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Editorial

WHAT DO YOU THINK OF THE JOURNAL?

REVIEWS of the quality, content and presentation of the *RE Journal* occur with the regularity of Hailey's Comet, albeit with greater frequency. One wonders what that heavenly body feels about the version he (she?) has viewed this time round compared with his previous visit. Superficially there are remarkable similarities. At 1s 6d the magazine was not cheap but it was the same shape and general layout inside. It was a monthly production with the twelve issues spread between two volumes, but this quantity of material is hardly appropriate to the days of the electronic media. Here is the big difference: over half of the content of Volume XII was concerned with military science and technology, a third with matters of organisation training and sport, one fifth with biography and memoirs and one tenth with history.

Now our needs today are not necessarily the same as those of the 1910 generation. However, what Halley has seen this time round looks more like a collection of historical reminiscences than a learned journal. "Learned journal", you say, "who wants to read all that technical jargon?" Therein lies the dilemma. When Halley was last around technology was still a field of fascination for the man in the street, or so it seems looking back. Articles about communications, submarines, flying and explosives (all covered in Volume XII) were not indigestibly technical but nevertheless were highly relevant to the military profession. But perhaps Lieut A C Fuller's article on Wireless Telegraphy with its simple diagrams and hints of O level physics fell on equally stony ground as Captain A P Sowerby's article on Computer Communications in March 1985. May be what we need is not so much a "learned journal" as a "professional journal".

Above all, readability seems to be the main characteristic which people seek today. The *Journal* needs something more to encourage people to open it. It lacks professionalism but it lacks also the personal touch, or so the modest feedback we receive seems to be saying.

There is also the question of presentation. Halley may have been startled to find that the cover of the *Journal* had turned from blue to white during his last absence. He may also wonder why it has not moved a little further with the times.

The last great effort to improve the Journal was in 1979. Apart from the change in jacket design, a spate of exceptionally good forward looking articles and a lively discussion in the Correspondence section ensued. There is some feeling that we need to make another big effort and may be even turn to slightly more radical measures to make the Journal more attractive to its whole readership. A number of ideas are being considered by the Publications Committee and some first thoughts are:-

Content. More up-to-date articles, possibly including some on equipment and techniques coming into service.

More forward-looking articles-but who will write them?

More Corps news, at present almost totally confined to the Supplement but in a rather impersonal and factual style.

Return to shorter, punchier articles (it has been suggested that the reader's interest declines with the cube of an article's length).

Less history, "I was there", and differential equations.

Layout. A change to a larger format would give better scope for photographs and other artwork, and would allow the two or three column layout of print that most magazines use nowadays. A4 (eg, British Army Review, New Civil Engineer) is popular and very widely used, but possibly too large.

What do you think? Letters to the Editor on this subject would be welcome (the shorter the letter the better the chance of publication).

Meanwhile the Publications Committee will work out more specific options with a view to canvassing opinion on these later in the year.

RE RE?

CAPTAIN (GE) F S COMPTON RE



Captain Frank Compton joined the Army as an apprentice in Chepstow in 1961. He served with 25 and 33 Field Squadrons as a combat engineer and at Cove as a training NCO. On completion of a Clerk of Works (Construction) course at Chatham in 1973 he gained site experience with the PSA Special Sites, Mildenhall and MAWA Salalah. Tours followed with 52 Construction Squadron on ADR trials, with the Queen's Gurkha Engineers in Hong Kong and the Permanent Way Team in Germany. At this point it was decided he had had enough site experience and was posted back to Chatham as SMI Construction. He was commissioned in May 1985 and is now serving with 64 CRE (Works).

INTRODUCTION BY LIEUT COLONEL T R KIRKPATRICK BSC

In most countries (even the USSR) successful construction work relies on the contractual checks and balances provided by a contractor and his workforce on the one hand and an engineer or architect and his staff on the other. The engineer's representative on site is known as the Resident Engineer, or for short, RE. History shows that not only do inexperienced contractors and consulting engineers need such a relationship, but that projects involving even the most experienced firms also benefit from this sort of arrangement.

These days more and more 'Turnkey' contracts are being let. For this type of work the contractor provides a complete package; the design, project supervision and construction functions all come from within his own firm, or from sub-contractors. These contracts seem to do away with the 'checks and balances' of the traditional system, but in fact the majority of companies continue to provide the different functions from autonomous departments within their organisations.

For some years before the Falklands campaign, major projects designed at Barton Stacey and constructed by the Corps had a Project Officer (Design) attached to the constructing unit. Whilst the Project Officer (Design) had a line of appeal to the Design Authority, he was firmly under command of the Project Commander. This delicate and often inefficient relationship resulted, in part, from the misguided impression that if the Project Officer (Design) became a Resident Engineer in the traditional sense, the power and responsibilities of the Squadron Commander towards the project would in some way be usurped. There was also a concern that a 'them and us' attitude which some people detect between the majority of the Corps and the units of MWF, would be strengthemed.

The situation became exacerbated in the aftermath of the Falklands campaign when it was often impossible for 62 and 64 CRE (Wks) to provide a Project Officer (Design) because so many of their men were attached to CRE (Wks) FI. Without the advice and guidance of someone who had been involved in the design of the job, and with the increasing lack of construction experience and training of our project Commanders, it is not surprising that a number of faults and unsound design changes crept into our work.

Whilst, for many good reasons our varied 'customers' have always been full of praise for the Corps, objective assessment of our performance has frequently shown

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Captain F S Compton

areas of our work which could be significantly improved. As the developing countries amongst our customers have become more sophisticated and as all of our 'clients' have become more cost-conscious, so they have come to expect the highest commercial standards of our tradesmen and management. Our customers, after all, make a significant financial investment in the materials for these projects, even if they get the labour free.

The Falklands experience introduced many units to the benefits (and some of the disadvantages too!) of close technical supervision by the design staff. It equally demonstrated that, on the best jobs, there is no need for a 'them and us' attitude to develop. The disbandment of CRE (Wks) FI, in its turn, allowed MWF to review its policy on project supervision. HQ Engineer Support agreed to MWF's proposals and attached a Resident Engineer, Capt(GE) Frank Compton, to Exercise Water Leap 85. The following article highlights his experiences and role during the project.

SINK OR SWIM AT COLD LAKE

BACKGROUND

Exercise Water Leap 85 was a very successful construction project undertaken by the Corps for the Canadian Defence Forces. It comprised the second phase construction of a major ammunition storage complex on the Canadian Forces Base at Cold Lake, Alberta, and required the building of roads, earth traverses, steel framed buildings and associated services. The work was designed by 524 STRE(Wks) for the Design Authority, CO 64 CRE(Wks), and was constructed by 3 Field Squadron.

Exercise Water Leap 84 had been carried out in the traditional way with the deployment of a field squadron to complete the first phase of the works. As with most major projects that the Corps undertakes, the design had been completed by MWF and a plan of work presented as one way of completing the task in the allotted time. The plan is provided to give the staff and the client sufficient information to decide whether or not to proceed with the project. The squadron, of course, prepares its own works programme having studied the design package.

During these initial stages of any project, questions on the design and the specifications naturally arise. Those identified prior to the squadron deployment may be resolved simply between the Design Authority and the project unit in the UK. It is a different matter once the unit is on site and work is underway, as time is then critical.

Most Squadron Commanders press on with the works as soon as possible in order to establish a lead over the critical path. An omission or ambiguity in the plans or specifications at this time is, to say the least, inconvenient. Queries have to be passed back to the Design Authority. This causes not only delay to the contractor unit, but also provides a difficult task for the designer, who is required to produce an answer without being able to see the whole of the situation. Additionally, it is quite common for the client to request changes and additions to the work once it is underway. The tradesmen on site also frequently have good ideas. It makes sense to improve on details or methods of construction as these ideas arise, providing progress or costs are not greatly affected. Squadron commanders are, in fact, encouraged to stimulate such thinking.

During Water Leap 84 all of these factors came into play. Many queries were referred back to the Design Authority in UK. Some, rightly or wrongly, were dealt with by Canadian site staff or squadron personnel. Some were not identified at all.

An example of the type of difficulty resolved locally occurred during the early stages of Water Leap 84. Site drainage proved to be a problem which needed resolving quickly so that work could proceed. A decision had to be taken whether to pass the problem back to Barton Stacey for consideration of both the long and short term implications or whether to resolve the immediate difficulty on site without risking a possible hold-up. In the event provision was made on site for temporary removal of the surface water into strategically placed sumps.

An example of the problems not identified on site was an inconsistency between

foundation details provided by MWF and the prefabricated steel sections supplied by the fabricator. The resulting misalignment of stanchions and holding-down bolts was caused by the foundation drawings being dimensioned in metric units and the steel being fabricated in 'rounded' imperial units. This explanation was not appreciated at the time as another fabrication problem seemed to be causing the misalignment, which was never entirely corrected.

THE APPOINTMENT

Little did I realise when I was posted to Barton Stacey on commissioning that my first job was to be that of Resident Engineer attached to the Canadian Base Construction Engineering Office (BCEO), Cold Lake. I was to interpret the design for the constructing unit and to supervise the work technically for the client. I had not been part of the detailed reconnaissance party myself, as my predecessor had been posted to sunny climes at short notice and I had stepped into his shoes during our handover period. Fortunately I had had similar contract supervision experience in previous tours with PSA and I also had sufficient time to read myself into the design before I left Barton Stacey.

For some years the Canadian authorities have found it beneficial to set up a small liaison staff to assist and guide the Royal Engineer squadron involved in Exercise Water Leap. BCEO Cold Lake had set up such a team for the first phase of the project in 1984 and I joined it for 1985. Its organisation is shown at Figure 1.



Figure 1. Site control and liaison staff

The Canadian Water Leap Coordinating Officer's job was to liaise between the squadron and the many agencies on the Base who were supporting it. He was also the



Photo 1. The completed Exercise Water Leap projects at Cold Lake, Alberta

focal point for the eventual users and maintainers of the facility to comment on the design.

My work as Resident Engineer included the interpretation of the drawings and specifications by answering queries raised by 3 Field Squadron, of which there were many during the early stages of the project. The Base, having had several months between the two phases to think about it, had more ideas as to how the facility could be improved better to suit their requirements. The improvements they suggested which could be incorporated without affecting overall progress on the project were all adopted and I was able to provide details of the variations to the squadron quickly.

As with all construction projects, problems arose on site as to how exactly certain elements of the design should be built. Most of the solutions were found by the squadron within the original design, often by reference to the Clerk of Works (Construction) on loan from 64 CRE (Wks) for the project. I was also available to advise as to how the specifications might be met and, where this was not possible or a better option was available, to approve variations to the design.

After the initial flood of design queries I spent an increasing amount of my time on quality assurance. The squadron passed me the results of all their quality control tests and the Canadian Senior Warrant Officer (Construction) and the NCO Trade Inspectors ensured that the work was carried out in accordance with the design and Canadian Codes of Practice. They were also useful advisers on local techniques of construction. From my point of view this system of control worked very well. 3 Field Squadron were clearly happy with the autonomy of their chain of command and, most importantly, the Base was more than satisfied that the facility met their requirements.

CONCLUSIONS

Most Royal Engineer projects, no matter how much work is involved, are completed in the time allotted. Delays from a lack of technical direction are absorbed in the time allocated for particular tasks. This of course has a direct effect on the standard of the work that can be achieved in the time given. It is clear that any elimination of the delays caused by lack of information or approval of changes will give the squadron commander more time to achieve better standards.

The appointment of a Resident Engineer for Exercise Water Leap 85 eliminated all of the potential delays caused by interpretation of drawings and specifications. It also provided a means for changes and modifications to be approved without delay and provided an independent quality check for our clients.

During the initial stages of the exercise there were some twenty variations to the original 'contract'. There were also several problems associated with the continuity of work between Water Leap 84 and 85. Although it would be difficult to quantify by how much, the presence of a Resident Engineer at this time certainly ensured that the Squadron Commander was not delayed in his drive to get on with the works, which helped to achieve a successful project for all concerned.

* * * * *





Their Very Own

The late LIEUT COLONEL R S HAWKINS MA C Eng MI Mech E



Lieut Colonel Raymond Hawkins has been a regular contributor to the RE Journal. His lass article "A Boundary Affair in the West" (June 1984) won a special award. This and his previous one "Once in a Windward Island" (December 1973) demonstrate his interest in military history and his concern with painstaking research. These qualities have been applied to his most recent article, published below, for which the Corps must be most grateful since no other comprehensive account of the origins of "Wing" is known to exist. It was with great sorrow that we learned of his death on 25 February 1986 before his final work could be published.

AFTER the unsatisfactory war in Crimea, George, second Duke of Cambridge, and

cousin of Queen Victoria, was appointed in 1856 Commander-in-Chief at the War Office. He instituted many changes in the structure of the Army and the War Office with the object of fostering the Regimental System. The old Board of Ordnance was abolished, and the former "Ordnance Troops", the Royal Artillery and Engineers came under the Commander-in-Chief's control. He attached great importance to Military Bands, and, for the first time, Corps and Regimental Bands were authorised on establishment, in each case with a civilian Bandmaster; in the past such Bands were financially supported by subscriptions from the officers. In 1857 the Royal Military School of Music was instituted at Kneller Hall, Twickenham for the training and improvement of military bandsmen. In 1861 the Royal Duke became Colonelin-Chief of the Royal Engineers; in that capacity one of his first actions was to instruct the Royal Engineer Establishment (REE) at Chatham to form a Band Committee, and to organise a proper military band, worthy of the Corps.

The Committee set about its task by examining the existing situation and available resources. In 1850 the Depot of the Royal Sappers and Miners had moved from Woolwich to Chatham, bringing with it the Depot Brass Band. Under the newly approved establishment, the authorized personnel consisted of one civilian Bandmaster, one Band-sergeant, three corporals, thirty musicians and twelve boys. The first Bandmaster was Mr William Collins, appointed in 1856, who for many years had been a musician in the RA Band at Woolwich. The Committee proceeded to list the instruments of the Brass Band:-

5 Valve Bugles	1 B flat Tenor
1 E flat Soprano	1 B flat Baritone
5 A flat Cornopeans	3 E flat Saxhorns
1 Tenor Trombone	2 B flat Bass
1 Bass Trombone	1 B flat Saxhorn

There was also a selection of instruments rated as "serviceable or repairable", which included cornets, horns, trombones, clarinets, flutes and bassoons; the inventory also showed "one Ophicleide, one Great Drum, two Drums (Russian, captured in Crimea) and one cymbal".

Bandmaster Collins had already organised a "Brass and Reed Band" of the type which became standardized in the years to come; it later became known as the "RE

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The Late Lieut Colonel R S Hawkins MA

W I N C S





Photo 2 First verse of the song Wings (1861)

Staff Band". It played on all sorts of private, social and formal occasions, at Divine Service and on the parade ground.

In 1868, Major General Sir T Gallwey was appointed Commandant of the REE which, the following year, became the School of Military Engineering. He soon noted that the tune played for march-past purposes on the parade ground, colloquially known as *I'm ninety-five! I'm ninety-five!* was that of the old 95th Regiment of the Rifle Brigade. This was a poor tune with no traditional connection with the Corps at all. The Commandant therefore called upon the Band Committee to consider a new RE quick-march, which should be distinctive and original enough to be regarded by the Corps as their very own.

The Committee set to work but had no thought or intention of composing one or more new tunes; there were plenty of existing tunes from many sources, and a suitable choice should be made of any which were not too commonplace or hackneyed. Furthermore, to save endless repetition of a single tune, two or more should be coupled with a key change, to give "sparkle" to the whole composition. At the time, the RE Bandmaster at Chatham was William Newstead, who had been appointed in 1865. He had joined the RA Band at Woolwich as a boy, aged 11, and as a skilled violinist and clarinet player, stayed with the RA Band for twenty-eight years. One tune proposed by Bandmaster Newstead for the RE quick-march, was a lifting march tune called *The Path across the Hills*; its origin was hidden in the past, and remains so to this day. It had the merit of being distinctive and not too well known; a century later, however, it became well known in a rather unexpected way.

Many years before The Band Committee started on its labours, Friedrich Rückert, a citizen of Coburg, Bavaria, was a prolific writer of poems and lyrics, mostly of a romantic nature. By 1823 he had published several volumes of his verses under the title *Liebesfrühling*; Number LXIII of this series was called *Flügel! Flügel!* with the opening verses:-

> Flügel! Flügel! um zu fliegen Über Berg und Thal, Flüge!, um mein Herz zu wiegen Auf des Morgen Strahl.

Flügel über's Meer zu schweben Mit dem Morgen rot, Flügel, Flügel über's Leben Uber Grab und Tod.

Many of Rückerts Liebesfrühling were set to music, with piano accompaniment, by various composers. Franz Schubert composed four such lieder and Robert Schumann twenty-one, including Flügel! Flügel! In time these sentimental ballads became very popular, and many were translated into English. Percy Boyd translated Flügel! Flügel! under the title Wings, with the opening verses:-

> Wings! to bear me over mountain and vale away; Wings! to bathe my spirit in morning's sunny ray; Wings! that I may hover at morn above the sea; Wings! thro' life to bear me and death triumphantly.

Wings! like youth's fleet moments which swiftly o'er me passed, Wings! like my early visions, too bright too fair to last; Wings! that I might recall them, the loved, the lost, the dead; Wings! that I might fly after the past, long vanished.

In mid-Victorian England, the pianoforte had become a status symbol. The wellto-do with large enough houses could well indulge in a grand piano, by "Broadwood" or "Steinway". The less well endowed were content with an "upright", with its two brass candle-holders, which took up little space in the sitting room. At these instruments children of all ages struggled under the tuition of governesses and music teachers. The art of singing was a social asset, and singing teachers proliferated; many an unmarried daughter and budding baritone displayed their virtuosity to an admiring audience in English homes.

To meet the burgeoning demand for piano and vocal scores, vast quantities of sheet music and albums of not too difficult piano solos, were churned out by the music publishers. Songs, generally of a sentimental nature, were in great demand, and song composers found a growing outlet for their skills. They came from many walks of life, and one such composer was Ellen Dickson, daughter of an Artillery Brigadier, who used the pseudonym "Dolores". In 1861, her song *Wings (Photos 1 and 2)* was published by Charles Jeffery of London, price 2/6.

Another lady composer was Mrs Charlotte Barnard, who wrote under the pseudonym "Claribel"; she was far more prolific than "Dolores", her best known song being *Come back to Erin.* At the time there was a persistent but incorrect belief which lasted for many years, that *Wings* was composed by "Claribel".

At Chatham, Bandmaster Newstead, with the approval of the band committee, arranged a new RE quick-march in trio form, using two tunes A and B. The march opened with tune A in the tonic key; then came two bars introduction in the subdominant, followed by tune B, and the trio was completed by a repeat of tune A in the tonic key. Tune A was *The Path across the Hills* (32 bars), with the last 8 bars repeated in the bass; tune B was *Wings*, already known as quite a good marching song.

The new quick-march met with general approval, but there were some dissenting views. A correspondent of the *RE Journal* wrote:- "Each portion of the tune is an excellent air to march to; but everyone who has marched past to the combination will remember how his equanimity, as well as his step, was upset by the "padding" during the change from the first to the second portion of the tune. Another view expressed was:- "Wings is not a good tune to march to, I take no notice of the air which always precedes Wings, as it is a hybrid production coming from no-one knows where. I cannot see that it is in any respect appropriate to the Corps." In spite of criticism this new march was accepted by the Corps for use on ceremonial parades in about 1870; with this general approval the scored parts for the band instruments were headed "Wings-the RE March."

The Duke of Cambridge was very concerned with the proper performances and activities of Military Bands. Many General Orders were issued on this subject; for example, in 1883, an order stipulated the "Regimental Quick-steps" that were to be used, on occasions when Bands of Infantry were Brigaded or massed. In 1889 the Commander-in-Chief noted with disapproval that the Corps march was not the one to which the RE were entitled by tradition, and common to the Grenadier Guards, the Royal Artillery and the Royal Fusiliers. These regiments and Corps, were all entitled to the grenade badge on their uniform, and so should march past to the proper tune, which was *The British Grenadiers*. The Commander-in-Chief clearly considered the march *Wings* frivolous and unmilitary, and decreed that it should be banned in favour of the march to which the Corps were entitled by tradition.

There was consternation and considerable umbrage in the RE Camp; however, there was some support for the unpopular edict, and a correspondent of the *RE Journal* wrote:- "Some of your readers may be unaware that the only authorised march for the Corps is the fine old tune *The British Grenadiers*, which we share in common with the Royal Artillery, Fusilier Regiments and those bearing the title "Royal". I have often wondered how, at Chatham, we came to adopt Claribel's vapid song *Wings* as our regimental march."

The general feeling however, was that the RE should have a distinctive march of their very own, and not shared with other Regiments or Corps. They had much in common with the Royal Artillery, and great respect for the Grenadier Guards, but who were these Fusiliers wearing the grenade badge, sprouting enormous quantities of flames? Historically they were infantry armed with a light flint-lock musket or "fusil", for the close protection of the Artillery.



Photo 3 Band instrument score of the march Wings (1903)

The Grenadier Guards were created in 1815 from the King's Regiment of Foot Guards, but by the end of the 17th century there were grenadier companies and battalions in many Regiments of Foot. They gained great distinction in Marlborough's Campaigns (1708–1711) and were immortalized in the words and music of *The British Grenadiers*, from the pen of that prolific composer "Anon". These devoted and courageous soldiers, who "carried caps and pouches, and wore the loop-ed clothes," could well sing with pride:-

"Whene'er we were commanded To storm the palisades, Our leaders march with fusees And we with hand grenades; We thrown them from the glacis About our en'mies ears, With a tow, row, row and a tow, row, row For the British Grenadiers."

These heroic words, and, for that matter, "Wings that bear me over mountain and vale away," had nothing to do with the activities of the Royal Engineers. For the time being, however, the Corps had no distinctive march, they could call their very own.

The years passed by, the old Queen died, King Edward VII came to the throne, and the Boer War came to its unlamented end in May 1902. The Army commander returned from South Africa, and was accorded his style and title Lieut General Viscount Kitchener of Khartoum, OM. He spent several months in England prior to taking up his appointment as Commander-in-Chief India.

On several occasions, Kitchener visited Chatham, where he had been a young RE subaltern in 1871. He well remembered marching past to the tune *Wings*, and was dismayed to find that this march was no longer used. He also learned that there was





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a strong demand among members of the Corps for the march Wings to be officially reinstated as the RE March.

At a Guest Night at the Officers' Mess, Brompton Barracks, Kitchener was guest of honour. After the circulation of the port and the Royal Toast, followed by formal speeches, Wings was rendered tutti cantabile con spirito fortissmo. The illustrious Viscount, greatly impressed, on his next visit to the War Office, discussed various matters with members of the upper hierarchy, and expressed his own views. Owing to Kitchener's high rank and enormous prestige, one matter in particular was carefully and seriously considered in the War Office. From its portals with the authority of the Adjutant-General, emanated in due course a letter, dated 14 October, 1902, which effectively reinstated the march Wings as the official march of the Royal Engineers, with the proviso that the music should be in a form and arrangement approved by the Commandant at Kneller Hall.

With Kneller Hall approval, the music of *Wings* scored for military band was published in 1903, Copyright by Hawkes & Son of London; rather surprisingly the march was incorrectly attributed to "Claribel"! The score for each band instrument (*Photo 3*) carried the sub-title "The Official Regimental March of the Royal Engineers, published by Authority." In this manner, William Newstead's arrangement of the RE quick-march regained its rightful place on the parade ground.

Half a century later, the fame of the march travelled North over the border, and West across the Atlantic. In the Scots Guards standard settings of pipe music (1981) a pipe tune entitled WINGS-The Royal Engineers Regimental March appears. In The United States Bicentennial Collection (1977) another pipe arrangement appears, headed WINGS-March-Traditional, adopted by the pipe band of The Royal Canadian Air Force and many others in North America. In each case (Photo 4) the Scottish pipe music is an arrangement of The Path across the Hills, used by Bandmaster Newstead for the RE quick-march a century earlier. The Sassenach music of "Dolores", unsuited to the native bagpipes, makes no appearance.

The Official Regimental March of the Royal Engineers consists of a lilting march tune of unknown origin, sometimes heard as the skirling of the pipes, and a sentimental ballad by a mid-Victorian lady, inspired by the words of a German poet. To this day, it is the exclusive right of the Royal Engineers, and no others, to march-past to *Wings*; after all, with its intriguing history, the march is unique and their very own.

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Central Music Library, Westminster (Photos 1 and 2) Royal Military School of Music, Kneller Hall (Photo 3) College of Piping, Glasgow (Photo 4) National Library of Scotland, Edinburgh RE Corps Library, Chatham

Sapper Support

THE RE Library has recently been presented with some diaries written by the late Brigadier W A F Kerrich during his time with 55 Field Company from November 1914 to April 1915. We are indebted to his widow for the gift of these diaries the flavour of which is illustrated in the following extract.

THE duties of RE in attack is a much debated point. Before the War I think there was a sort of general idea that they "led the storming party". That was the catch word and people had a vague sort of idea that they removed obstacles and used explosives to do so. A quite different idea as to their duties now prevails I am glad to say. It all hangs on this question "Are there any duties that a Sapper can perform that any Infantryman cannot?" The answer is "yes". He can make bridges, he can make roads, he can do thousands of odd jobs that a trained man who knows a trade can do, and that an unskilled man cannot. In that case the next step in the argument is obvious, namely that it is no good getting him killed off doing jobs that an untrained man can do just as well. Now had a field company been a larger unit, I think it likely that the job of throwing bombs would have fallen to our lot. Most field companies had the job at one time or another, some may still for all I know; but I do not think so, for it soon became obvious that the few men a field company could spare were a mere drop in the ocean compared with the numbers needed for the new weapon. Barbed wire has become such a formidable obstacle that it has to be cut by a heavy bombardment with shells. Cutting with wire-cutters-except for odd strands left by the bombardment-is suicide. What then does a field company do? There are two jobs that no one else can do. One is quick bridging, the other is demolition. I have done very little of either of these. Again you ask the question. The best answer I can give is that the officers are an extension of the Staff, and the men do odd jobs that require a skilled man. A job that requires a large working party is nearly always run by a Sapper officer. For example digging a new communication trench, a new drain, digging funk pits for the reserves in an attack, making a reserve line of defences-these are all run by the Sappers. The General orders them and may or may not site them, he then supplies a working party and washes his hands of the matter. We do the rest. The odd jobs that a field company do are beyond number. A few specimens are-making periscopes, attaching periscopes to rifles, making ladders to climb out of the trenches when attacking, making little foot bridges for crossing ditches, making experimental mortars to fight the German Minenwerfer, making sledges for the same, making steel loophole plates, teaching the Infantry to make hurdles and fascines, revetting, roofing shelters and dug-outs, loopholing houses for defence, mending broken wagons and carts when there is no time to get them replaced, getting out drainage schemes, impressing on the Infantry man the value of having a sufficient number of traverses in his trenches and of having his parapet bullet-proof, cutting down trees in the way of artillery fire, making mats, and making chevaux-de-frise. We manage the supply of sandbags, hurdles, corrugated iron, wood, barbed wire and stores of a kindred nature. We are the experts on all matters of trenchwork, schemes of defence etc, our advice is generally asked on such matters and sometimes taken. We give a good deal of advice on matters that have really nothing to do with us, and that is sometimes taken too. The one thing a field company RE officer must have is common sense, if he also has tact and a pleasant manner he will get on. If he has not got them he is kicked till he cultivates a passable imitation of them.



Map 1. Mount Pleasant Airfield site.

Mount Pleasant Airport Construction

MAJOR H M HOEY BSc



Major Mike Hoey has served with 34, 37, 11 and 12 Field Squadrons, commanding the last from November 1982 to February 1985. He gained his BSc(Eng) at Shrivenham and has completed the Professional Engineer Training (Civils) course. At Chatham he taught fieldworks and, later, civil engineering design. He was recently attached for a year to the PSA site control team at Mount Pleasant in the Falklands.

INTRODUCTION

BETWEEN November 1984 and March 1986, the Corps sent two officers to work on the Mount Pleasant Airport (MPA)

project in the Falkland Islands. They were Majors A J L Stalker and H M Hoey, both PQE (Civils) and they took posts in the PSA site control team. This article describes the work which they supervised. It should also give some idea of the scope and complexity of a £400million civil engineering project where the only resources closer than 8000 miles away were stone and water. The contracts are described, with an impression of the general conditions, followed by a record of both the PQEs' involvement. Then three particular subjects, the buildings, the pavements and the site control, are expanded to give more detail.

THE CONTRACTS

In order to provide an airport for widebodied jets and a garrison for the British Forces in the Falklands, three major contracts were let for work at Mount Pleasant. They are called 'RAF Works', 'Army Works Phase I' and 'Army Works Phase II'. The first two were won by a consortium of Laing. Mowlem and Amey Roadstone Constructions (LMA) and the third by Wimpey-Taylor Woodrow consortium (WTW). RAF Works started in the Falklands summer of 1983–84, the others a year later and both contractors will still be working beyond the 1986 winter. RAF Works

As the name implies, RAF Works has included the two runways, aprons and associated pavements which involved the removal of three million cubic metres of peat and clay and the spreading of some 200,000 tonnes of Marshall Asphalt. Also in the contract were the aircraft hangars, traffic control buildings and all essential services from a road network to power generation and water supply. Within the airfield complex LMA has built the accommodation for the RAF and will hand over its substantial contractors' camp to be permanent accommodation for the Army. As part of the same contract, a road was built down to the new port in Mare Harbour (*nee Map 1*). At the same time, but on a design-and-construct basis, they have built a 50km road linking Mount Pleasant with Stanley. The RAF Works is worth about £250m.

Army Works

The Army Works contracts actually provide facilities for RAF and Royal Navy as well as the Army, PSA and future contractors. Phase I includes the joint forces HQ, RAF communications facilities and the AAC buildings. This LMA contract was priced at about £50million Army Works Phase II is worth about £70m and is being executed by an entirely separate consortium, WTW, which has found its own subcontractors for specialist works. Phase II started in January 1985 and includes all

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Major H M Hoey BSc Mount Pleasant Airport Construction



Photo 1 Initial Stripping of peat.

the central functional offices, stores and garages, the Airfield Damage Repair (ADR) Squadron's plant and workshops and the massive Falkland Islands Logistics Battalion (FILOG) store sheds. In the same area are the PSA accommodation and the main aports pitches. There are sixty buildings there with associated roads and services. Elsewhere there is a large magazine compilex consisting of some thirty-five buildings, five water tanks, various hardstandings, nearly 6km of road and considerable earthworks. Some 9km to the south of the airport is a port complex also in the same contract. It incorporates three jetties, nine buildings, and large areas of hardstanding and associated roads and earthworks. Nearby in Mare Harbour, a 1.25km submarine fuel pipeline has been laid with a single point mooring.

Service Contract With limited local resources and a long supply line it was found necessary to let a service contract. As a result, LMA provides shipping, water and quarried materials for all contractors. In order to produce the latter, they operate an extensive quartzite quarry a few miles to the north, a tillite quarry and composite processing area alongside the airfield and various borrow pits around the site and along the road to Stanley. The tillite is only good for granular fill and sub-base material but the quartzite produces reasonable, if varied, aggregate for all concretes and the Marshall Asphalt. By the end of 1985 two and a half million tonnes of rock had been processed and three quarters of a million tonnes of freight had been shipped from UK. As an example of large-scale improvisation, the cargo ship Merchant Providence was moored

in East Cove and her deck reinforced; a Bailey bridge was constructed from there to the shore and she has acted for two years as a floating jetty-head for all the seaborne freight.

Contract Coordination

All of the construction contracts have been let on a lump sum basis and the conditions of contract are GC/Works/1. Most of the specialist work is done by domestic sub-contractors. The exceptions are the bulk fuel tanks and pipework which have been undertaken by McTay's and the M and E part of the RAF Works by Balfour Kilpatrick, who is a nominated sub-contractor. A PSA team supervises all the contracts under a Regional Director who also covers the PSA throughout the Falklands.

Mount Pleasant Airport Construction (1)



Photo 2. One of three civilian accommodation blocks nearing completion.

This site control team is made up of PSA Clerks of Works and Engineers as well as representatives from the survey firm, the QS firm and the various nominated design firms.

Although there has been plenty of interlock and overlap where necessary, the design work was split out to three main consultants: Sir Alexander Gibb and Partners who designed the structures and roads, Building Design Partnership (BDP), who did the architectural work, and Ewbank Preece Limited on the M and E services. PSA designed all aircraft pavements in house. Before the drawings were issued to the contractor, they were sent to PSA at Croydon for approval on behalf of the client, MOD.

As a result of this organisation the site team has been maintaining a close liaison with the relevant UK offices, as have the contractors' site staffs. For this to be effective several means of communication have been established. The key UK offices have direct facsimile ('fax') links with site and all have Telex facilities. There is a good telephone link via satellite and there are usually three airmail runs a week, with only a few hours lead time at the site end. In this way, the effect of the large geographical separation is considerably reduced in matters of management and control as well as the design changes frequently brought about by unexpected conditions.

EMPLOYMENT OF THE ROYAL ENGINEER OFFICERS

Not only did the Corps want these valuable attachments, but also the PSA had difficulty in finding civil engineers to man the site teams. Therefore it was agreed that two officers should be despatched at different times. In the event, each did one year, Major Stalker starting in November 1984 and Major Hoey five months later. Major Stalker

Major Stalker was based in Stanley initially where he worked for two months on the bypass which provides a 2.5km link between the Mount Pleasant road and the RAF Stanley access road. To those who know Stanley it may seem incongrouss for such a small place to have a bypass, but the military traffic from East of Stanley and the traffic to Mount Pleasant would soon destroy the appalling roads and tracks in the town. Eventually military traffic will be able to avoid Stanley completely. The road

Mount Pleasant Airport Construction (2)



Photo 3. Pavement Quality Concrete being laid in long rips on main apron.

was constructed by PSA's term contractors Fairclough-Miller who surfaced it with a wet-mix macadam.

He then spent six months as PSA's Resident Engineer on the Stanley to Mount Pleasant road. As explained earlier, this was a £12 million design-and-construct job giving the RE an unusual and challenging task. As the road progressed, there were frequent alignment changes especially when the famous Falklands rock-runs were encountered and the more infamous minefields had to be negotiated. Very close liaison was needed between the Resident Engineer and LMA's road engineer. Major Stalker also had extensive dealings with both PSA in Croydon, who naturally wanted to keep the road cost as low as possible, and the local landowners who had hitherto only travelled cross-country on the soft peat; a hard road constructed with ditches presented not just a new route, but an obstacle to sheep movement and landrover travel. Even 8000 miles away from 'Countryside Commissions' and the like, due consideration had to be given to ascthetics and the environment.

During his time on the road, work progressed in places from initial earthworks (there was still a 10km gap of virgin peat and rock, when he started) through to detailed planning and preparation for the final surfacing. The road is 8m wide with shoulders and it has an unbound rolled surface for most of its length. Over the steeper sections of the road, totalling 10km, it has a wet mix layer surfaced with sprayed chippings.

For his last few months, Major Stalker worked at the heart of the project, supervising work on the main apron between the runway and the main hangar. Although a part of the enormous 500m×220m Pavement Quality Concrete (PQC) apron had been used by Tristars and Jumbos since May 1985, there were still some earthworks and dry-lean concreting in hand during his start there. However most of the work was on the placing of PQC.

Major Hoey

In March 1985, Major Hoey was attached to the PSA and for seven months worked on the Army Works contracts followed by five months on the airfield. As an Assistant Resident Engineer in April and May he provided civil engineering expertise to the contractor and to PSA clerks of works concerned with the building works, mostly at

Mount Pleasant Airport Construction (3)

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the below ground level. Early in this period he reviewed and corrected underground services interconnections between Army and RAF Works contracts. These included the potable water, firemains, heating water, foul drains, surface water drainage, HV, LV and communications cables. It was a timely survey as LMA was bringing its main service lines through the Army Works building area at that time, so it required examinations of both the drawings and the actual service mains as built.

Also in the early part of the attachment, he monitored the establishment and initial production of WTW's concrete batching plant, checking the installation and procedures against the specification. In the same area a concrete block-making plant was constructed to save some of the high cost of importing blocks from UK.

While still providing general civil engineering advice to the building area in June and July, Major Hoey took a particular interest in the magazine site. The first task was to design a 1.2km road for the heavy quarry traffic to be diverted around the site. At the same time WTW started the initial earthworks on the magazine complex. Originally it had been planned to do this in the less severe summer months. In fact, 1985 had a mild winter and work progressed apace, resulting in almost continual site supervision on the magazine and on the diversion road.

The workload increased further in August when Major Hoey took over the dayto-day control of works down at East Cove and Mare Harbour including marine works and WTW's own sandstone quarry. Soon afterwards, with consultant engineers on leave, he became Resident Civil Engineer for both Army Works contracts. This produced a challenging combination of work which could include, within a one hour period, checking aerial base levels for LMA, inspecting some of WTW's formwork at Mare Harbour and attending a site progress meeting with LMA. In November he moved to the RAF Works contract and the airfield pavements in particular. A month was spent in detailed on-site monitoring of the two main activities: the spreading of Marshall Asphalt courses and the laying of PQC. The flexible basecourses were being laid by Blaw Knox paver on the secondary runway and wearing course trials were being conducted on the north taxiway. Most of the PQC on the main aircraft and helicopter aprons has been laid mechanically but all other areas were done by hand.

In December, Major Hoey took over as Resident Engineer for the airfield pavements. That includes the main apron, helicopter aprons, main runway, southern half of the



Photo 4. Processing area at WTW's sandstone quarry.

Mount Pleasant Airport Construction (4)



Photo 5. Tristar hangar viewed across the main apron.

secondary runway and the ATC taxiway plus the aircraft hardstandings. Another Resident Engineer looked after the fighter dispersals and the northern half of the secondary runway. At that stage the main runway was substantially complete and in use three times a week; only some peripheral work and repairs were outstanding. On the main apron only isolated bays and the drainage perimeter still had to be placed by hand and the secondary runway required only a wearing course. Work therefore concentrated on the helicopter aprons, landing pads, western taxiway and two hardstandings all in PQC and about 400m of flexible taxiways. Completion and repairs continued on the runways and main apron. This work included much physical examination of the PQC and Marshall Asphalt especially during trial runs. It also entailed close liaison with the design team in UK and the materials consultants, Sandbergs, on site, as well as the on-going communication with the contractor. *Routine Activities*

Both officers conformed to the work patterns of their PSA and consultant colleagues on site. Generally they worked an eleven hour day on six or seven days a week. The remaining daylight hours were filled by the two officers with hill walking, running and other pursuits. In particular Major Stalker fitted in some diving with both RN and Army teams. Major Hoey found a lake nearby on which he windsurfed on most weeks throughout the year. Each officer took a three-week mid-tour leave in UK.

BUILDINGS

FROM the top of the 31m high main hangar roof, one can still see the deserted Mount Pleasant House, a two bedroomed, locally fabricated, timber dwelling. With its small shed, they were the only two buildings on site in 1983. Two years later there were more accommodation units, also made in timber, but there the similarity ends. The new accommodation complex is built to house the garrison. Between that and Mount Pleasant House are a further two hundred steelframed buildings varying in size from a tiny gas bottle store to the Tristar hangar which is 58m square, incorporating 600 tonnes of steel. In all there are 200,000m² of buildings around the airfield. Structure

The steel buildings all employ the same principles of design and construction. They are steel portal framed structures founded on RC ring beams and clad with insulated, profiled aluminium sheeting. A few buildings are two storey and some of the wider ones are double-bayed with central valley gutters. Internal partitions are all in concrete blockwork and there are various floors: PQC in the hangars, surface hardened in control buildings and power-floated and trowelled in large stores.

MOUNT PLEASANT AIRPORT CONSTRUCTION

Ringbeams

The RC ringbeams are founded on formation of at least 150KN/m² or on pads under the columns where the ground is weaker. Unfortunately below the peat and clay there is a remarkably variable bed of tillite; in places it was so weathered and with such a high clay content as to be useless and yet, a few metres away, it had to be drilled and blasted. This was typical of foundations in the central technical services area, whereas at East Cove the ground had a high sandstone content giving a consistently firm formation but it was straightforward to excavate. The ringbeams were placed *in situ* and holding down bolts were fitted. On the RAF Works they were cast with the concrete in sleeves giving about 40mm movement, but in the Army Works, holes were percussion-drilled and the bolts set in precisely, anchored with a two-part epoxy mortar.

Erection

The galvanised steel portal frames were fabricated in UK and assembled by a small specialist erection sub-contractor on site. More teams from the same firm were employed to fix the cladding which arrived from UK in individual portable sheets



Photo 6. Plant hangar ready for cladding.

bent to specific shapes. Their biggest enemy was the wind, so the side of the prevailing wind was always clad first. With careful handling there was actually less damage on site than there had been in transit.

With the roof on and providing protection, the blockwork walls and then the floors were completed. As soon as WTW started to produce their own blocks, works rates improved because of the dimensional consistency of the blocks. Those imported from the UK had been so varied within the standard sizes that much time was lost by the block-layers, whereas WTW's plant employed only one multiblock mould for each size, resulting in uniform dimensions.

Basically, the buildings were simple to assemble and all the difficulties resulted from tie-in detail: reinforcement had to be adjusted to accommodate service ducts; the top of the block walls had to be fitted into the steelwork; and temporary doors had to be installed when deliveries of the huge folding doors were delayed.

AIRFIELD PAVEMENTS

THE Mount Pleasant runways consist of 3.5km of flexible pavement with 6km of taxiways and overruns in PQC and about 150,000m² of PQC aprons. Generally, the flexible pavements were founded on a 150mm granular subbase overlaid with 200mm of rolled dry lean concrete (DLC). The bituminous surfacing was hot rolled Marshall Asphalt placed in three base courses each of 60mm and a 40mm wearing course. There is no friction course, but the wearing course was grooved. The rigid pavements were made up of 150mm DLC with 400mm PQC on the main apron and taxiway and 250mm on all the helicopter surfaces.

Drylean Concrete

As the lower part of both flexible and rigid pavements, a rolled dry lean concrete course was called for. This very dry low strength concrete was best laid by a Blaw Knox paver as was done on the secondary runway. On the main apron some of the long runs were spread by grader. Although this was an acceptable method, the grading tended to dry out the mix completely before the roller could compact it into a wellknit matrix. It left a rather loose surface sealed ineffectively by the bitumen emulsion curing agent sprayed onto the rolled surface. The paver, on the other hand, achieved a substantial DLC layer at a respectable rate. The mix was agreed after a series of trial runs according to the airfield pavement specification. The mix was monitored and frequent density checks were made.

Marshall Asphalt

The quality of the Marshall Asphalt was more difficult to monitor. The mixes for base and wearing course were very dependant on the varying shape of aggregate procured from the quartzite quarry. Therefore, the tests stipulated in the specification were carried out regularly by both the contractor and Sandbergs. Mix quality was well controlled and the contractor used insulated trucks for delivery, which was important during so many weeks of low temperatures and high winds. Spreading was an equipment-heavy operation, especially during high winds; following the paver had to be smooth-wheeled steel rollers (one wet, one dry) and two pneumatic-tyred rollers just to keep pace with the paver. Only in this way did the mix get rolled effectively before it cooled and hardened.

Pavement Quality Concrete

PQC was laid mechanically for long runs (usually 100m or more) and by hand for shorter runs. Ninety per cent of the main apron and the AAC apron were laid by train, whereas most of the other helicopter loading pads and apron areas were hand-laid. All areas incorporating drainage tie-down points and hydrants were also paved by hand.

The mechanical laying seemed to be consistently five times faster than hand laying; approximate rates per team, working daylight hours only, were 600m³ per week by hand and 3000m³ by train. As most of the finishing actions were done by hand on both methods, the only main difference in completed pavement is that it was probably better vibrated by the train with its battery of fixed full penetration vibrators. *Quality Control*

The mixes were monitored continually by the resident materials technicians, Sandbergs. Clerks of Works supervised the laying procedures and temperatures and the engineers checked levels, depths and finished surfaces. This last was easy with PQC, but the quality of freshly rolled DLC or Marshall Asphalt was difficult to assess other than by comparison with other surfaces which had already proved to be satisfactory or by very experienced inspectors.

SITE CONTROL

In general the PSA deployed Clerks of Works and Foremen of Trades to supervise the day-to-day, hour-by-hour work on site. They were armed with the drawings and the specifications and they dealt with the contractors' foremen and junior engineers about details of the work. The engineers dealt with matters which either were not understood by the site staff after reading the drawings or were ambiguous on the drawing or in the specifications. Sometimes there were conflicts between building layout drawings, particularly where there was an overlap between design consultants. *Technical Information*

There were several channels for advice. Some work came verbally during walks around the site and discussions with the Clerks of Works and contractors' staff. Formal written technical enquiries flowed regularly from the contractor, sometimes unexpectedly, but usually as a result of discussion on the ground and over the drawings. These were solved directly whenever possible but often questions had to be referred to PSA or Gibbs in UK. Using the Telex facsimile, answers were normally quick



Photo 7. Main runway looking West.

during the UK working week. The facsimile allowed engineers to back up their arguments and proposals with their own sketches and calculations.

That sort of work entailed considerable interpretation of the drawings and specifications as well as physical examination of the problems on the ground. Nevertheless most of the difficulties could be solved with a good scale and an engineering calculator. There were no computers provided on site, but there was access to a private desk-top facility.

Contractual Instructions

Instructions to the contractor were issued by drawings from UK and by two written forms on site. One was the Site Officer's Instruction (SOI) which was initiated by the engineer and issued to the contractor on site. The other was a Confirmation of Verbal Instruction (CVI) which the contractors' agents presented for signature on site. The processing of these forms often pulled together all the component parts of the site control team; an example can be used to explain this.

On the magazine site, the original plan for surface water drainage was soon found to be insufficient to cope with the unexpectedly varied depths of peat. Various options were reviewed and discussed with the contractor's earthworks agent, before any irreversible work was carried out. After some simple calculations a reasonable and practical solution was chosen involving the movement of some culverts, the re-levelling of some runs and the addition of outfalls. It was summarised on a hand-drawn sketch which was "faxed" to PSA in UK for agreement in principle; they passed it to Gibbs who had designed the system originally. Meanwhile an SOI was typed and a site sketch was prepared and passed to the QS on site for initial pricing and copying to the QS consultant's office in London. This confirmed that the extra work was within the Resident Engineer's power to authorise, while also keeping the QS firm abreast of additional costs as they occurred. By this time PSA (UK) had approved the alteration and the SOI was signed and issued, via the PSA administration staff, to the contractor on site. Later the PSA surveyors worked with the contractors' staff to confirm original ground levels and the extent of the peat, while the Clerk of Works supervised the excavation and installation in accordance with the site sketch and original drawings. For problems in the buildings, the on-site PSA architect would also have been involved, usually confirming his proposal with BDP in UK.

Mount Pleasant Airport Construction (7)

THE ATTACHMENT

THERE can be no doubt that the Corps has achieved its aim of gaining up-to-date construction experience. Although the original intention was to concentrate on the airfield itself, a far wider range of work has been covered by the officers employed not only on airfield pavements but also on buildings, roads and marine works. It has been particularly valuable because both were given responsible positions provoking in-depth involvment in the works and frequent reference to the designs. These benefits were enhanced by the Falklands Factor (approximately=2). The theory was that with the long working hours, especially in the summer, usually seven days per week and living 'on the job', with only three weeks leave off site in a year, work experience was being gained at twice the rate achievable elsewhere. This is certainly reflected in the contractors' work rates on site which were generally double those on UK sites and probably even more when compared with locally-employed labour rates overseas.

Fortunately, however, the attachment did not seem like two years to each of the PQE officers as they were fully occupied and time never dragged. Nevertheless, the virtual absence of military contact over twelve months was strange and of course it was a long separation for these two family men. In spite of that it proved a most valuable attachment on an enormous modern project.

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Einstein

A BRIEF STUDY OF THE PHENOMENA ASSOCIATED WITH RELATIVITY AND THE EFFECTS THAT CAN BE OBSERVED DURING PARTICULAR MILITARY ACTIVITY

MAJOR V G IWANEK RE

It may at first seem a little far-fetched, but there does seem to be evidence to indicate that certain strange phenomena can be satisfactorily explained by reference to Einstein and his well-known but often misunderstood theory. Before going on to deal in detail with the theory of special relativity, it is necessary to set the scene.

It is dark, very dark. Wet penetrating drizzle drips relentlessly on the canvas roof. Inside, the issue 20.watt bulb casts more shadow than light onto a map already largely obscured by china-graph. A grimy mug of nondescript lukewarm liquid lies on the desk next to the operator's comic. No-one of seniority, importance or great military skill, is about. You are, as you have probably already guessed, in the middle of an incredibly important BAOR CPX, the time is around 0300 hours.

In the early hours of the morning on such an exercise a chap can get to thinking. The subject of the thought can of course be varied. Ranging from the heartfelt cry of "why me" to a genuine, if transient, interest in the proceedings, the mind, with luck, can be kept operating at a level just above the subconscious. The telephone rings. "Hello, Sappers?—Sappers we have a problem: a milk float drawn by a three-legged horse and driven by a saboteur has blown up on the MSR and produced a large crater completely blocking the road. Can you fix it straight away?"

Good grief, you think to yourself, who dreams them up? As you are bored, reasonably keen and hope for stardom, you go through the motions. You invent a handy TA unit equipped with D6s with Jaguar performance and, hey presto, no problem. Look at the clock (complete amazement!) it is only 0302. Time has slowed up. Is this time distortion or perhaps a slow clock? It is a clue of immense importance. If Einstein had been a Sapper officer he would have been years ahead of his time and saved a great deal of effort in the process.

So, time has slowed up. Why? A bright, hard-headed, clear-thinking officer would say that time slows up on CPXs in the middle of the night because such CPXs are



excruciatingly boring. This is unimaginative in the extreme and very unscientific. One really must look for a more elegant solution.

If ten minutes takes twice as long as it does during the day, then this is surely a manifestation of Einstein's special theory of relativity, in particular the Transverse Doppler Effect. According to the theory, as an object (say the Engineer Desk) approaches the speed of light relative to another viewpoint (in this case daytime) its mass increases, clocks slow down and dimensions shrink. Applying the relevant formula:

Gamma $= \frac{1}{\sqrt{1 - \nabla^2}}$ Gamma in this case = 2

Then V=86% the speed of light or around 160,000 miles per second

Poking your head out of the tent you will not fail to notice a disappointing lack of violent slipstream. Venturing further outside to find evidence of your high speed travel, you will find it has become more difficult to move around without being grabbed at by undergrowth and attacked by trees (those who wear masses of webbing may not be able to move at all). In daylight there was no such problem. A second vital clue has come to light: during the night the trees have moved closer together. Comparing daylight tree spacings with the night-time spacings and applying the same formula, the result is the same. The Engineer Desk is moving at 160,000 miles per second. Does MVEE know? Imagine the principle applied to minefield fencing. Laid at night while approaching the speed of light, 6ft pickets could be laid close together and in the morning found to mark the whole perimeter of a tactical minefield. The implications are not fully realised but it should be clear that the possibilities are only constrained by the imagination.

Looked at critically the lack of slipstream may cause doubt in less adventurous minds but even the unconvinced must admit that there is room for further study. Certainly the theory seems to explain all those hitherto unexplained Sapper nighttime problems: operations take much longer than senior officers expect because there is no room to move and the bits get heavier.

As the night drifts on the pencil appears to get heavier which, in the light of the above can now be seen to be a predictable consequence of nature. The telephone rings: "Sappers, forget my last. The infantry solved the problem. The saboteur survived the explosion and he was forced at gunpoint to fill in the hole. Please don't bother yourselves any more." Good Lord, you think to yourself as you glance at the clock, it is only ten past three.

The North West Frontier of India Military Operations in January 1947 "302694"

DELHI 14TH JANUARY 1947

"Nandhar Tribes in the North West Frontier Province have accepted the terms imposed by the Government of India for the wanton destruction and raids in the Hazara border villages last month".

Such was the brief communique in *The Times* which made no mention of the operation involved or more interestingly the part played by the Royal Indian Engineers of the 10th Indian Division. The Nandhar Tribes do not strictly inhabit the Province but an area lying about the upper reaches of the River Indus, south of Chitral and known as the Black Mountains; a wild region rising to about 7,000ft and studded with small fertile valleys. Mohammedan by faith, the tribes live in strategically placed defended villages scattered about the valleys.

For the previous hundred years they were a source of great annoyance to the border population of British India, and during that time no less than five expeditions were despatched to deal with these fierce and almost fanatical people. Trouble invariably started in the winter; no work is possible on the land, more adventurous exploits offered greater possibilities. Nevertheless the Nandhars were always aware of their security and independence under the impartial British regime, and it was partly on account of the then likelihood of government being transferred to a Congress (Hindu) *Raj* when the British withdrew—then planned for later in the year; and an incidental reason that they wanted sugar and cloth removed from rationing, that trouble again flared in December 1946, resulting in the sixth Black Mountain expedition, in which I was fortunate to be a member.

At the time I was Field Engineer 1 at HQRE 10th Indian Division, a division which had won its share of fame in the Italian campaign. Lieut Colonel (later Major General) H C W Eking DSO was CRE and we were based at Rawalpindi.

Before the impending operation we made a thorough reconnaissance of the approach roads, bridges and limited engineer resources of the area in the general vicinity of Abbottabed through which the expedition would be launched. The site for a small airfield was fixed at Oghi, not only for communications, but also for the speedy evacuation of casualties. It was clear the expedition would be very handicapped by the roads which were only of earth construction. The main line of communication lay over a pass 5,000ft high and only wide enough for one-way traffic. In places the road was perched on a ledge, from which any deviation meant likely death. The snow line was already down to 4,000ft.

Shortly after Christmas 5 Field Company RIE (Madras Sappers) commanded by Major 'Hank' Hart plus mechanical equipment from the Field Park moved to Oghi, the main base, and prepared necessary engineer services for the main force including a second field company following a few days later.

Oghi was a defended frontier Hazara village, the small police picket was however quite unable to prevent the sacking of the Hindu part of the village one dark December night. Thirteen villagers were murdered including a Mohammedan who sacrificed himself in a vain attempt to save a Hindu friend. Several other villages, Dalborai, Battal, and Ali were destroyed in similar fashion, the frenzy of destruction spread miles into British India.

On 3 January 1947 the punitive column consisting of Divisional HQ and one brigade moved from Ralwalpindi to Oghi-about one hundred and twenty miles. The weather was foul, rain and sleet turning to snow on the higher ground caused



Photo 1. Point 6159

considerable problems, and although we had started at 0600 hrs, the head of the column did not reach the pass until 1730 hrs by which time it was dark and the road was closed for the night. We found some cramped shelter in a fodder store and after feasting on chappatis and curry we sought some rest, in the choking atmosphere of the open fire. Rest was difficult as the Indians coughed all night, and the fodder store was alive with nocturnal insects. The following day was fine, but because of the wretched state of the road over the pass, the column did not move until 1100 hrs, there were just fifteen miles to go. The deep mud, overheated engines, lorries over, or partly over the edge, incessant halts all conspired to delay arrival at Oghi until 1745 hrs and as every good soldier knows it is great fun pitching camp on deep mud in the dark.

The snowfall of the previous day had turned to slush, the earthen roads had collapsed and were up to a foot deep in black mud, further movement of traffic was forbidden, the landing strip was useless. The sappers endeavoured to improve matters but there is a limit to the use of mechanical equipment in such conditions. And—this must be the theme of many an engineer story—it commenced to rain again. The damp and raw coldness were affecting the Madrassis, not at all acclimatised to such rigorous weather.

The following day, soon after first light, I left to reconnoitre the old track from Oghi to the frontier at a dominating map feature described as Point 6159, the track was known to have been used by a previous expedition. The purpose of my reconnaissance was to ascertain the possibility or otherwise of converting the track into a rough motor road suitable for one-way jeep traffic at least, or even more optimistically to take a squadron of tanks. I was protected by sixty men and a Viceroy's Commissioned Officer of the Jat Regiment.

The day was fine, but the muddy conditions underfoot made the going very slow. The task of reconstructing the track strewn with large boulders and very steep in parts seemed most difficult at first sight. Further up the mountain there was a covering of two or three feet of snow. I thought the proposed task impossible—even mules would have difficulty—and accordingly reported so to Colonel Eking on my return. The following day my opinion was reversed; the Divisional Commander ordered the reconstruction to be attempted and work commenced immediately. Division committed



Photo 2. Chitral from Point 6159

the whole of the Infantry Brigade to protection and work under the control of two field companies, the track would be three miles long to Point 6159. From that point there was the most splendid panoramic view of the snow covered mountains of Kashmir, Gilgit and Chitral, the Hindu Kush over a hundred miles to the north was just visible, but all seemed very peaceful in the offending valleys far below. Work proceeded apace but meanwhile the tribesmen had been informed by the political agent at a *Jirga* (tribal council) held by invitation at Oghi that we were willing to accept a cash payment of 75,000 rupees, a lodgement of seventy-five rifles (no doubt they would be the most ancient models available) and the surrender of forty hostages to good behaviour as an alternative to fighting it out—a fight they would surely lose—and they were offered one week to consider our demands.

A great show of force was maintained every day with maximum use of bulldozers and like plant pressing the track steadily to Point 6159, we were observed daily by a large audience of hostile tribesmen—all armed to the teeth, we understood the news of our activities spread far into the tribal regions. The troops laboured with pick and shovel, crowbar and explosive in sometimes appalling conditions of frost, snow, sleet, wind and glaring sunshine, excellent work was done by the Baluch, Dogra and Frontier Force Rifle Regiments but above all by the Gurkhas who revelled in these rugged conditions. As might be expected sickness and cold exhaustion took their daily toll, the sappers suffered badly from chilblains and frostbite.

Towards the end of the construction Colonel Eking had to return to Rawalpindi and instructed me to provide him with a progress report on his return. During the day I knew the track had reached Point 6159 even though there was still further work to be done on some stretches, I decided to inspect the whole track at the end of that day's work. On my way up I met Licut Colonel Brian Montgomery the CO of the 4th Baluch Regiment who demanded to know how long I would be. Unfortunately I underestimated the time it would take to complete the inspection; I again met a very irate Colonel Montgomery on the way down, but the CRE was presented with an exact report.

Very shortly afterwards the various *maliks* (tribal elders) saw the uselessness of continuing to resist the mounting pressure of modern arms and one by one they returned to Oghi to deposit some money as the first sign of their willingness to

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Photo 3. 13 Field Company at work

surrender. The time limit was extended to enable the more truculent ones further to consider their position and the intention to put tanks on Point 6159 was made very public. The truculent ones became increasingly friendly. I was often invited to a meal in their villages, regrettably I could not accept even though it was most likely I would have been received as an honoured guest.

The track was completed and with its completion the full surrender of the tribes was accepted.

Frankly I do not think tanks would have made it and obviously the jeep track was never used for the intended purpose but on 16 January 1947 and as a consequence of our Indian driver getting into difficulties, I was able to drive the first jeep to the summit of Point 6159. What a climb! Some corners were so steep three or four reverses were needed to get round and once I was lifted round by manpower. Not surprisingly the clutch was burned out!

To be sure the surrender terms were fully met the force remained in Oghi until 25 January. Not a shot was fired in anger, there were no medals for the last frontier campaign and the Nandhar Tribes were left with a much improved road for any future raids they might contemplate.



The Dykes of Walcheren

MAJOR I H JOHNSON RE CEng MICE



A graduate of Bristol University, Major Johnson spent five years with the United Kingdom Atomic Energy Authority before joining the Corps in 1969. He served in the UK and Singapore before attending the Long Civil Engineer Course at RSME with a civil Engineer Course at RSME with a civil attackment in Australia. He returned to regimential duty as Secondin-Command of 2 Field Support Squadron and then back to RSME this time as an instructor in the Design Branch of the Civil Engineer Wing. He commanded 55 Training Squadron RE followed by 522 Specialist Team RE (Works), where he was at the

time of the presentation, and is now in the Directorate of Engineer Services (Army).

INTRODUCTION

THE 1985 BAOR meeting of the Institution was held at Willich Depot on 30 October 1985. It was arranged on behalf of Commander Engineers BAOR by 522 Specialist Team RE (Works), With nine months to research his chosen topic and to present it, the Officer Commanding obtained the services of a Liaison Officer through the Dutch MOD. They appointed Lieutenant Colonel (Retired) G Minderhoud in March 1985 and without his hard work since then the presentation would have been impossible. This article is a resumé of the proceedings.

THE BATTLE FOR THE SCHELDT (Major I H Johnson)

On 4 September 1944 11th British Armoured Division entered Antwerp with its docks intact. However the coup was not exploited and in an extraordinary series of lapses the initiative was lost. Pausing to refuel and reform, the Allies unwittingly gave the German Commanders a chance to extricate their beleagured 15th Army from the south bank of the Western Scheldt Estuary and to regroup their shattered forces throughout the Netherlands. By also leaving the Germans on the South Beveland peninsula, the Allies permitted them to retain their firm grip on both banks of the 85km estuary and to maintain their stranglebold on the port of Antwerp at its eastern end.

Following the ill-fated Arnhem operation, the Allies, largely dependent on the Mulberry harbours far behind their front lines, were dangerously stretching their lines of communication and were making deep inroads into their scarce reserves of manpower, transport and fuel. They had to open up Antwerp and to do this Walcheren had to be taken.

Walcheren, a saucer shaped island about 18km in diameter with about 90% of its interior below sea level, was heavily fortified with twenty batteries. The guns were of between 105 and 280mm calibre matched by numerous smaller weapons for defence against ground and air attack. The *Kriegsmarine* also operated a flotilla of cighty-five minor warships out of Flushing harbour which included fifteen E and ten R boats.

It was the Canadians who first suggested flooding Walcheren, and the Supreme Commander's approval was given on 1 October 1944. The floods would ruin the livelihood of thousands of Dutchmen and undo the work of centuries, but the need for Antwerp was so pressing that it was decided that the operation should be treated as a current one of war. In this case no special explanation would need be given to the Dutch Government in exile in UK. On 3 October 1944 the first dyke breach was

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Major I H Johnson


Figure 1 The location of Walcheren.

made at West Kapelle followed by further breaches on either side of Flushing on 7 October 1944, and at Veere on 8 October 1944. Two weeks later the bulk of the island was underwater. The invasion that followed was successful and on the evening of 4 November 1944 the first minesweepers got through to Antwerp and over 1000 tonnes of stores were landed by 1 December 1944.

WALCHEREN 1940-45 (Mr JC Van Winkelen)

Mr van Winkelen was still a schoolboy during the German occupation of Holland 1940–44, living in the little village of Serooskerke in the middle of Walcheren Island. He was deeply impressed by the events of the war. The outbreak of war in May 1940, life under the Germans, the launching of the V2, the flooding, the invasion and liberation, and finally the repair of the dykes ensured a hobby of a lifetime. Mr van Winkelen lives today in the same house that he occupied as a boy forty years ago, surrounded by an almost unequalled personal collection of wartime historical information on Walcheren. He is currently the office manager of the Post Office Audit Division in Zeeland & West Brabant.

Holland was invaded in May 1940 and from that time things were never the same in Walcheren. Most consumer items disappeared from the shops and we existed from living off the land or on substitute items. For example coffee made from acorns and barley, and hand operated dynamo torches produced because of the non-availability of dry batteries. These torches were made by Phillips of Eindhoven in Holland's only concentration camp at Vught.

Life under the Germans was difficult not only because of the shortages, but in every respect. For example the disappearance of the postage stamp from a letter sent to a *Wehrmacht* major resulted in interrogation and subsequent dismissal of the delivering postman. It was however possible to maintain one's morale by pinprick attacks in retaliation. Before a house was commandeered it would be inspected for suitability, but when the new occupant arrived he would find it stripped of all furniture and fittings except the bare essentials—plain wooden table, chair and hard bed.

It was in mid-1944 that the first of three V2 rockets was launched from my village.



Aan bewoners van de eilanden in de monding van de rivier de Schelde

ONMIDDELLIJKE EVACUATIE:

Leest nauwkeurig de tekst aan de andere zijde van dit strooibiljet ... waarschuwt uwe buren ... gaat weg zonder uitstel.

Figure 2 A leaflet dropped by the RAF warning of flooding.

The noise was amazing and at first very frightening. Some of the villagers left immediately to stay with friends fearing a retaliatory RAF attack against the launch site. Luckily for us it never came. On 2 October 1944 the RAF dropped leaflets warning us of possible bombardment and flooding *Figure 2*. The next day I watched the Lancasters bomb West Kapelle but it was some days before the flood waters reached us in the middle of the island. It was not long after this that the Allies landed and on 8 November 1944 we were liberated. It was very sad for us that a Buffalo tracked vehicle carrying men of 79 Assault Squadron RE and 48 Royal Marine Commando which was travelling through our village, hit a mine, hidden by the flood waters, and overturned killing five Sappers and fifteen Commandos. (See Sapper June 1985).

Life became different yet again once the Allies had replaced the Germans and the floods replaced the dry land. The floods affected the animals as much as the human beings. Many were lost presumed drowned, but my own cat disappeared for many months before being found in a neighbour's barn, hungry but unharmed. We relied greatly for transport on the Army with its DUKW's, none more so than my own father. He was out one day in a neighbour's horse-drawn cart which became stuck in a slit trench beside the road. The rescuing DUKW was carrying Mr Attlee who, as a British Minister of State, was making a tour of the flooded areas. Obviously many houses became untenable because of the floods and buildings on higher ground were used to the full. Our church in Serooskerke was subdivided amongst several families, one of whom was delivered of a baby in the pulpit.

WATER WATER EVERYWHERE NOR ... (Mr J Tuynman)

Mr Tuynman was at school in Flushing during the 1940-44 war in Holland, living now in Middleburg only a few miles from his wartime home. His interest in what happened to Walcheren and Flushing in particular has increased over the years. He is very pro Royal Engineers following the Corps' massive repair efforts on the Island after the war. He is now the Secretary of the Documentic Groep Walcheren 1939-45 which is a local historical society. Having recently retired from being a teacher at a local Secondary-Modern School, his historical passion has been able to come to the forefront.

As it became obvious to the Germans that they would soon have to withdraw, they set about the systematic destruction of Flushing and its port facilities (*Figure 3*). The dock sides were cratered and the lock gates destroyed with prior assistance from the



Figure 3 Systematic cratering of Flushing docksides.

RAF, which meant that the Walcheren Canal could not maintain its level. Hence the power station was also effectively out of commission as it could only generate twice per day when the tide was high enough to yield cooling water for it. The Germans also wished to sabotage the ship which was on the stocks in the Flushing shipyard (*Figure 4*). Laid down in 1938 for Rotterdamsche Lloyd it was still unfinished in 1944. (It was known merely as No 214 but was later commissioned as the *Willem Ruys* and in recent years was modernised and renamed the Achille Lauro of 1985



Figure 4 The unfinished Willem Ruys, alias Achille Lauro, awaiting completion in Flushing docks.



Figure 5 Traditional dyke repair method.

hijack fame.) The Dutch managed a 24 hour reprieve for the boat on the grounds that it contained the only saline/fresh water plant on the island. Obviously the Germans still had to drink. In the ensueing 24 hour period the Dutch Resistance managed to remove the bulk of the charges from under the very noses of the occupiers and the ship was never destroyed as intended.

The German HQ was in Middelburg, but General der Infanterie Wilhelm Daser, Commander 70th Infantry Division and responsible for the defence of Walcheren, refused to surrender to anybody less than a Colonel. Major RHB Johnston of the 7/9th Royal Scots took instant field promotion to Lieut Colonel on his own authority and promptly accepted the surrender of the occupying forces.

Flushing harbour, although not required for landing stores because of the far more convenient and operational port of Antwerp nearby, had facilities such as the shipyard which could be invaluable to the Allies. Hence No 6 Port Construction and Repair Group RE together with the Admiralty Salvage Vessels *Kingarth* and *Swin* were posted in. Throughout 1945 they worked hard to restore Flushing to operability (their work is very well described in an article entitled 'Temporary Repairs to the Locks at Flushing' in Volume 2 of *The Civil Engineer in War* published by the Institution of Civil Engineers in 1948). Whilst in Flushing the Sappers forged unbreakable ties with the inhabitants which are still maintained by individuals today.

EFFECTIVE LIAISON-AN ESSENTIAL FOR INNOVATION (Mr A H Beckett)

Graduating from London University in 1935 Mr Beckett has a lifetime of innovative engineering behind him. He served in the Corps between 1940 and 1946. As an assistant to Lieut Colonel W T Everall (of Everall Bridge fame) he conceived amongst other things the Mulberry flexible roadway for which he was later to receive an inventors award. He was seconded to 21 Army Group as their field adviser on Mulberry installation and later he became the War Office Liaison Officer and Adviser to the Walcheren dyke repair forces under Brigadier E E Read. He is now Senior Partner of the firm of consulting engineers Sir Bruce White Wolfe Barry and Partners in London.

Is liaison necessary in engineering? Yes sometimes it is, and Brigadier E E Read CBE MC obviously thought so when he lent me his caravan and sent me to find a dry patch near Middelburg to make myself available to the *Rijkswaterstaat* engineers trying to close the four gaps in the Walcheren sea defences.

I was soon summoned to a meeting of some of the World's most eminent maritime engineers. They knew all about dyke building and especially the difficulties of closing dyke gaps. One of the engineers, Verhay, had been to London to ask for materiel assistance, and was offered much surplus Mulberry equipment, mostly pontoons, kite anchors and mooring wires. I was expected to tell the engineers how to use them. Fortunately all the engineers spoke English (their fourth language!). The contractors and their labour force spoke little English, the exception to the rule being the famous Corpus Karlis whose knowledge of dredging was probably without equal.

The water was rushing through the gaps in the sea wall four times a day at a maximum rate often exceeding 10 knots. Sand-formed dykes scour readily in water velocities in excess of about 4 knots, so the gaps widened and deepened until maximum flow dropped to this threshold velocity.

The established technique for dyke repair was to prevent the deepening process by laying down stone weighted brushwood mattresses on a broad front inside the dyke gap (Figure 5). Over this a boulder clay bund was advanced from each side, its scaward face protected with layers of brushwood, rubble and stone, buttressed on the inland side by pumped sand. Quick closure is essential because as the gap decreases, so the velocities increase again causing further damage. It was proposed to use my large pontoons or elements to make this quick closure. I was asked about my experience in dyke building and what gaps my proposed methods had been used to close. I could claim nothing. I was told the only way to close gaps was with large quantities of stone. But stone was simply not available.

It was at this stage Lieut Spolstra (better known as the writer Den Doolard) entered the argument. A demonstration of the high capacity of the kite anchor was arranged by stalling a winch-equipped caterpillar tractor. A similar test of a standard ship's anchor merely cultivated the beach leaving a long furrow behind it. I had sold the Dutch engineers an anchoring system to withstand the enormous forces imposed by the tide on the large elements. The first test using concrete beetles came at the Nolle gap. It was personally conducted by the senior *Rijkswaterstaat* engineers and was successful. At the next high tide however the management was not present when six inadequately anchored beetles were swept away. This failure strained the liaison relations, but not for long and the gap at West Kapelle was closed shortly after the Nolle gap. Unfortunately an exceptional tide and sea gale in September 1945 reopened the Nolle gap which at its worst widened at a rate of a slow walk backwards from the edges. We were back further than square one. If only the liaison officer from England had let them use stone!

A walk round Flushing harbour revealed a new and very long concrete pontoon and piles of torpedo netting removed from the German harbour protection against submarine attack. The Dutch agreed to my plans for sinking the torpedo net laden pontoon in the gap lest I return to UK to report that they refused to try my suggestions and thus dry up all UK assistance. The netting at first refused to slip off the sloping deck of the scuppered pontoon into the gap underneath. However, once the restraining dck bollards were removed a successful gap closure resulted. The torpedo netting arrested scour underneath, without mattresses, sufficient to hold dumped clay and pumped sand (*Figure 6*). Another engineering 'first' after all. Good engineering perhaps but possibly only through excellent liaison where most of the credit must go to the Dutch.





Figure 6 Second Nolle gap closure.

FROM DYKES TO DELTAPLAN 1945-85 (Professor J H van Loenen) Professor van Loenen is a graduate of Delft Technical University who has worked for the firm of Volker Stevin in both Holland and abroad for twenty-eight years. He has had a deep involvement in the Delta Works, having designed the Eastern Scheldt Bridge, as well as having ten years experience of North Sea concrete structures. He has recently been the chairman of Volker Stevin's British daughter company of Harbour and General Works which built the Orwell bridge near Ipswich. Since 1984 he has been the Professor of Civil Engineering at the Netherlands Royal Military Academy.

We have already heard about the traditional methods of dyke construction and how they were adopted to meet the needs of Walcheren in 1945. The floods of 1953 caused further revision of the methods. The combination of high tide, wind and low pressure over the North Sea all met between the coasts of Suffolk and Holland resulting in floods (*Figure 7*). The damage was mainly caused by overtopping of the dykes and then scour from behind rather than by direct frontal attack.

Drastic action had to be taken and the Delta project came into being in 1958 (Figure 8). Of the two options available (long dykes along existing shorelines or relatively short dams across the outer edge of the delta) that of dams was chosen, thereby shortening the coastline of the Netherlands by seven hundred kilometres. A glance at Figure 8 shows that in some cases the area of water to be trapped behind the main dams would have been enormous. One of the principles therefore of water control is to cut down the potential amount of water crossing the main barrier twice each tide by subdividing the enclosed area, hence the secondary dams. The next aim is to reduce the extremes of water level difference on either side of the barrier. To do this we restrict water flow through the barrier. Unfortunately restricting flow raises velocities and we have already heard that 4 knots is the maximum possible without scour. Thus an anti-scour sea bottom is essential.

Study of *Figure 8* shows that the northern openings in the delta have fixed barriers which act as the stopcock of the Netherlands allowing water through only when the Rhine is in full spate. The banks of the new waterway have had to be raised, instead of placing a dam at the Hook of Holland, to allow access to Rotterdam and eventually the Rhine. The same is true in the Western Scheldt where there is no barrier thus



Figure 7 The 1953 floods.



Figure 8 The Delta project.





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giving easy access to Antwerp. In 1973 a further Dutch Government study decided that the Eastern Scheldt had to remain open to the sea maintaining the ebb and flow of the tide. This would preserve the natural environment of the area whilst guaranteeing the safety of Zceland from the sea during storms. In 1976 Parliament approved the construction of a storm-surge barrier. The new scheme was so ambitious and complex that research and preparation became of paramount importance. Drawing offices and laboratories concerned with hydraulics, soil mechanics and environmental sciences explored the limits of technology. The result was a storm-surge barrier, due to be completed in 1986, about 3000m long consisting of sixty-two steel sluice-gates between piers. In normal conditions these piers will remain open and the tide will flow in and out as usual, but when a storm threatens they will close against lashing seas.

The seabed must be prepared and constructed in such a way that the enormous forces occurring when the gates are closed in a storm do not cause movement of the piers and jamming of the gates. After seabed compaction by vibration, prefabricated stone filled foundation mattresses, 200m×42m×360mm, were laid side by side along the centre-line of the barrier. These were topped by 60m×29m×360mm mattresses to reinforce the foundation structure. The prefabricated piers, each between 30 and 38m tall and weighing 18000 tonnes, were built in a gigantic dry dock constructed in the shallows in the centre of the Eastern Scheldt (Figure 9). With a floor area of one square kilometre, the dock's base is 15.2m below sea level. It is sub-divided into four to allow one quarter to be flooded at a time for extraction of completed piers. Using specially designed lifting and positioning vessels the piers were accurately lifted. transported and positioned on their prepared foundations. To increase the stability of the piers once they were installed, a sill, built up of graded layers of stone was constructed under water around the base of the piers. The top layer consisted of basalt blocks weighing 6-10 tonnes in order to ensure that, should a gate fail to close, the stone would not be carried away by the currents, thus endangering the whole barrier. Stone for the project came from Germany and Finland,

Once the underwater sill was completed the superstructure was placed. This consists (in order of assembly) of road bridge box girders, pier capping units, gates, sill beams and upper beams. The final action was to improve the flow profile around the piers by dumping further stone at their feet.

Once operational the entire operating system of the barrier will be tested at least once a month to ensure that the gates work properly. It is expected that they will have to be closed once or twice a year because of the exceptionally high water levels. It will take about one hour to close or open the hydraulically operated gates, because if they are closed too quickly undesirable wave movements may occur in the Eastern Scheidt.

After a period of questions and votes of thanks, the meeting was closed.

The Brandset Bunch v the Bomoen Baddies

CAPTAIN G A NIELD B Sc RE



Captain Geoff Nield was commissioned into the Corps in 1978. After an attachment to 10 Field Squadron and YO training, he completed a tour as a troop commander with 16 Field Squadron before taking his degree course at RMCS Shrivenham. He was currently commanding the Independent Field Troop RE (AMF (L)) at the time of this article.

As part of the British Contingent to the Ace Mobile Force (AMF) the Independent Field Troop RE AMF(L) has developed a unique relationship with its predominant host nation, Norway. A minimum of five months is spent in the country each year. During the three months of winter after Christmas the Troop trains for its role in support of the British battalion group. In the summer it completes a construction project for the Norwegian Government.

Northern Quest exercises have taken place in June and July since 1976 in Western Norway in the area of Mjolfjell, Brandsethdahlen and Voss. The Independent Field Troop RE AMF(L) has always been the tasked unit and the construction work has been, in part, quid pro quo for the training facilities offered to the British contingent during their winter deployment in the same area. The senior Norwegian military command is Distrikts Kommando Vestlandet (DKV) which has its headquarters at Bergen. Under command of HQ DKV, and the direct hosts of the Troop each year is the 10th Infantry Regiment (IR 10).

In 1985 Exercise Northern Quest had a fine competitive edge to it. The scope of work involved the extension of the Brandset range road by 1.5km to the Tverrelvi river and the construction of a high quality carpenters workshop in Bomoen Camp. In the first case the Troop had never attempted that length of road before and in the second case such luxuries as plumbing, lighting and underfloor beating for the workshop had never been undertaken in Norway in previous exercises. Both these major tasks were ideally suited to the Troop, providing balanced employment for all tradesmen. A further challenge was presented to troop administrative and logistic resources having to meet the demands of two locations separated by 40km. In all aspects, herefore, the Troop anticipated a testing period.

Three weeks pre-project training and warm weather in May raised everyone's hopes and the Troop arrived in Norway highly motivated and eager to begin. Our arrival, however, must have been the catalysis that set of the wettest summer in Europe since the last Irish potato famine. The road site presented us with our first problems. The access road (to be enhanced by a Norwegian firm at a later date) to our start point at Grannako Bridge was insufficient in bearing to take wheeled vehicles. The particularly damp conditions after the winter melt and the horribly regular rainfall had turned it into a quagmire. Attempts to win fill material from a local borrow pit were foiled by too high motisture levels. The only alternative was to haul river gravel up from a quarry 5km away which proved the Troop's 4-ton tippers to be totally inadequate for the task in hand. The potholed and uneven haulage road and 300m climb with a full load meant a turn round time of one hour (*photo I*) and finally led

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Captain G A Nield



Photo 1. A troop 4-ton tipper labouring under a load from the river quarry.

to both vehicles breaking down with fractured differential casings. Support from two 8-ton Norwegian tippers was welcomed on the fourth day of the exercise and speeded up construction considerably. The exercise start point was finally reached at the end of the first week with an additional 250m of road and four temporary culverts constructed.

With the first 'milestone' behind them and in spite of the enforced delay it did not take the plant party and culvert gang long to get their tails up and begin working in earnest. Once the early mechanical problems had been resolved and a routine developed work progressed at a steady rate of 50m a day (*photo 2*). The road was constructed through a sparse conifer woodland with an undergrowth of heather and gorse growing in a peat toplayer which varied in depth from 200mm to 1000mm in some places. Where the peat layer was less than 300mm it was excavated; if it was greater the ground was left undisturbed and Terram laid across the scrubbed site. As the elevation



Photo 2. A view looking back along the alignment showing the survey pegs and the Norwegian Akerman ditching.



Photo 3. Internal view of timber framework, insulation and reinforcement prepared for the fixing of underground cables.

of the road increased the quality of fill material improved proportionally, with a total of five borrow pits being opened.

During the second week, therefore, we abandoned the river quarry and developed the local resource. The task was not without its daily problems, the most irksome being the regular afternoon rain which kept moisture levels too high for compaction with the 5 ton vibrating roller until the last few weeks of the exercise. The early additional work and a particularly tight cascade meant that eighteen hours shift work was warranted for a two week period.

Whilst half the Troop were fighting against the elements in the Brandset Valley on the road the other half were involved in the construction of a carpenter's workshop in Bomoen Camp nearer town. The difference in work conditions between the two camps became the object of some good natured rivalry with the 'Bomoen Baddies' receiving considerable stick for their more comfortable surroundings. No matter what the circumstances, however, the pressure to complete the workshop to a very high standard was even greater. The Norwegians expressed considerable doubt as to the Troop's artisan capabilities in meeting the quality of work they desired. Their doubt even led to a visit by the project engineer to the Troop in UK and a tour around the Brompton workshops six months before the start of the exercise. Though the visit proved a complete success early weeks of the exercise proved a nervous time for both parties.

The workshop task was to extend an existing storage building in Bomoon Camp by 14.5m. It included the construction of the foundations, electrically heated reinforced concrete floor slab, timber frame building, washing and toilet facilities and associated plumbing, electrical and finishing work (photos 3 and 4). The quality control on the site was maintained by a Clerk of Works who was instrumental in preventing any major problems. Past experience in Norway pin-pointed the unreliability of certain local firms in providing materials at the right time. Forward planning and early materials bids avoided any time wasting and saved costs. During the construction work close liaison was maintained with the Norwegian camp maintenance tradesmen when their assistance and advice was occasionally sought. In respect of the electrical and plumbing services it was a necessity. In all, mutual co-operation was excellent and was a substantial influence in the success of the exercise.

In spite of some particularly wearing conditions a nervous host unit's doubts over



Photo 4. Troop carpenters fixing icopal shingle stick-on tiles to the roof boarding.

our capabilities were allayed and the finished product on both task sites earned confident approval and thanks from the Norwegians. The result has set the pattern for further Northern Quest exercises. The balance provided by the road construction and the carpenter's workshop employed all trades and departments within the Independent Field Troop RE AMF(L) in a demanding and challenging enterprise. In all respects the Brandset Bunch and Bomoen Baddies left fully satisfied with a happy customer and some excellent training completed.

KNOW YOUR HISTORY



Lord Kitchener's Coach

MAJOR A N STACEY MBE RE

FOREWORD BY COLONEL A H W SANDES MA MICE Chairman, Royal Engineers Historical Society

The Royal Engineers Journal of December 1959 included the short article by Major A N Stacey MBE RE reproduced below, which sought further information about the legend that an antique saloon railway coach in use on the Shoeburyness Military Tramway had been used by Lord Kitchener.

So far as I know the article did not produce anything helpful, indeed Major Stacey's interesting final comment, that the coach would continue to be treated as a valued Sapper museum piece under the care and custody of RE(Transportation), seems to have been inexplicably forgotten in the re-organization of Corps responsibilities in the mid-1960s.

However, the Royal Engineers Historical Society has now taken up the investigation where Major Stacey left off only twenty-seven years ago, and we hope that with the recent increase in interest in Corps history in general, and in the preservation of obsolete equipments in particular, it may yet be possible to establish a firm link between the coach and one of the most eminent officers of our Corps. I would therefore be more than pleased to hear from anyone who can help us in this project.

THE rolling stock of the Shoeburyness Military Tramway has, for many years, included a vehicle known as "Lord Kitchener's coach". It is an eight-wheeled non-bogie saloon which has the appearance of being constructed about the 80s and the bodywork, with overhanging eaves which bring it slightly out of gauge for general running over British Railways, suggests that it was intended, or adapted, for service in a tropical climate. The initials "TVR" (? Taff Vale Railway or something or other Valley Railway) on the luggage rack brackets, however, give cause for thought.

The coach has a plate showing that it was built by the Metropolitan Carriage and Wagon Co for the S and B Railway. It has also another plate inscribed "This coach did service on the Suakin-Berber Railway. It is reputed to have been the saloon used by Lord Kitchener". When and why the latter was affixed is not on record. Study of many books about K of K and military railways in the Sudan has not produced any positive evidence for the association alleged or, indeed, that Lord Kitchener had anything to do with the Suakin-Berber Railway.

That 200-mile standard-guage line was projected in 1884 as part of the general effort to relieve Gordon. Considerable quantities of permanent way and rolling stock (including six saloons) were ordered to the tune of £2 million, mostly second-hand ex-various railway companies in UK and of various unmatchable types, eg square fishbolts for round holes. Some reached Suakin and was used, some was never unloaded at that place, other items were diverted to Egypt and the rest never left England.

The full tale of this still-born scheme and its political and financial repercussions is another story which contains something of topical interest in regard to the relative responsibilities of RE and civilian works services, also the need for a comprehensive military railway organization.

Work actually started in March 1885 and was then, following the fail of Khartoum, regarded as contributing to the campaign to punish the Mahdi. Construction was stopped, on Wolseley's orders, in May when only 19 miles had been laid, as a result of the withdrawal of the Suakin Field Force. The line was then abandoned to the desert and to the Arabs who found the metals very useful for conversion to weapons and other purposes. It is doubtful whether any trains ran over the track except contractors' locos and wagons and an armoured vehicle improvised to protect the worktnen.



Photo 1. The coach at Shoeburyness 1985

The S & B Railway is quite different from the existing Atbara-Port Sudan branch (3ft 6in guage) of the Sudan Government Railways. This was opened in 1905 to Suakin, the Sallom-Suakin portion being taken up some time after the Sallom-Port Sudan section was laid in.

In the early part of 1885 Major Kitchener was DAAG in Egypt and he returned to England in July. Whilst he may have visited Suakin during the construction period there is no mention of it and it is doubtful whether the saloon would have reached Suakin, let alone been allotted for use by one who was not then a very senior officer. He might, of course, have accompanied the local commander, General Sir Gerald Graham, on a trip over the embryo railway.

The first direct reference to Kitchener at Suakin is when he was appointed Governor of the Red Sea Littoral in August 1886, by which time the S & B was history and history that many people wished to forget in view of the furore in the House about something like £1 million "nugatory" expenditure.

Wolseley is reported as asking whether the unused stuff at Suakin should be returned to UK and it is known that some items were taken over by the Egyptian Railway Board. Common belief is that much did return been and found its way to Shoebury and, later, to Longmoor. On the other hand it is recorded that materials still in War Office hands were hidden away at Woolwich and in time, quietly disposed of, perhaps by transfer to Shoebury.

Lord Kitchener's coach may have been in any of these lots but there is a note that 500 tons (presumably shipping weight) or rolling stock *en route* to Staakin was diverted to Egypt and consigned to the O i/c Railways at Wadi Halfa. What use it would have been on the 3ft 6in desert line is a moot point but this may have been an attempt to demonstrate that, after all, the money had not been wasted.

If the saloon was in this batch it may well have been retained for operation on the Egyptian (standard-guage) lines and allotted for use by Colonel Kitchener when he became AG in 1888 or Sirdar in 1892, but not on the S & B. In this event the question remains as to why and when it was returned to England.

Shoebury show the vehicle as arriving from Woolwich in 1898. Had it been running on the Arsenal lines or was Woolwich (? Crossness Pier) used as a convenient place for disembarkation? It might have been part of the gear parked at Woolwich out of the public eye as already described.

Lord Kitchener's Coach (1)

Is the tradition firmly based or is it something of a nice legend? Any information or suggestions leading to more definite clues would be welcomed. In the meantime Lord Kitchener's coash will continue to be treated as a valued Sapper museum piece under the care and custody of RE (Transportation).

An account of the ill-fated Suakin-Berber Railway project is given in Chapter 3 of *The Royal Engineers in Egypt and the Sudan* by Lieut-Colonel E W C Sandes. The railway was to be a rail link from the Red Sea to the Sudan. It started from Quarantine Island in Suakin harbour and early in 1885 sidings were prepared and a line laid across the causeway to the mainland. By 30 April of that year the line had reached Otao, the limit of the protection of the outer defences of Suakin. In May, however, the Government decided to abandon the project of continuing the line to Berber and the Suakin Garrison was greatly reduced. Most of the material and rolling stock shipped out for the Berber Railway project was sent back to England; nevertheless the cost of the 18¼ miles of railway from Suakin to Otao had amounted to £865,000.

Lord Kitchener was Governor-General of the Red Sea Littoral from 1886–1888 and it is possible that he may have used the coach described in this article to journey to and from his headquarters at Suakin to the limit of his territory at Otao. The journey would have been faster and more comfortable than by horse. There were no staff cars in those days.

Nothing now remains of the Suakin-Otao Railway. The present line runs from Port Sudan to Berber.--EDITOR.



Photo 1. The Nakano-Hashi bridge

THE Yokogawa Bridge Works, Ltd, of Tokyo, Japan recently sent the following communication to The Welding Institute. We are indebted to them for permission to publish and to RARDE (Christchurch) for bringing the subject to our notice. In the early days of 1985, an old footbridge name of Nakano-Hashi in Tokyo, consisting of welded truss members was put out of use and scrapped. The truss



Photo 2. Detail of weld and connecting pin

members of this bridge had been diverted from military bridge called KKT, which was designed and fabricated by the Yokogawa Bridge Works in 1929.

KKT consisted of many portable 3m long truss units with pin connections. The maximum available span was 32m. These units were made of angle steels by metalarc welding.

It was the first time welding techniques were applied to bridge fabrication in Japan. The welding was carried out using a motor-generator type DC are welder with 300A capacity and thin-coated electrodes named Type F. Both welder and electrodes were made by the General Electric Company, USA.

The Yokogawa Bridge Works has kept one unit of KKT truss from the bridge as a memento of the welded structure.

FOOTNOTE BY COLONEL J H JOINER B Sc, MICE, FI Struct E. THE JAPANESE KKT BRIDGE AND THE BRITISH BOX GIRDER BRIDGES.

NOTES and photographs of the Japanese military bridge known as KKT immediately give rise to comparison with the British Box Girder bridges developed at about the same time.

Major G le Q Martel DSO MC RE (later Lieut General Sir Gifford le Q Martel) first submitted his proposals for the Large Box Girder Bridge to the War Office in 1920, whilst commanding the Experimental Bridging Company Royal Engineers at Christchurch. As with the KKT, the box sections were pinned together at the corners to form girders, which were then laid side by side to form a deck bridge; unlike the KKT however the sections were not welded, but were made from standard rolled steel angles riveted together. Although the box sections of the two bridges are not dimensionally the same the general layout and bracing pattern of the two bridges was very similar, as can be seen from *Photo 3*, the KKT merely introducing extra vertical members in the panels. The LBG was the first British military bridge to use pins to connect members or panels together to form a bridge, and in this respect was a forerunner of the Bailey Bridge of World War II; the bridge was adopted by the British Army in 1928.

Whilst commanding 17 Field Company RE in the mid'twenties, Martel produced initial proposals for a lighter version of the LBG to be known as the Small Box Girder bridge. This bridge had very similar bracing to the LBG and once again box sections were pinned at the corners to form girders for use in a deck type bridge. In this case, however, high tensile steel members were used to fabricate the box sections, the members being welded together instead of being riveted. This resulted from considerable research carried out at EBE into welding techniques and also into design of pinned joints, work that once again laid foundations for the Bailey Bridge design that followed some fifteen years later. The first set of SBG equipment had been completed and was ready for trials by the end of 1928, just prior to the recorded date for design and fabrication of the KKT, that is 1929.



Photo 3. This photograph was taken at the time of the early trials on the Box Girder Bridge, carried out by the Experimental Bridging Company, Royal Engineers, in 1921, at Christchurch. Only enough equipment was available to provide hornbeam sections at one end of the three girder, 48ft long bridge. The bridge is shown being tested by a Heavy Tank Mark $V^{\bullet\bullet}$, on which was based the prototype Royal Engineer Tank, intended to carry and lay the 21ft Lock Bridge, an anti-mine roller, or a 15 ton crane jib, and was thus the fore-runner of the modern AVRE. The bridge in the back ground is a 165ft span Inglis Bridge Mark II, developed by Professor Inglis of Cambridge University, who was a wartime Sapper Major, during World War I; Inglis also produced the first designs for the Lock Bridge. A fuller report on the Box Girder trials, contributed by the RE Board, appeared in the October 1921 Journal, and included a very similar photograph to that above.

Early Days

MLC

IN 1886, judging by comments in the *Journal*, quite a few officers were not too strong on Corps History. Even today a reminder of some key occasions may not be out of place! In 1887, indeed as now in 1987, the Corps was faced with a centenary of one of its main landmarks, and in the 1886 *Journals* there was a lively interest as to exactly what was being celebrated and what should be done.

Firstly some dates! Up till 1716 the engineering and artillery needs of the Army had been provided on a somewhat ad hoc basis, eg, an ordnance train containing both elements was established by the Ordnance Board under the Master General of the Ordnance for a particular campaign, and thereafter disbanded. In 1716 a regular Corps of Engineers, which consisted only of officers, and Regiment of Artillery were created on separate and permanent establishments. In 1772 (as most of us know), a Military Company of Artificers was raised at Gibraltar. Up to that time, the necessary other rank element for engineer tasks had been provided by tradesmen and labourers drafted from the regiments in the garrison, and by civilian workmen sent out from England, the officers being supplied by the Corps of Engineers. In 1787 similar units were raised in the UK, known as the Corps of Military Artificers, with which the Gibraltar units were amalgamated. At the same time, in 1787, the Corps of Engineers was renamed as the Corps of Royal Engineers.

The Royal Warrant of 1787 stated that "our said Corps of Royal Engineers shall rank in the Army with our Royal Regiment of Artillery; and wherever there shall be occasion to take part with any other Corps of the Army the post of the Corps of Royal Engineers shall be on the right, with the Royal Regiment of Artillery, according to the dates of commission of the Officers of the Royal Regiment of Artillery and Corps of Royal Engineers."

In 1813 the title of the Corps of Military Artificers was changed to Royal Sappers and Miners and, finally, in 1856, one Corps, the Corps of Royal Engineers, to include both officers and other ranks, was established.

In 1886, as stated above, there was some discussion in the *Journal* about the forthcoming centenary. At the 1886 AGM it was decided that a committee should be formed to examine how the award of the Royal title should best be celebrated. But this was only after it had been pointed out that this change was only a comparatively minor episode, and in no way really indicated the formation of the Corps of Royal Engineers. An Engineer Corps, so it was strongly maintained, in one form or another, had been in existence for some 700 years. Even the first head of the Royal Artillery in 1716, General Borgard, was an Engineer Officer. In fact the award of the Royal title was only "an episode in a career," and that, for some, the pride of belonging to the Corps of Royal Engineers was in no way increased by the fact that the Corps had been Royal for a century. The conclusion seemed to have been that some sort of celebration should take place, but "it should not be made too much of."

Also it is of interest to note that, and as reported in the *Journal*, the Institution of Civil Engineers was concerned as to why the title of 'Engineer' had been appropriated for that profession. It seems that someone, in about 1771, was the first civilian constructor to call himself an engineer, although hitherto, and for very many years, the term had been applied to persons in military service. In essence the title 'military' or 'civilian' engineer only indicated whether an individual performed the same type of work, but under civil rather than military control. It seems that in 1886 the description 'Civil Engineer' had given rise to "much discussion." What had caused this discussion is not made clear, perhaps because some thought that military engineers should not be excluded from corporate rights in the civilian institutions.

The personal financial hazards of being an engineer in military service were nicely illustrated. In the *Professional Papers* for 1886, a long paper on the development of

Dover Castle records that in around 1780, when the French and Spanish threatened, the situation to those directly involved in building up the coast defences appeared to be urgent indeed, but their concern seems to have had little effect on government parsimony. The engineer at Dover reported "the little stock of ready money I could raise on my own has been expended to keep the labourers at work." "Happily" as the author remarks, "the patriotism of Engineer Officers of the present day is not required to stand the test of having to pay large bodies of labourers out of their own pockets."

Another example is contained in a very long obituary of Major General Boileau, FRS, published in the December 1886 Journal. The General spent practically the whole of his long and distinguished career in India, in the PWD. Boileau was a very thorough officer and had no patience with those who accepted shoddy work in the interests of saving money. In designing and building St George's Church and a college in Agra, he exceeded his estimate by £3,000. This he was required to repay before he was permitted to go on leave to England. This repayment "severely crippled him." It was recorded in Boileau's confidential file that throughout his career he was "guilty of attending more to the quality of his work than to its cheapness."!

A very large civil engineering project, the success of which "may be boldly questioned," was the Panama Canal, which figured quite prominently in the Journal. This was started under de Lesseps in 1883. The scale was staggering, cuttings, for instance, 120 metres deep, needing 20,000 labourers on this section alone. The deployment of excavators, locomotives and dredgers was on a "colossal scale." About one hundred million cubic metres of rock and other fill had to be moved, the disposal of which being almost as difficult as the excavation. French, American, Italian, Swiss, Swedish and Anglo-Dutch contractors were involved, of which the last had the largest share.

As with the Channel Tunnel, there had been alternative schemes, one of which being a ship railway. In this, ships would have been lifted bodily out of the water, placed on railway trailers, and thus transported from one ocean to the other. The rail bed was to be about 50 feet wide and the weight uniformly distributed on the trailers by hydraulic rams. Three locomotives of about 65 tons each were to be required. These could manage about a one percent gradient. Changes in direction of more than 20 miles radius were to be accumulated, and every so often abrupt changes would have to be made by using turn-tables based on floating pontoons. The supporters of this scheme naturally had many reasons for saying that the chosen scheme would be a financial disaster, even if the building and operating difficulties were ever overcome. Let us hope that the scheme selected for the Channel Tunnel will be as successful as the "fixed link" across the Panama Isthmus!

As in 1885, the controversy over the form the Gordon memorial should take was still active in the *Journal*, although after the wide-ranging discussions in 1885 Corps opinion seemed to have favoured a statue in Brompton Barracks. The matter was finally settled at the 1886 AGM. One speaker at the AGM whole-heartedly castigated his brother officers for subscribing such a "paltry amount" (which he understood to be £1,887). This he put down to the fear that the most likely place for any memorial was Rochester Cathedral. "The Corps never has taken and never will take the least interest in embellishing Rochester Cathedral." The speaker ended up with an impassioned plea for a Garrison Chapel to be erected in Gordon's memory.

After much discussion, some heated, the AGM voted in favour of a statue in Brompton, but against any memorial in the Cathedral. A bust in Westminster Abbey was also carried unanimously, with a replica of the bust to be presented to the Royal Artillery, who had also subscribed to the memorial.

Some miscellaneous items, published in the 1886 Journals, are of more than passing interest to the modern reader. Major General Sir Charles Warren RE had recently returned with much credit from successfully commanding the Bechuanaland Expedition. The object of this expedition, it is worth recalling, had been "to maintain the landed rights of the natives against the encroachments by the white settlers." Sir Charles, on his return from South Africa, was appointed Chief Commissioner of the Metropolitan Police. The Appointment received much favourable comment in the national press. An article in an Italian Military Journal stated that in the Tel el Kebir campaign of 1882, the performance of 8 Railway Company RE was "inefficiently accomplished". Readers of the 1882 Journals would not have got that impression! Anyway, it was alleged that the "few weeks of practising the men before they embarked (as readers of 'Early Days' in 1982 may remember) were judged to be quite insufficient for the duties they were expected to perform. Unfortunately, in this extract, no reasons were included as to why the Italian observer had come to this conclusion. Another Italian article—a hundred years ago editors of the Journal delighted in printing translations of extracts from foreign military reviews—was intriguingly headed "A dissertation on bad language amongst soldiers." Unfortunately only the bare chapter heading is given. Perhaps it might have answered the question why today's German soldier seems to draw his favourite epithet from that activity associated with a deep trench, while his British counterpart has a quite different approach!

In another short note headed "Our Trade with Western China" it is stated that America "is running us hard for the command of the China markets, and everyone knows that any interference with our seaborne opium trade would seriously damage the Indian revenue." The conclusion was that a secure land route from India to China was necessary. There is no knowing whether the RE reader of those days felt a stir of conscience as he read this. The drug trade today, eg, between Pakistan and Europe, is viewed rather differently.

The IGF, Sir Andrew Clarke, retired from his post as 'EinC' in July 1886. The Journal announced that he had become a director of the Palmer Shipbuilding Co at Jarrow and had been elected to the Board of the London and Colonial Mutual Life Assurance Society. Also, in each number of the monthly Journal were printed quite comprehensive lists of time expired other ranks, such as "Sapper R Taylor, age 45, service 21, single, plumber. Character v. good." Let us hope that they, like the IGF, got well settled into civilian life.

These notes have generally concluded with a comment on the RE Widows Society. The 1886 AGM was uneventful. The handsome pension of £30 per year, plus a £25 bonus, was continued—a total sum of perhaps well over £1,500 in today's currency.



THE ROYAL ENGINEERS JOURNAL

The Ravelin Museum



Photo 1 Artists Impression of the front of the building (by Lieut Colonel S C E Weld)

The pace is quickening in the Museum and Institution members will be interested to know how plans are working out. First, a reminder on the overall concept (see Plan A). The development is broken down into four stages:

Stage I is the move of the old Museum into the ground floor of the Ravelin Building. Because the northern side of the building did not become available until April this year, Stage I is subdivided into Stages 1A and 1B. Stage 1 depicts the chronological growth of military engineering from Norman times to the end of World War 2. However, it also includes, as a separate display, the Medal Rooms, including a special VC cabinet containing the 18 VCs in the possession of the Corps. The Museum Shop will open during this stage.

Stage 2 entails the roofing over the courtyard of the Ravelin building to contain a display of large construction equipment in a post war setting. A cafeteria is included in this stage.

Stage 3 will involve extending the displays into the moat, including the Engine Shed. Access is planned by means of a tunnel. Initially the Engine Shed will house the armoured engineer display although this may eventually move to the Stage 4 area.

Stage 4 will require a new building in the moat to the East of the Engine Shed. Some 20,000 sq ft of new space will house displays of the various specialist branches of the Corps and will bring the whole Museum up to the present day if possible with a glimpse, too, of the future. A special feature of Stage 4 will be the transportation section including a layout of the demonstration track recovered last year from Longmoor.



Photo 2 The VC Cabinet

PROGRESS

Construction work is now complete in all the rooms in the Stage I area. Some displays have been set up but a considerable task confronts the curatorial staff in laying out the remainder before the opening date on 30 August this year. A foretaste of the result is shown in *Photos 2 to 4*.

The construction work for Stage 1B is now in progress. A professional design team has been engaged to plan the layouts. The aim will be to create an atmosphere appropriate to the items being displayed and to cover as many aspects of the Sapper work as possible in the various theatres of operations in World War 2.

Design work is in hand for Stage 2 with the aim of letting a design-and-construct contract for the courtyard roof in the late summer or early autumn of this year.

At present work on Stages 3 and 4 is limited to cost estimating and obtaining overall clearance for the plans from the various authorities concerned.

ORGANIZATION AND RESPONSIBILITY

The Museum is a Corps Museum in the charge of the Institution. It has been decided that this situation, enshrined in the Charter of the Institution, will continue. To that end the Secretary of the Institution, Colonel G W A Napier, has been designated Museum Development Director. He will remain in overall charge of Institution affairs as its Chief Executive and will be given suitable support in the Institution staff to allow the normal Institution functions to continue as now.

A Project Officer, Major H A Caulfield, has been in charge of the construction side of the Museum since last August. He has built up a team, with the EinC's authority, of first class tradesmen who are now fully in the swing of turning out excellent work.

The Museum Curator, Ms Caroline M Reed, recently appointed to take over from Lieut Colonel C T P Holland MBE who retired early in 1985, is in charge of preparing the displays and for the manner of their presentation in conjunction with the designers.



Photo 3 The Siegecraft display

MONEY

The Appeal Fund launched by the Institution in 1983 to cover Stage 1 has been very successful. The total cost of Stage 1 will be about £90,000 and this will be covered by the donations received plus certain grants obtained for specific purposes. This handsome contribution from the Corps past and present has been crucial not only to cover the costs of Stage 1, but also to demonstrate the Corps' firm commitment to the whole project. It is not going unnoticed by those who are concerned with the further steps of fund raising.

Stages 2 to 4 are going to cost a further £4 million. The Corps is taking the lead in this matter under the active patronage of the Chief Royal Engineer. A firm of fund-raising consultants, Donors International, has been engaged. On their advice, a Foundation is in process of being formed by a Steering Group under the chairmanship of the Regimental Colonel, Colonel W T Dennison OBE, which will lead to an organisation of Trustees capable of providing for the capital requirements of the Museum. Even at this early stage much goodwill and enthusiasm in the project is being shown and there is full confidence that our eventual targets will be realised.

THE FUTURE

The more that plans develop, the more encouragement we receive from those with whom we come into contact. The Ravelin building raises an immediate response from outsiders who are struck by its appropriateness for the purpose. Its proximity to the 18th Century Moat which formed part of the defences of Chatham Docks enhances the building's significance. Its relationship to the impressive Fort Amherst development and Historic Dockyard Trust offer immense potential for the future in attracting visitors and placing the Medway Towns among the leading heritage centres in this country.

The pace at which work proceeds is very much geared to the rate at which money

Photo 4 The Crimea hut

can be raised. No stage will be started before the funds become available for it. In broad terms, however, the target completion dates, including the setting up of displays are

30 August 1986 (Open to the public)
March 1987
March 1988
December 1988
December 1989

The Corps can take great pride in the fact that so much of the work so far has been carried out by its own tradesmen. While, in the future, it will be necessary to turn to civilian contractors in a number of areas, there will continue to be many opportunities for work by Corps tradesmen and help will be sought from units in other ways as well. It is hoped that all unit commanders will be able to lend their support to this exciting project which has so much potential for the future of the Corps, not only in simply looking after our heritage but also in keeping the Corps, and its contribution both to the Services and to the civilian engineering world, fully in the public eye.

The Corps and the Rock Temple at Abu Simbel

In the September 1967 *RE Journal*, Brigadier A B D Edwards, CBE, MC, described the part played by the Corps in 1892 to save the Colossi at Abu Simbel from serious damage or even destruction from a landslide. He recorded that a member of 25 (Fortress) Company who undertook the work had recorded his visit by inscribing his name on one of the Colossi.

The Colossi have now, of course, been moved but the inscription "Sapper I A W Beale RE 1892" is still visible as shown by the photograph taken recently by a friend of Brigadier Edwards.

Photo 1. Foot of Abu Simbel Colossus

Memoirs

MAJOR GENERAL J R C HAMILTON CB CBE DSO MA

Born I April 1906, died 8 July 1985, aged 79

JOHN ROBERT CROSSE HAMILTON who was usually called Jack by his family and friends was born in 1906 and educated at Radley College. He passed into the RMA Woolwich in February 1924 and joined No 14 YO Batch at the SME, Chatham in February 1926.

Here, early in his career, a stroke of luck befell. It was agreed between the War Office and Cambridge University that the whole of 14 YO Batch would be accepted at the University in statur pupillari to read for the Part II Examination of the Mechanical Sciences Tripos, taking place the next year.

Jack therefore went to Gonville and Caius College in October 1926 and enjoyed with zest a way of life for a year against a background of civilized existence and study, which left its mark on his character

for life. His first posting was to 9 Field Company RE in 1928 at Shorncliffe, followed by two years in the Training Battalion in Brompton Barracks, Chatham. These were formative years, for what Ulysses said of Ithaca might well be said of the old TB "It was a small land but a fit nurse for men". Here he took a keen interest in the young soldiers' games and recreation—particularly Rugby Football. He had played rugger for Radley, the Shop and for Gonville and Caius College. FWS, himself a Cambridge blue, reports that "Jack was a very keen rugger player and helped many youngsters in every way he could. In later life he took to walking as a way of exercise, and after he left the Army he did a lot of it". Jack and his wife Rosamond also devoted many hours to creating lovely gardens in several houses where they lived after retiring from the Service.

In 1934 Jack was posted to 40 Fortress Company in Hong Kong and was promoted Captain in 1936. He returned to the UK that autumn to become Adjutant of a TA Battalion (5 Warwicks), which under the gathering clouds of war was being reequipped as a searchlight battalion in Birmingham. It was during this posting that Jack married Rosamond, who later presented him with two children; and through many years of War and Peace bringing many separations, gave a golden example to all of us of happy married life.

Shortly before the outbreak of World War II Jack was made Adjutant of 5 Divisional Engineers. Of those days CGT, then a young TA subaltern who was made Captain Hamilton's Assistant Adjutant remembers clearly the capability with which Jack dealt with the task of setting in train the various phases of mobilization. Jack went with the Division to France but he was recalled to the UK before the *Blitzhieg* began in order to attend the third Staff College War Course at Camberley. After Staff College a succession of staff appointments followed, including that of Instructor at the Senior Officers School in Devizes and later a spell as Staff Officer RE at Montgomery's South Eastern Command HQ in Reigate.

It seems he must have begun to make quite a mark for himself by then, for he was shortly appointed GSO1 in the Military Operations Directorate at the War Office, working on plans for the Normandy landings. Concerning this tour of duty PWD

Major General J R C Hamilton CB CBE DSO MA.

MEMOIRS

reports how "about two weeks before D Day Jack formally approached the Vice Chief of the Imperial General Staff (General Nye) reporting that all the plans for the landing having been completed might he (Jack) be transferred to some operational post—regardless of rank or employment—so long as he could be assured of being engaged in front-line service. On D Day it turned out that Jack's request had been granted, and he found himself at H+35 minutes afloat on the English Channel in a Canadian LST, forming part of the first wave of the Landing. Two months later, at short notice, he was appointed CRE 6 Airborne Division.

Summing up his impressions of those days PWD reports: "He led us from Normandy to the River Seine and, again, fighting in the Ardennes. We took part in the airborne crossing of the Rhine in March 1945. He was a natural leader, very unpretentious and thoroughly trustworthy. He could judge officers to a hairsbreadth, drive them ruthlessly when necessary and then, in a few words, show his innate sensitivity." After VE Day Jack went with the Division to Palestine. He had been awarded the DSO in 1944 and at the end of hostilities he received the Belgian Croix de Guerre with Palm and was appointed a Chevalier of the Order of Leopold II.

In 1946 he was appointed Colonel GS to the British Military Representative UNO in Washington. He returned in 1947 to the UK to take up the appointment of DDMO at the War Office. He was awarded the CBE in 1950, during which year he was a student at the IDC. In March 1951 he became Brigadier AQ Eastern Command until November 1953, when he was appointed Director of Plans at the War Office.

In 1955 he went to Malaya as Chief of Staff with the local rank of major-general. His last appointment began in 1956 as Director of Military Operations at the War Office and he retired at his own request in 1959. He was awarded the CB in 1954 and he was a Colonel Commandant RE 1962-71. After he retired from the Army he was appointed Bursar of Churchill College, Cambridge.

RHT (a Fellow of the College) writes: "When in 1959 Churchill College was founded, Jack Hamilton's name was put forward, in a strong field, as a candidate for Bursar. His referees recommended him very strongly, one saying that he was 'not one of our redundant officers' but a man marked out for higher rank who had nevertheless decided to leave the Army whilst he was still young enough to start a second career. On I July he joined the then small team consisting only of the Master (Sir John Cockcroft), the Senior Tutor and one or two other Fellows-elect. His principal responsibility initially was with the building of the College, which started very soon on a literally green field site. He was also responsible for every aspect of the College's development other than the purely academic. All went remarkably smoothly, so that within three years the College was working as if it had existed for much longer, whilst at the same time it had not lost its pioneering zest, to which Jack himself contributed in great measure.

"Before taking up the appointment he had been warned that he would have to deal personally with far more detail than an Army Officer is accustomed to, but even so I do not think that he quite appreciated the extent to which academics wallow in detail. This might have led to more friction than it did had it not been for Jack's deep understanding of human nature, and his tact and quiet diplomacy. He established good relations with colleagues, even when they were being difficult, and was at his best with the undergraduates and graduate students, and with the College staff. One of the happiest annual events was the garden party for the staff which he and Rosamond gave at their home in Comberton. They were both keen gardeners and their beautiful garden made a perfect setting for the party—and the sun always shone. He retired in 1972 by which time the College was fully established and had already gained a high reputation to which he had greatly contributed."

Jack Hamilton died at his home in Bridport in 1985 after a short illness. He was a wonderful friend and a vigorous, fighting soldier, sans peur et sans reproche. His many friends offer their sympathy to his widow and family, praying that the Almighty may sustain them in their sorrow with the Courage and Comfort that He alone provides. MCAH FWS CGT PWD JHL RHT

BRIGADIER R E FRYER OBE CEng MICE FRICS

Born 20 April 1893, died 10 October 1983, aged 90

ROBERT ELIOT FRYER was educated at Wellington College and the Imperial College of Science and Technology which he left for the War, obtaining a temporary commission in 1915. He served in France throughout the War, initially in 62 Field Company and later, in October 1918 as OC 547 Field Company. He then spent most of 1919 as Field Engineer to the Chief Engineer 4th Corps before being demobilized. In 1920 he went into business in Bombay. While there he married, in 1921, Alice Jervois who he had met when she was a "Fany" in Belgium two years previously. He rejoined the Corps, obtaining a regular commission as a Captain in January 1922. Two years then followed as Garrison Engineer in Ferozepore before he returned to England to attend the Survey Course at the SME

He must have been a successful student for he stayed on at Chatham as Assistant

Instructor until the end of 1929, when he was posted to M14 (the Geographical Section) where he remained for a further five years. AP remembers him from Chatham days from his friendly, almost fatherly, way of dealing with YOs. In M14 his university experience stood him in good stead as techniques in the Survey Service were being modernized.

Eliot Fryer returned to India in 1935 as Garrison Engineer Kohat District. However, this tour was to be short-lived for he returned to the SME as Chief Instructor in December of that year and remained there for a full three years. After a brief spell with Ordnance Survey he was posted to HQ 1st Corps in France as Assistant Director of Survey returning, after Dunkirk, to be Director Survey Home Forces until January 1942. Then began a long period of service in the Middle East, broken only by a brief period back in the War Office at the end of the War. He went out first to Cairo as a full Colonel in January 1942 as DD Survey at GHQ Middle East, becoming Director in May 1943 in the rank of Brigadier. In August 1945 he returned to GHQ as Director of Survey remaining until his retirement from the Army. He is well remembered in those days for his imperturbability and sense of humour, characteristics which were much needed in some of the darker moments of the War. The achievements of Middle East Survey at this time, well recorded in Brigadier Clough's Maps and Surveys bear witness to the pressures that must have existed. The list is remarkable including, in addition to support in the field army with a directorate at Allied Force Headquarters in Algiers as well as in Cairo, new mapping in many peripheral areas particularly Aden, Crete and Cyprus.

Eliot Fryer retired in March 1947 and became Head of Establishment of the Survey Production Centre at Hanwell. MHC recalls: "He was a delightful person to work for and, though possibly over-lenient with his juniors, he had a high standard himself which he ensured he lived up to. He was very interested in people and spent much time in the Drawing Offices with the draughtsmen. This attribute came out even more strongly in his reminiscences of the various wartime survey officers with whom he had come into contact and from whom he continued to receive a stream of cards and letters all his life. He treated life as a bit of fun and was never afraid to say exactly

Brigadier R E Fryer OBE

what he thought about someone, usually to their face, in such a way that there was not the slightest embarrassment on either side."

He retired finally in 1966 to Comrie in Perthshire where "his house and garden were a delight and a proof of his Sapper professionalism. The dining room was full of ticking clocks of indeterminate origin; his greenhouses were a tribute to his knowledge and interest in plants (and) he kept daily rainfall, temperature and humidity figures as he had done ever since I knew him".

He is survived by his daughter, Mary, who looked after him in his later years, his son Tony and two grandchildren.

BSIGI, HCO'HM, LJH, AP, MHC, KMP

BRIGADIER A WALMESLEY-WHITE CBE MA FRICS MIOP FBIM FRGS

Born 10 September 1917, died 1 November 1985, aged 68

ARTHUR WALMESLEY-WHITE was educated at Chafyn Grove, Eastbourne College, RMA Woolwich, and Pembroke College, Cambridge, and commissioned into the Corps in 1937. RLC writes: "I was involved in Arthur's life from the earliest days to the last. We were commissioned into the Corps on the same day and got the two vacancies for Sapper officers at Pembroke College, Cambridge. We rowed together in five Pembroke boats; we also rowed together in the RE boat which dramatically climbed 133 places in the London Head of The River Race (Mortlake to Putney) in 1939. Six of us-all oarsmen, all Sappers-pooled resources to forecast the questions in our degree finals, and each teach the others to do one of them, and we all (I think) got 2(1)s.

"He was far and away the best surveyor in our batch, with his immense practical and artistic skills (he remained a superb photographer all his life), though it took the Corps a year or two to direct him into Survey. Once there he never left it until he reached the top."

Although he did not become a surveyor until after the war his love of travel and adventure was soon apparent. JHSR writes: "Just before the war (in 1938) Arthur and myself and James Fenvick as founder members of the Cambridge University Spelaeological Society formed part of an expedition exploring the caves in the Dordogne. We went in Arthur's splendid Armstrong-Siddeley Sapphire and I still have a very detailed record of the trip made from Arthur's excellent photographs." He later went on a BSES expedition to leeland which may have helped to form his love of maps and surveying, and returned to the Dordogne in 1969 at the invitation of Professor Glyn Daniel.

During WW2 he served in a variety of RE field units and staff appointments before being posted, in 1946, as AD Survey in Palestine. This appointment combined two interests which remained significant for the rest of his life, for he retained a life-long interest in that part of the world while pursuing a career in Survey. WNM writes: "I took over 13 Field Survey Squadron at Allar Camp, Palestine, in 1946 with Arthur as AD Survey in Jerusalem. The Survey Troop based on Ma'an in Trans Jordan was

Brigadier A Walmesley White CBE MA

tasked with extending the trig in the area of the forts at Bair and Jafr up to the Saudi border.

"The Troop was supplied by a weekly delivery from Allar Camp (near Bethlehem) to Amman where stores were loaded on to ancient rolling stock of the Hejaz Railway and finally arrived at the end of the line at Ma'an. This was all very much Arthur's scene and his frequent visits to Ma'an and his survey recess of Trans-Jordan gave him the opportunity to take in Jerash and the old Crusader Casties between Amman and Ma'an, armed with his emergency ration box of nuts, raisins and biscuits." He left the Middle East in 1949 for the Ordnance Survey and two and a half years later went to the School of Military Survey as Senior Instructor Field Survey, and then Chief Instructor until 1956. After a staff tour at the War Office he was appointed to command 42 Survey Engineer Regiment in Cyprus which, with detachments all over the Middle East, enabled him to renew his love of that part of the world.

In 1962 he went to HQ NORTHAG, later extending his NATO experience by moving on to HQ AFCENT. Of those days JAS, who was at SHAPE when Arthur was at AFCENT and who got to know him well during this period, describes how duty liaison visits were followed by lunch *en famille* in the *maison* W-W, a charming and very French old house in the centre of Fontainebleau, after which, accompanied by their respective wives, children and dogs, they would saily forth into the *Forêt*.

JAS continues: "Arthur, with his genuine interest in people and things, his keen sense of fun and of the humour of things somewhat unorthodox, was without question one of the most approachable persons one could ever wish to meet. These attributes, coupled with his deep devotion to his family and home, and the feeling of complete dependability he exuded, greatly endeared him to his associates and colleagues alike and unquestionably contributed largely to the great esteem he very rightly enjoyed within NATO and to the effectiveness of his contribution to the Alliance."

He left the NATO arena to return to the Ordnance Survey in Southampton during which time he was promoted Brigadier. It was a time of considerable activity and change for after some 180 years the OS finally moved into purpose-built offices for the first time. His final appointment was as Director of Military Survey in 1969 from which he retired in 1972. This, again, was a time of much change and of achievement, recognised by the award of his CBE and soon afterwards by the upgrading of the appointment.

His retirement enabled him to settle finally in Devon, the county of his birth, in a lovely old farmhouse in peaceful rolling countryside just west of Exeter, which over the next few years he and his wife restored with very great sympathy and affection. From here he started a new career as a Planning Inspector with the DOE, continuing with promotion for 10 years until his retirement at 65, and developing, typically, a special expertise in public rights of way. This enabled him to continue many of his life-long interests-photography, hill-walking and especially gardening and woodworking at his home. He maintained his service links in many ways, by continuing as a member of professional and learned societies and by his very active tenure as Honorary Colonel of 135 Field Survey Squadron RE(V). He was frequently seen at the Royal Geographical Society (he had been a Fellow since 1946 and was a member of Council 1969-72) and at Geographical Club dinners, was an Associate and later Fellow of the Royal Institution of Chartered Surveyors from 1950, a long-time member of the Photogrammetric Society and Council member 1969-72, and a member of the British Cartographical Society from 1965. He published several papers in the journals of these societies. He held an especial affection for the Palestine Exploration Fund which he joined in 1957, becoming Chairman in 1973 until resigning shortly before he died. He was proud to continue the Corps link with the PEF, following as he did three previous Sapper chairmen (Sir Charles Wilson, Sir Charles Watson and Sir Charles Close), and the Centenary Exhibition of the Survey of Western Palestine, with which he was particularly concerned, was later shown at both Hermitage (in 1980) and Chatham (1981).

PRA writes: "During the period of his chairmanship (of the PEF), particular

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attention was given, under his influence, to the Fund's archives, both documentary and photographic. His direct knowledge of the Palestinian area resulted in attention being given to geographical matters and to the Fund's map collection.

"Members of the Fund, and particularly those who served on the Executive Committee during his chairmanship, came to have much affection for his quiet and firm handling of the Fund's affairs, and the Fund benefited greatly from his guidance through a number of difficult problems which affected it during the period. It is very much thanks to him that it is now in such good heart."

He maintained his active interest in these societies long after he retired and it was entirely typical of his warm interest in his fellow men that he should be seen at the Survey and Mapping Exhibition in the Spring of 1985, talking enthusiastically with young surveyors, military and civilian, attending the week-long meeting entirely at his own expense.

He had a very wide circle of friends who held him in very great respect and affection, and it is for the warmth of his personality and kindly interest in his fellow man that he will be widely remembered.

RLC concludes: "After the war he married my nicec, Jocelyn Beale, and, if I never contributed anything else in my life, I did bring together two very nice people whose four children were all together with them when he died.

"By coincidence we were both in the same hospital in September, he with cancer, I after a heart attack, and we talked a lot. He knew his fate quite clearly—though it came, perhaps mercifully, quicker than either of us then imagined, in five weeks spent at home putting his house in order with a relaxed humour which his friends will be able to picture. We would all like to think that, as soldiers, we will know how to face death with courage and dignity. Arthur certainly did just that."

PRA. MHC, RLC. RCAE, BStGI, WNM, JHSR, JAS, PFF.

LIEUTENANT COLONEL H M MILLAR MA SC RE

Born 5 October 1912, died 6 July 1985, aged 72

His father was a Scot who emigrated to Canada in 1910 and served in the NWMP/RCMP, retiring in 1928 to join the Bahamas Police Force. Hugh's early education was in Canada, followed by Queen's College, Nassau, from where he obtained a scholarship to the RMC Kingston. As a cadet he trained with the RCAF one summer and the RCHA another. He graduated Senior Under Officer with the Sword of Honour and the Governor General's Bronze Medal. He obtained his Mechanical Science Tripos Honours Degree at Cambridge, learned his love of rock climbing in Skye and was manager of the Cambridge Ice Hockey Team. He and five others were seconded to Horsham during their last summer training for hushhush work, converting underground stone

quarries into bombproof ammunition dumps. He was granted leave to visit his parents in Nassau on his posting to the Royal Bombay Sappers & Miners in India. He became

Lieutenant Colonel H M Millar MA

engaged to his future wife on the last day of his leave but they were not able to marry until three years later.

He arrived in Kirkee in 1938 and was posted to 42 DHQ Company in Quetta as the second of two British officers. Here he quickly passed his language exams and learnt to command Indian Troops. He rode hard and climbed a lot with other enthusiasts in the mountains. In 1939 he and two others made their way to Chitral and joined by the Garrison Engineer, Richard Orgill, and four Sherpa porters attempted to climb Tirich Mir (25,263ft), the highest mountain in the Hindu Kush. They pitched Camp VI at 22,000ft but could not reach the top of that route. After World War Two it was climbed for the first time by a Norwegian expedition.

Later in 1939 he was recalled to Kirkee to take over as Corps Adjutant to train vast numbers of village lads and form them into units, and train them for overseas service.

He then formed, trained and commanded a field company which, with Malaya fallen and Burma about to, was ordered to Bengal to join an independent brigade for the defence of India, against the Japanese attacking through the Arakan.

He was later recalled to take command of the OCTU, but after six months his Staff College nomination came through. His end posting was SORE2 to CE 15 Indian Corps in the Arakan where he arrived in time for the Japanese attempted invasion of India in November 1943, which was just held by 7 and 5 Indian Divisions reinforced by 26 and 36 Indian Division.

Throughout his service he had been reported on as a sound officer of strong personality and character, with good common sense and judgement and an infinite capacity for hard work, well developed powers of leadership, tactful and loyal and always smartly turned out, and a good all-round athlete. His promotion to Lieut Colonel came late in 1944 when he took command of 14 (Royal Bombay) Engineer Regiment in 457 Forward Airfield Engineers. With the Group Commander ill with jaundice, he constructed the two airfields required on the route to the 4 Indian Corps crossing of the river Irrawaddy at Nyaungu.

After some well-earned leave he returned to India. However, he was evacuated to UK in 1946 for a back operation which could not be carried out in India. Later he returned again to India and was appointed SOREI (Air) attached to 2 Group RAF in Bangalore planning the future Indian Air Force organisation, location of installations, maintenance of airfields required and disposal of others. His wife joined him for a pleasant year. Then the Group was Indianised and he returned to the UK in April 1948; almost at once volunteering to join an all arms team in Churchill, Northern Canada, to test winter warfare clothing and equipment and evaluate the effect of extreme cold on operating procedures. He spent two winters there, and took part in exercises with Canadian troops under extreme conditions of temperature and wind. Later he helped in the production of three manuals on Arctic Warfare by US, Canadian and British officers at Fort Leavenworth.

In 1952/53 he was posted as CRE Catterick, from where he left to command the Commonwealth Division's Engineer Regiment in Korea. He arrived just as a tenuous peace had been formulated. LS-B states "His background as a Canadian RE Officer, his broad experience in India and SE Asia, and his firm friendly personality was exactly right to sustain the enthusiasm and weld the energies of his Regiment, widely drawn from the UK, Canada, Australia and New Zealand. Inevitably the aftermath of war was a difficult period. Massive, concerted efforts were needed to make a viable new defence line in the divisional sector which was astride the main route to Seoul, replacing the strong defences which had been vacated in the Demilitarised Zone agreed in the truce. With tact and persuasion he ensured that the best use of national engineer resources was made in the primary task despite the many legitimate but more parochial demands being made upon them. Then, as the fragile truce continued, the defences grew in strength and another Korean winter arrived, his drive and pioneering initiatives worked wonders, bringing about improvements to field living conditions throughout the Division. By his example and endeavours, he maintained in his Regiment a harmony and high morale of an exceptional order. Many from MEMOIRS

different nations will remember him as a highly respected military engineer and a wise commanding officer of great understanding. His early retirement back to Canada after Korea was indeed a loss to the Corps".

In August 1954 he was due leave, so he took it via Canada, crossing the Pacific in the RCN destroyer *Crusader*. During his time in Canada he let it be known that he wished to retire there if he could get a suitable job. One was found and he was told to submit an application. So he returned to the UK where he had been posted as CO of the SME Regiment at Chatham, January 1955. The job offer arrived in June 1955 and in July the War Office returned him to Canada, from whence he had been recruited.

His second career was with the Department of Public Works in Canada. He was with the Development Engineering Branch of the Trans Canada Highway Division, working as Technical Administrator of roads and bridges in National Parks 1955. which was broadened to projects in the NWT and Yukon Territories. He worked on the Trans Canada Highway through Glacier National Park and received promotion to Operations Officer for the Western and Pacific Regions. In 1968 he was again promoted, to Director of Construction and Works Management, and yet again in 1972 to Director of Project Implementation. He retired at the age of 60 to build a lovely ranch house in the Rockies near Cochrane and climbed many of the highest peaks with the New Zealander Lloyd (Kiwi) Gallagher, who was a member of the Canadian Everest Expedition. He was killed riding in the hills on a normally sure footed horse which slipped on a bank and fell. In trying to regain its feet the horse gave him a massive kick in the head killing him instantly. Our deepest sympathy go to his wife Tilda and their son Torchy, who has represented Canada in the equestrian world in two Olympic Games, for the loss of a loving husband and father, and an ex-officer of great ability and charm.

LS-B, HRG

GIFTS AND BEQUESTS TO THE CORPS OF ROYAL ENGINEERS

INTENDING benefactors of the Corps may like to know the various Funds which welcome gifts and bequests and the advantages which may be obtained, both by the Funds and by the donors and their estates, under current legislation. Certain Funds, managed by Trustees on behalf of the Corps, are recognized by the Inland Revenue as being devoted to charitable purposes only. Broadly speaking these are Funds which are applied exclusively to the relief of sickness or poverty, or the advancement of education. The Funds at present recognized as being "charitable" for this purpose are:

- (a) Royal Engineers Officers, Charitable Fund.
- (b) Institution of Royal Engineers (including RE Kitchener Scholarships Fund and the New Museum Appeal):
- (c) Royal Engineers Association (incorporating the former RE Benevolent Fund).
- (d) Samaritan Fund-RE Officers' Widows Society.

In the case of the last named, this purely Charitable Fund is for the relief of widows and orphans of RE officers. Subscriptions and gifts to it have no connexion with members' subscriptions to the RE Officers' Widows Society and grants made from it are over and above any benefit paid by that Society.

Annual subscriptions to any of these Funds which are made by a deed of covenant, whereby the subscriber binds himself to pay the amount of the subscription annually for a period not less than four years out of income which has suffered tax in his hands at the standard rate, are treated as net payments and the Fund concerned can recover tax paid from the Inland Revenue.

Suitable forms of deeds of covenant can be supplied by the Secretaries or Treasurers of the Funds concerned.

Correspondence

Lieut Colonel Emeritus Professor R A Jensen, B Arch, BE, FRIBA, LFRAIA, FRTPI, FRAPI, JP 86 Patrick Street Careel Bay Avalon Beach NSW 2107 Australia

NEW TOWNS

Sir,—While I must give full credit to those, such as Brigadier Cowan (September 1985 *RE Journal*), who have worked within an established Government policy to make the New Towns work—so far as was practicable—it has to be said that, taken with the National Motorway system, and uncontrolled immigration, the policy has had a disastrous effect on the social structure, the economy and the environmental quality of Britain.

The neglect of the older cities has been the inevitable consequence of deflection of funds to the relatively easier "green field" developments, and it is now apparent to all that this is going to require a monumental effort of rectification—even if that is now possible. Until the situation is rectified, however, urban violence and unrest are a certain consequence; and one must hope that the present Government will take the necessary steps without delay to set right years of massive misappropriation of urban funds—something no previous government has been capable of or willing to do.

Since I have been emphasising the nature and dimensions of this problem for many years I feel no opportunity must be lost to underline moreover the serious loss of good agricultural land, which Britain of all countries can least afford, as involved in the New Town policy and Motorway programme. Moreover the financial implications of setting up complete new infrastructures while abandoning some of the existing services in older cities is nowhere referred to in the paper you have published: something in real terms which cannot be minimised—any more than the "New Town Blues" of isolated and alienated families, so often in an entirely hostile and unfamiliar milieu.—Yours faithfully, Rolf Jensen.

> Professor P Johnson Marshall, CMG, Dip Arch (L'pool), MA, RIBA, FRTPI, RIBA Dist TP, Beila Vista Duddingston Edinburgh EH15 3PZ

New Towns

Sir,—I have had an opportunity of reading Professor Rolf Jensen's letter relating to New Towns. He should be challenged to verify his extremely hostile criticisms. Many people in Britain and elsewhere, consider that the New Towns, in contrast to his negative opinion, have had a very beneficial effect on the social structure, the economy, and on environmental quality, and I am sure that an opinion poll would show that they would be right.

The accusation that they were a cause of the neglect of the older cities cannot be held seriously. The principal cause of neglect of many of the older cities, was the continued movement of wealth, work and people to the south east of England.
One might just as well accuse the rapidly growing suburban sprawl around many cities of causing neglect in the inner cities, and with more reason. The problem is admittedly very serious, but using the New Towns as a scapegoat may, perhaps, be understandable in the case of frustrated and ineffective politicians in the old cities, but surely not from a professional town planner. The causes of neglect are complex, and are partly concerned with the failure of Government policy to provide the necessary financial and statutory support, and with an understanding that when people desert the inner cities, whether to go out to unplanned suburban sprawl or to independent New Towns, or even to Australia, a large scale continuing Governmentally supported programme of inner city rejuvenation is necessary.

To accuse the New Towns for being responsible for the misappropriation of urban funds is a clear indication of a misapprehension of the problem, when the solution was to provide more money for the inner cities.

In regard to the loss of good agricultural land, thousands of acres were being lost to unplanned suburban sprawl before the war, particularly in the London basin, and the very compactness and good organisation of most of the New Towns has helped to preserve agricultural land. It has also put thousands of people more closely in contact with the realities of agriculture. The only alternative would be the decentralisation of several millions of people right outside Britain altogether.

The problem of infrastructure, too, is also based on a misunderstanding. First, many of the inner city infrastructural services were obsolete, and still require extensive and expensive overhauling. Again, the alternative is not one of New Towns versus inner cities, but New Towns versus suburban sprawl, and in the latter case, approximately the same amount would have to be spent.

The final criticism is so much at variance with the facts of the situation as to be irrelevant. In the early years of the New Towns it is true that the house building programme went ahead of the provision of social services and landscaping with some unfortunate results, but that time is long since past. The New Town environments were never hostile and most of them are today very attractive. Over the years the once-newcomers have settled down, for the most part as happy citizens. They have excellent services, good schools for everyone, convenient shopping centres, adequate health facilities, and a large number of social activities. On the whole, they have been thoughtfully planned, and well implemented, and provide in some cases useful models for a better human environment.

They are free from urban violence and unrest, and also pollution and vandalism, in contrast to some of the inner cities, which partly as a result of civic neglect, poor planning and lack of maintenance, have serious problems today. If one compares his accusation of "an entirely hostile and unfamiliar milieu" with that milieu which the British pioneers, who so largely created the USA, Canada, Australia and New Zealand, had to face, he would realize that his assertion is not in accordance with the facts.

One has only to remember the extraordinary achievement of Colonel Light in creating the planned New Town of Adelaide, in what was then a hostile and unfamiliar enough milieu, and to contrast it with the failure to implement Monarto New Town in South Australia, to appreciate the dimension of the disservice which such a letter does.

I hope that Professor Jensen will visit Britain and the New Towns and that it will cause him to think again—Yours sincerely, Percy Johnson-Marshall, Professor of Urban Design and Regional Planning (Emeritus) of Edinburgh University.

Captain J F Mapstone ERD Kassala House The Ride Ifold Billingshurst West Sussex

AN OFFICER BUT HARDLY A GENTLEMAN

Sir,—Referring to the Conclusion of Captain Stevens article (Journal Dec 85), as the RAMC solved the same problem over forty years ago, what prevents the Royal Engineers following the same precedent?

My wife was commissioned into the RAMC in 1946, and wore the same uniform as male colleagues, except for khaki skirt, and khaki beret in place of peaked cap—(her tunic, naturally, required some additional tailoring). Her basic training, including drill, was carried out with the men. She never wore WRAC (in those days ATS) uniform nor carried out any training with them.

She experienced no real problems, even when serving with I Guards Brigade, which was about as big a challenge as a 5ft 2in woman could take on!—Yours sincerely, J F Mapstone.

Major J D Lamport Box 698 Grand Bay New Brunswick Canada EOG 1WO

SEARCHLIGHTS IN THE ROYAL ENGINEERS

Sir,—I read Brigadier Chichester-Cooke's "Searchlights in the Royal Engineers" (*Journal* Mar 85) with a great deal of interest and particularly the preamble from which I quote: "This article tells the story of Searchlights in the Corps up to the end of World War II". May I take this opportunity to add a little to that story and mention that the 1st AA Battalion RE at Blackdown was not the only Regular Army unit involved in AA Searchlight work during the 30s?

I received my training in AA Searchlight work at Blackdown; subsequently took part in the Air Defence of London in 1934 and was posted to the 22nd Fortress Company RE in Hong Kong. Although it was called a Fortress Company, the 22nd's work consisted of manning, operating and maintaining AA searchlights in and around Hong Kong. From 1935 to early 1939, according to the rather meagre notes which I had kept during the period I served with the Company, it manned and operated AA searchlight lorries, where sites could be reached by land; constructed paths and roadways to sites unapproachable by vehicles and assisted in the construction of engine-rooms and accommodation.

Hong Kong and mainland Kowloon were easily accessible to AA searchlight lorries, but AA searchlight locations on the surrounding islands had to be reached by launch, of which there were only a small number and they were very much in demand. Communications were by signal light and Morse Code. In March of 1937, a combined service manoeuvre was held in Hong Kong with naval vessels, aircraft and troops from Singapore. Two items of interest (not in the textbook at that time), arose from these various engagements.

On occasions, when there were no aircraft to engage and enemy naval vessels attempted to sneak into the harbour, we were able to deflect our AA searchlights and illuminate them. This was an assistance to the Coast Defence lights of the 40th Fortress Company RE, our sister unit and caused a great deal of consternation aboard the "enemy vessels". We had very good showings in illuminating planes at that time due to their relatively slow speeds, but when one of the targetted planes decided to fly down our beam, it was quite an unsettling experience and we had a fairly accurate conjecture of what might have happened had it been a real enemy plane and it had opened fire.

Around September, 1938, when Germany had issued her ultimatum to Czechoslovakia and Japan was closing in on Canton, the installation of the remaining searchlights was accelerated and motor generator sets were exchanged for the Lister 15KW sets.—Yours sincerely, Jack D Lamport.

> Brigadier M H ap Rhys Pryce Late The Royal Welch Fusiliers 4 Ranmore Place Princes Road Weybridge Surrey KT13 9BJ

ARTIFICIAL MOONLIGHT

Sir,—As I was the Officer personally responsible for the resurrection of the use of Artificial Moonlight by the British Army, I was very interested in the excellent article contributed by Major R G Selby-Boothroyd TD, RE(V) to the *Journal* (June 85). I thought it might be of some interest if I recounted how I got the idea, and how we used searchlights in Normandy in 1944.

I was GS0I of 53 (Welsh) Division, commanded by Major General R K Ross, from May 1943 to September 1944. In 1943 the Division was stationed in Kent. In the Autumn of that year 160 Infantry Brigade was on a week-long exercise on the South Downs. As I walked along the country road during a visit to this exercise a searchlight came up from behind me and some distance away. I noted then that the field alongside was illuminated enough to make it much easier for infantry to go across country, and also to recognise a known comrade up to say 50yds away. I suggested to my General that it might be a good idea to use searchlights to help infantry forward in attack. He said "suggest it to Corps", which I did. A copy of the letter is in the Regimental Museum at Caernarvon Castle, and Corps agreed.

On a ten day divisional exercise searchlights were plentifully used for the bridging of the R Cuckmere and for the crossing of the R Ouse at night, also to facilitate the unloading of anti-aircraft ammunition at a railway station.

As pointed out by Major Selby-Boothroyd the ground under a searchlight beam is not very clear to an air observer and, if headlights are not used on the ground, activity cannot be pin-pointed.

I have thought a searchlight beam over a train-wreck, or a plane crash, or a multi-car pile-up on a road, all at night might much help rescue work. In Normandy we used searchlights to light up the rear area. MT could drive without lights, and the Signals Superintendent of 12 Corps told me the time of his DRs was cut by half. For one night attack one searchlight remained on: a fixed line by which tanks could go forward and also judge their return route.

After Falaise, 53 (Welsh) Division moved forward during the night of Friday 25 August 1944. I had arranged for two searchlights to shine along above the route so the drivers had little trouble and all went smoothly. I wonder whether one or two searchlights shining over Molesworth would have made Operation YELSTEAD casier, although lights could be used. The Artificial Moonlight could have been provided from the very beginning.—Yours sincerely, M H ap Rhys Pryce.

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THE RE LIST

Sir,—Colonel Frankau (Mar 86) might remember my article "Vital Statistics" in the September 1959 Journal. It was based on the November 1958 RE List, upon which I proudly made deductions.

Over the years I have considered updating my comparisons, but have resisted the temptation, lest my own vital statistics be added to the balance. At the time of my article the Corps had 15 serving generals, 27 brigadiers, 53 full colonels and 132 lieutenant colonels. The *List* told us that 217 of 227 were married. Today the corresponding figures for generals, etc are 5, 23, 52 and 140, total 220.

I am sure that, for those who care to delve, today's *List* compares well for detail with that of 1958. However, if members cared to divulge more, and if you could cope with the analysis, I'd always be interested!—Yours sincerely, Dan Raschen.

(Fortunately Colonel Mackintosh has delved, see below-Editor.)

Colonel H W B Mackintosh Strathnairn Crawley Ridge Camberiey Surrey

PROMOTION PROSPECTS

Sir,-Thank you for the November 1985 Corps List recently received.

As an alternative to (or perhaps additional form of) Trivial Pursuits over the Christmas leave, I did a quick comparison between some of the Officer Seniority Lists as at 5 August 1985 and their equivalent as at 1 March 1949. You may be interested to know that despite the Army having shrunk from 531,000 to around 150,000 in the intervening thirty-six years, our hierarchy of senior officers appears to have remained remarkably intact at its former level. We have much the same number of full colonels (49) now as we did then (53); and lieutenant colonels (140 now compared with 143 then). The balance is similar for brigadiers (29 then, 22 now), though we did have rather more major generals (13 compared with our present 6). But then we still had an Empire in 1949, and for example had to find three EinCs (War Office, India and Pakistan).

This then led me to look briefly at what everyone was actually doing. Today of our licutenant colonels, some thirty-six are commanding officers (or equivalent); in 1949 there were twice as many commanding things, but of course two-thirds of these "things" were Works. One has to remember too that travel between postings was leisurely to say the least and therefore AG7 had to maintain a "float": for example, of the seventy-three substantive lieutenant colonels in 1949, one was "on leave ex India", one was "on long leave in South Africa" and one was "en route to UK ex Iraq" (presumably lost somewhere on the MEDLOC route). Of the full colonels, at both dates about a quarter held command appointments; a much higher proportion of brigadiers do so now than was the case in 1949, though there were many more exotic one-star posts abroad then such as "Director Ad Hoc Disarmament Branch

BAOR" and "Brigadier Overseas Food Corporation East Africa". But to me the most significant trend is the number of warriors employed in Whitehall. In 1949, the War Office and Ministry of Supply absorbed a mere seven major generals, fourteen brigadiers, seven colonels and twenty-eight lieutenant colonels. Today the RE contingent appears to be five major generals, ten brigadiers, fourteen colonels, nineteen lieutenant colonels—and this to administer an Army not much more than a quarter the size!

All in all, if the present situation continues it would seem to me that our present twenty-four second lieutenants' chances of rising to lieutenant colonel and above are a great deal better than were their predecessors!—Yours sincerely, H W B Mackintosh.

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THE VALUE OF HUMOUR

Sir,—I have just read, enjoyed and re-read Captain S G Tenison's spirited article "Pom Senior" (*RE Journal*, Dec 85). It was full of interest and lightened throughout with humour. I feel sure this quality of humour matters a great deal in peace or war.

Humour must not, of course, be allowed to slip into levity, even if unintentional. I recollect that in the '14-'18 War, in my first small sole command (age 18, RFC) I took a detachment into the desert, my task being to lay out visible guides and clear rocks for forced landings on part of the route followed by our aircraft flying to the Hejaz on the Gulf of Akaba. In my daily log I recorded, with map bearings, "Dead Arab on LHS of track. Back of head bashed in." On my return journey I recorded, "Same Arab on RHS of track. Still dead."

I thought my job, with survey of track and exact location of all cleared indicator circles would meet with my senior's approval. I was wrong. My 'phone rang and an icy voice—at least it started icy and then warmed to red heat—drew my attention to the crime of levity in junior officers' reports; I was just able to remove the rocket from my backside before it propelled me back into the desert.

The humour of the British soldier and its effect on his morale and that of the enemy is well-known and needs no illustration. The effect of officer's humour is not often recorded; here is an example.

During the last War, I was visiting the Commando Training School at Loch Ailort, then commanded by Lieut Colonel, later General Sir Hugh Stockwell. Major, later Major General Jim Gavin, RE was demonstrating an elegant device which, buried in a track, would, under pressure, discharge a .303 bullet through a body or tyre. The device was 'live'; its efficiency was confirmed by a hole in the lecture-room ceiling, above which was the CO's bedroom wherein he was known to be taking an afternoon nap.

There was a stunned silence. The lecture-room door slowly opened, disclosing a dressing-gowned Hugh Stockwell who drifted across to Jim, and dropped a mush-roomed .303 bullet on his desk quietly remarking, "Not when I'm having an afternoon nap, Jim old boy. Not when I'm having an afternoon nap" and drifted out again.

He never again mentioned the incident but we found the bullet had flattened on the angle-iron of his bed. None of us will ever forget that lesson.—Yours sincerely, L J Cardew Wood.

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WORKS SERVICES-CONTRACTS

Sir,—Colonel Clarke's account of the Militia Hutting programme of 1939 is a valuable piece of Works Service History and an illustration of the shortcomings of Prime Cost contracts, which at the time could not be avoided.

Due to political pressures and vacillations, the Works Services in April 1939 were faced, at two weeks notice, with a building project, estimated at $\pm 10M$, later exceeded, which had to be ready for occupation in four months. Prime Cost contracts, with all their shortcomings (some of the final accounts were still unsettled in 1945!) were inevitable. Nevertheless to the credit of the Works Services, much of the accommodation was ready when the Militiamen arrived.

In 1941 the organization of the Works Services was substantially revised and augmented to deal with a long war. In April 1942 the DFW was informed that accommodation for one million US troops including depots, workshops, hospital and hutted accommodation would be required; divisions arriving in September. The operation had the code name *BOLERO*. Reorganization was sufficiently advanced, including standardization of designs coupled with standard Bills of Quantities, for the resumption of competitive tendering for measured contracts. Conventional Cost Accounting (Construction Accounts) had been mechanised. The estimate submitted to the Treasury in April 1942 was slightly underspent when the *BOLERO* accounts were closed at the end of hostilities in Europe in 1945.

I hope Colonei Clark will not mind my amending his recollection of the appointment of General Collins. During the militia camps project he was successively DFW, Controller General Military Works Services (CGMWS) and DQMG. The appointment of the first EinC in the War Office (Major General C J S King) occurred in October 1941, a historic extension of the duties of the Corps and its influence on the deliberations of the General Staff.—Yours sincerely, H E Hopthrow (DDFW and DFW 1942-45).

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MY WAR IN WORKS SERVICES

Sir,—The extract from the talk given by Major Laurence Kitching in the December 1985 Journal, brought back many memories, particularly of Benghazi. I was the subaltern in charge of the E and M Section of 588 (Glamorgan—not Monmouth) Army Troops Company, the company given the job of completing and commissioning the petrol installation. Our previous experience had been largely on water supply (cg the desert pipeline) and petrol techniques were new to us. Fortunately we had the benefit of a very experienced Shell engineer called Jackson (he had escaped from Singapore) who was attached to us for the job. One of the two 5200 ton concrete CORRESPONDENCE

tanks had been completed and used by the Italians, who had demolished a corner of it. Before it could be repaired it had to be cleared of petrol fumes, and "Jacko" organised some windsails, as used on board tankers, and sniffed the atmosphere in the tank daily, eventually declaring it safe for welding operations. It was only then that we confessed that a Basuto pioneer had been discovered some days earlier smoking a cigarette in the tank!



I enclose some photos including one of the laying of the pipeline to Berka I and Berka II airfields. The latter used standard 3in screwed pipe and to achieve petroltightness we used a shellac jointing compound and an enthussatic team of six men on three chain tongs to get extreme tightness of the joints. When the 4½ miles of pipe were completed it was clear, on testing with water, that there was some obstruction in the line. Using the technique of drilling ¼in holes in the pipe (subsequently scaled with a cotter pin) and taking pressures to compare with the theoretical hydraulic gradient, I managed to locate the obstruction to within a few feet. It turned out to be a tin can, normally inserted at the end of each days work to prevent ingress of rodents, which had been left in the pipel In other respects the pipeline was perfect, without a leak.

Other memories include the tanker Armilla with her flamboyant and hospitable Dutch captain; the improvised manufacture of a 'swing-arm' for the second storage tank; the construction of several floating pipelines, which preceded the sunken pipelines for the ship-to-shore connection, but which were wrecked in the storms; the floats used 44 gallon drums on a welded framework, and the drums were cleared of fumes by an expert Sapper who threw lighted matches into the bung-holes from several feet away! And so on—it was a considerable and unusually interesting job.—Yours sincerely, P H Woodward.

Correspondence

Book Reviews

MAPPING FROM AERIAL PHOTOGRAPHS C D Burnside

(Published by Collins—Price £25.00)

THE publication of the second edition of C D Burnside's *Mapping from Aerial Photographs* is a reflection of two things, the popularity of his first edition and the rapid introduction of advanced technology in the form of analytical instruments in the last five years.

The success of the book is due to several factors the most dominating being the digestible and logical manner in which the concepts and ideas of photogrammetry are developed. Mr Burnside's career as a lecturer has resulted in a text which is precise and clear in its explanations. Selection and treatment of topics is sensibly covered and where complexities arise these have been cross-referenced. The methodical and logical ordering of the subject matter plays an important part in helping the reader progress. Diagrams that are so necessary in such a book have been carefully thought out to illustrate the issues involved and are excellent.

Students learning the science of map making from aerial photography will find this volume a very valuable reference book. Given a sound mathematical foundation they will be able to achieve a thorough understanding of the theory, applications and limitations of photogrammetry for mapping, and to a limited extent, terrestrial photogrammetry. Also included is a comprehensive bibliography that is referenced throughout the book to point readers to more comprehensive texts on specialized subjects. This book is highly recommended.

JGF

FORCES '86

(Published by Marshall Cavendish: Price £7.95)

FORCES '86 is the lastest in a series of books by the same publisher which seeks to provide a readable and informative account of the operations, equipment and personnel of the British Armed Forces through the eyes of a variety of authors. Earlier books dealt with the Falklands War and the effect this had upon the Forces in the aftermath of the 1982 Campaign. This book heralds a wider perspective and covers a variety of different aspects of military life in each of the three Services. Indeed, with subjects as diverse as Exercise LIONHEART, Royal Marines Recruit Training, the Gurkhas, Space Wars, RAF equipment trends and an interesting insight into the RN Submarine Service the book may truly claim to have something for everyone.

The book is well-presented and is illustrated with many excellent photographs which make the price of £7.95 very reasonable. While it includes material which is technically interesting it is written with a journalist's penchant for eye-catching, easily-read prose. Regrettably there are also examples of the lack of attention to detail which journalists sometimes display and there are minor errors of fact in the text which detract from its impact for the discerning reader. However none is serious and there is much here which the layman will find of interest.

Forces '86 is a book which would sit comfortably on a School Careers bookshelf and it would make a welcome present for any young person with an interest in the Services. It is unlikely, though, to deserve a place in the average family or military student's bookcase.

CMD

BOOK REVIEWS

TO THE KWAI—AND BACK WAR DRAWINGS 1939–1945 RONALD SEARLE

(Published by Collins in association with the Imperial War Museum-Price £15)

This is a remarkable book beautifully produced. The author was a sapper in 28 Fd Coy which landed in Singapore in January 1942 where he spent three and a half years as a POW in Changi, on the Burma Railway cholera and all, and back to Changi. He joined the Army at the age of 19 in September 1939 from art school and the drawings, now in the Imperial War Museum, cover the whole war. They were drawn at the time and carried by him at considerable risk during captivity. They are brilliantly drawn and also brilliantly perceptive of conditions and of people, British and Japanese and local and are accompanied by his account of his experiences which is balanced, interesting and rings wholly true.

The book is an excellent record by the author who probably had as bad an experience as any POW who survived, yet I was so filled with admiration that I did not find it gloomy.

The end of the introductory chapter sums it up in "the drawings can be looked upon as the graffiti of a condemned man ... who found himself reprieved ... This book—these drawings, such as they are—belong to those who were not".

This book could become a classic like the memoirs of Rifleman Harris on the Peninsular War.

NHSB

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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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