involved the complete demolition of the interior, including training room, and the rebuilding to the latest *NRSA* specification (25m). The Nissen structure was reinforced with new purlins and some new ribs and then completely covered with a new layer of mineral felt.
2. *Royal Navy Youth Club*. The work involved was similar to the range and consisted of partial demolition and rebuilding. It involved most of the artisan trades and enabled the plumbers and pipefitters to practice the now rare task of plumbing into existing sewer systems. It also gave the bricklayers the opportunity of laying a concrete floor and then finishing by laying a screed.
3. *Drawbridge Mechanism Refurbishment*, was to be the task that would keep the "black" trades employed. It involved removing an ageing rusty mechanism from the Landport Tunnel entrance and generally making good.
4. *Renovation of 32lb cannon and the Manufacture of a Carriage*. The Gibraltar Museum Trust had found a 32 pounder cannon and were very keen to have it refurbished, a carriage made for it prior to establishing it as a Tourist attraction at the Moorish Castle. This was the fourth task for the Exercise and it was to provide some interesting challenges.

The mounting of the exercise was not without its high spots. Op *YELSTEAD* severely restricted pre-project training as did the Regimental Cadre. Modes of transport were to change twice, permitted freight was to fluctuate from 15000lbs airfreight to nil and finally to two 8 tonne containers of sea freight. Being told of the non-availability of critical engineering items at the eleventh hour ensured the build up to the exercise remained active. Despite these minor set backs *SIXTH SHOT* was mounted at the allotted hour. Another high spot was reached when the advance parties flight was diverted to Portugal and finally arrived in Gibraltar one day before the

Captain T W Wye RE Eng Tech MHTTA

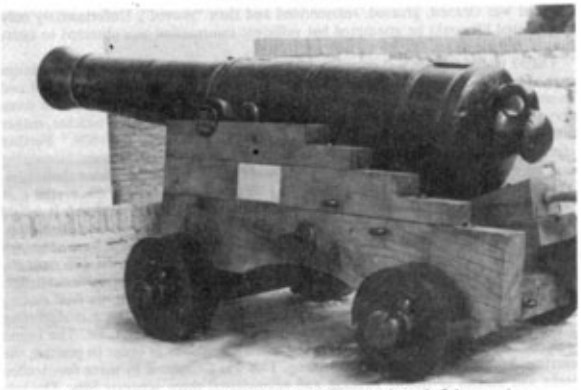

Photo 1 The completed article. Note the markings on the end of the trunnion.

main party. On arrival the Troop was deployed into various sized sections and all four tasks were attacked simultaneously. The complementing of the troop with Clerks of Works Electrical and Construction proved a great boost and it is unlikely that the electrical work would have been completed had it not been for the Clerk of Works (Electrical).

The indoor range was by far the "major" project of the four and completely occupied the Clerk of Works (Electrical) and ten tradesmen. This was at times supplemented with Combat Engineers who were employed mainly on the roofing. This was a very unpleasant job as the space between the top of the Nissen Hut and the roof of the chamber was in places only 0.3m. The carpenters were employed replacing purlins, rebuilding the studwork and reboarding the training room, cladding the baffles and building the bullet catcher and target holder. The complexity of the electrical systems proved too much for the two class 2 tradesmen and only the timely intervention of the Clerk of Works enabled the task to be completed. The electrics were completely new and included ventilation, heating and a variety of lighting paraphernalia to suit most conditions. Some conventional brickwork and interesting sheetmetal work completed the range construction.

The refurbishment of the Youth Club was more routine but provided some excellent training for the tradesmen. Much needed plumbing and pipefitting coupled with screed laying benefited the relevant trades enormously. Genuine tiling, painting and decorating was much appreciated by the painters and decorators who were often reinforced with combat engineers who were employed as "Brush Hands". Some minor electrical work completed this task.

The drawbridge mechanism proved particularly interesting. The bridge had not been lifted for many years, indeed the existing bridge would undoubtably fall to pieces if it was ever attempted. The mechanism consisting of an upper shaft and a lower shaft which were connected by chains from the drawbridge through to the counterweight box that was situated in two runners. The shafts were completely seized and the rails for the counterweight box were eaten away by rust over the bottom third of their run. On dismantling only one casting was found to be broken and all the bearings proved to be in excellent condition. The bridge locking mechanism unfortunately was not complete. New metal was welded to the runners and various wheels, the complete

machine was cleaned, greased, reassembled and then "proved". Unfortunately only a simulated lift could be attempted but sufficient information was obtained to assist future improvements.

The 32 pound cannon was completed by two carpenters and the odd general duties man. The barrel had been buried for many years and was encrusted with mud and concrete. A week was spent chipping away at the accumulated debris before some very interesting data was found. On the end of the left 6" trunnion the number, maker and year of manufacture was found: "... 75311 ... CARRON 1809." Further cleaning unearthed a fine crest, the inevitable ordnance mark and some interesting ranging marks round the base. The carriage made of oak had some hidden challenges. The drawings available were for "general" 32lb carriages. We soon discovered that uniformity is not one of the strong points of nineteenth century cannons. It would appear that weapons of the same calibre came in many lengths and diameters. Considerable changes to the positioning of the "cheeks" of the carriage were necessary to tailor our cannon to its permanent partner. The positioning of the gun onto the "Queen" Charlotte battery adjacent to the Moorish Castle proved a positive challenge. The distance from where the crane could drop the barrel (only) to its final resting place was some 40 metres. This manhandling operation was achieved by manufacturing a cannon trolley which was controlled by the Troop Tug of War team. The barrel weighed some 3 tonnes and this had to be lifted 1.3 metres in order to position the carriage beneath it to facilitate final fitting. This was completed by using four trolley jacks and masses of timber packing and necessitated three separate lifts. The two pieces matched perfectly and the general appearance was greatly enhanced by the very accurate ironwork that had been manufactured by Engineer Resources at Long Marston.

The exercise had lasted six weeks and had provided some excellent artisan training. All the tasks had been completed on time and all customers had expressed their satisfaction. The DRPR produced by 64 CRE (Wks) had proved realistic and the military units in Gibraltar tasked with assisting played their part admirably. The men employed had enjoyed their stay and had not only benefited from some excellent training, had the added bonus of regular trips to Spain and the surrounding countries, but had also taken advantage of the many sporting and recreational facilities available in Gibraltar.

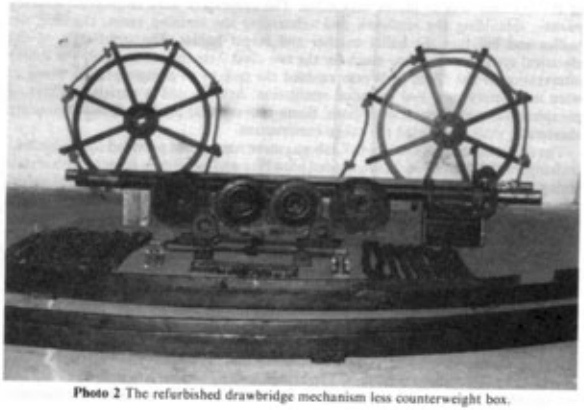

Photo 2 The refurbished drawbridge mechanism less counterweight box.

On Crossing the Rhine

LIEUT COLONEL BRUCE W REAGAN

Lieut Colonel Bruce W Reagan was Battalion Commander of the 150th Engineer Combat Battalion at the time of the events recounted in this article. He retired from the Army in 1965 and is now enjoying a second retirement after fifteen years as a consulting engineer. His article "Sir Donald Bailey's Little Gem" appeared in the December 1984 Journal.

ON the evening of 22 March 1945 General George S Patton's forces were fronting the last major obstacle to the heart of Germany—the Rhine River. Although a bridge had been captured some weeks before at Remagen, and a bridge-head tenuously held, this was to be the first river assault crossing of this famous stream since Caesar's time. General Patton had been goading his troops to get to the Rhine with more than his usual zeal. Only later was the reason for such extra drive revealed. He knew that his arch-rival, the detested Field Marshal Montgomery was mounting an extensively planned assault further downstream for the night of 23 March and Patton wanted this plum for his credits.

At the final co-ordinating conference for this action just before dark, it was revealed that the engineers responsible for the crossing were to be augmented by a variety of supporting units. Included, in addition to extra bridging suppliers, were smoke generators, anti-aircraft and field artillery, special units trained in protective boom construction (a must based on recent Remagen experience) and more importantly, a US Navy Detachment of Landing Craft, Vehicles and Personnel (LCVP) for working in the strong Rhine currents.

The bridge location, long before established by the Third Army Staff was to be at an existing ferry site near the villages of Nierstein-Oppenheim, just south of Mainz. A river harbour with a riverside levee provided some protection from opposing direct fire for assemblage of the equipment. The plan, conventional for such actions but on a considerably larger scale than theretofore, was to ferry the infantry across in small row boats for stealth in overcoming bank side defences, then to follow with a build-up to provide a protective shield for construction of a bridge. Once reasonably secure the bridging could be started. It was scheduled for 0300hrs, a few hours after the assault started. A disturbing bit of news at the conference was that the landing craft were still en route but having trouble making some of the short turns at the masonry cornered streets, typical of many German Villages. Some houses had to be destroyed before the long loads could get through.

The briding equipment of the era, called the floating treadway, was comprised of thirty-foot pneumatic rubber floats each supporting two steel beams spaced to accommodate the treads of a tank. These only twelve foot sections when floated into position, pinned together for articulation, and properly anchored, could support the thirty-five ton Sherman Tank. It was a hairy and undulating passage with floats at times under the water surface. Pre-assembly of the sections—one inflated float, two treads, necessary pins, etc making up one truck load, had already started in the cover

Lieut Colonel Bruce W Reagan

Photo 1 Assembly Area for the floating treadway bridge

of a forest to the rear. At the conference it was decided that the landing craft would be given priority on placement in the water to hasten build-up of troops on the far side. Two were to be assigned to the bridge assembly.

A complication arose. How could the bridge be properly anchored under these ground conditions? The approach was to be at a former, and still active, stone paved ferry slip which was just at the end of the harbour outlet. Near shore anchorage by long steel cable guys to the bank would prevent passage of the remaining float sections at about half way across. It was decided that the bridge would have to be assembled from the far to the near shore—not conventional but do-able.

The initial crews and equipment, minimized as exploratory to determine extent of any opposition and to avoid any appreciable losses of either, were in position to move to the harbour by H hour. Most of the landing craft had arrived but alas, not the unloading crane. At the harbour, after some head-scratching, it was decided to cut a ramp through the stone revetment by dozer, slide the craft off their carriers and push them in with the dozer. Amidst cries by the Navy commander of "You can't do that to my hulls", the craft were soon in the water. Concurrently assembly of rafts consisting of two sections of bridging was underway. There were to be forty-one such rafts to bridge the 972 foot gap. The first raft was towed across amidst splatterings of water from poorly directed artillery. On arrival, the leader, sensing possible complications, decided he'd better check the surrounding houses to ensure that no observers brought in more effective artillery fire—especially with dawn and bettered visibility approaching. The covey of enemy artillery spotters he overcame were either too surprised to react or disconsolate with their position and as dawn came on so did the obscuring smoke screen to inhibit further observation.

The smoke was effective except for the never before seen first jet aircraft—the German Me 262. They heckled the operation all day but their speed and apparently inexperienced pilots resulted in only one hit but the damage was quickly repaired. Later, we found their source. Deep in a forested area, a single assembly track ended at a nearby autobahn. Once assembled, it was assumed, a pilot was told to go up and take out the Nierstein bridge. Consistent over and under dropping of its armament indicated the pilot's inappreciation of the jet speed.

On crossing the Rhine (1)

At 1800hrs the last connecting pin was in place and the armour started rolling across. It was like the fast lane on an Interstate. During all this time the protective barriers were going in. They were in three separate bands stretching at an angle across the river, well upstream. The uppermost was of several steel cables well anchored, floated by 55-gallon oil drums and intended to deflect or stop any damaging barge. The second was a single cable also floated, with concertina barbed wire on top and wire mesh suspended to thwart any swimmer from going over or under. The third was a series of three log booms, lashed together by wire cables and expendable if a surface floating mine should hit them. Along this stretch of river there were also low level artillery and sharpshooters to take out any floating identifiable, large or small.

The always active Rhine had a number of sunken barges abandoned along its banks. Its rapid change of water elevation dictated orders to ensure that all such flotsam be securely tied down. Unfortunately, not all were. The first sight at dawn on 24 March was a disturbing "S" wave in the bridge. A barge below the lower boom had re-floated and found its way into fouling the anchorage and leaning against the bridge. There were some tense moments in re-establishing proper anchorage. Also that night there was another near tragedy. Two "Gamma" swimmers, men in rubber diving suits, were apprehended coming out of the water, hands aloft. They professed to be an especially trained under-water demolition team. That they had gotten into the water several miles up stream, with magnetic mines strapped to their backs and a knife to cut them off. The intent was to float to the bridge, hunch up to attach the mines, cut them off and float on down to see the bridge destroyed. Fortunately, the anti-personal boom diverted them.

So ended a memorable day heightened by the presence of the ubiquitous General Patton. Overlooking the traffic moving across, his query was "Where's my third bridge?" (There was a second finished a few hours after the first a half mile downstream)" "I ordered three bridges and I see only two." Needless to say a third bridge was put in-only to be rarely used because the whirlstorm of action had passed on.

Photo 2 The bridge looking West, completed at 1800hrs 23 March 1945, by 150th Engineer Combat Battalion, length 972ft

On crossing the Rhine (2)

An Officer but Hardly a Gentleman

CAPTAIN (RETD) P J STEVENS WRAC RE

Penny Stevens (née Denton) was commissioned into the Womans Royal Army Corps in January 1981 and became the first woman to be permanently employed with the Royal Engineers. After serving for four years on a Short Service Commission she has retired to join the ranks of underpaid wives and mothers. Her previous experience in engineering before joining the Army was a first class honours degree in Naval Architecture obtained from Southampton University and one year of working with Atkins Research and Development.

SELECTION

AFTER one year of working in civilian life I realised that there must be more to life than earning large sums of money by cajoling a temperamental computer into predicting the motions and stresses induced in floating oil rigs being used in the North Sea. Drastic measures were called for and therefore I approached my local Army recruiting office. Being October the no doubt wise but overstretched corporal smiled and explained that he did not think that the Royal Engineers employed women. I persisted and having got the same answer from the WRAC recruiting office in London returned to the computer to formulate new plans.

Unbeknown to me the WRAC passed my application to the Royal Engineers and the recruiting cogs creaked into action resulting in an interview with a charming district recruiting officer who arrived complete with pre-RCB, RCB and training course dates. Less than two months later following a fun and challenging pre-RCB at Chatham and a more mundane RCB at Westbury, I reported to the WRAC college.

TRAINING

I completed the nine week graduate entry training course at Camberley as this was the only initial training open to me. I will not dwell on this part of my training as the WRAC training has changed considerably since this time; the six months course now being held at Sandhurst. Suffice it to say that although the training was probably adequate for WRAC officers intending to become assistant adjutants or WRAC platoon commanders it fell far short of giving me the background training I required for Chatham. The lack of experience in tactics and field craft was to prove a psychological if not a practical disadvantage on the YO course.

Following Camberley it was baptism by fire with a three week attachment with 22 Engineer Regiment. In retrespect this break offered an excellent opportunity to make up the deficiencies of the WRAC training. However the time spent attached to the various parts of the Regiment did convince me that I had not just made the biggest mistake of my life.

The first part of my YO course, the construction course, made me feel much more at home and was to prove very useful as my troop commander's tour was to be with a construction squadron. The second part, the combat engineer course, proved both challenging and enjoyable. I was fortunate to have female company for the YO course,

Captain P J Stevens WRac RE.

Captain Debbie Foggin WRAC was temporarily attached to the Royal Engineers for the course and a subsequent tour. Her moral support made the steep learning curve much more fun. Before the first exercise I had never cooked compo or handled an SLR and spent days wondering what a "basher" was. Needless to say I survived and my antics must have caused many a wry QMSI smile. I recall the first mineclearing I ever tried on a night exercise clad in a huge pair of combats without braces. I experienced some difficulty in crawling along the ground between cow pats and thistles trying to locate mines whilst holding my trousers up. The directing staff viewed the entire operation through an image intensifier. However, fortunately they did not give up and less than three months later as Staff Sergeant for a double span MGB build at Upnor I not only got the bridge in in record time but felt confident doing it.

In summary the entire YO course was to prove perfectly possible for women. Even those parts requiring physical strength, for example bridge building, simply required determination and enthusiasm. For other ladies I would recommend this as an ideal way to lose weight although it tends to lead to disconcerting biceps size. Throughout the course I continued to fail to grasp any tactics which was mainly a personal failing. I also lacked practice in giving a workable set of orders which resulted from the short WRAC training and should not have occurred if I had had TA or OTC experience.

Troop Commander

I understood when I had been accepted for permanent employment with the Royal Engineers that I was to work mainly in the PQE side of the Corps. I was therefore not surprised when posted to 52 Construction Squadron to enable me to obtain some ground experience. I did sense the relief on the part of all the other potential units. Back in Tidworth on a full time posting the challenge of proving that not all women are dumb and blonde began in earnest. To my surprise I found the Officers Mess caused problems that I had not envisaged. In the same way as any other lone women in this bastion of male chauvinism I found that the sometimes undivided attention I received when I was just trying to relax was not much fun. However after several months peace was eventually established without too much male pride being lost. As far as life in the Regiment was concerned I felt my position was no different to that of the WRAC Assistant Adjutant and found new problems with regimental duties once I had mastered the art of getting into the Orderly Officers' landrover in a No 2 dress skirt.

In comparison, my job as a troop commander was far more of a challenge. My troop Staff Sergeant was everything I had come to expect from my YO course. He never did divulge what crossed his mind when he was informed that he was to be awarded the doubtful privilege of the first female troop commander but I can well imagine. My Staff Sergeant had an excellent ability in letting me do things my way but then rescuing me before too many mistakes were made. In this respect I was probably no different to my male counterpart. However in addition he was to prove one of the few people I worked with in the Corps who could correctly anticipate any unusual problem areas. How many troop commanders have a chance to accustom themselves to the decor of their troop lines before the first room inspection on the pretext of showing me their exact location. In summary I felt we made a good team with the division of labour probably more clearly defined than normal; I handled all paperwork, PR, welfare and morale problems leaving staff to get on with the nuts and bolts of the job in hand.

The other members of the troop seemed to adjust to the change with very few problems. I was judged, I suspect very much by the same standards as my male counterparts. My inability to drink at their relentless pace was countered by the novelty of being able to dance with your troop commander at squadron functions. Their loyalty was all I could have hoped for and was demonstrated usually to my disadvantage on numerous occassions. In one exercise at RAF Bruggen they took on the rest of the RAF junior ranks bar after one of them considered I had been insulted and were sent to cool off in the Guardroom. Less than two days later they were back

again having been caught carrying out a troop raid on the RAF Stores to procure Ma'am a correctly fitting pair or wellingtons, a problem which I had previously asked the G1098 Storeman to rectify.

During the year I completed several CPXs and a squadron exercise at RAF Bruggen and Exercise WATERLEAP 82 on Meaford Range in Canada. I thoroughly enjoyed the time and although my approach to various problems may have been unusual the results seemed satisfactory. My only low point if I could call it such was towards the end of the five months on Meaford camp where as the only women with 250 men I was beginning to doubt my sanity.

Further Postings

On completion of my year as a troop commander I was sent as second in command to 522 Specialist Team Royal Engineers in Willich. Again this posting had been mapped out from the start and the emergence of the Falklands situation meant that Willich was a better choice than Barton Stacey. A number of problems quickly became apparent; a degree in Naval Architecture was no substitute for the long civils course at Chatham and I felt technically lost in the post. During my year as a troop commander I had thoroughly enjoyed working with soldiers and did not relish returning to an office. Finally I was the only unmarried member of a somewhat elite Officers Mess and the youngest living-in member by 22 years.

Fortunately my plight was discovered by the Commander Engineers BAOR and after three months I was sent as a combination of second in command and adjutant to Kiel Training Centre. Although this job was not specifically working with engineers it did give me valuable experience in the fields of adventurous training, Army cutbacks and visits of senior officers. Towards the end of this time with the completion of my intented three year SSC in sight I felt that I had not achieved enough with the Corps. However my future marriage to a Royal Engineer and my determination to extend only if I could get a posting to the same area posed somewhat of a problem to PB7. All parties concerned agreed that we should not serve in the same unit and with my husband joining 28 Amphibious Engineer Regiment as Adjutant my options were limited. The problem was solved by posting me as the Intelligence Officer for the co-located 35 Engineer Regiment although there was a small drawback. In the upside down world of staffing justification the officer serving in this post is permanently attached to the Royal Engineers branch of the Headquarters of 4 Armoured Division at Herford, an hours drive away. With this in mind I decided that discretion being the better part of valour I would only extend for a further year.

The combination of desk work, and exercises at the Headquarters meant that not only was best use made of my abilities but I also thoroughly enjoyed the tour. It was my first exposure to an all arms environment. After a shaky start during which my office companion frequently had to act as a go-between as other staff officers refused to acknowledge that I could be an engineer I eventually found my feet. With no pre-conceived notions and no career on the line I was able to get thoroughly involved in the job without the usual staff worry of having to watch one's back.

Life however was not always a bed of roses, the major problem being that although permanently attached to the Royal Engineers I was still WRAC cap-badged. This meant that I was still bound by all WRAC employment regulations and should not have been deployed forwards of the Corps Rear Boundary. Although this was moderated to read the Divisional Rear Boundary I was still unable to fulfil my proper role with the Divisional Main Headquarters. Instead, on deployment I worked a Royal Engineers desk at the Rear Headquarters which, although it gave me good experience in the field, logistics and administration were very frustrating and led to poor continuity in operations and intelligence for the Engineer Branch. My only other problem in this tour were purely personal and resulted from my attempts to be an efficient staff officer and also a good wife. A year of leaving home before my husband and returning after him, of continually being out on exercise when he was in and vice-versa was certainly a challenging start to the marriage.

Conclusion

I joined the Army to be a Royal Engineer and having to wear a WRAC cap badge was not only an inconvienience it was also misleading. If the Royal Engineers intend to continue employing women they should press to cap badge them and thus take full responsibility for them. In doing this they would then be able to employ them where they saw fit. For practical reasons women would still have to complete basic training with the WRAC at Sandhurst and obviously wear WRAC uniform with Royal Engineers accoutrements.

Finally in answer to criticism that employing women is nonsense as they will inevitably get married, leave and have children. I would suggest that the type of women most suited to the Royal Engineers will follow this path sooner or later. However, being of necessity fairly determined they are unlikely not to complete the minimum commitment of three years and will probably wish to prove the point by extending for a further two years. Far more important in my view is whether the Royal Engineers could employ a woman if she battled through to Major.

Ballooning Days 1887–1888

COLONEL SIR CHARLES F ARDEN-CLOSE KBE CB CMG FRS ScD

A recent gift to the RE Library has been an album of early photographs and supporting text put together by Colonel Sir Charles Arden-Close in 1938 to record his experiences in early ballooning in the Corps. The album is the gift of his son Colonel R F Arden-Close. This article is the main text in the album and is supported by two of the many interesting photographs.

In the year 1873 tentative experiments in ballooning in the British Army took place at Woolwich. In that year Captain C M Watson was engaged with Sir Frederick Abel in working out schemes for generating hydrogen for balloons. In 1878 Watson was working with Captain Templer and in the same year we find a "Balloon Committee" consisting of Col Nugent, Abel and Col Noble, with Watson and Templer, experimenting with the fabric for balloons. Captain Templer owned two private balloons, the *Crusader* of 25,000 cubic feet capacity, and a smaller one, the *Pioneer*.

On 3 July 1878, Templer and Watson took a free run in another balloon, the *Excelsior*, coming down at Ardingly in Sussex. On 11 September they took a free run in Templer's balloon the *Crusader*, and came down at Ilford. Meanwhile experiments were continued with regard to the manufacture of hydrogen, the use of captive balloons, the construction of a light flexible wire cable, the use of steel tubes for containing the hydrogen, and many other details. Watson became ADC. to the Inspector General of Fortifications (IGF) in October 1878, and left the balloons. The IGF. in those days was Sir Lintorn Simmons, who was Lord Beaconsfield's military adviser at the Berlin Congress. In 1882 the balloons were moved from Woolwich to Chatham.

In those days, and for many years afterwards, very little money was available for the balloons. The officers who worked at the subject were usually employed on other duties as well. Amongst those officers may be mentioned Captain Lee, Lieut Macdonald and I believe, Lieut Mackenzie. All contributed to a gradual improvement and standardization of the material.

Lane-Poole, in his life of *Watson Pasha*, mentions a still earlier pioneer in ballooning, Colonel G E Grover, who did some ballooning in 1862. But I suppose that this was unofficial, and I think that we can put the first beginning of British official Army ballooning as dating from 1873.

The next name of importance in this history is that of Major H Elsdale. I don't know what was his first introduction to the subject, but it is certain that in 1883, when

he was at Halifax, Nova Scotia, he carried out some very interesting experiments in Balloon Photography. He used small balloons, filled with coal-gas, the balloons being just large enough to lift the camera, which had an arrangement by which, after a certain interval, the plates were exposed in succession. Then the balloon automatically tilted up, and came to earth. To prevent injury to the camera gas buffers were tied round it. These, and the fact that the little balloons acted as parachutes when falling, did effectually save the camera and plates from damage.

I have two of the prints of these air-photos taken in 1883. Elsdale has written on the back of one of them: "This is a plan of the citadel of Halifax, taken by me in 1883. It is greatly fogged owing to the rough paste-board camera employed not being properly light-tight. But it shows the outline of two-thirds of the citadel very well, with the two Ravelins and their masonry keeps". On the back of another balloon photograph, taken by Elsdale in the same year, he has written: "Plan of the Barracks &c near the citadel, Halifax. We made a plan from an enlargement of this negative, (originally only 5 inches square), which was accurately tested by careful chaining on the ground. The result was extraordinarily good. A small element of error was introduced into the plan by the great difference of level of the ground, which is sloping down from the glacis of the citadel ... At higher elevations of the Balloon the error caused by the ground not being a flat plane ... would of course be reduced in proportion to the elevation".

So far as I remember Elsdale used sometimes to let the little photo-balloons up on a string. But of course, in these cases, the balloon would not go very high. Curiously enough in the last few years, Mr P L O Guy, the archaeologist, has been using exactly the same method to get air-photos of ancient sites. He took such photographs at Megiddo in Palestine.

All this work of Elsdale's was his private undertaking; he paid for it all himself, anyway in those days. A few years afterwards I think that the War Office may have allowed a little money to be spent on similar experiments at Lydd and at Chatham. Certainly when he left the Balloons some of these cameras were available at the latter station.

A few years later, I think in 1891, when I was serving on the Survey of India, I asked the Surveyor General, Colonel Thuillier, if we could ask the Home Government to lend us one of these cameras, and a small balloon, and some tubes of hydrogen. Rather to my surprise the Home Government at once agreed, and the whole apparatus arrived at the Survey of India Offices at Calcutta.

Now, my idea, which I put forward with the original scheme, was to photograph some of the ruined cities of Agra from the air, with a view to getting plans of some of these intricate ruins. But my chief, for whose memory however I have a great respect, would not allow this, and decided that the experiments should be limited to Calcutta. Calcutta was not a very suitable place. There was no freedom, the place was a mass of houses and gardens, and worse than all, the weather was bad.

Well, we flew the small balloon from the roof of the office, but it was rather windy, and not very bright, so we got rather poor results. I had to go off in two days to Burma for my work on the survey of that country, and that was all. If there had been anyone keen on the matter at the Survey Headquarters at Calcutta, a good deal might have been done, and the Survey might have led the world in air-photography. Of course, nowadays, balloon photography is only of value in very special circumstances, such as the mapping of archaeological sites, and very rarely even then. The aeroplane has almost completely superseded the balloon.

Some time between 1878 and 1884, but I do not know the exact year, Templer's ballooning days, that is, his days of active ballooning, were brought to a sad end. He was taking a free run with a Member of Parliament named Powell, and they found that they were being blown out to sea. Templer, quite rightly decided that the thing to do was to bring the balloon down close to the ground, and then for both of them to jump together. I suppose that there was a strong wind and that he did not think that the grapnel would hold.

Photo 1. Balloon (Chatham?) c 1889

Anyway, he brought the balloon down, gave the word to jump, and Powell's nerve apparently failed him, for he did not jump. The balloon went up and out to sea, and Powell was never heard of again. After this tragedy Templer never got into the car of a balloon again, and he never did any practical ballooning all the time I knew him. Though he was useful in minor ways, especially in the matter of material.

Balloning Days 1887,1888 (1)

USE OF BALLOONS IN WAR. In 1884–85 the French used balloons in the Tongking campaign. We sent out a balloon detachment to the Bechuanaland expedition. This expedition was under the command of Sir Charles Warren, who had about 4000 men under him. I remember very well the farewell dinner that we gave him in the RE Mess at Chatham. The expedition reached the Vaal River in January, 1885, and was completely successful. Elsdale was in command of the Balloon Detachment, but, as far as I can remember, the balloons were not able to do much on account of the height of the country above sea-level. Of course these balloons were of the old spherical type, for "Sausage" balloons had not then been invented, though a few years afterwards we did begin to experiment with small long balloons, intended to keep in the eye of the wind. But we were a long way off the Caquot balloon of 35,000 cubic feet used in the Great War.

MY INTRODUCTION TO BALLOONING. I came back to England after a year's service at Gibraltar, in January, 1887, and was posted to a Depot Company at Chatham, with a view to finishing my courses and qualifying for service in India. Whilst finishing these courses I was appointed Secretary of the Thames and Medway Defence Committee, but that is another story.

In those days the balloon establishment consisted of, Major H Elsdale RE, OC Balloons; Major J Templer, Instructor in Ballooning; Lieut G E Philips RE, Lieut H B Jones RE, a detachment of 13 NCOs and Sappers; with a small civilian constructional staff. For transport there were two gas-tube wagons, one balloon wagon, and one general service wagon. The establishment was housed in some wooden huts on the way to St Mary's Barracks. Horses were borrowed as required from the Field Company RE. I don't think they liked the arrangement much.

Elsdale asked me if I would like to serve on the Balloons, and, as I got on well with Phillips, who was in my batch, I said that I would. Subalterns were only attached, and I belonged to a Depot Company, but spent most of my time with the balloons. Phillips was half French, and knew something of what the French were doing about military balloons. I joined the Balloons in 1887, and went out with the rest to the Balloon Camp at Lidsing, near Chatham. Here we had a certain amount of practice with captive balloons and an occasional free run. Major Elsdale was then OC Balloons and Major Templer was Instructor. The position as between Elsdale and Templer was a difficult one, and ultimately culminated in a court martial, Templer being accused of communicating secrets to some foreign officers. Templer was honourably acquitted, and looking back upon the unhappy incident after fifty years I am convinced that the fault lay not so much with Elsdale as with the higher authorities, for Elsdale merely communicated his suspicions to the Commandant, suspicions which were proved to be groundless.

A very pleasant part of our work was the annual Siege Camp at Lydd. Here we spent, (that is H B Jones and I), some weeks practising the observation of artillery fire, from captive balloons. This was usually done from a distance of about two miles, and as the balloon rarely went higher than 1000 feet in those days, it is easy to calculate that we obtained no searching view; though it was, of course, better than could be got from the ground.

On one occasion I was going off for a free run, with F H Kelly, now deceased, as a learner in the car, when the men who had the duty of letting us go, did not allow enough "lift"; so the balloon *Swallow* with the two of us on board, could not be got to rise properly, in spite of our throwing out much ballast. We hit a neighbouring farm house just above the front door, then climbed up the roof, where the balloon became entagled in a chimney and split; the gas poured out; we slid down the roof; were caught by a small parapet, and climbed down ignominiously by ladder to mother earth. General Richardson, RA, the Commandant, painted the scene on a panel in the mess hut. I expect that the panel has long ago disappeared.

In 1888, during an inspection by the then I G F, General Nicholson, I went off for a free run from the flat ground, opposite to St Mary's Barracks. I passed over the

Photo 2. Balloon Detachment RE 1887

Dockyard and was impressed by the admirable view for photographic purposes of that establishment. Shortly afterwards I got into a rain storm and the first that I knew of it was a small torrent of water pouring down my neck,—the top of the balloon had collected the water and a small oscillation had spilt it into the car. Before this, on another run, with Phillips, I think in 1887, we saw a curious optical effect, which has been noted by other balloonists; the image of the balloon in rainbow colours, projected on to the clouds, with the shadow of the car in the centre of the balloon thus outlined.

Let me end with a small story. At Lydd I had the pleasure of showing a lady the balloon *Swallow*, which had been filled with gas and was securely tucked down behind the screens. I showed her the car, and the grapnel, the sand-bags and the rest of the apparatus. She said that she thought that she understood it all, except one thing. Then she said, "How do you breath inside"?

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Balloning Days 1887,1888 (2)

Memoirs

MAJOR GENERAL SIR J DRUMMOND INGLIS, KBE, CB, MC

Born 4 May 1895, died 7 January 1985, aged 89

JOHN DRUMMOND INGLIS ('JDI'), who came from a family with a long history of military service, was educated at Wellington and the Shop. He was commissioned into the Corps in August 1914 and served during World War I with 38 Field Company and later 17 Field Company, both in Macedonia. He was awarded the MC in 1916 and promoted brevet Major in June 1919.

After the war he did a Supplementary Course at Chatham and a Long E&M Course. In 1923 he was appointed an Instructor at the School of Electric Lighting at Gosport. In 1926 he was made Superintendent of the Air Defence Experimental Establishment at Biggin Hill. This establishment served "B" Committee of the RE Board, established after the war to deal with research and development across the whole field of equipment then the responsibility of the Royal Engineers, including bridging, demolitions, field engineer equipment, air defence, signals, radar and camouflage.

In 1931 Drummond Inglis was posted to India as Garrison Engineer at Bannu where he remained until he returned to the United Kingdom in 1934 as Vice-President of the Mechanization Board in Woolwich Arsenal. He was promoted Lieutenant-Colonel in September 1937. At this time the situation in Palestine, where efforts were being made to establish a national homeland for the Jews, was deteriorating and in October 1938 Drummond Inglis joined 7 Division as CRE based on Jerusalem. He was awarded the OBE in July 1939.

On his return to the United Kingdom he was promoted Colonel and appointed Deputy Chief Engineer Home Forces in July 1940, Chief Engineer South Eastern Command in January 1941 and Chief Engineer GHQ Home Forces in the rank of Major General in April 1942. It was at this time that his great contribution towards the planning and execution of the engineer support to the invasion force began. He had taken part in the initial studies by HQ 1 Corps in December 1941 which, incidentally took place at Minley Manor. From then on he presided over the many complex aspects of the preparations for the Normandy landings and the subsequent operations in Europe until the end of the war in 1945, having been appointed Chief Engineer 21st Army Group in July 1943. His early recognition of the fundamental engineering problems involved in an opposed landing across shelving beaches, and insistence on the necessary support played a major part in the success of the whole campaign. In December 1945 he gave a lecture on the work of the Royal Engineers in Europe 1944 to 1945, reprinted in the *Journal* of June 1946 from the *RUSI Journal* of May 1946 which must be the definitive succint account of the engineer contribution to the campaign. Full of lessons from which many would benefit today this dispassionate account reflects a thorough going engineer with an immense capacity for organization and an exceptional ability to accept heavy responsibility. Indeed, he is remebered as a man who did not suffer fools gladly but was kind, sensitive and modest; reluctant to talk of his many outstanding achievements.

For his services during World War 2 he was awarded the CB in 1944 and created a KBE in 1945. He was also made an officer of the Legion of Honour, a Knight

Major General Sir J Drummond Ingles KBE CB MC

Grand Officer of the Order of Orange Nassau and awarded the French Croix de Guerre with palms.

General Sir Drummond Inglis was appointed Colonel Commandant in 1945 and was Representative Colonel Commandant in 1956, the year of Her Majesty the Queen's visit to the RSME. In retirement he went into business first with BOAC and later as chairman of AVP Industries, the plywood group, while still continuing his wide range of outside interests which included exercising his talent as a painter in oils. After his first wife died he married a great friend, Joan, with whom he enjoyed a happy companionship in his latter years and to whom our deepest sympathy goes.

REJ

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SIR DONALD BAILEY, Kt, OBE, D Eng, C Eng, MICE, MI Struct E, JP

Born 15 September 1901, died 4 May 1985, aged 83

Sir Donald Bailey's death this year was an event of special poignancy to Sappers who have been intimately concerned with the Bailey Bridge over the years or worked with him on this or other projects. This memoir recalls Sir Donald particularly as a man rather than attempting to do justice to his celebrated engineering achievements.

DONALD COLEMAN BAILEY was born at Rotherham and educated at the Leys School, Cambridge, and Sheffield University where he took several degrees culminating in a Doctorate of Engineering.

His early experience was obtained in the Efficiency Department of Rowntree and Company, in the Civil Engineer's Department of the LMSR and in Sheffield's City Engineer's Department before being recruited into the Scientific Civil Service.

He joined the Experimental Bridging Establishment (EBE) in 1928, as a Civilian Design officer, at a time when this was run by a Sapper captain and was located in converted stables in a corner of the Gunner barracks at Christchurch. SAS, then the captain concerned, recalls some of the problems in those days of having to vet designs from outside, "Examining them with care to see if any germ of an idea might be valuable. Donald and his few staff took this in their stride but had to have versatile minds to deal with such items as tank stepping-stones, mat bridges, rope ladder bridges and many more, and yet keep the main programme turning. By a miracle it became apparent that Donald's idea of the Panel Bridge, rechristened the Bailey Bridge, would enable several other designs then in contention to be superseded. As tests progressed it was astonishing how the versatility of the design was found to fulfil other needs. Fortune seemed to smile upon the project from the start."

The contribution of the Bailey Bridge to the winning of World War Two has been well chronicled. Two articles in the *Journal* as recently as December 1984 make the point; one an unsolicited testimony from a US Army Engineer, the other illustrating the scale of the bridging requirement in Italy.

Sir Donald Bailey Kt OBE D Eng C Eng MICE

Colleagues of those days remember the man who presided over this miracle. DMD writes "He was a man for whom I have always felt the highest regard. Both at work and in his private life he was always modest, considerate and courteous and I consider myself privileged to have had the opportunity of not only working under him but also counting him as a friend."

RF writes: "I just met Donald in early 1941 when my father, as a member of the Ministry of Supply's Structural Engineering Committee, was called in to advise on the design of the Panel Bridge. Later, after joining the Sappers, I was posted to the EBE and worked under him. It was a most satisfying experience as, by that time, the "versatility of the design" was being exploited to the full. I was privileged to have a hand in this and, later, to be attached to Chief Engineer HQ 21 Army Group to help the troops in NW Europe to make the best use of the Bailey Bridge equipment."

Sir Donald Bailey's memorial service took place in the Priory Church Christchurch. The address from which the remainder of this memoir is taken was given by HATJ-K who, as lieutenant, was Experimental Officer at EBE when Bailey was appointed and became a close colleague over many years.

"He had a natural flair for engineering design particularly in his development of welded structures, of which he was a pioneer. He was such an easy man to work for, never ruffled, always considerate, and positive in his criticism of one's designs and calculations. I do not remember a single cross word from him and when crises occurred he was resolute and unflappable.

"When he became the first Director of the Military Engineering Experimental Establishment I returned as his Deputy and so had experience of his administrative and leadership qualities. During the fifty-four years that he served at Christchurch, he did much to build it up into the efficient research and development establishment it was acknowledged to be. During this time he became a very good friend of the Corps of Royal Engineers, of whose Institution he was an Honorary Member.

"But despite the responsibilities that were his lot, and the honours that were rightly bestowed on him, Donald Bailey always remained an unaffected and simple family man, an affectionate husband, father and grandfather. He was a friendly and approachable man, whether at the Golf Club, or with his cronies round the bar at the Kings Arms. He was as happy with a junior draughtsman or a fitter in the workshop as with a General or a Minister of the Crown; all felt at ease with him.

"He left Christchurch to become Dean of the Royal Military College of Science at Shrivenham. There his renown and prestige did much to enhance the University status of the College; and his long experience of working with military officers stood him in good stead with a mixed military and civilian teaching staff.

"After his retirement in 1966, and his first stroke, Donald had five happy years in Southbourne with Phyllis, who had been such a support to him throughout his career since 1933 when they were married in this Priory Church. But after her death, it was not very long before he suffered the most incapacitating stroke that marred the last years of his life. His great brain remained active but the severe impairment of his speech must have been most frustrating. However, after a time, Mildred came into his life and made a substantial number of his last years reasonably happy and peaceful.

"Let us all then join with his family in thanking God for him, some of us with memories that endeared him to us—memories of a truly great but humble man, who rightly deserved the honours bestowed on him, for he served the nation faithfully and well."

RF, SAS, DMD, HATJ-K

BRIGADIER J R T ALDOUS CBE MC DL

Born 5 October 1898, died 11 July 1985 aged 86

JAMES ROBERT TRAVERS ALDOUS was educated at Cheltenham and Magdalene College, Cambridge. He was commissioned into the Corps in 1916 and joined 210 Field Company in France where he won an MC. JCBW, a fellow subaltern in the same company writes of those days. "The Great War in France in 1918 consisted of long periods of dull routine and mild discomfort, interspersed with comparatively short periods of extreme liveliness. Jim managed to survive the former without getting bored and the latter with dignity and élan—in brief, a good sound professional soldier." Brigadier Aldous wrote an article about an episode in World War One, "Something of War", published in the *Journal* in March 1981, which is a vivid portrayal of the realities of battle and the human reactions to it.

After the war he served with the German Polish Boundary Commission in Paris and, after a course at the SME, was posted to 13 Survey Company in which he served for six years until 1928. He then joined the Bombay Sappers and Miners and spent two and half years as a company commander, seeing service on the North West Frontier before returning to the Staff College, Camberley.

Various staff jobs then followed in the South of England until he went to France with the BEF in 1939 as GSO1 LofC. On his return to England he became CRE 2 Division until October 1941 when he took up command of 5 Infantry Brigade which he took to India. In August 1942 he was appointed BGS 4 Corps in Assam. Of this time CARN writes "As the BGS to General Scoones, he was faced with appalling problems. The withdrawal of the remnants of the Army from Burma; many thousands of refugees fleeing from Burma using tracks through the very mountainous country (there were no roads); the organisation of the defence on a 500 mile front with the minimum of troops and negligible air support. At the same time he had to start planning the re-entry into Northern Burma in the winter of 1942/43 in order to start the construction, with American assistance, of a road from Assam to link up eventually with the Burma-China road.

"Whilst he was heavily involved in these devastating problems, he suddenly started losing his sight. The doctors, unable to diagnose the cause, eventually decided to evacuate him to the UK by sea round the Cape. This took months. At Millbank, after extensive tests, the trouble was finally diagnosed to be due to a faulty growth of a wisdom tooth."

After he had recovered from this misfortune he spent a year as Commandant of the OCTU at Newark until being appointed BGS HQ Northern Command. He was awarded the CBE in 1946. In 1947 he was given command of 161 East Anglian Independent Brigade at Colchester, retiring from the Army to farm in March 1950.

As well as building up a 750 acre farm into a flourishing concern and which he continued to run until a few months before his death, Jim Aldous gave much of his time to local affairs in Suffolk. He became Chairman of the County Council, of the East Anglian consultative committee, a JP, High Sheriff and Lay Canon of St Edmonsbury Cathedral.

A keen sportsman, he had ridden his own horses in steeplechases and point-to-points in the years before the war. Latterly, in addition to his continuing involvement in the

Brigadier J R T Aldous CBE MC DL

countryside and farming he took an interest in poetry, winning the Crabbe Memorial Prize on one occasion. A devoted family man, he had married Nancy Morse in 1925. They had two daughters and a son, now serving in the Royal Regiment of Fusiliers, to whom we extend our deep sympathy on the loss of a much loved father.

JCBW, EICJ, CARN

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MAJOR GENERAL A J H DOVE CB CBE

Born 25 August 1902, died 25 May 1985, aged 82

ARTHUR JULIAN HADFIELD DOVE was born in New Zealand but was educated at Haileybury. He won a Prize Cadetship into The Shop where he won the King's and Pollock Medals and four other prizes. From the start of his career, it was evident that he was a man with high intellect and perception, gifts which were to prove invaluable in the demanding staff appointments which he was to hold with such distinction in later years.

As a young officer he pursued many of the outdoor activities which attracted others of his day and generation. He was an accomplished fencer who specialised in the sabre, performing creditably at the Royal Tournament on several occasions and he was a formidable opponent on the tennis court and in the boxing ring. He was confident on horseback and enjoyed all team games.

After serving as a troop commander in 9 Field Company at Shorncliffe, Dove was involved in the survey of the greater part of Northern Sierra Leone—a task which gave him exceptional independence and responsibility as well as the challenge of leading a substantial native workforce. Tours as Garrison Engineer in Catterick, Iraq and West London preceded his attendance at the Staff College in 1934–35. Dove was appointed briefly as Second-in-Command of 42 Field Company in Egypt in 1936 at the time that mechanization was occurring, but as the Palestine situation deteriorated he was made Brigade Major of 16 Infantry Brigade. He played a major part in the developing use of mobile columns which proved most successful, and before he was posted to the War Office as a GSO2 in DMT he had been awarded the MBE and mentioned in despatches twice.

In the early stages of the war, Dove served on the staff of GHQ BEF in France coordinating the obstacle plan prior to the evacuation at Dunkirk and at GHQ Home Forces under Field Marshals Ironside and Alanbrooke. He was responsible for two major exercises designed to test coastal defences and concluded that if Hitler had endeavoured to invade England in late 1940 or early 1941, he could not have failed.

After commanding 13 Field Squadron and a short tour as Deputy Director of the Home Guard, Dove was appointed CRE of the Guards Armoured Division, much of his training concentrating on the use of the new Bailey Bridge. After a short tour as Chief Engineer Combined Operations, during which Dove directed the Sapper reconnaissance of the Normandy Beaches, he returned to the War Office in 1944 as Deputy Director of Military Operations. During his three years his tasks included the preparation of the Control Commission for immediate post-war Germany and personal involvement in the treaties with Italy, Hungary, Bulgaria, Rumania and Finland. This

Major General A J H Dove CB CBE

brought him into close contact with Ernest Bevin and took him into the negotiations inside the Palace of Luxemburg in Paris and the Kremlin. For his extensive contribution in such a demanding appointment, Dove was awarded the CBE in 1946 and the CB in 1948.

From 1947 to 1950 Dove was Deputy Adjutant General at Bad Oeynhausen. These were testing days for those in BAOR. Uniform had to be worn at all times, fraternization with the Germans was forbidden and internationally the situation was tense as it became evident that Russia could no longer be treated as an ally. NATO was in its infancy and the Berlin airlift took place. Although Dove had never served on the 'A' side before, his calmness and high powers of intellect won him many admirers.

In 1951 Dove was appointed BGS(SD) at HQ MELF at a time when the Middle East was the centre of much unrest. Enosis and Mau Mau were developing in Cyprus and Kenya, the Abadan crisis occurred, there was an overt threat to the Middle East from Russia and Egypt abrogated the 1936 treaty with Britain. Dove was regularly dealing personally with Nasser and returning to London to brief Eden as negotiations approached crisis points. When Dove went to say goodbye to Nasser, the latter remarked: "I must never forget that the British Government is my enemy number one. But (with a smile) we do rather like Englishmen!".

Dove's last appointment was on promotion to Major General as Director of Quartering from 1954 to 1957 at a time when the Army was still 400,000 strong and the Middle East situation was still volatile. He travelled extensively to gain first hand knowledge of problems and was painstaking in the burdensome task of getting his estimates accurately assessed.

On retiring in 1957 he became Technical Director of the Federation of British Industry and became Chairman of the RE Association and a Colonel Commandant in 1961. He also served on the governing bodies of twenty-six organizations with philanthropic or spiritual aims.

Contemporaries who knew and worked with Arthur Dove found him invariably to be a modest, cheerful, genial and sympathetic companion. In particular he was known for his quiet but forthright Christian faith. This had not come to him naturally. As a YO at Chatham he realised after attending a meeting by invitation of two brother officers that in spite of having godly forbears (his grandfather had been Primate of New Zealand) and being as outwardly correct as others, he was in fact spiritually bankrupt. Quietly but decisively he put his trust in Christ. It was a fulcrum moment and for the rest of his life it could be said that he walked with God.

In 1947 Arthur Dove married Betty Bartholomew who shared his ideals in every respect and created for him a most happy home life. SHMB recalls a prosperous and delightful OCU weekly Bible study which they ran: "Arthur's dissertation on Christianity and the challenge of communism was crystal clear and to the point. That was just one of his expositions; but whatever the subject in the light of his Bible reading and Christian thinking" To Betty and their daughter Susannah we offer our sympathy and record our gratitude at having known so effective a Sapper officer and so consistent a Christian man.

WICD SHMB DMRB SAS

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Correspondence

Lieut Colonel J A F Walpole RE
CIS (ADP) 4
Room 1256
Main Building
MOD, Whitehall, London SW1A 2HB

Rogues Gallery

Sir,—I refer to Brigadier Genet's letter in the September 1985 *Journal*. I fully support his suggestion about brief career summaries and photographs of newly promoted Sapper Brigadiers.

I believe that another 'important' category of reader could be added to his list; those officers who spend much of their time away from the Corps. For example, in the last nine years I have only served with the Corps for two years, the remainder having been spent on staff training and in staff appointments. In two years' time when I finish my current tour the proportion will be rather worse!

In idle conversation with two other serving officers of similar vintage it became apparent that they would both welcome the idea. Indeed there was a thought that the scheme could usefully be applied to newly promoted Sapper Colonels; but perish the thought.—Yours sincerely, J A F Walpole

Colonel G C Clark OBE
Stoke Farthing
Broad Chalke
Salisbury

The Royal Engineers Draghounds

Sir,—I read the recent article by Lieut Colonel Coombs in the *Journal* on the post-War history of the R E Drag with great interest. I do not know of any similar record having been made of its pre-War history and, to complete the record, the following details may be of additional interest.

J E C McCandlish took over as Master when John Marsh left Chatham in 1931. He was followed by R E Black (1932), G C Clark (1933) and F S Davey (1935). The Secretary and Treasurer during those years was A J Edney, while H S Francis, P J Scratchley and A G Tuite were Whips.

Hounds were kennelled in the old Fort situated on the Great Line beyond the U S Tennis Courts and overlooking Chatham Town Hall. Driver Hanson was the Kennelman.

At the beginning of each Season about twenty "fifteen-bobbers" were taken over from a Cavalry Regiment at Aldershot (who always did us very well) and these, supplemented by the three Chargers and one or two of the dozen light-draught horses on the strength of the Training Battalion provided enough mounts for the reasonably large Fields.

The Drag met twice a week and, with about a dozen Lines, all maintained by Posted Officers or YOs. we were able to organise quite a varied card of Meets covering the country between Meopham on the West and The Three Squirrels at Stockbury on the East.

The season ended with Hunter Trials at Chattenden and the monthly bill for anyone hunting regularly on one of the "fifteen-bobbers" was something like Five Pounds!—Yours sincerely, G C Clark

The Revd N D Howell-Everson
The Rectory
Bamford
Nr Sheffield

Searchlights in the Corps

Sir,—Please may I be permitted to make a small correction to Appendix A to Brig Chichester-Cook's article on Searchlights in the Corps?

The Queen's Surrey Regt 4th Bn, never rebadged as Sappers, having been one of the curious cross-breeds between Infantry and Gunners, and eventually rebadging into the RA as 63rd SL Regt. The 30th Bn were raised and remained Sappers until transferred into RA in 1940. The Kent Fortress Engineers became 74th SL Bn RE: I don't know what the 29th raised from, but it may have been from scratch.

I speak with some feeling about the Queen's as they were based on Mitcham Road Barracks in Croydon which had a superior Belisha Drill Hall erected for the benefit of 315 Coy 30th Bn, in which I was enlisted. The Jews had no dealings with the Samaritans in those days, and I am sorry to say that there was a good deal of professional contempt expressed by the "proper Electrical Engineers" for the "amateur" infantry stable-mates.

I believe that there were small detachments of "Fortress Engineers" who managed to retain some form of independence during the RA take-over, and these had a longer history of operating AASLs than the Bns numbered 28 onwards; it would be interesting to hear from anyone who served in their early days.

Training was exceptionally keen, in the post-Munich era—does anyone remember Brig Perowne's bible "The Training of the AA Spotter" which all units devoured, and the constant week-end exercises and twice-weekly drills which made the detachments really capable of looking after themselves when the time came?

There is scope for a history of AA Command from its earliest days (its keenest) to its latest (its most scientific). So far as I am aware there has never been published an Order of Battle of the complete Command, and it will soon be too late.—Yours sincerely, N D Howell-Everson.

Mr H J Raymond
Hollyhurst
Woodland Road
Darlington DL3 9LW

Searchlights in the Corps

Sir,—I have been most interested in the articles on searchlights in the March and June *Journals*. However, neither article has dealt with the early use of searchlights by the Corps.

Searchlights were used in the submarine mining days to illuminate minefields and I think they were used in Survey work in Africa in the last century.

Again, they were much used in Coastal defences. Both the submarine mining uses and coast defence uses are dealt with respectively in the *Submarine Mining Manual of 1880* and in *Military Electric Lighting Volume II (1909)*, yours faithfully, Harry Raymond

(Mr Raymond served a full career in the Corps starting in Boy's Service. He served in many parts of the world including Italy during the war and has experience of searchlights in Malta, Bermuda and the United Kingdom.)

Book Review

GREAT UNCLE FRED'S WAR
EDITED BY ALAN PRYOR AND JENIFER K WOODS
(Published by Pryor Publications. Price £7.95)

SAPPER Fred Mills set out in September 1917 with the rest of a draft heading for the Middle East. Their journey took them through France and Italy and by sea across the Mediterranean to Alexandria. Fred remained in Egypt until January 1920 when he returned to England for discharge. Thus he served on the fringe of the war taking no part in actual combat.

He did, however, keep a diary throughout the period recording in it simple but often acute and revealing observations about the places he visited and life in the ranks. Its attraction lies more in the flavour it gives than in any historical facts it reveals.

The diary has been edited by his great niece and published by Pryor Publications with a painstakingly researched series of photographs relevant to the events Uncle Fred observed. It makes a delightful and well produced book which will enhance any collection of the period.

GWAN

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Journal Articles

THE Editor is always pleased to consider articles and correspondence submitted for publication in the RE Journal.

The latest date for submission is two and a half months before publication (eg, by 15 September for the December Journal).

Submissions should be typed double-spaced, ideally no more than 12 to 15 pages of typescript.

Illustrations can be reproduced from coloured or monochrome photographs, slides or negatives, drawings, maps or sketches. They should be accompanied by a suitable caption.

Only *unclassified* material can be published. Security clearance should be obtained before submission.

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