THE ROYAL ENGINEERS JOURNAL

DECEMBER 1989 VOL 103 No 3

Guidelines for Authors

The Editor is always glad to consider articles for publication in the *Journal*. Guidelines for prospective authors are:

Subject. Articles should have some military engineering connection but this can be fairly tenuous, specially if an article is witty.

Length. Normally, chance of publication is in inverse proportion to length. More than 4500 words (5 pages of text) tends to lose most of our readers. Blockbusters can sometimes be serialised.

Clearance. Opinions are an author's own. The wise man clears an article with his boss on any policy matters. Security clearance must be obtained locally.

Copy. Ideally the text should be double space typed and include the author's pen picture and captions for art work.

Photographs, should be black and white. Coloured photographs rarely reproduce well unless they are very good quality with sharp definition. A head and shoulders photograph of the author would also be helpful.

Line drawings, if possible, should be drawn in proportion with the page (5.75in x 8.0in). Size is immaterial.

Rewards, can be generous. The committee has about £250 in prize money to allot for each issue plus the valuable annual prizes. All authors receive £5 to cover costs.

Pseudonyms, may be used. They will not be revealed by the Editor under any circumstances.

Contributions to the Journal *should reach the Editor by:*

4 January for the April 1990 issue
Early May for the August 1990 issue
Early September for the December 1990 issue

Submissions before the deadline will be particularly welcome.

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ISSN 0035-8878

THE ROYAL ENGINEERS JOURNAL

Published in April, August and December by The Institution of Royal Engineers, Chatham, Kent ME4 4UG. Telephone Medway (0634) 42669 or Chatham Military Ext 2299.

Printed by Staples Printers Rochester Limited, Love Lane, Rochester, Kent

Volume 103 DECEMBER 1989 No 3

Contents

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Editorial

CROSSROADS

BRIGADIER STEPHENS' article summarising the position about professional qualifications brings to an end the debate which started in the December 1987 *Journal* with Major Yule's persuasive appeal for a system of qualifications for members of this Institution distinct from whatever professional qualifications they might achieve as members of other professional bodies. This exhaustive discussion has effectively ruled out such a move for the foreseeable future though no doubt the buoy will present itself again for circumnavigation after another ten year cycle or so.

This step is something of a crossroads in the development of the Institution. Another factor is the growth of the Museum, one of the Institution's principal responsibilities, into a major activity on behalf of the Corps dependent for its financial sustenance on sources outside Institution funds. Ultimate responsibility for the Museum remains with the Institution, and must do, unless the Royal Charter were to be amended, but "he who pays the piper calls the tune ..." and the cosiness of the Institution/Museum relationship will inevitably be eroded. There is some debate as to whether this is good or bad for the Institution. Some wish to see the guardianship of the Corps heritage which has always been an important role, remaining pre-eminent; others feel that there should be more to the Institution than "dwelling on the past" or becoming simply an old boys' club.

The transcript of your Editor's address to the 30 Engineer Brigade Study Period aims to provide something of a backdrop for discussion of the role of the Institution and a provocative article on this theme is planned for the April *Journal*. Council are already looking at the issue and steps will be announced shortly on widening the associate membership arrangements so as to build up more contacts with friends of the Corps, particularly in the civilian branches of the engineering profession.

Meanwhile, as the President's address to the AGM, reported in the *Supplement* indicates, the Institution continues in a healthy and active condition. The number of institutions with whom we hold joint meetings has increased and next year the first meeting with the Royal Institution of Chartered Surveyors takes place on 7 February 1990. There is a very solid base on which to build. The question now before us is, what sort of an Institution do we want?

Professional Qualifications For Military Engineers

BRIGADIER M J F STEPHENS BA CEng MICE, Deputy Engineer-in-Chief

OVER the years Sapper officers of all ranks, both serving and retired, have debated the subject of professional qualifications for military engineers. Following renewed interest expressed in the columns of this *Journal* (Dec 87), The Council of the Institution of Royal Engineers (the Institution) commissioned a study by G A Lee Esq BSc FEng FIChemE and Colonel (Retd) J H G Stevens BSc CEng FICE. The aim of this study was "to determine if the Institution of Royal Engineers should seek recognition by the Engineering Council (EC) in order to define and award professional qualifications leading to chartered status and, if so, to recommend how this might be achieved".

The interim report of the Lee/Stevens Study, as it came to be known, was circulated to members of the Council of the Institution seeking advice on whether or not to pursue the approach to the EC. The Engineer-in-Chief agreed to sound out the senior serving members of the Corps who themselves in many cases sought the views of junior members under their command.

The purpose of this article is to record the findings of the Lee/Stevens Study, illustrate the spectrum of comment gained from its circulation amongst the senior members of the Corps and publicise the EinC's line on future action.

LEE/STEVENS STUDY

IN their researches Mr Lee and Colonel Stevens looked back at a previous proposal in 1961 to introduce grades of membership in the Institution. This proposal was abandoned for a number of reasons which still apply in varying degrees today. But there has been sufficient change within the organisation of the chartered institutions, particularly with the formation of the EC, to justify a further look at the question.

The Lee/Stevens Study first examined the desirability of the Institution seeking to award recognised professional qualifications and listed advantages and disadvantages. These are included here in full as they formed the basis of most of the opinions expressed by senior serving officers and they also provide a useful guide to factors to be considered in any future action.

Advantages. Were the Institution to award recognised professional qualifications:

- The special skills of military engineers would be recognised and the standing of the Corps and the professional status of its members enhanced. The morale amongst those who currently feel that their training and experience are not properly recognised would be raised accordingly.
- RE officers could become Chartered Engineers (CEng) without going outside the Corps.
- Certain RE other ranks might also become Incorporated Engineers (IncEng) — previously Tech Eng — without going outside the Corps.
- The status of the Institution would be enhanced if it were to become a fully active professional body in addition to its being a learned society. This would give the Institution a new *raison d'être*.
- Recruiting and retention in the Corps should benefit.

Disadvantages. The disadvantages are that:

- It is very unlikely that acceptable standards of qualifications could be devised which would apply fairly to both the Regular and Reserve Army. It would probably be necessary to exclude TA candidates from the scheme, at least in the initial stages.
- The basic academic standard for CEng is an honours degree in engineering. Only about half the regular officers have relevant degrees and many senior officers are non-graduates. It is possible that a small number of non-graduate senior officers could become CEng through the Mature Candidate and other routes, but some anomalies are still likely to occur. If the number of potential CEng candidates in the Regular Army, ie those holding engineering degrees, is too few, it may be necessary to form a new body, eg 'Institution of Military

Engineers' in order to obtain EC recognition. This would split the Institution and could become divisive within the Corps.

- The EC would most probably insist that the grade of 'IncEng' was available to senior non-commissioned ranks. The Institution's charter would need to be revised unless a second body was formed.
- Promotions and appointments of serving officers and NCOs are governed by the rules of MS and AG respectively. Although it may be possible to modify these rules to take account of professional qualifications, it is difficult to see how such change would benefit serving officers or ORs. Except perhaps for the consultancy and academic fields, industry, whilst encouraging their attainment, also takes little notice of professional qualifications and believes that quality and experience are more important than letters!

Since the training and experience would be in military engineering it is difficult to see the extent to which qualifications would be relevant to civilian employers. However, it would demonstrate the individual's application and discipline in achieving CEng.

It can be argued that officers might be deterred from professional engineer training (PET) if CEng could be obtained through another route. If fewer officers receive training and experience in construction engineering through PET courses the Corps' capability in this field would decline.

Additional staff would be required to administer the procedures — professional interviews, verifying training and experience records, dealing with individual cases etc. This would lead to greatly increased subscriptions (including a contribution to EC) from the relatively small numbers involved.

Good quality potential officers without engineering degrees might be deterred from joining the Corps for fear of becoming second-class citizens.

Currently all members of the Institution are designated "Members". If CEng is achieved through the Institution it seems certain that different membership grades will become necessary — perhaps up to seven or eight. Allocation of current members to new grades could pose problems.

The Study then identified two possible routes to recognition by the EC:

- The first would be for the Institution to become a 'nominated body' under the EC with similar status to the main professional institutions, such as the Institution of Civil Engineers, and able to submit candidates for registration as CEng.
- The alternative would be for the Institution to become an 'affiliated body' to the EC and, by association with an existing nominated body, put forward candidates for registration through that nominated body.

Based on the current membership of the Institution, the Study estimated optimistically an initial chartered membership of 300-400. A professional institution supported on its formation by this number of chartered members would be too small and costly to be viable, and it would be most unlikely that either the EC or the Privy Council would support a proposal for nominated body status. A more realistic approach would be to seek recognition as an affiliated body. Many of the 50 or so institutions recognised by the EC wishing to put forward candidates for CEng — to their own education, training and experience standards — do so through affiliation to one of the 17 institutions holding full nominated status. (Author's note: Mr Lee has pointed out in subsequent correspondence that being "affiliated to" does not imply being "subordinate to" a parent nominated body.)

Mr Lee and Col Stevens felt that the next step was to get the Council of the Institution and the EinC to consider the desirability of proceeding, and pointed out some of the problems to be solved if the Institution were to do so:

- A suitable nominated body prepared to sponsor military engineers would have to be found.
- Standards of training and experience required for chartered membership would have to be agreed with both the sponsoring nominated body and with the EC's Board of Engineering Registration.
- A method would have to be established by which senior NCOs with the necessary education, training and experience to qualify as IncEng could be included.
- It would have to be decided whether or not to form a second body.

Comment

The Council discussed the matter at their meeting on 12 December 1988 and decided that the next step was for the EinC to canvass the views of his senior colleagues. The Study report was subsequently circulated to all serving Royal Engineer brigadiers and above who, in many cases, consulted junior officers under their command.

The replies received were predictably comprehensive with much helpful and constructive comment. The spectrum of response covered a few marginally in favour of pursuing the approach to the EC, but the majority were firmly against going further down the affiliated body route. Of those in favour, a few argued strongly the need to reward in some way the qualifications and experience gained by military engineers. The arguments varied from firm advocacy of a specific reward and cautious approach to the EC, to a 'last resort' approach if we are unable to achieve better recognition through less adventurous channels. In sum, the arguments for were considerably less cogent than those against proceeding. A digest of the latter follows. (Limited space precludes inclusion of every detailed comment; the author has tried to provide an objective summary of the full breadth of arguments expressed, but accepts that the impact of some of the original remarks may have been tempered somewhat!)

- *Status of Qualification.* A professional qualification purely within the Institution of Royal Engineers would have little, if any, relevance within the Army and would be in danger of being classed as a second-class qualification by those outside. As such it would be of little value to someone seeking employment on leaving the Army, certainly no more than that at present afforded by the combination of capbadge, rank training and experience.
- *Relationship with Civilian Qualifications.* Even accepting that an engineering honours degree would be a necessary starting point, a purely military qualification gained through military engineering experience alone, could dilute the status of the genuine PQE and debase the coinage of his hard-earned civilian qualification.
- *Potential for Divisiveness.* The honours degree starting point for chartered status would create a division amongst Sapper officers which might deter non-degree officers joining the Corps. The counter argument that the chance of gaining chartered status during service could attract more graduates is weakened by the questionable status of such a qualification. Some expressed the feeling that we should avoid becoming a "boffin-like" Corps; we need to continue to select officers from a fairly wide background with other than pure engineer qualifications. Only in this way will we be able to recruit sufficient officers with the other military qualities so important if we are to retain our high standing in the Army and outside. This wish to retain the broad qualifications base for our officer recruits prevents us following REME's example — they demand a common graduate level before YO training which includes an attachment to civilian firms counting towards civilian qualifications.
- *Quality of Military Engineering Experience.* A persuasive argument against seeking chartered status based on purely military experience was that it would be wrong to create an illusion of professionalism (in the civilian sense) by claiming more than we deserve for the work we do. It is probably fair to say that the majority of officers other than PQEs, do not do enough genuine military engineering of an imaginative, innovative or complex nature to warrant chartered status. The point was made that military engineers are hybrids, a mix of engineer and soldier; it would be hard to fit the requirements of the EC without either overstating the engineering aspects of our job or undervaluing the military skills we also need.
- *Manpower and Financial Implications.* Extra staff would be needed to administer any scheme to award qualifications. The cost of these, added to the other administrative costs which would arise, would be difficult to justify in the current climate.
- *Status of IncEng.* Many feel the need for a qualification for our non-commissioned technical ranks, although one person argued that such a qualification related to pure military engineering could put senior NCOs in a position of technical superiority over many junior officers. This is already the case with clerks of works and it might be wise not to extend the practice.

- *Chance of Failure.* In the light of all the other arguments against approaching the Engineering Council, there would seem to be a high chance of the submission being rejected. One officer warned that if this were to happen the Corps' standing in the eyes of the civilian institutions could be diminished.

- *Qualifications for the TA.* Arguments that a military qualification could embrace the TA were countered by the feeling that those members of the TA wanting qualifications would be more likely to work towards something associated with their civilian employment.

Future Action

With the majority feeling so strongly expressed the EinC recommended to the Council of the Institution that it should proceed no further on the lines originally proposed. However, concern was voiced by many of those consulted that more needs to be done to seek recognition by existing professional institutions of appropriate experience, including that gained by the Corps' senior NCOs. Accordingly the EinC agreed to look at the following possibilities and, where appropriate, task his staff to take follow-up action:

- Members of the Corps should seek a wider range of existing civilian qualifications, eg MI Nuc E, that could lead to CEng.

- The Corps should strengthen as best it can the normal routes whereby officers gain professional qualifications.

- Cranfield should be asked to examine the possibility of a distance learning modular course for the award of a diploma, which, combined with other training and experience, could lead to membership of a civilian institution.

- The Corps should consider restructuring its officer recruiting and training policy to conform with EC guidelines. Even if it does not increase the number of graduate officers it should at least strive to recruit more of those with relevant degrees.

- The Corps should publicise the Mature Candidate route to professional qualifications and encourage officers to keep a record of all engineering projects, including such military tasks as bridging, minelaying and demolitions, with which they have been involved to support their applications. Providing they have a relevant degree and the right sort of engineering experience officers could achieve CEng through existing channels. Garrison Engineers without degrees may also be qualified to try the Mature Candidate route.

- It should be considered whether civilian institutions might be approached about the possibility of awarding a military associate membership, eg AMICE(M), on the basis of YO training and relevant experience.

- The Institution might wish to establish a relationship with the EC that stops short of chartered status. The aim of such a relationship would not necessarily be of benefit to individual members,. It would be more of a recognition by the EC of the special position of the Institution as a learned body with whom it has a valued close relationship.

- The question of status of military engineering should be re-examined as 1992 approaches when there will be a much larger group of EURO-NATO military engineers.

Some of these suggestions are complementary to Army-wide initiatives in hand at present and the EinC will ensure that the Corps' interests are properly represented in any discussion on them.

Conclusion

Our President summed up, at the Council's July meeting, by saying that he felt that the Council had now played its full part in discussion of the subject. He recommended that the Council take note of the view of the Corps (outlined above) and leave any further action in the hands of the EinC. Although the Lee/Stevens Study as such was effectively concluded, Colonel Stevens would continue to investigate our relationship with the EC in conjunction with EinC's staff.

It was generally agreed that little can be gained from further debate on the lines followed by the Lee/Stevens Study. Now is the time to explore the other avenues open to us and constructive comment and innovative proposals on future action will be welcomed!

The Memorial Bailey Panel at Christchurch Quay

SIR DONALD BAILEY the inventor of the World famous Bailey Bridge, came to Christchurch in 1928, to join the EBE as a designer, and remained in the vicinity until his death in 1985. On 5 April 1989, the Borough of Christchurch, the Royal Armament Research and Development Establishment (Christchurch) and Thos Storey (Engineers), combined to honour Sir Donald. At a ceremony on Christchurch Quay, a brass plaque surmounted by a Bailey Panel was unveiled by Brigadier H A T Jarrett Kerr CBE, who worked with Sir Donald on the design of the bridge during World War 2.

Brigadier H A T Jarrett Kerr and the Major of Christchurch, Councillor Mrs M Pardy, at the unveiling ceremony

The wording on the plaque reads:

Sir Donald Bailey Kt OBE, at the Experimental Bridging Establishment, Christchurch, invented a bridging system in 1940-41. Standard components were used to construct bridges of different spans and forms. During World War 2 over 260 miles of the bridge were manufactured. This Bailey Panel was presented by Thos Storey (Engineers) Ltd.

Christchurch Council was represented by the Mayor, Councillor Mrs Margaret Pardy, the Chief Executive, Mr Colin Dewsnap, and a number of the Town Councillors. After the ceremony the guests were entertained to lunch by Major John Hatherell OBE, Managing Director of Thos Storey, at the RARDE (Christchurch) Officers Mess.

The Memorial Bailey Panel At Christchurch Quay

The Institution

A transcript of the presentation delivered by the Secretary, Colonel G W A Napier, to the 30 Engineer Brigade Study Period on 29 October 1989.

THIS is the first time I have been offered an opportunity to talk about the Institution and I thank Brigadier Garth Hewish for it. The fact is that remarkably few members of the Institution really know what it does or should do. A number of people are not even sure whether they are members or not. To be honest I did not really understand myself what the Institution did until I took over as Secretary.

Inevitably I must take you back into history to explain the origins of the Institution and my start point is the situation after the war against Napoleon. The years in the half century or so after Waterloo were really the most formative in setting the place of the Corps in its professional and social context. Two powerful forces were at work; the extraordinary acceleration of scientific discovery together with the exploration of techniques for its application; and the astonishing rate of imperial expansion. One has to remember that in 1820 Royal Engineers represented a substantial proportion of the trained engineers in Britain. The strength of the Corps in 1800 was 94; it peaked in 1813 at 262 and by 1819 comprised 193 rising to 288 by 1846. By the mid 1850s the Corps numbered 350 and in 1870 817, of which 395 were stationed in India. By comparison the membership of the Institution of Civil Engineers was 220 in 1830; around 700 in 1850 and by 1870 had reached 1700. Of course by then the number of professional institutions had also proliferated.

So here was this elite body of professionals who were not only involved in honing the leading edge of scientific discovery at home but who also often found themselves the only qualified people in distant parts of the globe faced with daunting responsibilities for creating an infrastructure in virgin territories.

Under the editorship of Lieut William Denison, later to become Governor of New South Wales, the Corps began to publish professional papers through which to disseminate their experiences. These were, and still are, a mine of information. They ran from 1837 to 1904 when they were absorbed into the *Royal Engineers Journal*.

In 1875 when the fashion for professional institutions was well established, the Corps decided it too must have one. By then the civilian institutions had added the role of qualifying body to that of exchanging information but the Corps recognised from the start that the professional standards of military engineers would always be a matter for the War Office and so the Institute — as it was then known — confined itself to the learned society role, specifically the business of continuing the publications and by then, a matter of increasing importance, the care of the heritage of the Corps. The Library was established and a collection began to be built up of museum objects although the museum was not formally set up until 1912. I will return to these two later.

The final chapter in this evolution was the granting in 1923 of the Royal Charter placing the affairs of the Institution in the trust of the Council. The title "Institute" had been dropped as by then it had connotations of charitable institutions for the deprived.

Now, it has to be said that the Charter, through its Bye-laws does set the Institution somewhat grandiose and ambitious objects. Most of these are now the proper business of the Engineer-in-Chief. But, when I discuss with you in a minute the quandary that faces the Institution at present over its role, you may wish to note and remember that at the time that the Charter was drawn up there was no Engineer-in-Chief. The most senior officer in the Corps was the Director of Fortifications and Works and he was the first President of the Institution, though there was also a Corps Committee set up in 1907 to coordinate the demi-official work of the Corps.

So I am led to the conclusion that the Institution was seen then as having some influence, in the name of the DFW, on the maintenance of training standards and that the publications, the Library and the Museum were part and parcel of that business. Since those days the Engineer-in-Chief's branch has developed into the repository for professional training standards and, on the demi-official business of the Corps, the Chief Royal Engineer and his structure of committees has been set up which has perhaps polarized in a slightly unnatural way, the business of the "Institution" from that of the "Corps". As I see it, we are one body but the Corps has chosen to

invest the Institution with the responsibility for managing certain of its functions and granted it a degree of autonomy so to do.

However, let me now tell you what we actually do and how it works.

The bread and butter is of course publications. The periodicals are:

The *Journal* — containing articles on professional subjects, general interest, historical matters and memoirs, book reviews and correspondence. Published every fourth month.

The *Supplement to the Journal* — a newsletter, published every second month with notices of Corps events, postings and promotions, sporting activities, births, deaths and marriages and so on.

The *RE List* — is published annually and contains the names of all regular full-time and part-time officers and retired members of the Institution.

In addition to the periodicals we also publish Corps History, now in its tenth volume. Daunting it may look but I can tell you we are lucky to have it. The Gunners have only just started to publish theirs.

Next to mention is that we administer a number of trust funds. The principal one is the Kitchener Scholarship Fund, set up to provide for the education of the children of any Sapper of any rank who dies in service. The fund is at present disbursing some £6000 a year for this purpose. There are also minor trust funds which provide prizes and medals for various achievements in the Corps.

Now I return to the Library and the Museum.

In the early days our forefathers envisaged the Library as playing rather a bigger part in Sapper officers' daily life than perhaps it does today. The earliest Corps Library was located in the Mess and, later, station libraries were set up in London, Dublin and Aldershot. They were, presumably, working libraries. After World War Two our present Corps Library was set up here at Chatham from the many thousands of books that had been stored during the War in crates.

It is a private library in the sense that the books are owned by the Corps and managed by the Institution. That is, we provide funds for its maintenance, currently some £4000 a year, out of the Institution's subscription income and policy is set by the Institution's Publications and Library Committee. It is MOD-supported in the sense that the premises are provided by the MOD as are the full-time staff of a Librarian, Major John Hancock, and his assistant Mrs Maggie Magnuson. We do also pay for another part-time assistant from Institution funds.

The Library has a wonderful collection of books and original documents, primarily about the history of the Corps and military engineering but on a wide range of associated subjects as well. It does not however, claim to maintain an up-to-date collection of technical books. This is the responsibility of the schools and of TICRE who also hold technical reports at Chilwell. The Library does have a photographic collection of exceptional value. Photography as a military skill was taught at Chatham from the earliest days and the Library collection has benefited from that as well as inheriting private Sapper collections from then to the present day. If I may insert a commercial at this point, could I urge that any of you who either has or knows someone who has photographs with Sapper connections, to let the Library have them if and when they no longer want them. In my view it is of the utmost importance that we maintain the strength of that collection for the benefit of future generations.

The Museum is now becoming part of my personal province and will become a full-time responsibility for me from the early part of next year when I will be handing over my duties as Institution Secretary and Editor of the *Journal* to Lieut Colonel Freddie Beringer. I would like to tell you just a little about the Museum project which is tremendously exciting.

The Corps Museum was formerly a somewhat modest affair located within Brompton Barracks, in the original Chapel. Unusually among military museums it has always had as one of its aims, the displaying of its wares to the general public. The difficulties surrounding that in its old site, plus the need for more space, led to its relocation in 1986 in the Ravelin Building from which date it has been open to the general public for £1 for adults and 50p for children, OAPs and unwaged. At present it tells the story of the Corps up to the end of World War Two but you will be aware, I hope, that there is a very ambitious plan in hand which will not only bring the story up to the present day but will also develop all aspects of the Museum, to enable the magnificent collection of artefacts and documents that the Corps owns to be preserved, displayed to the public and more even than that, to be made use of as a resource for the education and

inspiration of the public and of our own people.

The programme is ambitious. It involves roofing over the courtyard of the Ravelin Building, a contract for which is in process of being let. It involves the enhancing of what is already a very fine permanent exhibition by the addition of interesting, even exciting, interactive displays to widen the appeal to family audiences. It involves developing all sorts of programmes to make the place a popular and worthwhile venue for many groups of the population including school parties. Activities of all sorts will take place; indeed have already started. The searchlight day we sponsored in February of this year was a great success and we have plans for many similar occasions.

Of course it is going to cost money and I need to say a word about that. Some of you will remember that in 1984 the Chief Royal Engineer launched an appeal within the Corps,the aim of which was to get the move completed from the old site. Some £90,000 was raised by private subscription. Subsequently the Royal Engineers Museum Foundation was set up to seek funds for the project from outside the Corps. There was a very encouraging response to that and some £700,000 has been raised with generous contributions from a number of firms and from local authorities.

The Corps is very much indebted to the members of the Foundation for their personal generosity and energetic and supportive help, particularly Colonel Peter Williams, whom many of you will know from his TA activities, who was chairman for this first phase.

As so often happens, we were some way into developing our plans when it became clear that a reappraisal was required to ensure in particular that we could cover our long-term running costs. In October 1988 we called in Museum planning consultants and, with the help of funding from the English Tourist Board and Kent County Council, commissioned a Feasibility Study report to include a five-year business plan. They recommended certain improvements to our plans to widen the appeal of the Museum and enhance the facilities. Inevitably capital costs are involved and the Foundation have set their hand to the raising of a further £1 million. Colonel Peter Williams, having earned the undying gratitude of us all for what he has done, has handed over the chairmanship to Mr Idris Pearce and he and his team under the Presidency of the Chief Royal Engineer, have magnificently set their hand to the raising of this new sum.

Ladies and Gentlemen, if my involvement in the Museum has taught me nothing else, it has revealed a wonderful vein of generosity and support for the Corps which it is easy to forget when one is going about the daily business of soldiering. We do belong to a unique family and the Museum will be a symbol of that.

So what lies ahead now for the Institution? I have already explained that the Institution is an autonomous body, bound to certain responsibilities by its Charter. Nevertheless, it was set up by the Corps and effectively its autonomy is in the gift of the Corps. I have already explained that the Corps did not ever see the Institution as a qualifying body. However, times change and the question was recently raised again as to whether we should have our own qualifications and seek recognition by the Engineering Council in our own right. Should we offer "MInstRE" and seek to put "CEng(Mil)" after our names. A very thorough examination of this proposal has been made and the arguments and upshot will appear in an article in the *Journal*. In brief, a far reaching discussion throughout the Corps has led to the conclusion that the various disadvantages of taking this course, outweigh the advantages. So we remain a learned society but none-the-worse for that.

The question is, how can we best capitalize on the vigour which is available to us through the Royal Charter to help maintain the Corps in its rightful place in the profession of engineering?

That is the challenge that faces the Institution today. My personal view is that we have a most valuable asset in whose name much more could be done for the Corps. Even if recognition by the Engineering Council is not a desirable aim there is no reason why some form of certification of steps in an officer's career should not be made in the name of the Institution. I believe the Corps benefits by having such an autonomous body but it must never become so detached from the mainstream of Corps life that it cannot be useful to the Corps.

So may I conclude by suggesting that membership of the Institution is an excellent way of playing a full part in this unique family of ours. Associate membership is open to territorial officers but we hope that you will take full membership at least while you are serving with all that that entails.

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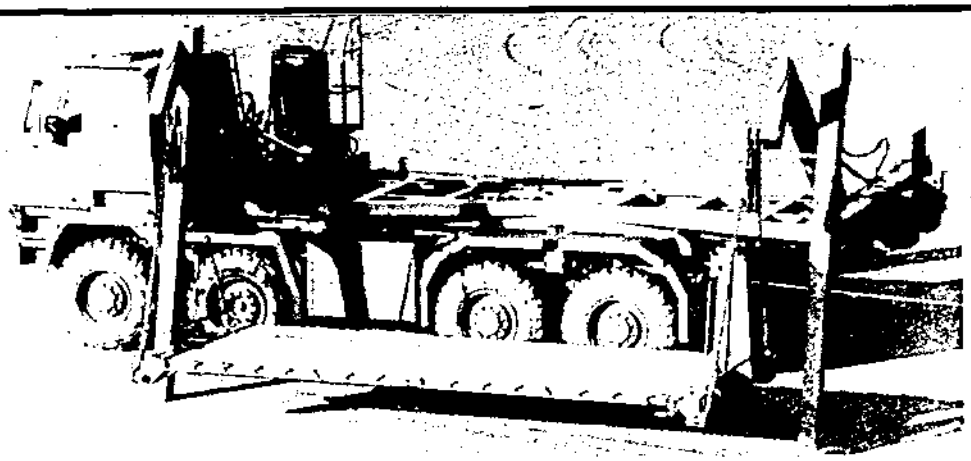
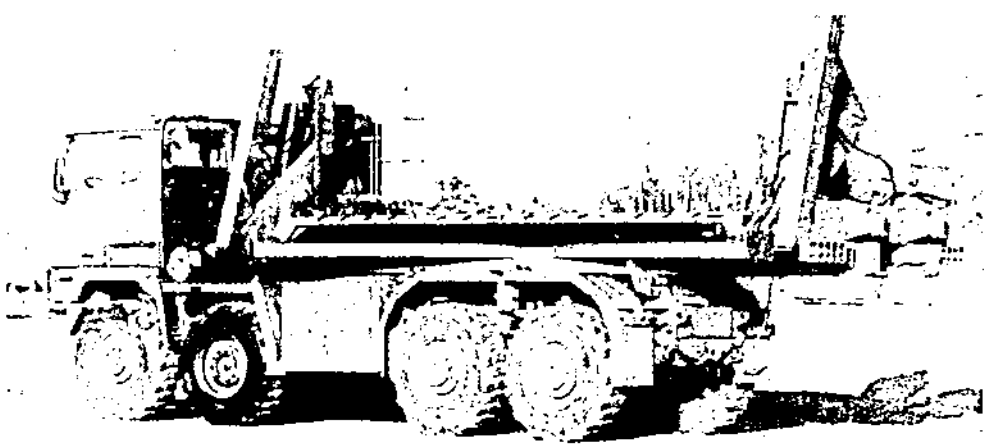


SRTE picking up a flatrack



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Airmobile Sappers

MAJOR W A BAILEY BSc(ENG)

Major Bill Bailey enlisted into the Royal Engineers on 13 September 1971 and was commissioned on 9 March 1973. After a tour as Platoon Commander, 9 Independent Parachute Squadron, he attended a degree course at RMCS Shrivenham. Further tours included Regimental duty, 2IC 10 Field Squadron, SO3 (Int) 39 Infantry Brigade and, following promotion to Major, Staff College, then DCOS HQ Berlin Infantry Brigade. He assumed the appointment of Officer Commanding 51 Field Squadron on 8 January 1988, and has commanded the Squadron during its change-over to an Airmobile role within 24 Airmobile Brigade.

Major Bailey is married with one daughter aged three and his hobbies include windsurfing.

BACKGROUND

IT is a rare occasion when a single simple request, involving the movement of a 10kg load over a distance of six to eight feet, can involve a number of departments and organisations within two of the Armed Services in detailed discussions over a 14 month period and have interest shown by elements of the third and Senior Service. The problems start when the load is a barmine, being delivered via a chute to the ground from the back of a Chinook creeping forward in hover taxi.

Airmobile Sappering is not new, 9 Parachute Squadron pioneered the role and of course 5 Field Squadron have furthered the cause during the 6 Airmobile Brigade trial. Unfortunately, neither Squadron tried to move that 10kg load in quite the same way as I have described above and so for the last 18 months it has been up to 51 Field Squadron, the Corps' newest airmobile squadron.

This article is about 51 Field Squadron's re-roling as an airmobile squadron in support of 24 Airmobile Brigade and its development of mine delivery methods from helicopters.

INTRODUCTION

24 AIRMOBILE Brigade is based at Catterick Garrison. The Brigade consists of three infantry battalions, Headquarters 27 Field Regiment, Royal Artillery, an air defence troop, 51 Field Squadron, 9 Regiment, Army Air Corps and logistic and service support elements. Two of the battalions are airmobile and are equipped with 42 Milan and nine mortars, the remaining battalion is equipped with Saxon. The Lynx squadrons will be equipped with Tow.

The Brigade's role is to act as a reserve which, by 1991, could be part of a NATO airmobile division. The Brigade's likely tasks are:

- To establish a defensive position to block an enemy armoured break through our forward divisions, in preparation for a counter attack by our own forces.
- To hold ground to cover the withdrawal of another formation.
- To seize and secure crossings over an obstacle through which another formation can pass in either withdrawal or advance.
- Counter descant operations.

The most difficult and likely task that the Brigade will undertake is the occupation of an unprepared defensive position. In this scenario the creation of obstacles is the Squadron's major task. The Brigade must be complete, dug in with obstacles ready, in under 12 hours.

MINEFIELDS

THERE are of course many types of obstacle which can be created depending on the ground, resources, time and available manpower; however nothing is as effective, flexible and quick to produce, as a minefield.

At the beginning of 1988 we experimented with a variety of vehicle-borne and manual methods of

Major W A Bailey BSc
Airmobile Sappers

creating surface-laid minefields. The biggest problem was that the number of aircraft needed to fly forward the vehicles, men and mines, was far beyond that which we could expect to be allocated to us from the Brigade for any operation. Minor problems at this time included the misuse and damage reports detailing collapsed springs on overloaded landrovers; fortunately, I had an understanding CO! However, whichever combination of vehicles and men we tried, we could not beat six hours for a 1 kilometre, six-row surface minefield with three types of mines in it.

At this stage we considered that we were moving too much equipment for very little return, in terms of obstacles completed. It seemed pointless to fly vehicles forward to be used as mine carriers when we had helicopters available. We knew that Scout helicopters had been used to lay small local protective minefields, in the past. Few details were known and our requirement was for something much larger. Initially we relied on RCT transport to deliver mines from the host division's minedump, however we soon decided to collect the mines using Chinook from their minedump and deliver them to our forward troop minedump.

Lynx Minelaying

The mines themselves were picked up in 18 nets and delivered to the forward minedump under two Chinooks. Individual pallets were then slung under a Lynx and delivered to 18 locations in the minefield, where a troop quickly broke down the pallet and laid out the mines in six rows. This method cut the number of aircraft required to lift the Squadron forward and utilized the resources around us, but it still took approximately five hours to complete 1 kilometre of six-row minefield.

Unfortunately, minelaying from helicopters such as Scout had gone out of vogue when Lynx was being brought into service and the aircraft were not cleared for such use. This meant that a rather frustrated Squadron Commander had to approach a very senior Army Air Corps commander with the idea, which he agreed to, during a rather nice cocktail party.

Two days later, 657 Squadron, AAC, landed a Lynx next to six pallets of mines and four Sappers loaded 60 mines on board with the rotors still turning over their heads. Once over the minefield, one sapper knelt in the back of the aircraft and passed mines from the pile to a second who sat with his feet on the skids and laid the mines onto the ground. The aircraft flew from the troop's forward minedump in a controlled hover taxi and during minelaying, the pilot kept the aircraft as close as possible to the ground, approximately at a height of two or three feet.

Setting out is a slow process, however using a Lynx we managed to speed the procedure up. Mine dispensing could take place on the front rows, once they had been set out, while the setting out party continued in their Lynx. The whole task could be carried out in approximately 40 minutes dependent on the ground conditions. Recording was carried out in the normal way by the troop commander.

We quickly discovered that the sapper on the skids had to talk to the pilot to control his forward speed and height to ensure the correct mine spacing was achieved. With practice the aircraft crew and sappers became much faster and we learned many lessons, such as that one must lay "up-hill" or the tail rotors try to dig the mines in.

To speed up the laying still further we found that three aircraft could work in 1 kilometre of minefield, each laying two rows of a particular type of mine. To load these aircraft we devised a simple Lynx minedump layout, located as close to the minefield as possible. This included foreign object damage (FOD) nets, to protect the aircraft from the mine wrappings in the pallets.

Arming the mines has been the subject of some debate in the Regiment and Squadron. As we do not know the robustness of the barmine design, we decided to arm the mines after they had been delivered to the ground. Although this took longer, it also overcame any possible problem the aircraft's electronic systems might generate. Project Manager Mines and his staff in the Ministry of Defence are resolving the questions that remain, on the carriage and arming of mines in service helicopters.

We found that three men can arm a one kilometre row of mines using yet another little drill in about 10-15 minutes. Thus with two men in each aircraft, four men in each of their individual minedumps, a fencing and recording party and the arming parties: one troop could lay and arm one kilometre of six-row surface minefield in two to three hours. We were now starting to produce obstacles in a realistic time frame, as far as the Brigade were concerned.

During the next few exercises we laid some six or seven kilometres of minefields in this way,

frequently laying two minefields at the same time using two troops. Lynx minelaying was included in the NATO Military Committee Demonstration on Airmobility, which took place on Salisbury Plain in 1988. The AAC pilots and ourselves believed minelaying in such a fashion demonstrated true airmobility, at that time.

Puma Minelaying

It was obvious that the Puma had mine dispensing potential right from the start. The increased payload and endurance of the aircraft meant that we should be able to lay the minefield even quicker than using Lynx. Unfortunately the Puma was also not cleared for mine dispensing and it took a further four months before we could test the concept.

The aircraft can carry between 60 and 120 mines dependent on fuel load. However, the major peacetime restriction we had to overcome was the unsecured load; the large number of mines sitting unrestrained in the cabin of the aircraft, waiting to be delivered to the ground. The security of internal loads is paramount to the safe handling of the aircraft and to ask a pilot to detract from this security, is like asking a sapper to ignore the rules for explosive handling in peacetime.

We therefore spent much time and effort demonstrating the movement of the helicopter from the minedump to the minefield. The aircraft was kept in hover taxi throughout the trip and of course remained in this flying mode while dispensing the mines. Again, the distance from the minefield to the minedump was kept as short as possible.

As for the Lynx, the Sapper mine-dispensing crew consisted of two men and they were sometimes assisted by the aircraft loadmaster, when he was not busy on his other duties. The aircraft is very manoeuvrable and like the Lynx capable of working in quite close terrain, although this slows down the operation.

Because of the uncertainty of aircraft availability, we adapted our minedump design to suit Lynx or Puma, so that any combination of aircraft, up to three in total could operate together in a one kilometre minefield.

Chinook Minelaying

The Lynx and Puma offer a method of mine dispensing in close country. Their biggest drawback is that the mines have to be delivered to the troop's forward minedump under two Chinooks, if the host division's minedump is more than three to five kilometres away. What we wanted to do from as early as April 1988, was use the Chinook as the mine dispensing aircraft and utilize its remarkable load-carrying capacity to the full.

(One of the limitations of the Squadron's utilization of helicopters for mine dispensing, is that we do not know which aircraft we will be allocated until they arrive at our landing site. This of course means that we cannot modify any aircraft, nor rely on the aircrew to have any specialist mine dispensing skills. However, benefits of this system of aircraft allocation, are that we do not have to rely on specially roled aircraft surviving the first few days of war, before the Brigade is launched on an operation.)

A number of other practical problems had to be overcome before we could start using Chinook. The aircraft we calculated could hold 724 barmines and 12 men would be needed to pass the mines to the rear ramp. This is enough mines for two rows, two kilometres long which the aircraft could lay in two passes. However, after some trials on a simple Chinook mock-up we built at Ripon, we quickly learned that this would mean the aircraft staying in the hover taxi for approximately 40 minutes. Not only was this tactically unsound, it also required the aircraft to use too much fuel while fully loaded. To cut the time in half we had to lay two rows at once. However, the ramp was only three metres wide; too close for the rows of barmines if we were not to risk the chance of sympathetic detonation. We therefore needed two chutes to widen the gaps between the mine rows, one on each side of the ramp.

(For the record and to prove that we really did try to follow the Sapper norm of 15 metres spacing between mine rows, we asked the RAF if the aircraft could fly diagonally forward in the low hover. We could then dispense the mines from the front starboard door and the port side of the rear ramp, which would give us the required spacing. Although the Chinook could indeed fly in this configuration, there was the danger of "dynamic rotation". If the side of one of the aircraft's wheels caught the ground, the aircraft would "tumble". As result we learned a new phrase and dropped the idea.)

The requirement for the chutes meant that the whole business had to be the subject of a JATE trial, which only the MOD could sanction. To obtain MOD approval for the trial took nearly a year and we started the trial in February 1989.

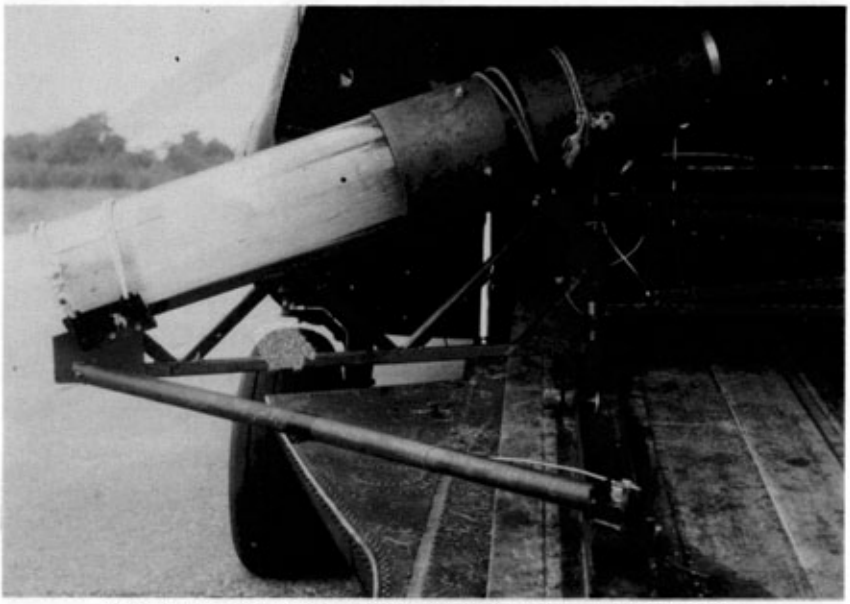
Two mine chutes "out-rigged" in preparation for dispensing mines

Throughout our development of the concept we have repeatedly met resistance from a variety of people for all sorts of reasons, however nobody said it would be easy. Generally, once we explained what we wanted to do and why we had to do it, most people became quite helpful.

The first chute we produced was made by the Regimental Workshop REME literally overnight, in May 1988. The chute had a "U" shaped channel, and was fixed to the rear ramp by four "J" bolts fastened to the four tie-down points. The first prototype was never intended to be flown; however, pictures of it were used on many presentations and it helped to demonstrate the simplicity required of the final design.

When Brigadier Kennedy, Commander 24 Airmobile Brigade announced that he wanted to demonstrate mine dispensing from Chinook to the visiting German CGS in March 1989, we hurriedly built a second working prototype. For the record, Captain J Miller RE produced the final design for the frame for the prototype chutes and Staff Sergeant Bendle of 15 Field Support Squadron built them in less than a week. The "U" channels were replaced by plastic tubes to alleviate the problem of rotor downdraft. Using the chutes we achieved a nine metre separation between rows.

The internal loading plan for the aircraft was completed by Squadron Leader S Dennis of JATE, after lengthy discussions with Lieut (now Captain) A J S Green RE, who spent some time at JATE trying various methods of loading a Chinook mock-up. We calculated the aircraft could carry up to 724 mines, however this apparently meant it operating at the edge of its peacetime capabilities. The full load was only just within the centre of gravity envelope for the aircraft. After much debate Squadron Leader Dennis devised an acceptable peacetime tie-down scheme for up to 364 mines, dependent on the single engine shut-down characteristics of the aircraft being used and the current atmospheric conditions. (The number of mines that may be loaded on any one day due to the atmospherics can vary from one



The chutes are held-on with bungies so that they will "give" if they hit the ground in flight

Chinook to another, dependent on the method of calculation by the pilot). This tie-down scheme cleverly used four NATO post pallets, which could be rigged inside the aircraft using 5000lb tie-down strops by the Sappers in minutes.

In each aircraft 12 Sappers are required to stand up and move so that they may pass the mines down the length of the fuselage to the chutes, while the aircraft is moving slowly forward. This alone nearly defeated the concept as a lot of discussion had to take place before the Sappers were allowed to stand up in a flying helicopter, secured by RAF despatchers' harnesses.

In the last week of June 1989, the Squadron carried out a week of extensive loading and mine dispensing trials while based at Longmoor Camp. Two Chinook, two Puma and two Lynx were provided for our daily use. Captain M Dunford RE of JATE had, in a very short space of time produced the final design of the mine dispenser, constructed to aircraft specification in their workshop for this trial week. This week's training proved invaluable. It not only allowed us to continue the Chinook mine-dispensing trial, it also allowed us to finalize much of the minutiae of moving the Squadron forward on an airmobile deployment.

With Wing Commander D Forsythe RAF as host, the Brigade's Deputy Air Mission Commander, the Station Commander, RAF Odiham, and many of the staff officers responsible for helicopter operations in the Ministry, watched a simple display of Chinook and Puma minelaying one afternoon. I mention this one demonstration in particular because it was noticeable, after the event, that many of the doubts people had had were put to rest and people now understood the simplicity of what we were trying to do. In any event, many more people were prepared to help the JATE trial to succeed and life became generally easier.

Route Denials

Although the Chinook minefields create the major part of the Brigade's obstacle it would not be complete if the roads and tracks through the defensive position were left open. Consequently one field troop is given this task and 20 route

A Squadron Chinook starts mine dispensing

denial packs are flown forward with the Squadron from our concentration area. Each pack consists of two Rapid Cratering Kits (RCK), ten FWAM(E) barmines, ten anti-personnel mines, plastic explosive, detonating cord, safety fuse, detonators and grip switches. The packs are individually netted so that they can be flown under a Puma once delivered by the Squadron's Chinooks. The troop also have first use of the one stripped-down landrover the Squadron flies forward. To ensure that no target is beyond the reach of the troop, all six four-man teams are capable of abseiling 200 feet through tree cover with a route denial pack. Analysis of pre-planned defensive locations quickly identified areas where it was not possible to land a helicopter, such as key track junctions in the forests on ridge lines.

Brigade and Regimental Test Exercise July 1989

The latter half of 1989 was always going to be the time when the skill and speed of operation of the Brigade was tested. This was when we had to have all our trials completed, our SOPs written and equipment procured. In preparation for Exercise *Flying Key*, the 1 (BR) Corps test exercise for the Brigade in September 1989, the Brigade Commander and our Commanding Officer decided to test the Squadron on Exercise *Pegasus Mane* in July 1989.

The first week of the exercise allowed the Squadron two opportunities to practice producing the obstacles for a typical defensive position task, before the test. JATE produced a second set of mine dispensers, which after some late-night modifications, meant we were ready to have the first-ever full run-through of our concept with all the equipment, manpower and helicopters we required.

In the first run-through one troop was tasked with producing a two kilometre minefield using two Chinooks, another troop with a one kilometre minefield using Lynx and Puma and the third troop with creating 20 route denial tasks, some of which required the teams to abseil into the

target location from their Puma. The Lynx/Puma minefield, meant that the troop which went to the forward divisions' minedump location had to be capable of rigging the 19 pallets of mines required very quickly, while the Chinooks refuelled. Refuelling of the aircraft was a weakness in our Sapper concept of operation that became critical at this time. We had no control over the distance to the refuelling location, we did not know the fuel state of the aircraft when they arrived in our concentration area and different aircraft use different amounts depending on a whole host of additional factors. All of this we knew, as we had spent long hours with the Support Helicopter (SH) Force discussing the problem. We calculated that while we were netting our loads the aircraft would need to refuel having flown some 100 kilometres or more at full load. If the aircraft had refuelled earlier, then they were forced to sit on the ground while we completed the netting of the mines, a tactically dangerous situation.

The Brigade Commander and I watched the netting of the loads and having seen the speed of one Chinook minelaying on an earlier trial, I was asked why I did not just lay both minefields using Chinook. There were a number of reasons, however, and I explained the principal one which was that up to now I had never been guaranteed the exclusive use of two Chinooks after we had flown forward. I had to be prepared to use any type of aircraft to get the job done. Brigadier Kennedy then guaranteed the aircraft which simplified our concept of operations and eliminated the critical refuelling problem mentioned above.

After some thought, because it meant changing our concept at the eleventh hour before the Brigade and Regimental test exercise, we decided to use our second defensive position to test the idea. This meant two troops now flying into the forward minedump to load their Chinook, while their recce teams, under command of the troop commanders, set out the minefields using a Lynx each. The third troop remained on the route denial task. Fortunately, we had trained more than one troop on Chinook mine dispensing which, with limited aircraft hours, was not as simple as it may sound.

The second full run-through was completed on 15 June 1989 on Catterick training area. Two troops dispensed the mines from Chinook and two two-kilometre minefields were dispensed, fenced and armed for the first time.

Two days later the test exercise examined our *modus operendi* critically. Initially, to test our flexibility, we planned and moved to one defensive area and, just before we started to work, the Brigade told us the enemy had switched its access of advance and we had to consolidate, re-plan everything and start again — all on radio silence! This of course would have been a nightmare for any squadron commander, with his men spread over a couple of hundred square kilometres. Therefore to ease my problem, they cut me off and took me to lunch and told my Second-in-Command to do it instead!

Many helpful suggestions were offered by the DS staff to improve our drills, however they agreed that the concept worked. We moved 100 kilometres (finally!), collected our own mines, laid two two-kilometre, eight-row surface minefields with three types of fuses and attacked 16 route denial targets, all in less than six hours.

Anti-Personnel Mines

To improve the effectiveness of our minefields we went to dispense Ranger mines into our barmine field. Having looked at many different methods of dispensing the mines all of which were relatively slow the Squadron Sergeant Major, Warrant Officer Class Two Green, came up with a simple quick answer. He suggested we dispense the mines from our Lynx on the enemy side of the minefield flying at a height of approximately 75 feet so as not to disturb the armed mines on the ground. He designed and had built an arming lever for the Ranger clip. We hope to have the drill cleared for use by the 1 (BR) Corps test exercise for the Brigade in September 1989.

Conclusion

The current methods of mine dispensing from helicopters allow us to use the in-service mines available. We can collect, load and move the mines with the minimum assistance from the host division (a minimum of one JCB is required at the minedump). We can speed up our operation, if the experts tell us it is safe to arm the mine in the aircraft, before it is dispensed. However, there is a very real need for a purpose-built helicopter mine-dispensing system to be procured as soon as possible. Such systems are available now commercially and, if the logistics of the mine re-supply can be resolved, would speed up still further our support to 24 Airmobile Brigade. Already people are asking if the Brigade could do

it faster. It is the time taken for the infantry to dig in, which is the Brigade's critical timing, not our operation.

The Squadron has achieved much in a relatively short space of time. We have concentrated on using and adapting that which was available to us. We have only been able to succeed due to help and support of a number of senior RAF and AAC officers and of course the crews of the aircraft. Sappers have again shown that no matter what the role or method of going into battle, there is a need for military engineers — up front.

Royal Engineer Geologists and the Geology of Gibraltar

Part II — The Age and Geological History of the Rock

COLONEL E P F ROSE TD MA DPHIL MIWEM FGS and
CAPTAIN M S ROSENBAUM RE(V) BSc PhD ARSM DIC EurIng CEng MIMM FGS

Part I of this series of articles showed how unpublished research by Sapper A L Greig during the years 1941-1943 had greatly changed earlier geological interpretations of the Rock of Gibraltar. Greig's studies had major implications both for tunnelling works and for attempts to improve the supply of groundwater to the garrison by the sinking of new boreholes during the latter part of the 1939-1945 War.

Part II now shows how detailed studies carried out by Captain G B Alexander in the immediate post-War years revealed much more of Gibraltar's geology. These studies generated an entirely new geological map and interpretation. Although unpublished, they were to influence construction work on Gibraltar for over 40 years, and provide a basis for the recent research to be described in Part III.

Introduction

Alan Greig's (1943) major conclusion was that a "Shale Series" of clay-rich, weak, relatively insoluble rocks did not occur only at the western edge of the Gibraltar peninsula, lying above the Gibraltar Limestone, as had previously been believed (Ramsay & Geikie, 1878). Rather, the "Shale Series" could be seen east and north as well as west of the Main Ridge, and continued *beneath* the Limestone.

This interpretation was endorsed by the Director of the Geological Survey of Great Britain, Dr E B Bailey MC, FRS. Bailey (1952), moreover, believed that the single Shale Series was younger in age than the Early Jurassic Limestone, on the basis of fossils sent to him by Greig. As a consequence of this inversion, he implied that the Rock must be *upside down*. He concluded that Gibraltar was the eroded remnant of a rock mass overturned and thrust into its present position during the earth movements which formed the associated Spanish (Betic) and Moroccan (Rif) mountain chains, events now believed to have occurred some 20 million years ago.

Although an extensive and careful piece of work, Greig's account of the geology of Gibraltar was nevertheless prepared under the constraints imposed by war. Even when supplemented by Bailey, it was incomplete in three major respects:-

> Although there was evidence that *some* of the isolated Shale outcrops were of the same age, there was no conclusive proof that *all* outcrops were of the same age, and therefore that there was but one Shale Series beneath the Rock of Gibraltar.

> Although the Gibraltar Limestone was known to be very thick (up to at least some 2000 ft thick), Greig was unable (and for tunnelling purposes deemed it unnecessary) to divide this thick sequence into thinner mappable units, and so facilitate a more detailed interpretation of the geological structure and geological history of the Rock.

> Concerned as he was with tunnelling through bedrock, Greig made no attempt to describe and interpret the volumetrically significant superficial deposits of Quaternary (Pleistocene) age which mantled the lower slopes of Gibraltar and which provided an easily accessible source of fill and construction materials.

These deficiencies were seemingly made good by another member of the Corps, George Baker Alexander (*Photo 1*).

Alexander was both a Yorkshireman and a Cambridge graduate, thereby following a precedent set by the very first British military geologist to serve as such (W B R King, who distinguished himself in both 1914-18 and 1939-45 wars). Born in Barnsley and educated there and at The Grammar School, Leeds, Alexander went up to St John's College, Cambridge, in 1926, took Natural Sciences Tripos Part 1 in 1928, his BA degree in 1929, and Part 2 of the Tripos in Geology in 1930. His College tutor was the polar explorer J M Wordie, later Master of St John's. With such a pedigree, Alexander achieved greater status in Gibraltar and the Corps than Sapper Greig. He arrived on the Rock in 1945, at nearly 38 years of age ... as a 2nd Lieutenant.

To be fair, Alexander had made an unpromising start in his brief military career. He had enlisted in the Territorial Army in May 1942, but in the Royal Artillery, as a Gunner! After service with 39 Signal Training Regiment RA and 3 Medium Reserve Regiment RA he was posted to 140 Officer Cadets' Training Unit RE in August 1943. Granted an emergency commission as 2nd Lieutenant RE in October 1944, he saw service with 2 (later 402) L of C Troops Engineers, and temporary attachments successively to 9 Boring Platoon RE and to DCRE E Glos, before embarking for Gibraltar on 8 March 1945.

He arrived on 16 March, and was to serve there for nearly three years. Posted first to the Chief Engineer's pool, he was appointed staff officer RE 3 on the Chief Engineer's establishment and promoted war substantive Lieutenant (Acting Captain) in February 1946, and finally served from July 1946 on the staff at Headquarters RE Gibraltar Garrison.

Records at Imperial College London indicate that Alexander had begun geological research there for a PhD degree in March 1933 on the "Zonal Succession of the Carboniferous Limestone of Derbyshire", but that he had left by June 1935 with little record of achievement. On Gibraltar things were to be different. He began geological work without even a hand lens to assist him, as he ruefully explained in a letter dated 6 June 1945 to the Keeper of Palaeontology at the British Museum (Natural History). By the time he returned to the UK from Gibraltar in February 1948, Alexander had achieved wonders: an entirely new geological map (in three sheets, at scale 1:2,500) distinguishing 19 stratigraphic divisions within the bedrock sequence of Gibraltar, and seven categories of superficial deposits; an incredible 33 east-west cross-sections which together illustrated the geological structure of the Rock down to sea level throughout its length; diagrams which illustrated the relationship of Gibraltar to the geology of southern Spain, and the sequence of raised beaches on Gibraltar; and several geotechnical reports interpreting aspects of the geology for specific military or construction projects. Not bad for a man awarded only 3rd Class Honours in Geology!

Alexander's contribution provided the geological basis for extensive post-War building work on Gibraltar. Part of it has been made familiar to visitors through diagrams displayed in the Gibraltar Museum, but none of it, so far as we are aware, has been published or even acknowledged in print. Reed's (1949) full and critical account of Gibraltar in the context of the geology of the British Empire makes no mention of it at all. Very recent work has now developed Alexander's studies a stage further, so due credit is opportune.

Alexander's Map

A simplified version of Alexander's geological map is illustrated here as *Figure 1*. *Figure 2* illustrates four geological cross-sections, selected from his original 33 drawn at 1:2,500 scale so that comparison can be made with previous cross-sections of similar orientation by Ramsay & Geikie and by Greig (*Figures 2* and *3* in Rose & Rosenbaum, 1989). It is not possible at this scale to do justice to the detail shown on the original map and sections, but *Figure 3* shows the full sequence of numbered bedrock units mapped by Alexander, and *Figure 4* the raised beach levels indicated on the map and the units distinguished within the superficial deposits. (These and other figures in this account preserve spellings of the original drawing, even where these now appear old-fashioned or arguably erroneous. Modern spellings are adopted in the text).

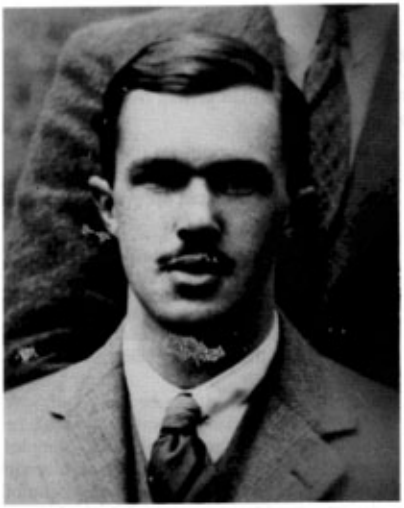


Photo 1. G B Alexander as a member of the Sedgwick Club (Cambridge University geological society), 1929.

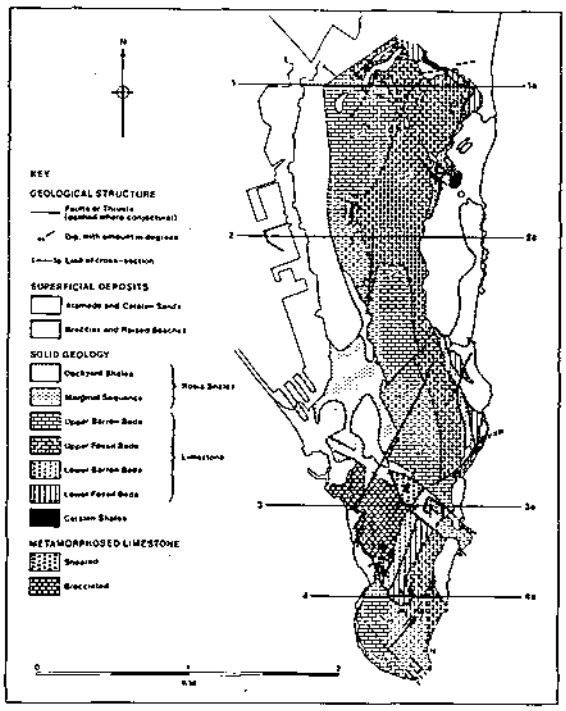


Figure 1. Geological map of Gibraltar (simplified and reduced from unornamented CE Gib Drawings Nos 1635-7 at 1:2,500 scale produced by G B Alexander)

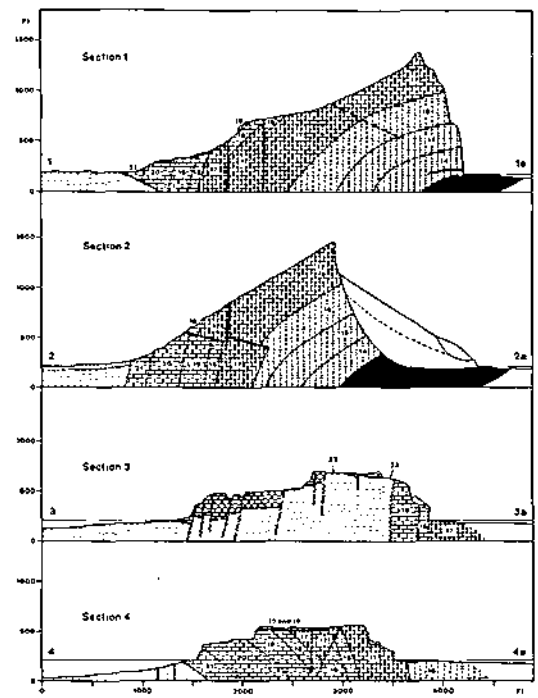


Figure 2. Geological cross-sections west-east across Gibraltar along the lines of section indicated on *Fig 1*. (Redrawn from CE Gib Drawing Nos 1638-42 at 1:2,500 scale. Ornament as for *Fig 1*; numbered rock units as for *Fig 3*.

Three very important features of bedrock geology which are immediately apparent from Alexander's map and stratigraphic sequence show how his interpretation differs from all previous accounts:-

Shales. Alexander confirms Greig's record of shales north and east, as well as west, of the Main Ridge of Gibraltar, but groups them into two different shale units:-

a . Rosia Shales (west of the Rock)
b . Catalan Shales (to the northeast and east of the Rock).

He thus rejects the interpretations by Greig and by Bailey that a *single* shale unit underlies the Rock.

No written record can be traced of why Alexander made this distinction, although he did make a collection of rock samples representative of the units shown on his map which eventually came into the possession of the Gibraltar Museum via the British Museum (Natural History). It seems that he inferred from observations made during his mapping that the shales to the west were of a different type from those to the northeast and east of the Rock. Moreover, from observations made on similar rocks in Spain (as discussed below), he inferred that the shales to the west were older than the Gibraltar Limestone whilst shales to the northeast and east were younger than the Limestone.

Limestone. Previously, all authors had mapped the Gibraltar Limestone as a single rock unit. Alexander recognized four main divisions within the rock and, by recognizing further subdivisions within these, he was able to map the Limestone in terms of eight different units. The stratigraphic detail shown on his map therefore represents a major advance on all earlier maps and accounts of the Limestone, and emphasizes a far more complex pattern of faulting within the Rock than hitherto recognize

Geological structure. From his map and the ages which he ascribed to his rock units (*Figure 7*),

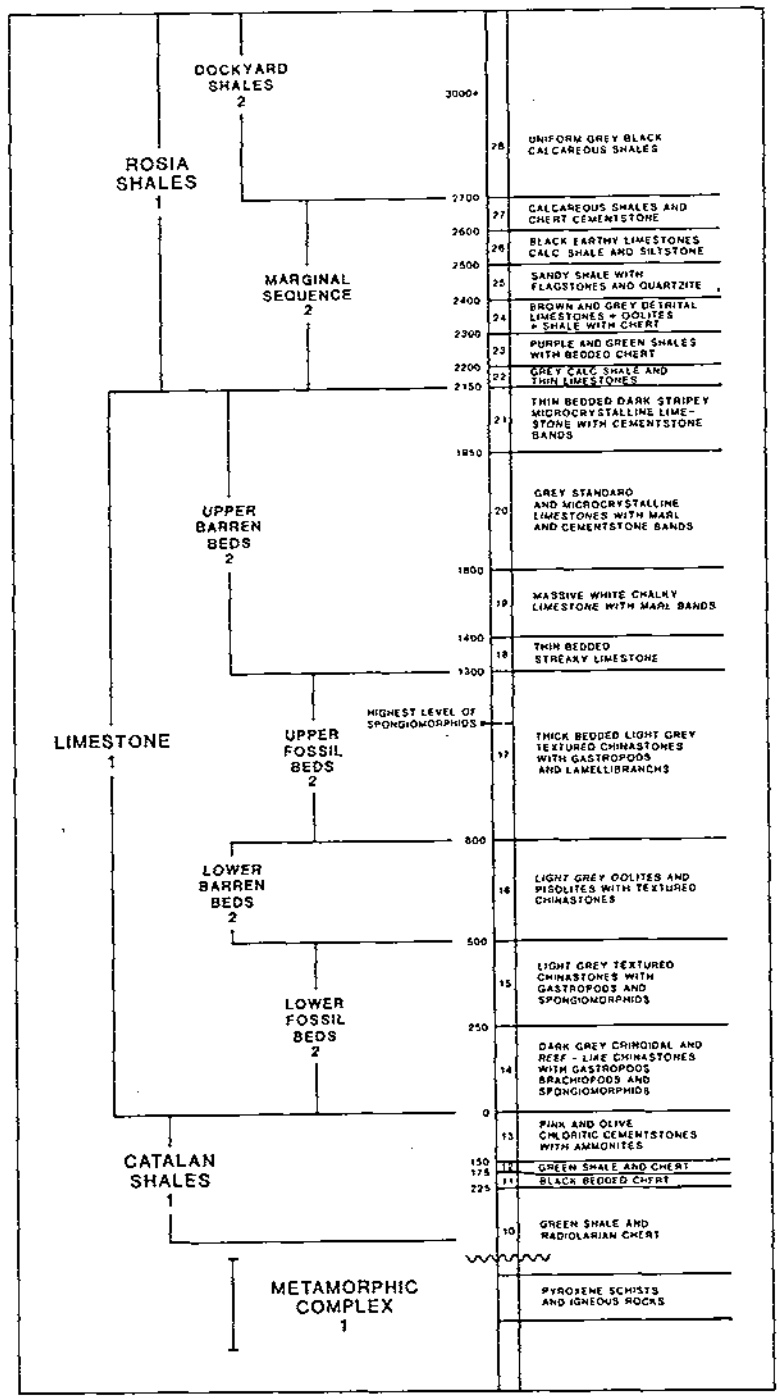


Figure 3. Bedrock stratigraphic sequence as distinguished and mapped on Gibraltar by G B Alexander (after CE Gib Drawings Nos 1637 and 1648). Nineteen units shown on the map are numbered 10-28, with thickness in feet indicated from base of the Limestone. The Rosia Shales, Limestone, Catalan Shales and Metamorphic Complex are all numbered "1" to indicate their first order importance as stratigraphic units. Second order divisions, of the Rosia Shales and the Limestone, are numbered "2".

it is clear that Alexander believed the Limestone beds in the Southern Plateaux to become younger eastwards, in the direction of dip. Consequently, the sequence here must be the "right way up", in its original depositional orientation, and *not* overturned as explicitly claimed by Ramsay & Geikie (1878, p 510) and implied by Bailey (1952) (who claimed that the

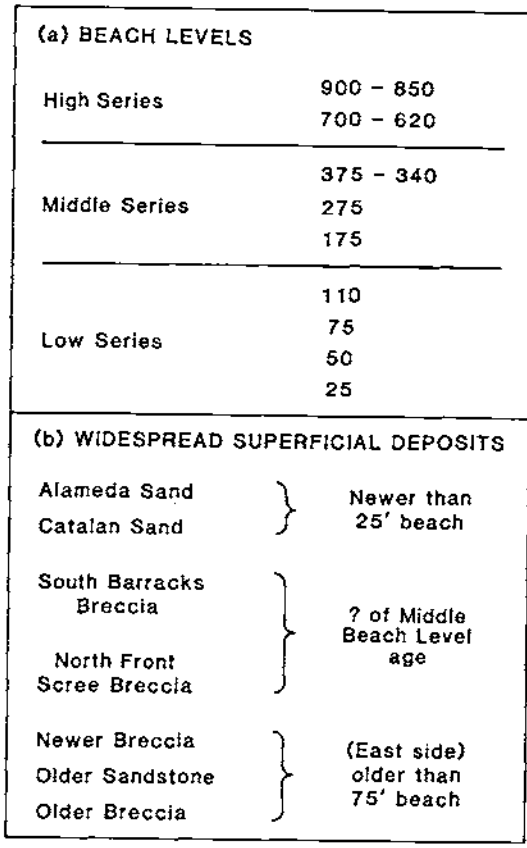


Figure 4. Beach levels and superficial deposits distinguished on G B Alexander's Geological Map of Gibraltar. Beach levels are shown by height in feet above mean sea level. Widespread superficial deposits were mapped as seven separate units. Additionally, defined beaches were mapped either as lateritic breccia or as aeolian shell sand, and beach traces or scanty deposits shown in outline with beach level indicated. (Redrawn from CE Gib Drawing No 1635).

Rock, and therefore presumably the *whole* of the Rock, had been inverted during mountain-building processes).

The Limestone units in the Main Ridge are shown by Alexander also to become younger eastwards, but since here the dip is to the west, the Rock must indeed have been overturned, so that older beds lie on top of younger ones. In this region, it seems that Bailey was quite right in his interpretation and that Greig (who made no specific reference to overturning in his own account) may have been over-cautious in disassociating himself from Bailey's structural interpretation of the Gibraltar region (Bailey, 1952, p 173).

The engineering implications of these three changes in opinion should be obvious. To the hydrogeologist, it is significant whether boreholes are likely to penetrate fissured limestone which easily yields water or less permeable shales which do not. It is also significant for a limestone whether it is a massive homogeneous mass which will tend to have a poor groundwater yield or is penetrated by numerous faults and fractures which can significantly enhance the potential for water supply. The relationships between the different rock types, and their elevation with respect to sea and ground level, combine with the resistance to solution developing caves to influence the groundwater yield further.

Lack of homogeneity in the Rock is also of importance to the construction or tunnelling engineer, and recognition that the Limestone of the Main Ridge has been overturned gives warning of the highly stressed nature of the Rock, and the need to take this into consideration for design.

Regional Geology

Alexander made observations not only on Gibraltar but also on nearby areas of Spain, at a time when geological studies were less rigorously subject to formal approval than is the case today. (Geologists now wishing to study in Spain require prior written authority from the Spanish National Commission for Geology). *Figure 5* illustrates, in simplified form, Alexander's geological sketch map of the "Gibraltar" Bay region. *Figure 6* reproduces his geological cross-sections which illustrate the structure across the bay of Gibraltar, and the region immediately north of Gibraltar, through Sierra Carbonera. Finally, *Figure 7* provides a cross-section east-west through the region of La Hoya de los Gaitanes, north of Alora, together with a description of the rock units designated by letter on the section, and a suggested correlation between these rocks and those of Gibraltar.

These regional studies have three important implications for Gibraltar itself:-

They confirm earlier interpretations of the Rock as a mass of old (Jurassic) limestones thrust over young (Tertiary) shaly sandstones.

The regional map (*Figure 5*) confirms the statement by Ramsay & Geikie that Gibraltar is an isolated mass of limestone, very different from the younger sandy and shaley "Flysch"

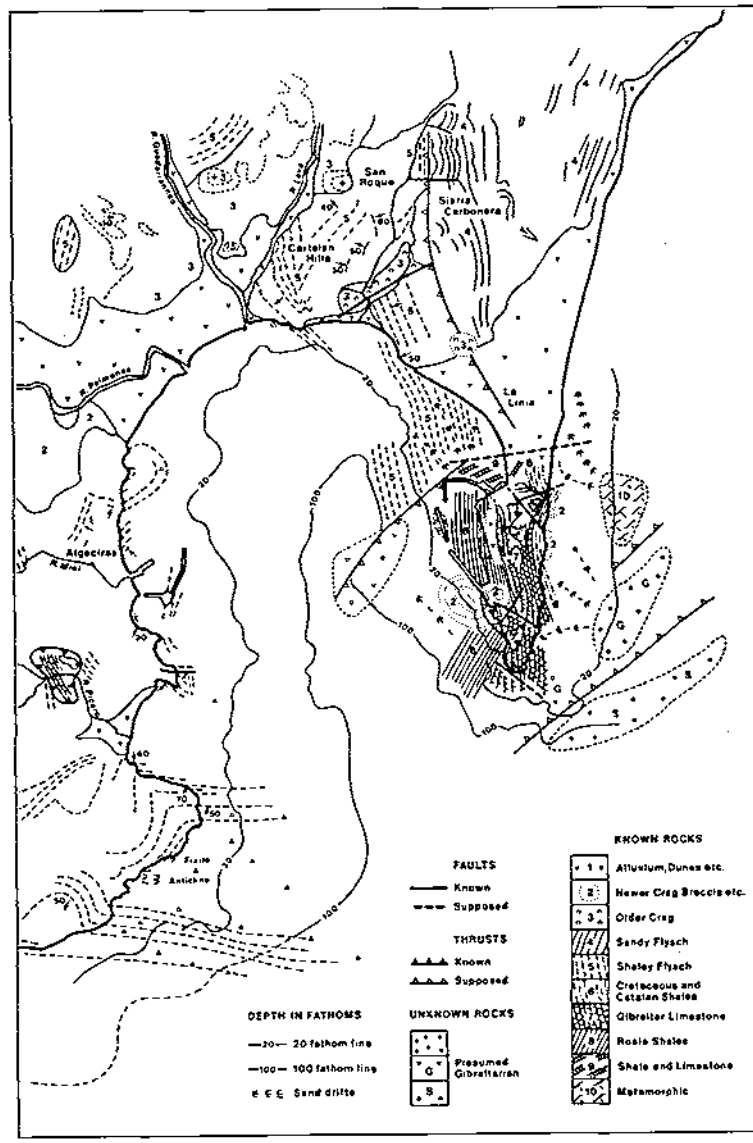


Figure 5. Geological sketch map of Gibraltar Bay. (Redrawn from CE Gib Drawing No 1643 at greater scale: simplified, with minor amendment, but original spellings.)

rocks to be seen west and north of La Linea. A fault is inferred to separate these two very different rock types, crossing the Isthmus approximately in the region of the Spanish/Gibraltar border, well north of the sheer North Face of the Rock. Indeed, the rocks of the bay area as a whole are shown, albeit diagrammatically, to have been much deformed by folding, faulting and thrusting.

The thrusted relationship between the Rock of Gibraltar and rocks visible near Algeciras, westward across the bay, is much more clearly illustrated in *Figure 6*. A thrust plane is shown extending from beneath Gibraltar to intersect the Spanish mainland west of Algeciras, below Puente de Quijo. Rocks identified as similar in type and age to the Gibraltar Limestone and the eastern shales of the Rock are shown underlain by "Shaley Flysch". A massive quarry complex is still being worked on this site, and it seems clear that Alexander noted the similarities between the rocks (especially shales) better exposed here than on Gibraltar and used the evidence of the Spanish rocks in his interpretation of the geological structure of Gibraltar.

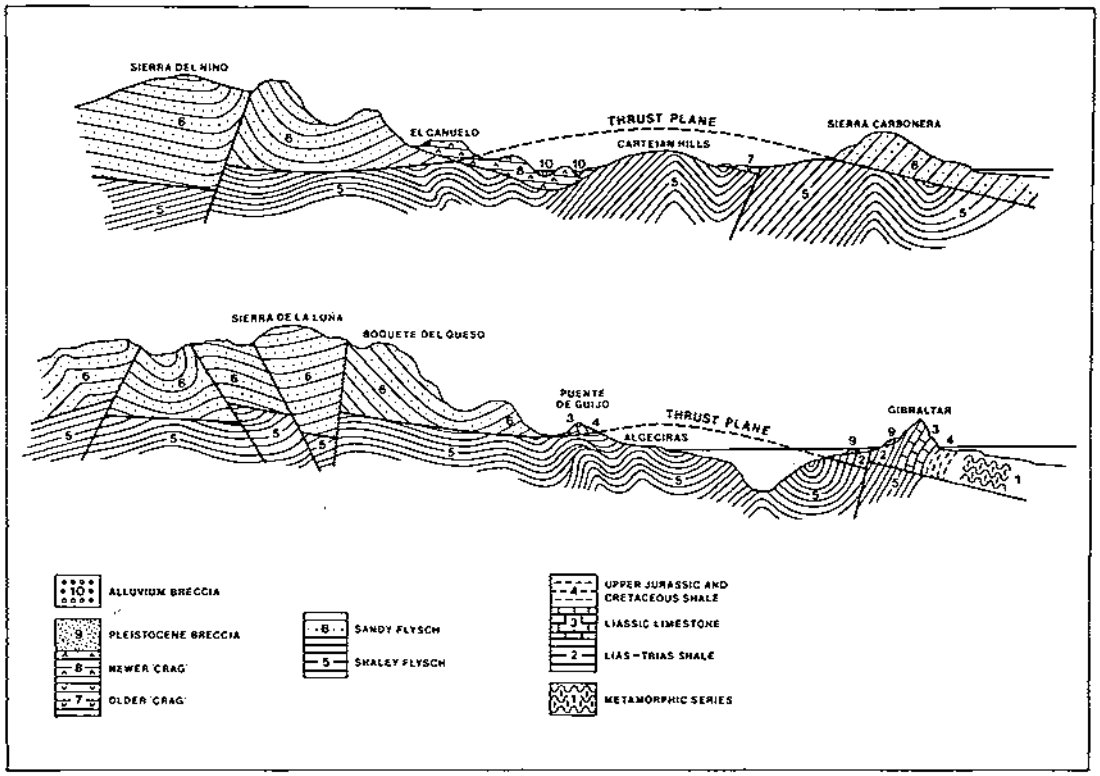


Figure 6. Geological cross-sections west-east. 1.Across campo North of Gibraltar. 2.Across Gibraltar Bay. (Redrawn from CE Drawing No 1644 at greater but unspecified scale.) The term 'crag' has long been used in East Anglia to denote unconsolidated shelly sands deposited during Plio-Pleistocene (Ice Age) times. 'Flysch' is a word of Swiss Alpine origin, typically denoting a thick sequence of alternating sandstones and mudstones deposited by fluid gravity flow (turbidity) currents in a marine trough adjacent to a rapidly rising mountain chain.

Interpretation of Gibraltar as a thrust mass was not a new concept. Bailey (1952) noted that it had been proposed by several authors prior to 1943. It is, however, a significant concept. Since Ramsay & Geikie (1878) had first inferred that Spanish Tertiary rocks might continue at depth at least below the sands of the Isthmus, hydrogeologists (including Bailey) had concluded that Gibraltar might secure improved supplies of groundwater by deep boreholes down into such Tertiary rocks. Bailey inferred that Tertiaries would be found beneath shales which underlay the whole Rock. Alexander's section indicates that he believed that Tertiary rocks were indeed there, but not always beneath shales, and not necessarily at shallow depth. To date, no borehole on Gibraltar has knowingly penetrated rocks of Tertiary age (and the need to do so is now disputed).

They provide evidence that the eastern and western shales of Gibraltar are of different age.

Although the map (*Figure 5*) shows only that the western (Rosia) shales of Gibraltar are distinct from the eastern (Catalan) shales, the cross-section (*Figure 6*) gives definite dates for these different rock units. The western shales are ascribed to the Lias-Trias, and are therefore dated as older than the (Liassic) Limestone. The eastern shales are ascribed to the Upper Jurassic and Cretaceous, and therefore dated as much younger than the Limestone. The pattern on Gibraltar of younger shales occurring to the east of Liassic Limestone is consistent with that inferred for similar rocks shown at Puente de Quijo west of Algeciras. It is quite clear from the age ascriptions of the Gibraltar rocks and their orientation as shown on *Figure 6* that

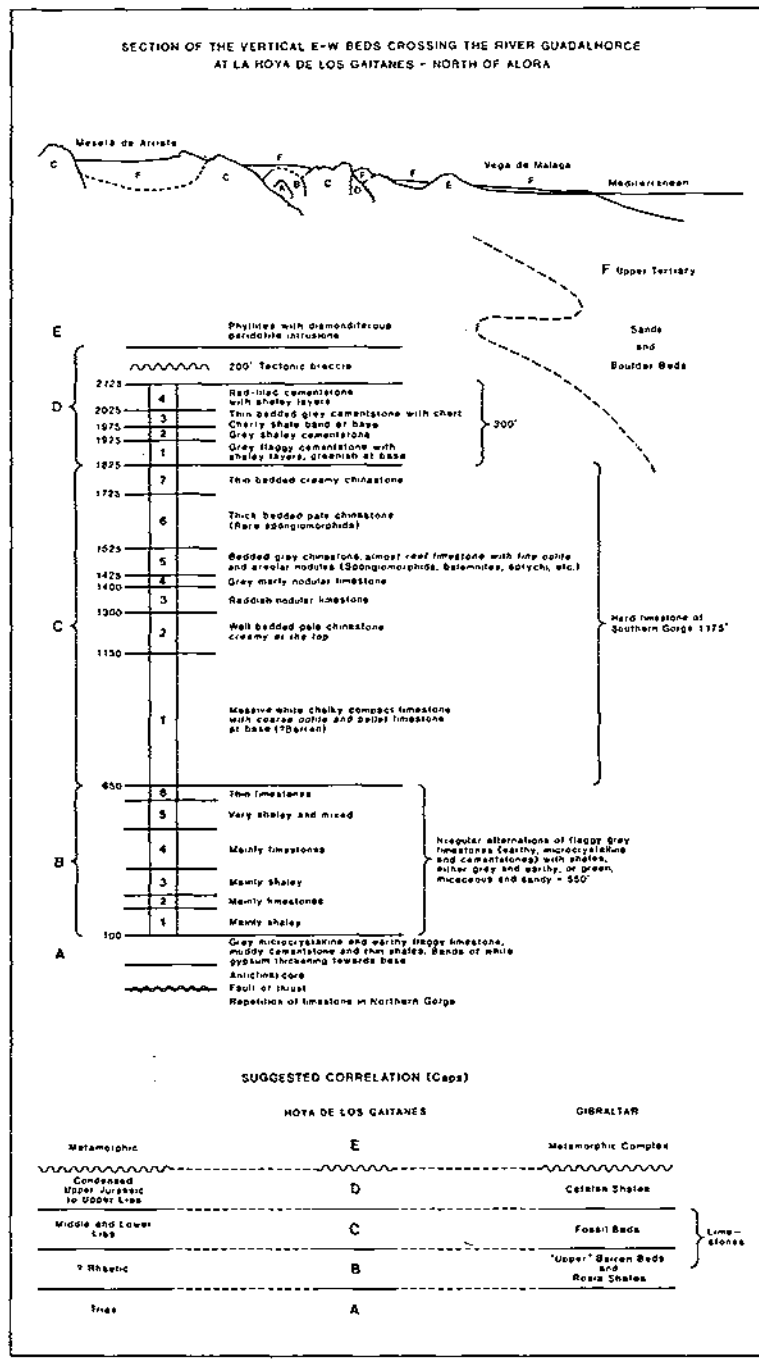


Figure 7. Geological cross-section west-east through La Hoya de los Gaitanes, north of Alora, with key to rock units, and suggested correlation with sequence on Gibraltar. (Redrawn from CE Gib Drawing No 1646.)

Alexander believed the rock sequence in the Main Ridge of Gibraltar to have been overturned, so that older rocks now lie on younger rocks beneath them.

The age relationships thus inferred are consistent with those shown on *Figure 7*. By comparing the Gibraltar sequence with that of Hoya de los Gaitanes in Spain, some of whose

rocks could apparently be more precisely dated by use of fossils than is possible on Gibraltar, Alexander tentatively inferred a Rhaetic age for the Rosia Shales and early part of the Limestone succession, correlated the rest of the Limestone with the Lower and Middle Lias, and ascribed the Catalan Shales to an Upper Lias — Upper Jurassic age range.

The age of the western shales is the most important aspect of Alexander's interpretation. Ramsay & Geikie (1878) and Bailey (1952) believed for quite different reasons that shales on Gibraltar were all younger than the Limestone. Greig's (1943) account implied that they were older, but on structural geological evidence now known to be in error (for he believed that a *single* shale unit underlay *uninverted* Limestone). The Rhaetic is now recognized as the latest of six standard stages within the Triassic system, and if Alexander's ascription of the Rosia Shales to this unit is correct, then the time of formation of these rocks would now be put at some 219 to 213 million years before present. This is an age significantly older than estimated previously.

Ramsay & Geikie had recognized the Jurassic age of the Gibraltar Limestone, and Bailey (1952) cited fossil evidence for an Early Jurassic (Liassic) age. However, in the discussion annexed to Bailey's account, the distinguished specialist on Jurassic geology Dr W J Arkell concluded that the Gibraltar Limestone must be correlated with the *Lower* Lias. Alexander's ascription of "Middle and Lower Lias" to the "Fossil Beds" within the Limestone is at least partly consistent with this ascription. Lower Lias rocks are now believed to have formed some 213 to 200 million years before present, Middle Lias rocks between 200 and 194 million years ago, so the age difference is not great.

There is, however, a significant difference between the ages for the Catalan Shales inferred by Alexander and by Bailey. Alexander inferred an Upper Lias to Upper Jurassic age (*Figure 7*), perhaps leaving open the possibility that these shales extended even into the overlying Cretaceous (*Figures 5, 6*). Bailey (1952) in contrast cites fossil ammonites, collected by Greig and identified at the British Museum (Natural History), which seemingly give a clear indication of a *Middle* Lias correlation. Bailey did tentatively infer an Upper Jurassic age for the cherts within the Shale Series on the basis of microfossils (radiolaria) identified within them, but the date was disputed by W J Arkell who claimed that it was "offset by all the evidence of the Betic Cordilleras and Balearics, where no such rocks are known in the Upper Jurassic."

Although age correlations are therefore controversial, Alexander must be credited as the first geologist to clearly distinguish the eastern from the western shale succession on Gibraltar. By so doing, he implied in contrast to Bailey that limestone rather than shale would be encountered to significant depth in boreholes beneath the main mass of the Rock.

They indicate that a metamorphic complex lies offshore to the east of Gibraltar.

Both map (*Figure 5*) and cross-section (*Figure 6*) show metamorphic rocks cropping out beneath sea level east of the Gibraltar peninsula.

Some evidence in support of this interpretation is given in a brief (two page) unpublished report by Alexander on the Eastern Beach, where he records that "Apart from tunnel spoil, the overwhelming bulk of the pebbles consist of metamorphic schists." "The source of this ... metamorphic rock is quite unknown, but taken with the northward spread of tunnel spoil, and the rarity of sandstones (the nearest Spanish rocks), it seems unlikely to be the Spanish Coast, and must lie under the seas to the east and at no great distance." Alexander therefore includes a metamorphic complex adjacent to the Catalan Shales in his stratigraphic successions (*Figures 3, 7*), but the boundary between Shales and Metamorphic Complex is shown as a non-sequence (no indication being given as to whether this non-sequence is a fault or an unconformity).

No previous author had indicated that metamorphic or igneous rocks might lie anywhere near Gibraltar, although more recent marine research has puzzled over the source of such material in sediments on the modern Mediterranean sea floor in the vicinity of the Rock (Kelling & Stanley, 1972).

Raised Beaches

It has long been recognized that the Southern Plateaux of Windmill Hill Flats and Europa Flats are ancient wave cut platforms, eroded at a time

when sea level relative to the Rock was much higher than at present. Ramsay & Geikie (1878) described features not only of the platforms, but also the sands and gravels (now generally removed by building works) which provided evidence of the raised beaches associated with them.

By meticulous mapping, Alexander recognized evidence for not just two, but nine former beach levels (*Figure 4*): a Low Series of beaches with heights at some 25, 50, 75 and 110 ft above modern sea level; a Middle Series with heights at 175, 275, and 340-375 feet; and a High Series at 620-700 and 850-900 feet. By relating them to beach levels, Alexander was able to show that some of the extensive sand deposits shown on his map (the Alameda Sands of the town area, and Catalan Sands of the eastern coast) were of relatively recent origin, more recent in formation than the 25 foot beach which lay beneath them. In contrast, other deposits were relatively much older. Breccias on the east side were notched by the 75 foot raised beach, and were therefore formed before it. Moreover, as already noted by Ramsay & Geikie, a layer of sandstone separated underlying and overlying units of breccia, so there must have been at least two different periods when the climate was sufficiently cold to cause brecciation of Limestone cliffs to form screes by freeze-thaw action.

Alexander plotted the heights he had measured for raised beaches on Gibraltar during 1945-7 on a diagram (*Figure 8*) which enabled him to compare them directly with the then latest authoritative account of Mediterranean sea levels during the Pliocene and Pleistocene periods (Zeuner, 1946). In consequence he was able to indicate the sequence and relative duration of sea-level changes, and for his Low and Middle Series at least, the probable time of their formation in years before present. It appears that the Monastirian, Tyrrhenian, Milazzian and Sicilian shore-lines by then widely recognized in the western Mediterranean all left their mark on Gibraltar.

Zeuner's (1946) work has now been modified by more recent studies, so uncritical comparisons may be misleading. Moreover, evidence for the highest beach levels is now not easily verified: Alexander may have misinterpreted scanty deposits, or those deposits may now have been obscured or excavated during construction work. Nevertheless, Alexander's detailed mapping of these sediments stands as a lasting contribution to science and as a record of part of Gibraltar's geological history that is steadily being eroded by modern development.

Conclusion

Alexander arrived back in UK from Gibraltar on 3 February 1948. His major contribution to advancing geological understanding of the Rock is indicated by the range of documents left behind him (as referenced here, plus a few brief, specifically military reports). One thing was lacking: a written text actually to describe the geology of Gibraltar, and so explain and amplify his map.

That such a memoir was planned is indicated by correspondence in 1st Fortress STRE archives whereby, on behalf of the Governor, efforts were made to trace Alexander in the UK and find out what had happened to the "promised" (?) report. Correspondence in British Geological Survey archives indicates that E B Bailey for a time confidently expected Alexander to contribute to the paper he eventually had to publish alone in 1952. Records at the British Museum (Natural History) indicate that Alexander studied Gibraltar rocks there for a while, but that in April 1948 his visits abruptly stopped. Military records give his "date of release" as 6 May 1948, and note that all correspondence ceased in that year. The London Gazette of 16 April 1954 records that he relinquished his commission and was granted the honorary rank of Captain on 15 March 1954.

After repeated efforts to trace him had failed, Alexander's "notes and maps" were returned by the British Museum (Natural History) to the Chief Engineer's office on Gibraltar in 1958. Rock specimens were similarly returned to Gibraltar in 1967, to the Curator/Archivist at the Gibraltar Museum, when it was presumed that Alexander would not return to make further use of them. Documents at the British Museum (Natural History) speculate that Alexander might have been taken ill or that he might have joined the petroleum industry abroad, but the reasons for his sudden and total disappearance from the British geological scene remain a mystery.

Not for another twenty years was any further work undertaken on the geology of Gibraltar as such, and then, from time-to-time, Sapper geologists returned to the Rock, as members of the Engineer Specialist Pool (V). Working in close association with geologists from the Institute of Geological Sciences (later renamed the British Geological Survey), academic colleagues, and engineers of the Gibraltar Government Public

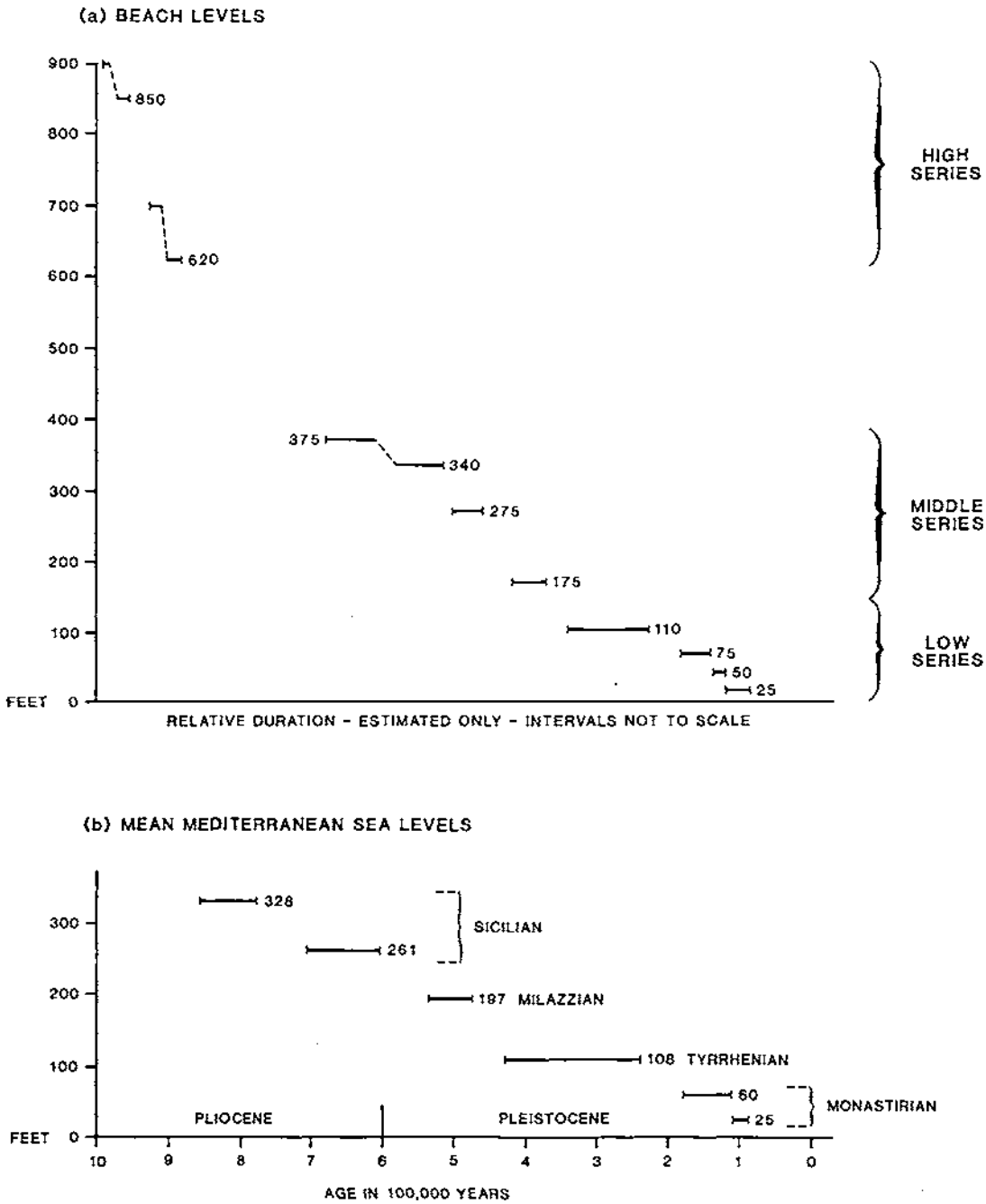


Figure 8. (a) Raised beaches on Gibraltar: height plotted in feet above present mean sea level. (b) Mean Mediterranean sea-levels: diagram showing relation of altitude to time for the high sea-levels of the Pleistocene (after Zeuner, 1946, p 144). (Redrawn from CE Gib Drawing No 1649.)

Works Department and of the Property Services Agency, they carried geological investigations a stage further. These new studies revealed problems of interpretation that may have prevented Alexander from completing his final report. These studies, and their results to date,

document yet a further chapter in the history of geological research on the enigmatic Rock.

ACKNOWLEDGEMENTS

We thank Christine Flood of Royal Holloway and Bedford New College (University of London) for redrawing the figures used in this article from original RE drawings prepared by or under the supervision of G B Alexander, and Sarah Viggers for typing the manuscript. I N McCave (Woodwardian Professor of Geology in the University of Cambridge and Fellow of St John's College), L R M Cocks and R J Cleevely (of the Department of Palaeontology, British Museum (Natural History)), G McKenna (Chief Librarian & Archivist, British Geological Survey) and J C Thackray (Honorary Archivist to the Geological Society of London) as well as military archivists all kindly provided or searched for information concerning G B Alexander on our behalf. Numerous additional acknowledgements made in the previous part of this account are equally applicable here.

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(4) Sections West-East 1. Across campo North of Gibraltar 2. Across Gibraltar Bay. CE Gib Drawing No 1644.
(5) Section of the vertical E-W beds crossing the River Guadalhorce at La Hoya de los Gaitanes — north of Alora. CE Gib Drawing No 1646.
(6) Plate 1. Gibraltar rock sequence. CE Gib Drawing No 1648.
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Armoured Engineer Vehicles — Have The German Engineers Got It Right?

LIEUT COLONEL J S FARMBROUGH BSc(ENG) CENG MICE

The author has spent 31 years in the army including over ten years on courses at Sandhurst, Shrivenham, Chatham, Middle Wallop, Camberley and Mülheim. Other than seven and a half years at MOD he has served in Berlin, Singapore, Malaya, Cyprus, Zimbabwe and now the Free State of Bavaria where he is CRE at the Court of King Ludwig (deceased).

INTRODUCTION

WITHIN the Central Region, engineers of the six Nations have broadly the same tasks. That is to say mobility, counter mobility and survivability. Why is it then that they are all equipped in different ways? In particular the German Engineers appear to be tackling their tasks with equipment that is unique within NATO.

In this article I will look at four such pieces of German engineer equipment which are either in service or coming into service in the German Army, these are *SKORPION, KEILER, BIBER* and *DACHS* or in English — Scorpion, Wild Boar, Beaver and Badger — or in Sapper terms — Vehicle Launched Scatterable Mine System (VLSMS), mine clearing tank (AVRE), armoured vehicle launched bridge (AVLB) and engineer tank (AVRE). These four have some capabilities that are not found in other NATO armies — why is this? To answer this question we must first look at these equipments to discover their capabilities and then examine how we tackle the same tasks. Only then can we hope to either answer the question posed in the title or leave it open for the reader to answer for himself.

BACKGROUND

ALTHOUGH the tasks are the same for the engineers of five in-place Corps, the equipment that they choose to carry out these tasks is different. The factors that influence each nation in their choice are different. For instance the availability of money and the priority given to engineer equipment varies from nation to nation. Other important factors are historical experience and the capability of the sappers — conscript or regular. The tasks of the four vehicles under discussion are respectively minelaying, minefield breaching, assault bridging and armoured support to combat engineering.

Now a look at each of these German equipments in detail.

SKORPION

THE anti-tank scatterable minelaying system *Skorpion* has now been in service with the German Engineers for nearly two years. It consists of the US M 548 vehicle with six scatterable mine laying units mounted on it. Each of these units holds 100 AT2 anti-tank mines giving a total of 600 mines per reload. They have a laying range each side of the laying vehicle of 65 metres. The mines have variable self-destruct times set at the time of launching. Low densities are used — the Germans believe that mine densities of less than one mine per metre of front is all that is required. This means that one vehicle load of mines can lay over a kilometre of (German) minefield in ten minutes although in practice they usually deploy *Skorpion* in pairs giving them double this capability.

Armoured Engineer Vehicles
Lieut Colonel J S Farmbrough

Skorpion — Short range scatterable mine layer

The engineers therefore have the capability to lay minefields very quickly using scatterable mines laid by a purpose-built, dedicated, tracked vehicle. No other nation in NATO has this *capability* at present. The UK has the requirement that may or may not be fulfilled at some time in the future as long as money is available. The US has the GEMSS system but this is a towed trailer system. They also have the *Vulcano* system under development.

The German engineers also have a mine laying system that can surface lay or bury mines using the new recently delivered (First equipment October 1988) Swedish Minelaying system that lays the full-width attack DM 31 mine, however, they do not have an anti-personnel scatterable minelayer like *Ranger*. Future developments for *Skorpion* include anti-personnel mines and smoke. With these two equipments they have a complete minelaying capability which is way ahead of all other NATO nations.

AT2 mine used with *Skorpion*

KEILER

THE new German mineclearing tank now called *Keiler* is due to enter service in the early 1990s. will give the German engineers a minefield breaching equipment quite unlike anything else in NATO or the Warsaw Pact. Based on Leopard I it has a reverse flail that is to say that unlike the flail tanks of the second World War, the flail

Aromured Engineer Vehicles- Have The German Engineers Got It Right 1

AVLB — *Biber* — Beaver — Based on *Leopard 1*

"flicks" the spoil away from the tank as opposed to pounding the ground and smashing the mines. The UK has Giant Viper and the US MICLIC (Mine Clearing Line Charge) for breaching minefields but these have limited lengths (180 and 100 metres respectively) as against *Keiler* which can clear an unlimited depth of minefield albeit in slow time. The German Engineers are also looking at GV and MICLIC to complement *Keiler* and if they procure either of these equipments they again will have a comprehensive mineclearing capability way ahead of any other NATO nation and even if they don't they still have a unique mineclearing vehicle in *Keiler*.

Biber and Dachs

Biber or in British terms — AVLB, is based on the current German MBT Leopard and has a unique horizontal launch system which does not require the highly visible vertical launching systems used by other NATO engineers. No other NATO army has an AVLB based on its current MBTs or an AVLB with a low profile launch system.

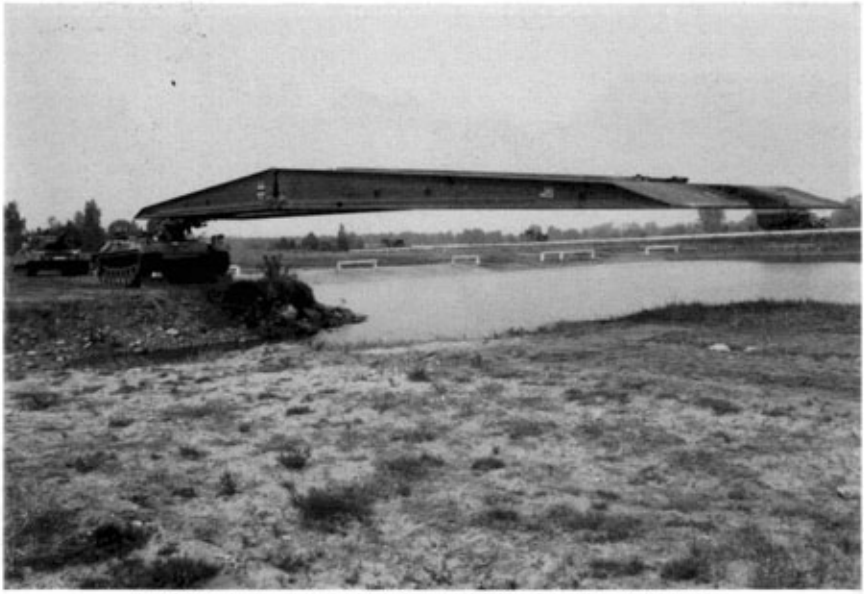
Similarly *Pionierpanzer* I and II (*Dachs*) or AVRE in British terms are based on a current MBT and *Dachs* has two capabilities again unique within the Central Region. It has an hydraulic excavator of very useful dimensions and it can snorkel. It can also doze, scarify, excavate, crane, weld, recover and carry out most of these operations from under armour and in water with a depth of up to four metres.

The UK has AVRE in its various forms but no NATO nation has an engineer tank based on its current MBT which can snorkel, excavate etc. We have CET and US will shortly (perhaps) have ACE but these earthmovers/swimmers are only lightly armoured. We could however turn the question round and ask why don't the German Engineers have fascines or mineploughs?

Conclusion

I hope I have shown that the German Engineers have some equipment that is unique to engineers in NATO and hope that this poses the question — Have the Germans got it right? If one is to look

Armoured Engineer Vehicles- Have The German Engineers Got It Right 2



AVLB *Biber* demonstrating its 'low profile' launching system — the bridge is 22m long

at assets available at 'Brigade level to carry out the tasks then the differences are not so great. Using projected future equipment and organisations for the German engineers (*Heeresstruktur* 2000) and the UK engineers (Close Support Squadron) at Brigade level we come up with the following table:

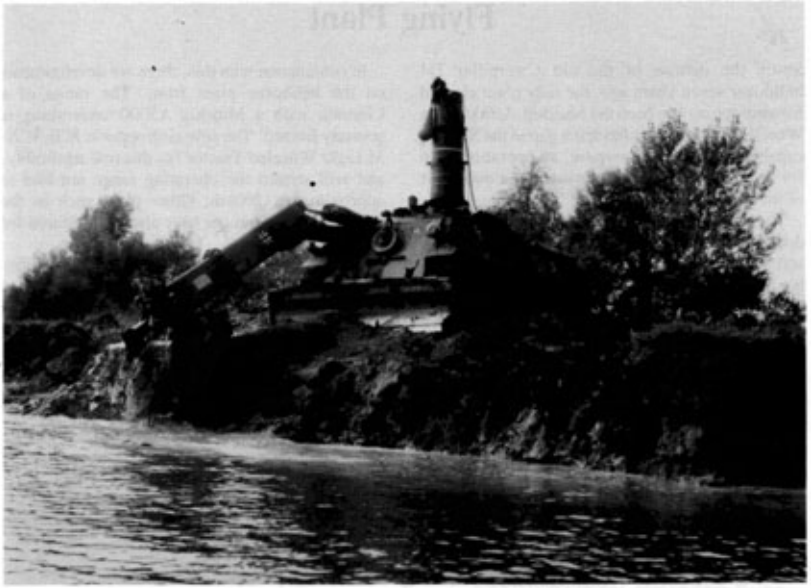
TASK	UK	GE
MINELAYING		
Scatterable	VLSMS	*Skorpion*
Mechanical	Barminelayer	MiV 85
MOBILITY		
Earthmoving and Path Finder	AVRE (CET Light Armoured)	*Dachs*
Assault Bridge	AVLB	*Biber*
MINE CLEARANCE		
	GV	*Keiler*

Equipment numbers have been left out of the above table for security reasons, but I believe that there will be little *numerical* difference in the major engineer equipment available at Brigade level. However, the basic question remains why have Germans uniquely opted for a flail tank, a snorkel tank, a tank with an excavator arm and a horizontally launched AVLB and at the same time

Dachs (formerly *Pioneer Panzer II* or Engineer Tank II) based on *Leopard 1*

Dachs preparing to snorkel

Armoured Engineer Vehicles- Have The German Engineers Got It Right 4



Dachs preparing a bank before entering the water where it can snorkel in depths of up to four metres

they are the first NATO army to get a VLSMS into service by at least five years. The answer in part is money and more importantly the priority which the General Staff are prepared to put on engineer equipment. The Germans spend about the same on defence as the UK does but they have a larger army which is offset to some extent by the cheaper cost of conscripts.

Whatever the reasons the German Engineers have certainly got the equipment they need. It is up-to-date and it can keep up with their armoured formations. They do not have the Centurion, Chieftain, Challenger mix that we have — all engineer tanks are Leopards. It has unique capabilities such as snorkelling, flailing, engineering scatterable anti-tank mines, low profile launched AVLB and tank excavators — have they got it right?

Flying Plant

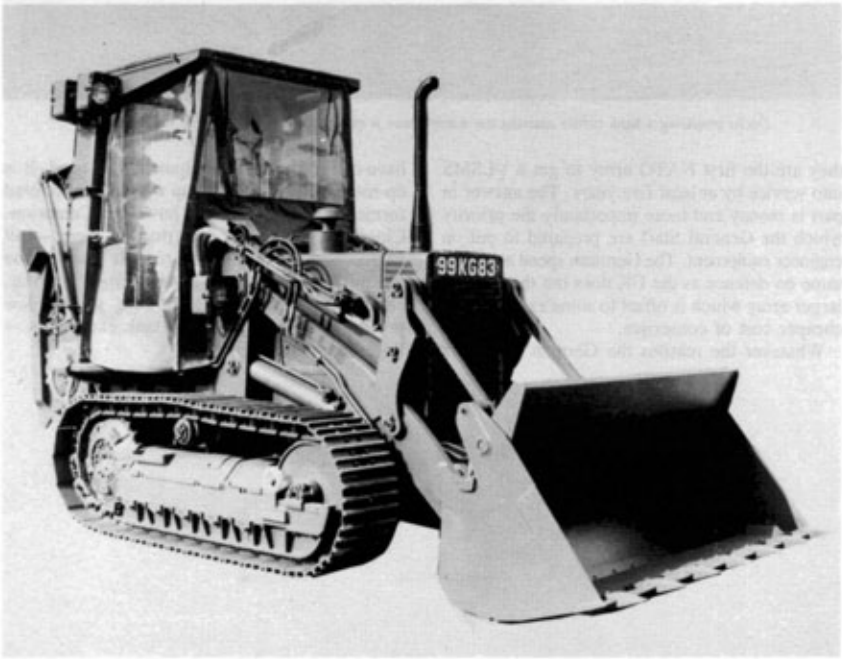
SINCE the demise of the old Caterpillar D4 bulldozer seven years ago, the only plant cleared for airdropping has been the Muirhill A5000 Light Wheeled Tractor. This has left a gap in the Sappers capability to clear, or prepare, an operating strip for the Hercules C130s, to bring in the main part of an intervention force.

There is a need for a combination of air-droppable wheeled and tracked tractors, dumpers and compaction plant. This is now being addressed by the purchase of light wheeled and crawler tractors which are designed to fit the Heavy Stressed Platform (HSP) and the clearance for dropping of the relatively new Benford 2500 dumpers and the 2.5 tonne self-propelled roller. There will be only limited quantities of these equipments held, but they will be enough for the job until larger plant can be airlanded.

In conjunction with this, there are developments on the heliborne plant front. The range of a Chinook with a Muirhill A5000 underslung is severely limited. The new airdroppable JCB 3CX-M Light Wheeled Tractor fits this role admirably, and will stretch the operating range ten-fold to approximately 200km. Other plant such as the Thwaites Giant dumper have also been cleared for lifting by Chinook.

Further into the future, the greater availability of Puma on the battlefield may also be exploited by clearing the Benford 2500 dumper for underslinging and the purchasing of smaller plant such as skid steer loader/excavators for trenches.

These developments should mean that within two years the Sapper capability to support both airdrop and heliborne operations with plant will have improved significantly.



Allis FL5B Light Crawler Tractor

Benford 2500 Ultra Light Dumper

Benford 2.5 Tonnes Self Propelled Roller

JCB 3CX-M light wheeled tractor

An Airstrip Built by 15 Field Support Squadron on the Island of Unst in the Shetland Islands

LIEUTENANT COLONEL P F W JACKSON MBE

The author joined the Corps in October 1944, and after training, spent the next four and a half years in RE Bomb Disposal. There followed tours of duty in Hong Kong, Ripon, Japan, Malaya (involved in bomb disposal work). In the 50s and 60s he completed three tours in BAOR at intervals between service in UK, Aden and later the Gulf State of Sharjah. On commissioning, his first appointment was Regimental Quartermaster of 71 (Scottish) Engineer Regiment (V), then Quartermaster in 11 Field Squadron with the usual roulement tours in Northern Ireland, Belize, Harrier Support in BAOR and eight months in the Sudan. There followed five years in Hameln with 35 Engineer Regiment and 28 Amphibious Engineer Regiment, finally retiring from the active list whilst serving with 42 Survey Engineer Regiment. He currently holds the post of RO3 Resources with 15 Field Support Squadron in Ripon.

UNST is Great Britain's most northerly territory with Muckle Flugga light-house, built by Robert Louis Stephenson's father c. 1850, being its most northerly building. Unst lies 200 miles north of Scotland in the Norwegian Sea and is said to be 180 miles away from its nearest railway station at Bergen in Norway. An almost treeless landscape dotted with greystone crofts and cottages, the island is famous as a bird sanctuary. A dozen varieties of sea bird estimated at several hundred thousand nest on the island, particularly in the north-west where the Hermaness Nature Reserve is situated. In the last century and the early part of this one, crofting and fishing were the major industries, with cottage industries, such as the knitting of fine wools being in a supporting role. However, the fishing industry has virtually disappeared and the young folk are leaving Unst in search of work on Shetland-Mainland and in Scotland, particularly Aberdeen where much North Sea oil developing industry is taking place.

The building of a new car ferry terminal at the southern tip of Unst has opened up the island to tourists, bird-watchers and conservationists alike, allowing one to arrive with an independent means of transport necessary in order to explore this fascinating island which has no public vehicle system, and only one taxi. With the demise of the fishing industry, the Royal Air Force stationed on Unst, has become the single biggest employer for local people. The Air Force base itself is quite large with its military staff of about 200 plus the married families element of a further 200 or more, bringing extra cash and trade to the island.

The new radar surveillance site is located on the highest hill in the north of the island at Saxa Vord, while the base camp is situated near Haroldswick, a bay on the north east coast. The presence of the military on Unst however is not new. Both the Army and Royal Air Force were there in some strength during and after World War Two, operating a radar installation and a repair base for flying boats in Baltasound. However, with the disappearance of flying boats and sea planes, attention was turned to airstrips and land planes.

In 1967 as part of a programme of MACC (Military Aid to the Civilian Community), the then Board of Trade (Aviation Branch) gave a list of airfield works required in the more remote parts of Scotland and Zetland. These included Fort William in Scotland, Lerwick, Yell and Unst in the Shetland Islands and on the main island of Fair Isles.

In March of that year, a party representing the Board of Trade, the Highlands and Islands Development Board and the Corps of Royal Engineers, visited the Shetlands to inspect possible sites. The Zetland County Surveyor accompanied the group to agree feasibility of the

Lieut Colonel P F W Jackson MBE
An Airstrip Built By 15 Field Support Squadron

sites visited. It was agreed that Unst had the highest priority and that the site selected at Baltasound on the east coast, should be studied further, to see if the Royal Engineer effort could complete the work in the Summer of 1967.

The initial impression was that the work would involve the removal of heath/peat topsoil, the cut and fill of predominantly soft rock material then roll and finish off the runway with a "blacktop" surface. This was to prove later to be an incorrect impression leading to a major change in the airstrip design after work had commenced. The initial requirement set out by the Board of Trade and Zetland County Council, was for a two runway airfield at Baltasound. It was agreed the Royal Engineers would construct the east-west runway and complete it to sub grade levels with culverting, the County Council being responsible for the second runway, also the drainage and top dressing of the first.

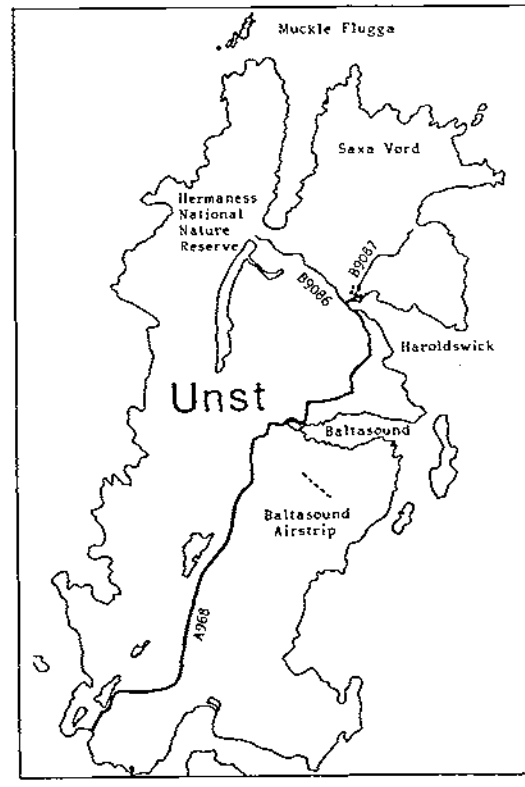
The task was given to 15 Field Support Squadron RE, part of 38 Engineer Regiment (Lieut Colonel J H Foster) based in Ripon, North Yorkshire, and code-named as exercise *North Air*. In April 1967 the airstrip design and work calculations were completed. Unst was to have an airstrip 2900 ft (854 m) long with a 90 ft (27 m) wide runway. In fact the design change, necessitated by the rock being much closer to the surface than predicted, was for a re-alignment of the centre line gradients of the runway which produced a final strip 2250 ft (686 m) long by 75 ft (23 m) wide.

15 Field Support Squadron's detachment was allocated the LSL *Sir Bedivere* to move 34 pieces of heavy equipment plus vehicles, stores and personnel from Hull in East Yorkshire to Baltasound on Unst, arriving at Skeo Tang on the 15 June 1967. Equipment was beached and then tracked the two miles to the site location ready for the start date of 19 June. The officers and soldiers were fed and accommodated at RAF Saxa Vord with an overspill being billeted in Haroldswick Hall. It is interesting to note that in 1967, there were only two steamer sailings per week from Lerwick to Aberdeen and vice-versa. It therefore took a soldier three days travelling time to go from Ripon in North Yorkshire to Unst.

Spares and repair equipment required during the exercise, travelled a similar route arriving on the inter-island steamer, MV *Earl of Zetland*, in Baltasound on Mondays and Fridays. Visiting VIPs came by air to Sumburgh on Mainland-Shetland and travelled thence by vehicle and boat to Unst.

Work progressed albeit slowly because of the lengthy periods of heavy rain, until by September it was seen that progress was almost at a standstill and it was decided to suspend the operation until the following Summer. Despite the difficulties created by the inclement weather, much had been achieved in this first phase. Particularly important were the lessons learnt about the logistics of the exercise — the "pipeline" times for vehicle and equipment spares, the effect of the wet weather on plant and machinery and the morale of the soldiers working under adverse conditions. These lessons were to be invaluable to the success of Phase 2.

Now that the spadework had been done in 1967, the second phase was able to get started much earlier in the year. After a detailed recce in February, 15 Field Support Squadron RE once again assembled its equipment, stores and men and returned to Unst by the brand new LSL *Sir Percival*, which was making its maiden voyage. There were some new faces and new machines, otherwise few changes. Accommodation and feeding of the men was once again prevailed upon the Royal Air Force to provide. This administrative



arrangement was indeed a great help to the detachment, allowing full concentration to be given to the task in hand.

So on 6 April 1968, the Sappers arrived once again in Baltasound. It was during the off-loading of the machinery and equipment that an unfortunate incident occurred when a heavy 'digger', weighing some 15 tons, and a trailer loaded with small stores, slipped and were lost in 40 feet of water. Despite this initial set-back, work commenced according to plan.

The weather this time was kinder to the project team than in the previous year, with the rainy spells interspersed by longer periods of dry ones. These periods were put to good advantage and allowed work on the all-important drainage to go ahead. This would otherwise have been a major problem as the weather normally kept the area well saturated. A ditch had to be dug up to 10 feet deep on the uphill side of the strip and a 3 foot diameter culvert sunk 10 feet deep across the width of the strip. About 3000 lbs of explosives were used to cut through the rock levels and to break up the odd large boulder lying on the surface.

A quarry was opened up on site and started producing graded rock for the sub-base. Now began the grading and levelling by dozers to final formation of the runway, followed by compacting with heavy vibrating and multi-wheeled rollers. Cleaning and grading the runway shoulders required moving tons of silt and rock to aid landscaping. The sub-base was laid with compacted crushed rock, the hardcore being put in layers and each course rolled.

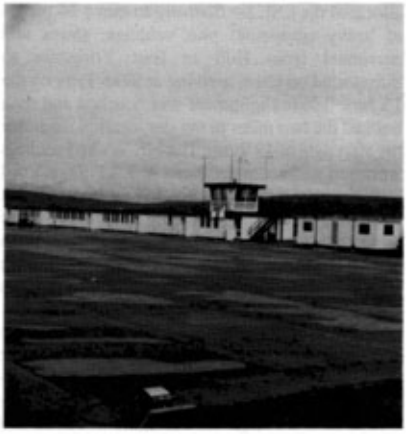
Almost a month before the official opening of the airstrip in August 1968, the first aircraft landed, an Islander of Loganair, bringing passengers and stores. This was to be the first of eight pre-opening aircraft sorties. At last on the 5 August 1968 there arrived by RAF Pembroke, the General Officer Commanding Scotland, Lieut General Sir Derek Lang KCB DSO MC, to perform the official opening ceremony. A brass plaque suitably inscribed, was unveiled by the General as he officially handed the airstrip over to Mr R A Johnson the Zetland County Convener.

Now all was over as far as the soldiers of 15 Field Support Squadron RE were concerned, and they packed their equipment and re-embarked on the LSL for the return journey to North Yorkshire. As arranged before the exercise began, the Zetland Council completed the airstrip drainage and laid the blacktop runway surfacing.

At the start of exercise *Air North I and II*, 15 Field Support Squadron was entitled 15 Field Park Squadron RE and a regimental shield bearing this inscription, is displayed in the Officer's Mess, RAF Saxa Vord.

Everyone agreed, it had been a most successful operation despite being bedevilled in the beginning by the weather. Unst had its airstrip, the Corps of Royal Engineers notched yet another success in its belt. Throughout the exercise, the link with the local population on Unst had been on the most cordial of terms. (At least one soldier from 15 Field Support Squadron married a local girl from the island.)

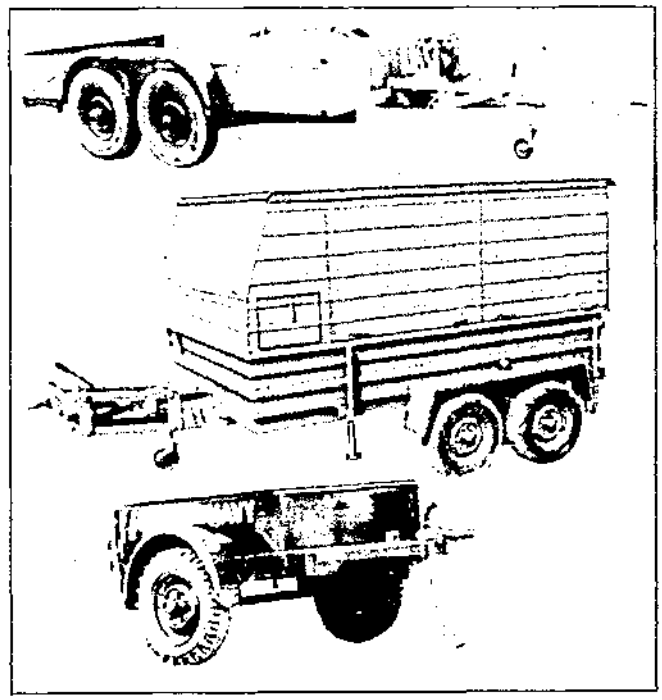
In 1985, the airstrip has changed beyond recognition with all the hallmarks of a busy airport. A hangar, a control tower with the usual terminal buildings have been added. Operating both day and night, Unst airport serves as a terminal for the crews flying out and back to the North Sea oil rigs and thence to and from Aberdeen by airliner. Customs and fire-fighting crews complete the picture of a modern day air terminal, one which returning soldiers of 15 Field Support Squadron RE would scarcely recognise. The brass plaque signifying the opening of the airstrip in 1968 is still the same, except it now reposes on an inner wall in the airport lounge.



Unst Airport as it is today

An Airstrip Built By 15 Field Support Squadron

Military trailers of all types



From two-wheel half-ton chassis to eight-wheel 15 ton low loaders, the RM range includes steering axles, ground loaders and tippers, with bodywork from basic cargo boxes to cabins. Also made are vehicle transporters of all types and tankers for water, oil and chemicals. Fitting out is undertaken to customers' requirements. Special-purpose designs include cable drum transporters, mobile radio mast units, trailers for military vessels, and trailers incorporating water filtration equipment. The company has been assessed and registered by the British Ministry of Defence as operation quality control procedures in accordance with AQAP 4.

The illustrations show a 4-ton plant trailer with ramps and servo braking (top), a purpose-built trailer for water filtration equipment with body panels which open up (centre), and a general-purpose cargo trailer (bottom).

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NIM
The General's Match-stick Game

LIEUT COLONEL D W B WILLIAMS

In December 1965, while serving in the Royal Engineers Combat Development Staff at Chatham, the following memo arrived in my 'IN' tray:

HQ ENGINEER-IN-CHIEF
Southill Barracks, CHATHAM, Kent
Telephone: Medway 44555 Ext 377
30 December, 1965

RECDS

LIGHT RELIEF

1. The Army Commander, Eastern Command has asked me to help him to achieve an unexpected victory against a certain senior retired officer of the Corps who invariably beats him at the match game. This, as you may know, consists of removing matches from three piles, the object being to leave your opponent with the last one.
2. What he wants is a statement of the formula which will ensure victory, assuming that your opponent does not know it as well, when that is the case I presume the one that has the first move must win.
3. I have told him that I will give him the answer by 31st January. It may be that this problem would be up Major Williams' street, and if you want any further information about the rules of the game or what is required, please let me know.

(Sgd) J H S Bowring
(J H S BOWRING)
Major-General
Engineer-In-Chief

A few days later a reply was despatched:

4 January 1966

E-in-C (2 copies)

NOT-SO-LIGHT RELIEF
THE ARMY COMMANDER'S MATCH STICK GAME, or NIM

1. We are glad to say that the solution of the match stick game is already known to us, otherwise 31 January 2066 — let alone 1966 — would have been too soon for us to have worked out an answer from scratch.
2. The solution is offered in the hope that it will not be spread about too broadly, because it has been one of our standard party tricks, and a source of free beer, for a considerable time in the past.
3. We hope that the Army Commander will now be able to play on equal terms with the senior retired officer of the Corps who has so far defeated him.
4. He may then go on to counter-attack by suggesting a game with two changes in the rules, namely:
   a. start with *four* piles instead of three.
   b. the taker of the last match *wins*, instead of loses.

We have provided him with the secret of winning this game too.
5. We would be interested to hear the result of the next encounter.

(P R Russell-Jones)
Lt Col RE
GS01
RE Combat Development Staff

GENERAL OFFICERS IN CONFIDENCE

NIM
THE GENERAL'S MATCH STICK GAME

INTRODUCTION

THIS game has been played and studied for about 3000 years. Generations of mathematicians have tried to find a formula for success, but not until the present century was a full solution forthcoming, and then only because renewed interest in the binary system of numbers brought it to notice. The game is called NIM.

THE GAME

IN its elementary form the game consists of two players, and they start with three piles of matches. The players take turn, and turn about. A player can remove any number of matches from any *one* pile. The object (usually) is to make one's opponent take the last match.

For simplicity, it will be assumed in this paper that the two players are:

the general, and the anti-general
abbreviated to: the gen and the anti-gen

The anti-gen tosses a number of matches on the table, and divides them into three random (?) piles, of 3, 8, and 11.

They toss for first go, anti-gen wins and gallantly offers to let gen have first go. Play proceeds as follows:

GEN'S GO	ANTI-GEN'S GO	REMAINDER LEFT IN PILES 1st pile	2nd pile	3rd pile
STARTING POSITION		3	8	11
removes 4 from 2nd pile		3	4	11
	removes 4 from 3rd pile	3	4	7
removes 1 from 1st pile		2	4	7
	makes mistake and removes 1 from 1st pile instead of 3rd pile	1	4	7
(he can win now, but he does not know it) removes 2 from 2nd pile		1	2	7
	removes 4 from 3rd pile he has now rectified the mistake	1	2	3
says "blast", then removes 1 from 3rd pile		1	2	2
	removes 1 from first pile	—	2	2
admits defeat				

This game illustrates the fact that there are a number of combinations of numbers which will eventually win regardless of what the other player does next. Thus, anti-gen knew that 3, 8, 11 was a winning combination — that was why he allowed gen to go first. He also knew that 3, 4, 7 was a winning combination. Also 2, 4, 6 which he should have left in his second move instead of 1, 4, 7. Finally he knew that 1, 2, 3, and 2, 2 were unbeatable end positions.

As they play more games, and anti-gen invariably wins, gen begins to twig that some of the low combinations like 1, 2, 3, : 1, 4, 5, : 3, 3 : 4, 4 are also winning combinations, and he must try:

a. to leave them for anti-gen.
b. not to allow anti-gen to leave them to him.

Eventually he will realise that there are higher winning combinations, and will note these down thus building up a table of winning combinations of two piles and three piles. Both players are then able to tell whether any particular starting position is a winning or a losing combination. If the former, gen will invite anti-gen to go first. If the latter, gen will wish to have first crack himself, in order to convert it into a winning combination.

First Change of Rule

Both players will now probably decide that the game has become dull. One might then say "I'll tell you what — let's try it the other way round. He who takes the last match *wins*, instead of loses." They start again. After some trials they find to their amazement, and perhaps fascination, that combinations that won before still appeared to win, even though the object of the game was now diametrically opposite to what it was before. The only difference was in the end game after the 1, 2, 3 or 2, 2 combinations had been reached.

Second Change of Rule

Gen and anti-gen eventually both find, once again, that the game has lost its interest to them. After a certain amount of sorrowful pipe-sucking the brighter makes another suggestion, "Let's try it with four piles instead of three." Again they experiment, and are able to build up a table of winning combinations of four piles, three piles and two piles. As before, these combinations win whether they play the "last match wins" or "last match loses" game — except in the final moves — and their new list includes, of course, the winning combinations found in the three pile game.

It now strikes gen that there may be a secret

formula which determines whether a given combination of 2, 3, 4 or more piles is winning or losing. Like hundreds of generations of gens before him he secretly consults his astronomer, geometer, or tax adviser, and asks for the formula. None have been able to oblige — until the twentieth century. We are now able to assert that the present gen is the first gen to be given the full gen. It is as follows:

Binary System of Numbers

First, gen must learn to count in the binary system of numbers. This is not difficult — all he needs is one thumb and no fingers. The thumb represents *one*; no thumb represents *zero*. He need write only 1 or 0.

Conversion of the customary decimal counting table to his new binary one is like this:

DECIMAL NUMBER	BINARY NUMBER
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111
16	10000

Gen is now mentally equipped to face anti-gen. His further actions are as given below:

The Solution

At the start of play, or when his turn comes, he must:

- Count (in the decimal system) the number of matches in each pile, thus 3, 8, and 11.
- Write them down (mentally?) one under the other, thus:

  3
  8
  11

- Convert (mentally?) each to binary, carefully tabulating the binary figures, thus:

  3 ... 11
  8 ... 1000
  11 ... 1011

- Add (mentally?) the binary digits vertically *in the decimal system* (peculiar isn't it) thus:

  3 ... 11
  8 ... 1000
  11 ... 1011
  2022

- If all the figures in the sum are *even*, the combination is a winning one. If *any* are *odd*, the combination is a losing one.

  Hence the combination 3, 8, and 11 is winning (and gen must decline the invitation to start).

Now consider the stage when anti-gen made a mistake, and left 1, 4, 7. Gen should have:

- Done the following sum (in his head?):

  1 ... 1
  4 ... 100
  7 ... 111
  212 one odd figure — therefore a *losing* combination

- Said to himself "Anti-gen has left me a losing combination. Therefore, if I can take the right number from a pile to convert it into a winning combination, I've got him cold. But what number."
- Seeing that the offending figure in the sum was the figure *one*. Eliminate that, and the job is done. What he wants is:

  1 which is — 1
  100 — 4
  101 — 5
  202 a winning combination

- Taken two matches from the third pile to convert 1, 4, 7 into 1, 4, 5.
- Anti-gen will now probably try one more move at random which will again leave a losing combination, gen will again do his binary sum to put it right, and anti-gen will then concede the game.

The Counter-attack

Having established his equality in the present game, gen starts on the counter-offensive. He suggests *four* piles instead of three and a change of rule so that the taker of the last match *wins*, instead of loses.

He nonchalantly tosses a few more matches on the table, divides them at random(?) into four piles and:

- counts, 2, 4, 5 and 7.
- writes and converts to binary.

```
2 ... 10
4 ... 100
5 ... 101
7 ... 111
     322
```

One odd digit — therefore, a losing combination.

- Tosses a coin, calls heads, wins the toss, and elects to go first.
- Decides that one way (but not the only way) of making all even figures in the sum is to convert the fourth pile from binary 111 to binary 11, thus he wants

```
10 ... 2
100 ... 4
101 ... 5
 11 ... 3
     222
```

a winning combination.

- Takes four matches from the 4th pile making it seem to be a completely random choice, looks up and says, "your go old man".
- Goes warily in the final end game, after the stage of 1, 1, 2, 2
  or 1, 2, 3
  or 2, 2
  has been reached

  (otherwise he may lose in the last move of the game and this would be a pity having gone so far).

Conclusion

Gen has triumphed over anti-gen, and all due to his learning to do arithmetic in the binary system. If he can do it mentally his victory will be doubly satisfactory. Anti-gen will be astonished.

If gen can't do it mentally, then perhaps a scrap of paper and pencil might be permitted as an aide.

If gen can't do arithmetic at all — well all is not yet lost. We append a few winning combinations for him to learn by heart, or else write on his cuff.

RECDS(D W B Williams)

January 1966

Afterthought

Having played the game with four piles between two people, what about bringing in a third person — perhaps anti-gen's wife — and give each player three lives. Solution next year.

The table of winning combinations is not attached as readers of this article may wish to compile their own tables, or programme their personal computers to do so.

July 1989 DWBW

21 March 1918

MR T C NICHOLAS OBE MC

Photo by Dona Haycraft

Mr T C Nicholas is now Senior Fellow of Trinity College, Cambridge and celebrated his Centenary in August 1988. In 1914 he was a Research Fellow in Geology. In 1915 he was sent from the War Office to join the staff of the Dardanelles expedition as Map Officer. In Cairo he met T E Lawrence who, while disapproving of the operation, agreed to take charge of all the map printing required in Egypt. Returning to England on leave in 1916 he was transferred to the RE and joined the 5 Field Survey Battalion on 1 July for the Somme Battle *during which, on a few occasions, he was sent to take panoramic photographs from the front line for which he received the MC. In 1917 the unit was moved to Flanders for the* Passchendaele Battle *and in January 1918 to the then quiet St Quentin Front. After the events recorded below he was promoted Major, awarded the OBE and a month's leave. He learned after demobilization of his promotion to Lieut Colonel.*

21 MARCH 1918 is a date that I thought would never be erased from my mind, the day the Germans began their great attack on the 5th British Army in front of St Quentin, and so nearly succeeded in breaking right through to the coast at Abbeville, as their tanks did in 1940, and cutting off the British Army from the French.

I remember it as a day of thick fog which lasted all day and most of the next. We knew the attack was coming and I lay down on my camp bed in a hut at 5th Army HQ at Nesle without taking off my uniform. I didn't sleep much and was awake when the German barrage suddenly began at dawn. I jumped up, looked out of my window and saw nothing but thick fog. About 6.30 an orderly came with a signal message by phone from one of our seven observation groups: "Barrage began 4.55. All lines to posts cut by 5.15 but this HQ not being heavily shelled. Please send instructions."

My CO, Lieut Colonel Legh, had not returned from leave, so as second-in-command I was in charge of the battalion, of an HQ with map store and printing and lithographic sections and a survey unit, together with seven sound-ranging sections and seven observation (flash-spotting) groups, which were strung out all along the Army front, about 20 miles long and very thinly held.

Before I could think of any instructions to give, our telephonist reported that the line to that Group HQ had also been cut, so there was nothing I could do.

All day long the continuous rumble of the German barrage went on monotonously. In the middle of the morning I walked through the fog down to Army HQ and saw the head of the General Staff. There was almost no information, the lines to all the forward troops were dud and most of the Divisional HQs had reported no useful news other than that they were not getting any!

We stood and listened to the continuous distant roar, like a drum roll. "Ours more than theirs," he remarked unconvincingly.

Then a report came in that one of our infantry had turned up at some more forward HQ, claiming that he had been captured but had escaped in the fog and got to a road where he had been picked up by a vehicle returning to a Divisional HQ where he had been arrested as a deserter, but on learning his story was being sent to Army HQ for further interrogation.

Mr TC Nicholas OBE MC
21 March 1918

He arrived while I was talking to General Malcolm and his story was that German infantry had suddenly appeared in his trench through the fog and had taken them all prisoner, taken away their arms, and had made signs to them to walk on down the communication trench. As they went he saw a gap down which he bolted, and escaped in the fog and went on walking till he struck a road, just as a British lorry came slowly by. This had taken him to Divisional HQ — I can't remember what was his unit, but he had been in a support line, not the front line, near a canal a little south of St Quentin, a town which was just behind the German front line. He had heard no rifle or machine-gun fire and they were just getting breakfast when the Germans suddenly appeared in their trench.

I returned to our HQ which was in a series of wooden prefabricated Army huts outside the small town of Nesle, where we had our Mess. One of our men was a bricklayer and had managed to build a brick fireplace which had been a great comfort during the cold winter.

The sound of distant gunfire gradually subsided and the fog thickened again as evening came on, and I went down to the GS Intelligence Office to get the "Situation Map" which we printed every evening on our big flat-bed lithographic press, housed in a large outhouse in the town. It just showed what was or was believed to be the distribution of enemy troops behind their front line, what particular units had been identified from trench raids at night, deserters, intercepted wireless messages (which the Germans used a great deal) and so on. Normally the front line was the same every night. As soon as it was printed, despatch riders took it to the various Corps HQs to be distributed to divisions and lower units along the 5th Army front.

On the night of 21 March all that could be shown was that the position of the front line was quite uncertain, that the Germans had made several deep penetrations into our line and that many new German formations were taking part in their attack. I was told that 5th Army HQ was about to move back to Villers Brettoneux (a little east of Amiens) — a very long way back, but behind us there was the many-miles-deep area of the old Somme battlefield criss-crossed with old trenches and rusty barbed wire and not a building standing — and that we should all get ready to move, and there would be no more maps to print until the move had been completed.

So as soon as the hundred or so copies of the situation map had come off the press, I gave orders to the Printing Section to work all night dismantling the machines to send back next day to the base (Abbeville), and the stout fellows had the whole thing and all their letterpress, printing press and stores ready for transport early next morning and loaded onto a train, one of the last, as it happened, to get away safely before the lines got choked with traffic.

Only a small part of the 5th Field Survey Battalion was at Nesle, I guess less than 100 officers and men, with a high proportion of officers and skilled technicians, surveyors, lithographers, draftsmen, printers, etc, men not soldiers at all but specially enlisted for their skill as craftsmen. Whereas each sound-ranging section had three or four officers and a number of technicians and each observation group about three officers, one for each observation post and an OC, and the crew of each post, half a dozen or more. The latter were mostly experienced soldiers who had served with the gunners or infantry, as had a few of the other ranks in the Sound Rangers. It seemed to me that in a general retreat there was a great danger that some of the Sound-Ranging HQ might be captured with their highly secret apparatus. This had been mainly devised by Lawrence Bragg, a former Fellow of Trinity, then a Professor of Physics at Manchester and afterwards to succeed Rutherford at Cambridge. He was actually in charge of the senior Sound-Ranging Section at Mont Kemmel, south of Ypres and in the Second Army area.

We knew that the German sound-ranging equipment was nothing like as good as ours and were most anxious they shouldn't learn how we did it. It seemed to me the most important thing was to withdraw the Sound-Ranging HQ with its apparatus to safety. The microphones, which were tiny and very inconspicuous, could be left where they were — they were unmanned and connected to HQ by ground lines. So I decided to order all the 14 sound-ranging sections and observation groups to concentrate at Battalion HQ at Nesle — they would not become useful again until the battle front became stationary once more.

The question was how to get the order to each of the 14 HQs as all telephone wires were dead. I decided to get my two most trustworthy officers, Captain Hodgkinson, who had been in charge of a sound-ranging section all through the Battle of the Somme, and Captain Besly, a Caius man and a

talented musician (after the War organist of the Queen's College, Oxford), who had commanded an observation group, to set out with their cars and to visit each and give the order personally to each CO. Hodgkinson to visit all the sections and groups south of Nesle and Besly all of them north of Nesle. Thus, provided they could find their way in the dark and fog and get through, ensuring that all 14 got the order to pack up and move at once to Nesle, in the event of difficulty in getting through, preference to be given to the Sound Rangers.

They set out at nightfall and each of them succeeded during the night, in spite of all the confusion in the back areas, in visiting every single HQ and giving my order to the senior officer in charge. So during the next day parties of officers and men with their transport kept on arriving at Nesle HQ until by about midnight all the Battalion, for the first time in its existence, was concentrated on the same place, and the cooks prepared an endless succession of meals in our very overcrowded mess. Many of them had never seen each other before!

The next day, 23 March, was a rest day, the fog was beginning to thin and we had the spectacle of a German reconnaissance monoplane being shot down by three RAF fighters, which made several attacks on it until it caught fire and fell to the ground in a column of black smoke some distance away, the unfortunate occupants throwing themselves out of the plane with their clothes on fire some seconds before it crashed out of sight. There were no parachutes in that war; if you ran out of fuel or had engine trouble, unless you could achieve a forced landing, you died.

I remember that the RAF planes were "pusher" biplanes with the propeller behind the pilot and observer, FE2D I think they were called. The original BE2C biplanes and the RE8s which succeeded them were terribly vulnerable to the Fokker monoplanes in 1917. I remember being told in 1917 when we were clamouring for air photos of the new Hindenburg Line that the Germans were building (with Russian POWs, it was said) to withdraw to behind the old Somme battlefield, that of one flight of eight RE8 photography planes sent out from one aerodrome, only two returned with photos for us. One of the most important duties of the Field Survey at HQ was the drawing and printing in the field of large-scale trench maps scale 1/5000.

Part of our battalion started moving to the rear on 24 March — we had decided to make for a village a few miles east of Villers Bretonneux, where we had spent the winter of 1917/18 before advancing to Nesle, called Lamotte en Santerre. We had to march by road, about 25 miles, to Villers Brettoneux, only senior officers and packs and kitbags being allowed on our very limited transport.

The remainder followed on 25 March. I was the last man to leave, with my batman; an old infantryman who sat in the back of my Sunbeam car with his rifle at the ready. No officers other than Army Service Corps (ASC) were allowed to drive cars in that war, and every car had its own ASC chauffeur who was responsible for its upkeep. I recall that we passed an ordnance dump where they were handing out any stores that anyone cared to take. I took a bottle of white wine and some tins of biscuits, and I recall taking a final look around my office and leaving for the Germans with regret a very nice brown casserole with narcissus in full flower and a very nice brown pitcher full of branches of blackthorn in full blossom.

Just as we started, a rumour began among the few troops remaining in the town that German cavalry had been seen to the north of the town — but it caused a minor panic. Men ran out of the houses and started climbing into lorries standing in the town square and driving them off along the road we had to traverse.

As we passed the building which had housed the General Staff an officer leaned out of an upper window shouting "Stop this damn panic!" but I don't think it had much effect.

Some miles along the road I saw a stationary car with an officer whom I recognized. It was my friend Campbell Smith (a great friend of TCN, who subsequently became godfather to Bry and is still alive and in good shape — a few months older than TCN!). He was a lieut colonel in charge of one of the "special companies RE" which were formed to man gas projectors, large mortars which hurled huge canisters full of lethal gas, which broke on impact, a distance of several hundred yards. (The idea was to set up a hundred or two of these projectors in a trench in or close behind the front line and fire them simultaneously by remote control.) They were obviously useless in mobile warfare and the special companies just swelled the forces covering the retreat. We stopped and had quite a long chat. He didn't believe

the Germans were within miles! His men were taking up a defensive position astride the road.

I don't remember much about the remainder of the journey to Villers Brettoneux save that the fog had turned to thin mist with a blue sky and sun overhead and that progress was very slow with all transport going one way and at one point I saw a stretch of railway with three stationary trains close behind one another. I don't know whether they were eventually able to proceed and escape the Germans. Two days before, on 23 March, the railway was working and the 8th Division from the reserve detrained at Nesle looking very clean and smart but totally without maps, and I conducted a number of their officers and men to our map store and handed out a "divisional issue" of 1/100,000 road maps (large-scale trench maps were obviously useless). I have often wondered what became of all those officers and men flung in to stem a whole retreat.

My car arrived at Villers Brettoneux rear HQ and I reported at the General Staff Office, feeling more dead than alive, in the afternoon of 25 March, not having had my clothes off since early morning of 20 March and no proper sleep — and there found my CO, Lieut Colonel F B Legh (also an Old Berkhampstedian!), who had just arrived back from leave and took over command from me.

As I was being led off to get some food and sleep, a letter was thrust into my hand addressed by the Head Porter of Trinity. I managed to slit it open and when I saw the contents put it carefully into my pocket and said, "If I ever get back to England I'll keep this all my life and write on it the circumstances under which I received it."

It was the famous "College Clock" letter which you have all often seen, telling me that under the Summer Time Act the hands of the College Clock would be advanced one hour and that at the Easter Feast evening dress would be worn and doctors would wear scarlet.

I slept for a long time after that, and when our numerous and varied units had at last reached Lamotte en Santerre, Colonel Legh organized those who had had some war experience into two half companies, commanded by Captain Hodgkinson and Captain Besly, and they reinforced a thin line which had been formed to defend Villers Brettoneux, if the Germans arrived before any other reinforcements could be brought up. The draftsmen, compositors, photographers etc, with myself and a few HQ officers were billeted in a village school nearby.

The Germans found their pursuit greatly hampered by the devastation of the old Somme battlefield, the mass of impassable shell craters, trenches and old barbed wire with only one or two roads through it, but they did make one weak attack on our miscellaneous force, in which Captain Besly was wounded and taken prisoner with some others, and I think there were a few fatal casualties. But the attack petered out, probably through the difficulty of getting any supplies or ammunition through the devastated tract behind them. And the French, who had not been involved in the March offensive, rapidly brought up in "camions" troops to plug the gap and a kind of front line gradually formed which held until our highly successful new offensive with the Australian Corps, Canadian Corps and one Third Corps on 8 August. In the meantime the 5th Army ceased to exist and we were taken over by the 4th Army and formed a HQ at Flixecourt in the Somme Valley, halfway between Amiens and Abbeville and our Printing Officer Lieut Geddes (a good Scot with printing experience) reassembled the printing equipment, evacuated from Nesle on 22 March, in a requisitioned string and rope factory at Abbeville and was soon in production.

Kongaita Bridge

CAPTAIN D R HO

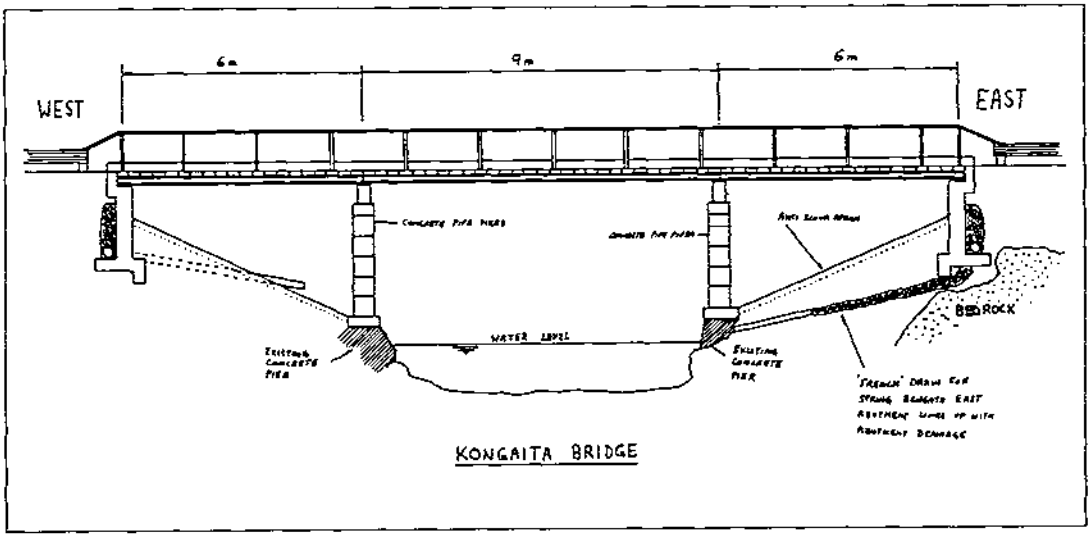
Captain David Ho was commissioned into the Corps in April 1987 after graduating from The University of Dundee in Civil Engineering. After the Young Officers course he was posted to 38 Engineer Regiment in Ripon as a troop commander in 32 Field Squadron. On his return from Kenya he was cross posted to Plant Troop, 15 Field Support Squadron.

THE town of Nanyuki which lies to the north east of Mount Kenya was at one stage considered to be a frontier town during the Mau Mau Crisis. It is now the home of 4 Brigade of the Kenyan Army whose rifle range is separated from Nanyuki by the River Likki. Access to this range and some local settlements was originally achieved over a timber bridge constructed circa 1956, which was subsequently overbridged with a Standard Bailey Bridge in the 1970s by 10 Engineer Battalion from the Kenyan garrison. 10 Engineer Battalion provided one MWE, one MWD and a MMG for the advance party in December and periodically thereafter. They were invaluable for the initial site clearance and for the digging out of the Bailey Bridge ramps. A Kenyan Army officer, Captain Geoff Muturi, who attended 92 Young Officers Course at Chattenden, was the Liaison Officer and was probably instrumental in our obtaining their plant support. The Squadron was loaned two Kenyan Army Lowloaders and three 3 tonners for the duration of the tour from a Transport Battalion. These vehicles were used for the initial deployment of the plant and for the subsequent movement of materials. The Bridge was designed by MWF who supplied the Squadron with a GE and CoW (C) for the duration of the tour, they were based at Isiolo at the Squadron Tented Camp. All the tradesmen were from 32 Field Squadron, although about ten ex-Apprentice Tradesmen were posted in from Training Regiment shortly prior to our departure in November, and the Squadron Orbat was reorganised internally to suit the tasks.

As part of Exercise *Larchpole 89* my troop task was to replace these bridges with one using a concrete, steel and timber design. Following the OC's confirmatory reconnaissance in October 1988 my own planning began for the construction of Kongaita Bridge. According to the method of works for the project a 7 tonne bridging crane was required. Unfortunately the proposed source of this crane, 10 Engineer Battalion, was unable to supply a working machine. The problem was solved by designing in UK an aerial ropeway to span the 21 metre gap. It had to have some degree of sideways movement to allow for the accurate positioning of a concrete skip. The only remaining problem was the local availability of the timber spars and ledgers, the quality of timber in Kenya being suspect.

Pre-project training took place in November with the construction of a Kongaita Bridge abutment in Ripon, as part of the on-going construction of a future training bridge for Laver Banks Training Area. Valuable lessons were learnt about the peculiarities of the job, in particular the problems associated with the excavations and bar bending. A new ratchet bar bending machine was bought and the formwork for both abutments was

Captain D R Ho
Kongaita Bridge



KONGAITA BRIDGE

prefabricated in Ripon and transported by seafreight. These measures were later found to have saved a great deal of time in the initial stages of the project.

The advance party arrived at Nanyuki in mid-December and, as described in the Detailed Planning and Reconnaissance Report, found the bridge with badly worn Bailey decking. The timber bridge bearers were almost completely rotted through at midspan and both existing concrete abutments were badly undermined. The approaches to the bridge comprised of a steep murram track on the home (west) bank with a sharp left bend 50 metres from the bridge and on the far (east) bank the track swung sharp right immediately after the bridge and then opened out onto a relatively wide hard surfaced track. Numerous large camphor trees of up to 1 metre diameter grew on the embankment overlooking the bridge on the far bank. On inspection, many of these were found to have been hollowed out by the local population for firewood, however one solid tree was found just off the bridge centreline. The embankment on which the tree grew and the home access track were both substantially higher than that of the bridge so plans for the aerial ropeway were revised in order to use the tree as the far bank anchor and a Caterpillar D6 dozer for the home anchor. This produced a very flexible ropeway that could raise and lower its load by moving the D6 backwards and forwards, with sideways movement of the D6 being used to change the alignment.

The stripping of the Bailey began with the assistance of an excavator which obligingly dug out the two ramps buried under 150-200 millimetres of compacted murram. (Murram is the local road construction material consisting of weathered basalt). In doing this two holes were excavated on the approaches to the bridge which were conveniently long enough to accommodate two bays of the bridge. This negated the requirement for use of nose sections to raise the bridge as it was boomed back up the track. The timber bridge's four roadbearers comprising 300 millimetre diameter tree trunks, had rotted through at midspan. However, its supports at the abutments, the timber piers and the timber rakers were still standing. This allowed the Bailey bridge to be lowered onto relatively sound members in compression. Despite over ten years of continual use, all the bridge components were dismantled without any difficulties.

After the main body's arrival in January, setting out began with the establishment of two survey stations on both banks to produce a braced quad from which the bridge components were located by intersection of angles. The determination of the co-ordinates and levels of these stations were hampered by the zeal of the Kenyan plant operators who succeeded in removing the two existing stations either side of the bridge. Fortunately the remaining station on the access track to the site was undisturbed.

The construction began with concurrent activity on the two pier base slabs and the west abutment

Standard Bailey Bridge with rollers in position ready to be boomed off timber bridge

Burma Bridge with D6 connected to aerial ropeway in the background

foundations. The existing concrete pier foundations were prepared for a new reinforced concrete pier base slab. The existing concrete surface was roughened and 19 dowel pins were drilled and grouted into each slab to provide horizontal resistance against flash flood forces. Meanwhile the excavator was used to deepen the two abutments, under the direction of the surveyors, with the final digging completed by the ubiquitous combat engineers. Backfilling to actual foundation level was achieved by laying and compacting murram from a nearby borrow pit. The backfill material was finally capped with concrete as a precaution against rain damage and to provide a clean and level starting surface to the abutments. These first concrete pours were used as working trials for the use of the aerial ropeway. This established a basic requirement for eight men to haul a fully laden 200 litre concrete skip, with a further four men required to pull the skip sideways for final positioning.

After a night of 'unseasonal' torrential rain, at 0630 hours on 19 January the River Likki rose by 1.5 metres and whilst the rising water lapped at the freshly poured west pier base slab formwork, the works footbridge timbers were reduced to flotsam two kilometres downstream. As no materials were available to construct another

Kongaita Bridge 1

Far bank hauling party

footbridge at the river level, to await the next flash flood, the excess steel wire ropes and cordage from the original aerial ropeway design were used to construct a Burma bridge, with the necessary stores and manpower being hauled across the gap in the concrete skip. Naturally once this high level crossing had been completed the river level fell for the rest of the project.

Work resumed on the west abutment where the concrete base had prevented any damage to the ground beneath the abutment. However, the east abutment excavation was reduced to a quagmire of clay above the bedrock, with a spring emerging from the rock face directly beneath the proposed new works. A channel linking this spring to the river was excavated and a french drain installed to prevent any future undermining of the abutment. Additionally concrete was used to bring the bedrock up to foundation level.

The west abutment was completed after three concrete pours; foundation, wall and capping piece. The formwork was struck after between 24 to 48 hours and wet hessian and polythene used for curing for seven days. The formwork panels were then cleaned, repaired and moved to the east abutment, via the aerial ropeway, where the process was repeated.

Positioning of RSJ by aerial ropeway

Kongaita Bridge 2

them. Our various plates and angles came in useful for all sorts of unexpected jobs, particularly making joints in timber that the timber company could not cut long enough. We had thrown a couple of dozen OPH pins into the container as an afterthought, and they were invaluable as wedges, levers, carrying bars, spindles, pegs, you name it. We had also had a set of four 6m SWR strops supplied in error instead of four 6ft strops. In the event they too were invaluable for providing instant anchors around trees for Tirfors and aerial ropeways.

Apart from the staff, the workforce consisted of thirty venturers split up into five groups. At the end of each three-week phase the existing thirty would go to other projects on the expedition, and thirty more would come in. In spite of the group organisation, we were dealing primarily with thirty individuals, and so it was much harder to manage than a Troop which has a well-defined command structure. Each group had a two-day spell on camp duties in turn, leaving four groups on site at any one time.

Similarly group leaders were appointed, and changed every other day. A collective briefing for all was held at the start of each phase where we explained the background and design of the bridge, and then each evening we held a briefing for all staff and group leaders where we brought people up-to-date with the day's activities, set out the next day's task allocation, and sorted out any problems. These meetings were sometimes highly charged but we never actually had a mutiny!

We tried to let the venturers put as much in, in the way of ideas, as they could. Similarly we tried to encourage people to use any skills that they wanted to practise. The range of experience was vast: from a qualified builder and a mining surveyor through sponsored management high flyers to people who thought a hammer was a horror film. In all respects the girls performed as well as the boys, although they were usually less powerful when brute force was required. They maintained a high level of interest, and despite their general lack of previous experience, their technical ability was very good.

One of the most amazing things was the satisfaction people seemed to get from digging holes. Everything for our bridge was dug by hand, including the two anchor pits which were each 2m deep x 3m wide x 12m long. Nigh on 100 tons of earth had to be dug out of each pit, and having positioned the anchors, back filled again.

The rather loose organisation put a premium on man management skills. We had to get to know over 30 venturers quickly in each phase in order to get the best out of them. There was always the danger that they would lose interest due to the size of the project, and the long, strict hours of work, so we tried to involve them as much as possible in the day-to-day running and planning of the project, without losing control ourselves. As far as possible groups were given specific, manageable aims to achieve, and we tried to ensure that each phase built something tangible, that was 'theirs' at the end of the phase. Even so, the staff had to put in an immense effort to keep the momentum of the project going.

I have mentioned control on site before, and this was always a problem. The site itself measured 200m long x 50m wide, and the two banks were linked to each other and to the camps by telephone. There were three staff to supervise thirty people spread all over the area, and it was very hard to keep an overview of the site,

Attaching the sway bracing: Spot the 50% female element in this team!

Royal Military Academy Woolwich — The Shop

It may be that new generations of Sapper Officers trained at Sandhurst have never heard of the Royal Military Academy Woolwich, of the "Shop" as it was more popularly known. Until the outbreak of war in 1939 officers of the Corps had for some 150 years trained at the "Shop" with their brother officers from the Royal Artillery and latterly the Royal Signals. A brief history follows for which we are indebted to the Royal Artillery Institution.

Brief History — 1741 to 1939

The Royal Military Academy was established on Crown land at the Warren, Woolwich in 1741 under the terms of a Royal Warrant signed by King George II on 30 April 1741.

In the early days discipline was extremely slack as the cadets had to find their own lodgings in the town of Woolwich and their ages ranged from twelve to the early twenties. There is a record of a cadet aged thirty years. The building in 1752 at the Warren of a barracks for the cadets improved matters. The civilian staff of those early days included a Professor of Mathematics and a Professor of Fortification and Artillery. The length of course varied and seems to have depended on the number of vacancies for commissions related to the wars of the time. Passing-out examinations were held in public and were entirely oral.

During a visit to the Academy in 1805 King George III ordered that the Warren should be styled the "Royal Arsenal" in future.

On the completion of the existing buildings facing the Front Parade 128 Gentlemen Cadets moved in on 12 August 1806. While the Royal Arsenal was retained until the late 1850s as overflow accommodation to cope with increases in the number of cadets, the new buildings and revised organization contributed to an immediate further improvement in discipline and in application to studies. The next major addition was the provision in the early 1860s of the School of Arms and Gymnasium and the East and West Wings as far as the Middle Road.

From its beginning the Shop had included in its intake cadets destined for commissions in the service of the East India Company. In 1810 the East India Company set up its own military college at Addiscombe (now part of the London Borough of Croydon). The Addiscombe college closed in 1861 and the last batch of cadets was divided between the Shop and the Royal Military College, Sandhurst.

The average length of residence of a cadet at the Shop was gradually reduced from six years and ten months during 1820/25 to three years and eight and a half months during 1848/54. In 1862 the age of entry was made 16 to 19 years. By 1863 nomination to attend the Shop was ended and all cadets had to gain entry by open competition. At the same time the length of course was reduced initially to two and a half years and by 1882 to two years. As regards the number of cadets in residence in any one year detailed records exist from 1820; 147 cadets in 1820 and, with considerable fluctuations both upwards and downwards over the years, there were 283 cadets in 1900. The largest number of 343 cadets was reached in 1916. The strength in the summer of 1939 was 271 cadets.

In the field of games it is of interest to note that the first formally recognised athletic sports meeting held in England was the Shop sports meeting of 1849. Cricket was played from the earliest days of the Shop and the first Woolwich-Sandhurst match was held in 1865. Rugby football was played from 1862 and Association football from 1881. Racquets seems to have been played from at least 1806; the game ended in 1929 and was replaced by squash racquets. Gymnastics, fencing, water polo and revolver shooting were also included in the physical recreations of the cadet. During the first few years of the twentieth century hockey, rifle shooting, boxing and lawn tennis were added. There were inter-company competitions for most of these games but the main objective was to have a 'first team' which could defeat Sandhurst and also, after 1920, the Royal Air Force College, Cranwell. During the 1920s riding and golf were added to these contests.

During the South African War (1899-1902) and the First World War (1914-1918) commissioning from the Shop into the regular army continued but the length of the course was considerably reduced and the age of entry expanded on both occasions.

From 1924 onwards the length of the course was eighteen months and the age limits for entry became 18 to 19 years. Special to arm training ceased and the hours allotted to mathematics and science proportionately increased.

During the Munich crisis in September 1938 the cadets dug air raid trenches in the Shop grounds and fitted gas masks. The senior and second classes came very close to being commissioned.

As far back as the early years of the nineteenth century there had been proposals for the amalgamation of the Shop with the Royal Military College, Sandhurst. Nothing had ever come of these proposals but in 1868 a Royal Commission was appointed to consider the matter. The Commission sat for over a year and came out strongly against amalgamation. The matter was again explored in 1902, in 1923 and in 1926. On each occasion amalgamation was rejected. However, in 1933 a War Office committee found that amalgamation would result in an annual financial saving of £42,000; a large sum in those days. No action was taken until 1938 when it was accepted that amalgamation would have to go ahead and detailed plans were prepared at the War Office during the winter of 1938/39 for the amalgamation to be effected in August 1940. Rumours of these plans were given substance at the Shop by a hurriedly arranged visit of inspection by Mr Hore-Belisha, Minister for War, on 17 February 1939. On 7 March 1939 Mr Hore-Belisha announced in the House of Commons that the amalgamation would take place.

Meanwhile a mobilization scheme for the Shop had been drawn up and this entailed its closure and the dispersal of the cadets to Officer Cadet Training Units immediately on the declaration of general mobilization. This scheme came into effect on 1 September 1939 and by that evening all the cadets had left. The closing of the Shop was a great shock to all its members and not least to that loyal and hardworking element, the Shop servants who were now without a job. The Commandant issued a final order of the day to the staff on 2 September 1939. The Shop was no more.

Over the period 1919 to 1939 the Gentlemen Cadets who passed out from the Shop were commissioned as follows:

Royal Artillery	1784
Royal Engineers	803
Royal Signals	292
Royal Tank Corps	18
(Re-designated Royal Tank Regiment-1939)	

In addition the 214 GCs who were dispersed from the Shop on 1 September 1939 received commissions on completion of their courses at the relevant OCTUs in late 1939 or during 1940 depending on their choice of corps.

Reunion

Some three years ago it occurred to Lieutenant Colonel L V McNaught-Davis of the Royal Signals that 2 September 89 would be the 50th Anniversary of the closure of the Shop. He proposed that there should be a Reunion of Former Gentlemen Cadets at Woolwich to mark the occasion.

This idea was met with enthusiasm by the Gunners, Sappers and Royal Signals and a Committee was set up under the Chairmanship of the Regimental Brigadier Royal Artillery to make the arrangements for the Reunion.

The first problem was to contact all those former Gentlemen Cadets who were still alive to see if they would like to attend. It was easy enough to find the lists of those who have passed out of the Shop since well before the 1914-18 War. It proved more difficult to establish who were still alive and even more difficult to find their addresses. Notices were put in Regimental magazines and in the National Press to help publicise the event.

The response was surprising to the organisers and the Committee had to consider, because of pressure of numbers, whether wives should be excluded. Happily it was decided that the facilities could be stretched to accommodate the numbers, and wives were included.

Thus it was that on Saturday 2 September 1989, some 660 former Gentlemen Cadets and their wives descended on Woolwich, arriving by bus, train and private car. It seemed to those on reception, that many had such vivid memories of their first arrival at the Shop, that they were quite apprehensive and fully expected to be ordered to parade in full kit in twenty minutes. No such events were planned and the outline programme for the day was as follows:

1030-1130	Reception
1130-1200	Coffee — In four rooms covering the periods 1917-1928, 1929-1932, 1933-1936 and 1937-1940
1200-1230	Service of Thanksgiving
1230-1430	Pre Lunch Drinks and Lunch
1500	Dispersal

A room was also set aside with a most interesting collection of "Shop" memorabilia.

The only official guests for the day were the Master Gunner, the DRA, the Chief Royal Engineer, the EinC, the Master of Signals and the SOinC.

Two former Gentlemen Cadets Brigadier the Reverend W B Rowett and the Reverend W A Tighe took part in the Service. The address at the Service was given by General Sir Reginald Hewetson GCB CBE DSO and the New Testament Lesson was read by General Sir Charles Richardson GCB CBE DSO.

Reunions do not always "come off", but this day proved to be a great success. This success owed much to the splendid organisation at Woolwich, the brunt of which was borne by the Gunners. We are all greatly indebted to them.

St George's Church, Enham Alamein — The Alamein Church

AFTER the First World War the village of Enham was used as a major rehabilitation centre for gassed and wounded ex servicement and over the years has offered help to those who served in two world wars and other campaigns. A small private chapel was owned by Enham Village Centre and was known as St George's Chapel. Shortly after the Second World War the Egyptian Alamein Committee donated a large sum of money to Enham village as an expression of gratitude by the Egyptians for their deliverance at the turning point of the war — the Battle of El Alamein.

The Chaplain at that time — a Major the Reverend L S Pettifer — had served in the Royal Signals at El Alamein and he formed a small committee in 1973 to raise some £11,000 to extend and refurbish the existing chapel. Money came in from many sources and units that had been involved in the battle contributed handsomely. All the furniture of the church had been specially made in mahogany and each item was presented by a unit that had served at El Alamein. Also there are at least five coloured glass commemorative windows and various other items which have been presented by units. Three of the pews have the badge of the Corps of the Royal Engineers. On the wall are the usual painted wooden badges of 8 Army, Corps and Divisions and British, Australian, South African and New Zealand units as well as those of the RAF and the RAAF. Due to an unfortunate oversight, Indian Army units were not contacted and therefore there were no Indian Army badges in the chapel. The present St George's Church was dedicated on St George's Day, 1974. Every year in October there is an Alamein Service at which over 200 veterans assemble from all over the country and this is followed by a march past and refreshments.

The Indian Army was represented at the battle by 4 Indian Division and 21 Indian Infantry Brigade. The order of battle contained the following units:

1st Punjab Regiment	1st Battalion
6th Rajputana Rifles	1st-4th — & MG Battalion
7th Rajput Regiment	3rd & 4th Battalion
10th Baluch Regiment	3rd Battalion
16th Punjab Regiment	4th Battalion
2nd King Edward VII's Own Goorkha Rifles	1st Battalion
8th Gurkha Rifles	2nd Battalion
Queen Victoria's Own Madras Sappers & Miners	9 & 12 Field Companies 11 Field Park Company
King George V's Own Bengal Sappers & Miners	2 & 4 Field Companies
Royal Indian Army Service Corps	
Indian Electrical & Mechanical Engineers	
Indian Medical Services	17 — 26 — 29 Field Ambulances & 75 Light Field Ambulance

When it was discovered that Indian Army units were not represented at the church, the Indian Army Association decided that the matter should be rectified as soon as possible and regimental associations were contacted to see if they would be prepared to present their own regimental badge. All agreed and a special service was held in the church on Friday 12 May 1989 to present the twelve plaques. By this time the incumbents had changed and the new rector — the Reverend David Jardine, who is Rector of Christ Church Smannell with St George's, Enham Alamein — had many connections with India and had been at school himself at Srinagar, Kashmir.

A congregation of nearly 100 numbering 18 former officers (and their wives) of the two Sapper and Miner groups assembled to witness the presentation on a warm, sunny May day. Major Tony Williams presented the plaque on behalf of the Madras Sappers and Major Bill Gerrie MC, who was at the battle as a subaltern with 4 Company and the only survivor who could attend, presented the Bengal badge. Brigadier C H Sanderson OBE, who was CIEME 4 Indian Division at the battle, gave

The vicar with Major General J H S Majury

the reading from Ecclesiasticus chapter 44. The Indian Army Association prayer was read by Major General J H S Majury CB MBE, President of the Indian Army Association and an address was given by Major Robert Henderson (11 Sikh), Chairman of 4 Indian Division Association. After a photograph was taken of all present, a lunch was provided by the Enham Foundation in their nearby institute.

Enham Alamein is some two miles north of Andover on the A343 to Newbury and the church and museum nearby are well worth visiting by those who served or who are interested in the Western Desert campaigns of World War II.

We are grateful to the Andover Advertiser *for permission to reprint the photograph above.*

St George Church Enham Alamin
The Alamein Church.

The Romney Hut

BRIGADIER H E HOPTHROW

The author enlisted in June 1915. He served as a wireless operator on the Western Front, taking part in the Battle of Third Ypres and subsequent battles. He was commissioned into the Corps (RARO) in 1925. He joined 107 Company RE Supplementary Reserve, commanding it from 1931 to 1935. He was recalled to the colours in 1939. During World War Two he went to France with the BEF and was evacuated from Dunkirk. He then held various works appointments becoming Director of Fortifications and Works in 1943, in which appointment he had to arrange for the accommodation of a million and a half of American troops as well as a million homebased British. He retired in 1945 and now lives at Cowes.

In 1939-41 there were two predecessors to the Romney Hut, one was difficult to erect the second one proved to be a disaster.

The hut, or really the shed, that was provided for the Expeditionary Force 1939 was an impressive structure and when erected an efficient one but erection was a serious problem. The difficulty was due to the necessity of connecting five members of each roof truss at centre span at the full height, or so I have been told. The five members were pierced by identical holes and a single bolt had to be threaded through them. Unless the main columns were very carefully set out the problem would be enhanced. Add to that, the need to have a steel-erector at roof truss height in mid-span as well as support for the five members which would require at least one long Jib derrick crane.

The next was the Iris hut. This started as a temporary erection at the Inspectorate of Royal Engineers Stores at Chiselhurst ("Iris" was the acronym and their telegraphic address). It was constructed of tubular scaffolding and was intended and in fact used as a temporary measure for a few months in the summer to cover some materials that were waiting for incorporation or for inspection. By the end of the summer it had been dismantled.

It had attracted the attention of some sapper visitors to Chiselhurst, and copied in various commands. I am informed that the design was not disseminated by the War Office.

Towards the end of 1941 there were heavy snow-falls in the north of Britain but the Iris shed had not been designed for any snow load; the results were disastrous. We had messages at GHQ Home Forces from most of the Northern Commands reporting that their Iris sheds had collapsed.

At this time Major General A J B Buchanan was Director Fortification & Works, I was Deputy Director (Works). The head of the design branch in the Directorate was Lieut Colonel E F Brawn, a very ingenious designer. At a joint meeting to discuss the matter, difficulties became apparent particularly those of supply of materials; rolled steel was in enormous demand throughout the country and we were warned that we would be unlikely to get any allocation. Colonel Brawn discovered there was a surplus of Bessemer Steel at the new works at Corby and that it was convertible into steel tubes. The design then known as the Romney Shed emerged.

Why "Romney"? Why "shed"? The Directorate was housed in Romney House, Mersham Street, London SW1. In the Engineer Stores Directorate at that time, there was a senior officer, (not the Director), who might be described as a two ulcer man with a three ulcer outlook. Anything that was referred to as a hut he claimed as his right and he became very difficult if he thought the Works Directorate were infringing on it; so we decided to call it a shed.

The design of the shed or hut was extremely simple. The arch was made up steel tube shaped in sections of a semi-circle all of them flanged and drilled for bolts, the same bolt fitted all the holes in all the flanges. There was also a purlin which could be fixed to the tubes with the same bolt. So the whole arch of the vault could be constructed with only three different parts. It would then be covered with corrugated iron sheets by conventional fastenings.

We heard from the Near East that native labour could erect a Romney Shed but they could not erect a Nissen Hut because there were too many different parts. General Buchanan expressed the opinion that the design was second only in importance to the design of the Bailey Bridge.

After I succeeded General Buchanan I considered whether it was possible to cover the vault with

Photo 1. — 24ft Nissen hut

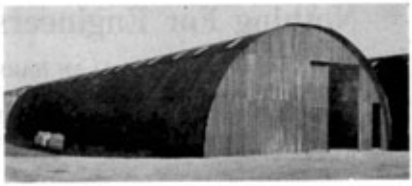


Photo 2. — Romney hut, exterior

canvas as a preliminary, during active service, before there was an opportunity to cover it with corrugated iron. Again we met difficulties in the availability of textiles, however one large cover was made and a whole shed erected on some open land in front of Wormwood Scrubs Prison.

A meeting was held on the site at which were in attendance the Engineer-in-Chief, the Director of Warlike Stores, and the Director of Ordnance Services. The question was raised about the security of the plastic windows in the "roof". There were two Sappers in the building and a very long ladder, I joined them in getting it on end and attempting to burst through some of the windows, an attempt which failed. We had obviously impressed our visitors and by the time D-Day arrived sufficient textile had been found to create a number of them during the first phase of the landing. This shed was called "Semi-Romney".

The design has been copied by many civilian contractors. I have seen a number of them in Holland in recent years. They had obviously been newly constructed usually of rolled steel sections; the shape of a Romney Shed but a long way from the original design which, in addition to its simplicity, solved a difficult problem of supply. Sheds that are not constructed of steel tubes are not Romney.

The Romney Hut.

Nothing For Engineers To Fear But Fear Itself

EMERITUS PROFESSOR SIR ALAN HARRIS CBE BSc FEng FICE FIStructE MIConsE

This article originally appeared in the New Civil Engineer, *on 30 March 1989 and is reproduced with their kind permission.*

THUS said General Sir William Jackson, most literate of Sappers: 'The matter of war is not death but the fear of death.' Civil engineering is a dangerous calling; some of its fears are all too rational — collapse and the death of many, shame, bankruptcy. Others are irrational and must be overcome before construction is possible. Let us speak of these. Few divers are lettered men; but there is one long word which they all know — 'claustrophobia'.

It starts on the diving boat. Two men help you into the diving suit — rubber and canvas 5mm thick, three holes in it, two for the hands (tight fitting) and one for the head through which you climb in. (You can't get out without them). They put on the corselet and bolt the rubber to it; the helmet is screwed on with a quarter turn and locked. In the meantime, you have been fitted with lead-soled boots; lead weights on chest and back.

You stump your way to the boatside ladder, climb over, and the front glass is screwed in. No communication now, save by diver's telephone (unreliable), or by jerking the breast rope. Dip below water, close the valve. A tap on the helmet confirms that there are no leaks. Down you go.

You will have got over the initial panic at being shut in and you get on with the job. Panic is waiting though, as soon as something goes wrong.

Your breast rope or airline gets snagged on wreckage or your boot gets wedged with something resembling a UXB glimpsed in the murk. Or you just get lost — the deep mud of harbours is easily stirred up. 'Get me out of here'. Take a grip — think what you have to do and do it.

Sewers are claustrophobic. All in local government know that the sewer gang are a race to themselves. Jolly? Perhaps, but certainly a touch of the rustic, if not the earthy. A legendary member of the gang, a man of full figure, both fore and aft, was wriggling down a 70cm diameter SW sewer at Hendon when he was caught by a thunderstorm and flash flood which backed up behind him, expanding his person. He continued wriggling, aided by an intermittent lubricating layer, and got out. Thought it a huge joke.

I was doing a new sewer alongside a collapsing brick eggshaped sewer 75cm by 1.1m at Willesden (Labour council, so it was direct labour and I was the guvnor). It was 200m long and I went down it to check the connections which discharged at random intervals. I tried to get up a 70cm by 90cm branch but did not like it a bit.

The termination of the sewer — a sheer drop into a barre — put the wind up me; the safety chain had rusted through and was dangling. Had I gone over the edge I would have ended up on the screen at the sewage works.

At Ostende, a diver working on a damaged lock gate got the worst of both worlds. He carried on too long after the turn of the tide and was swept off his feet.

On the quay they were quick to take up the slack, but not before he was washed into the sluice. No pulling him back, but he was held from the wreckage down the hole. Another diver went down, edged to the sluice, and held his hand until the tide turned. Helped save his sanity, perhaps.

I had claustrophobic nightmares for years after the war.

As for vertigo, picture the steel fixer squatting on a stanchion 12 storeys up with his eye on the girder swinging from the crane hook, right hand up ready to receive it, left hand rolling a cigarette which he sticks in his face and lights just in time. He then walks along the girder to talk to his mate at the other end.

The spectacle adds reality to lines drawn following calculations.

Again at Hendon, there was pointing to do on the top of the brick stack of the refuse destructor and it was desirable for the borough engineer to be able to say in council that it had been seen by his staff. Volunteers were called for. 'You don't have to do this, Harris' — but anything for a lark. I got there when the steeplejacks had got to the top by the two chair, three spike and hammer method and had fixed a pulley and rope; I sat on a piece of wood at the end and two men hauled away, stopping for a breather every now and again during which, for all I know, they put a foot on the rope. A wind was blowing and I swung round the stack.

Once the job was finished I went up again, this time up a ladder fixed to cleats. Acute panic in the first 5m, but after that I preferred it to the bosun's chair.

A rung or two missing here or there, and upper lengths lay over the lower ones, and there was a tricky moment when the ladder rounded the corbel — but I got up and down again. The honour of the department was safe. Fred Dipnah has taught me nothing.

I once suffered vertigo underwater. A 150m long by 25m max head sheet pile cofferdam at Brest was leaking. The man on site said 'if only I had an engineer diver.' I must have been boasting in the Paris office, because I was on the next night train to Brest where I spent an interesting and remunerative month.

In shallow water I came to the edge of an underwater rocky cliff; very dangerous. In balance at 5m depth, you are at some 1.5 atmospheres; fall 15m and you have doubled the pressure. The suit is flexible, the helmet is not and the diver is forced into his hat by a ton or two.

In Sydney, dining with the deputy commissioner of roads, my wife said 'Can one go over the Sydney Harbour bridge?' 'Yes' he said 'tomorrow?' So up we went next day over the top of the arch.

My wife, who had mountaineered in her youth, danced around happily and stood on the edge, the better to see the passing ships. I must have lost something of my bottle for I edged my way up the handrail in the centre with white knuckles.

During construction, it seems, when the whistle blew men raced down the rib to get well placed in the canteen queue.

A very distinguished engineer was inspecting the Saltash bridge; halfway up the rib he froze; six men surrounded him and inched him down.

Irrational fear. To walk on a 300mm flange 40m in the air is no more difficult than walking on a plank on the ground; crawling down a hole is no different from crawling through long grass. Is it?

Fear. François Villon, surely the patron saint of the Latin Quarter (my favourite part of Paris) had it right:

Since Popes and Kings and sons of Kings
Conceived in the wombs of Queens
Go cold and stiff to their buryings
And others take their diadems
Shall I, poor prentice lad from Rennes
Shall I not die? Yes, if God will
So I have time to sow my greens
*Honest death is welcome still.**

Sometime. Can't fit it in for the moment.

*Englished by Scott Moncrieff, the translator of Proust.

The Korup Bridge

CAPTAIN J E B LOCKYER

The author was commissioned into the Corps in 1977, and joined 36 Engineer Regiment. He transferred to the Territorial Army in 1980, and read Chemistry at Bristol University. He is presently Operations Officer with 212 Field Squadron (ADR)(V). He has taken part as Staff in two expeditions with Operation Raleigh, *in Malaysia (1987), and Cameroon (1989). He is a Chartered Accountant, and is still addicted to riding large motorcycles.*

Introduction

The Korup National Park is an area of coastal rain forest situated in the South West Province of Cameroon, adjoining the Nigerian border. One of the projects on the recent Operation *Raleigh* expedition to Cameroon was to build a bridge over the Ndian River which borders the park, to provide all-year access to the area for the local population, scientists and tourists.

Rather than concentrate on technicalities, I would like to outline some of the challenges involved, and to give a flavour of what it was like to mount such a project completely from scratch.

The Concept

During the dry season (December to March) the Ndian is easily forded, or bridged with logs dropped across the deeper sections. During the wet season however, the river swells to about 90m wide, moving at about 20 knots, and crossing it is extremely hazardous.

The solution adopted had to be simple to build and to maintain, and to maximize the use of local resources. Consequently we settled on a nominal 100m single span, suspended trackway between two 10m high timber trestle piers, which would provide adequate clearance for debris to pass underneath at high water. The piers would be constructed of local hardwood, principally Ekki which is highly resistant to insect attack and the effects of damp, and founded on reinforced concrete footings. The deck would be of 'softer' hardwood (Tali) laid directly on the SWR main cables.

The bridge was designed by myself and Mr Rory McGowan, a graduate engineer with Ove Arup, and later we were assisted on site by Sapper Ian Grant of 38 Engineer Regiment. All works were done by hand, as no plant was available.

Preparation in UK

In true military fashion we had very little time in which to come up with a design and a plan for the task. In the event, it was only 12 weeks from commencing planning to the container of tools and equipment being shipped for Cameroon. In this time Rory and I had to come up with a complete set of drawings and then a list of quantities for tools, equipment and material; the procurement people at Operation *Raleigh* then had to buy it and have it delivered for packing.

We knew very little about the site, and due to the appalling communications with Korup, there was no chance of us getting answers to our many questions. The gap had been surveyed by an Overseas Development Agency engineer, so we knew what the A/R span should have been, however, we had no information at all about the banks. As a result we ordered every conceivable tool for the job (none were available in Cameroon). We tried to keep the design as flexible as possible, and we added a generous 10% to our worst estimate of all quantities. We standardized as many of the fixings as possible, for instance by specifying various lengths of threaded bar which could be cut to length on site, and we ordered a number of drilled plates and angles in useful-looking sizes. Some were specifically needed for the

Captain J E B Lockyer
The Korup Bridge

The old and the new. The view towards the home bank from the river bed. Peak flood level is approximately 1m above the bottom of the vegetation on the bank

design, and the rest we included for insurance.

The design calculations were lifted straight out of the *Basic Bridging and Basic FE* books, and I found the inspirational value of the 1957 Bridging Book to be far superior to the modern version. I must have read it from cover to cover a couple of times, and some of the ideas in it are excellent. For instance it suggests dovetailing deck units together: not only does this make their location much more positive but it also greatly increases the lateral stiffness of the walkway.

Preparation in Cameroon

In traditional 'first in, last out' style I flew to Cameroon in November 1988 six weeks before the expedition was due to start, and Rory came out a fortnight later. The first job was to go and see all the local officials to explain what we had come to do, and why. We had sterling assistance from the Korup Park staff for the whole period of the project and this was a major help in negotiating Cameroon's all-encompassing bureaucracy.

Due to the absence of telephones or a postal service, we had to make personal calls on everyone who might be remotely interested in the project, and this, to a European, can be immensely frustrating. We had to obtain consent to build our camp, to clear the site on each bank, to cut timber and so on. In general the local people were only too happy to oblige, so long as we went through the proper channels and observed the local protocol, no matter how time-consuming. If you tried to short-cut the system however, you could be in deep (and expensive) water.

Site preparation was relatively straightforward. We dug various test pits for foundations and anchorages, and once the container with our tools and equipment arrived we could survey the site properly. At this stage we had to start the detailed design again from scratch and so finalize the timber order and check again on quantities, especially SWR. The A/R span was revised to 110m, giving a pier-top to pier-top span of 120m, and we revised the anchor positions once we had a bank profile. These adjustments had a consequential effect on our dip and tension calculations,

Use of piers and main cable as aerial ropeway to carry anchor logs to far side

and hence on our SWR quantities — had we enough?

One of the problems with this sort of task is that non-engineers have great difficulty in envisaging its scale and the practical difficulties involved, so the engineer must use all his communication skills in order to put his point over. For instance the client wanted all the timber cut locally using chain saws, to save on cost. It took a three day trial to prove that it would take far too long to cut the 22 tons of timber involved by this means, and only then were we authorized to buy it from the local timber company as originally planned. Interestingly though, the local chain saw king could achieve an excellent standard. Locally, all timber sizes from 13mm x 200mm to 300mm x 300mm, up to 12m in length, are cut using hand-held chain saws, and the results are more than adequate for general building purposes.

Access to site was another concern. The road to the local town of Mundemba becomes a quagmire in the rainy season, and did not dry out enough to transport the timber in from the sawmill until early January, when the project had already started. In the event, after careful recce of routes to site and the culverts involved, we managed to drive the whole timber delivery actually on to site and this was a considerable relief to us.

Perversely the main constraint on siting the bridge camp in an area where the annual rainfall is over thirty feet a year was the provision of water, as well as access for resupply, adequate space, and a short walk to the site itself. The two streams near the camp dried up, and the water in the Ndian became increasingly like soup as the dry season advanced. Eventually we obtained our water from the municipal supply in Mundemba five miles away. We could have done with a lightweight purification set, but God knows where we would have obtained the chlorine.

Works on site

We adopted a field engineering approach to the building of the bridge. On Day One we had x amount of kit, which we had previously calculated in UK would be enough, and from it we had to build the real bridge to the final design. It was rather like being given a No6 Meccano set and trying to build a No7 model with it, and so our ingenuity and flexibility were taxed to the limit.

We used the bridge to build itself as much as possible. We built six different aerial ropeways using handrail or bracing cable stretched between trees to get the necessary stores across the gap, and when it came to moving the two 2-ton anchor logs across, we used the main cables slung between the two completed piers. Each pier was built in two halves and half winched upright as with a shears. For the first half the winch rope was passed over a suitable tree (which would deflect alarmingly) and for the second half the rope was passed over the now upright first half which acted as a derrick. Once both were properly in position they could be braced together fore and aft, and the pier completed.

The deck was located by prefabricating 2m units, each weighing about 100kg, and then using a handrail slung centrally between the two piers as a combined crane and aerial ropeway to lift them into position, working from the far side to the home bank.

We had various power tools on site, run from lightweight generators. We also used up to six 3.2 ton Tirfor winches at any one time: for this sort of project you can never have too many of

them. Our various plates and angles came in useful for all sorts of unexpected jobs, particularly making joints in timber that the timber company could not cut long enough. We had thrown a couple of dozen OPH pins into the container as an afterthought, and they were invaluable as wedges, levers, carrying bars, spindles, pegs, you name it. We had also had a set of four 6m SWR strops supplied in error instead of four 6ft strops. In the event they too were invaluable for providing instant anchors around trees for Tirfors and aerial ropeways.

Apart from the staff, the workforce consisted of thirty venturers split up into five groups. At the end of each three-week phase the existing thirty would go to other projects on the expedition, and thirty more would come in. In spite of the group organisation, we were dealing primarily with thirty individuals, and so it was much harder to manage than a Troop which has a well-defined command structure. Each group had a two-day spell on camp duties in turn, leaving four groups on site at any one time.

Similarly group leaders were appointed, and changed every other day. A collective briefing for all was held at the start of each phase where we explained the background and design of the bridge, and then each evening we held a briefing for all staff and group leaders where we brought people up-to-date with the day's activities, set out the next day's task allocation, and sorted out any problems. These meetings were sometimes highly charged but we never actually had a mutiny!

We tried to let the venturers put as much in, in the way of ideas, as they could. Similarly we tried to encourage people to use any skills that they wanted to practise. The range of experience was vast: from a qualified builder and a mining surveyor through sponsored management high flyers to people who thought a hammer was a horror film. In all respects the girls performed as well as the boys, although they were usually less powerful when brute force was required. They maintained a high level of interest, and despite their general lack of previous experience, their technical ability was very good.

One of the most amazing things was the satisfaction people seemed to get from digging holes. Everything for our bridge was dug by hand, including the two anchor pits which were each 2m deep x 3m wide x 12m long. Nigh on 100 tons of earth had to be dug out of each pit, and having positioned the anchors, back filled again.

The rather loose organisation put a premium on man management skills. We had to get to know over 30 venturers quickly in each phase in order to get the best out of them. There was always the danger that they would lose interest due to the size of the project, and the long, strict hours of work, so we tried to involve them as much as possible in the day-to-day running and planning of the project, without losing control ourselves. As far as possible groups were given specific, manageable aims to achieve, and we tried to ensure that each phase built something tangible, that was 'theirs' at the end of the phase. Even so, the staff had to put in an immense effort to keep the momentum of the project going.

I have mentioned control on site before, and this was always a problem. The site itself measured 200m long x 50m wide, and the two banks were linked to each other and to the camps by telephone. There were three staff to supervise thirty people spread all over the area, and it was very hard to keep an overview of the site,

Attaching the sway bracing: Spot the 50% female element in this team!

The completed bridge, looking towards the near bank

and not to get bogged down in detail when sorting out a particular group's problem.

The telephones were not particularly reliable, and often we had to resort to the MK1 larynx to communicate around site.

Planning was a nightmare, simply because once the job started there was hardly any time to do any. We worked on site from Monday to Saturday, then on Sunday Rory and I would spend the day working out details and taskings for the coming week. During each phase we let the first week slide to a certain extent, and on the first Sunday off I would sit down and work out the bar chart for the following two weeks, now that I knew how fast this particular group could work. I had drafted a bar chart in UK to check that the project was feasible in the time allowed, but once work started the draft went out of the window, as we altered the building sequence to overcome the various problems that arose. The bar charts that we drew on site were pretty accurate, though, and an invaluable aid to clear thinking when things started going wrong.

Another aspect of control that crept up on us all unawares was that of stores control and lead times. Virtually all our equipment and spares had to be supplied from UK, via the once-weekly flight to Douala from Gatwick. Consequently the lead time for resupply was two or three weeks, however often we did not know what we were running short of so far in advance. Resupply of augers and drills was our biggest headache, followed by the provision of extra main cable — our calculations in UK eventually turned out to be 4m short. The best turnaround we had was an urgent request for additional Tirfor winches. A venturer on another project heard us asking for them on the radio and gave HQ his father's telephone number in Glasgow where he runs a Tirfor agency. HQ rang the father who talked British Airways into flying three winches down to Heathrow for free. They were picked up by Operation *Raleigh* staff and put on that day's flight to Cameroon, and we had them on site six days after asking for them.

All the same, our lifting and pulling capability on site was seriously affected for that six days, so I guess that the moral is to make sure you

have a 30-50% reserve on site of all your vital tools. Similarly with consumables: by the time we had worked out what sizes of drills and augers we were using most, had found out how many we had and how long each was lasting, then they were about to run out anyway.

NB: You can resharpen augers, but the grub screws vibrate free from the extension pieces and get lost. Drills simply break. We had to drill for every nail in the wood we were using, and there were nearly 4000 nails in the deck alone.

Finally a note on health and safety. Protective clothing was worn on site as appropriate, and in spite of the inexperience of the workforce, moving some very heavy loads around site and working a lot above ground, there were no injuries.

We did our best to run a pleasant camp, with good food and sleeping accommodation, proper medical backup, and good hygiene. Even so, when a lot of people are living pretty well on top of each other, there are bound to be problems.

The main 'official' diseases were malaria and river blindness. The incidence of malaria was low although people started going down with it towards the end of the expedition, familiarity breeding contempt perhaps. River blindness takes a long time to develop, so had no effect on our performance in the timescale of the project. 'Unofficial' diseases included a particularly nasty gastroenteritis, caused probably by the water, blood poisoning caused by scratching insect bites, and simply feeling *crook* — origin unknown.

After the first ten days on site we were running about 8-10% laid up and unable to work, which peaked at 40% for a week or so during the second phase. The expedition did not continue long enough to assess the long-term illness rate. Very few people got away without some sort of bad guts, however, I do not think that many people had a recurrence once they had got over their initial bout.

Summary

In many ways this was a classic Sapper task. It was a long way from home, and required both a determined, professional approach and the traditional Royal Engineer's qualities of inventiveness and ability to improvise.

The bridge has always been the pièce de résistance of the civil engineer. It was particularly satisfying to carry this one through successfully all the way from outline concept to completed project.

How the Humber Was Closed

MAJOR-GENERAL SIR GEORGE K SCOTT MONCRIEFF KCB, KCMG, CIE

Reproduced from Blackwoods Magazine, *August 1923. The principal contractors concerned were Messrs C J Wills and Sons of 28 Victoria Street, and we are indebted to Mr Arthur Wills' ("Mr Arthur" in the article) family for this information.*

THE estuary of the Humber, lying almost midway between the Thames and the Firth of Forth, a distance of 400 miles or thereabouts, has, from its central position, obvious advantages for a fleet operating in the North Sea. It is also the only estuary along the whole of that length of coast where a fleet of small-sized vessels can find anchorage. For although Harwich, where the rivers Orwell and Stour unite, has some commercial importance, and was, during the war, a base for small craft and submarines, yet the size of the harbour there is very restricted and the approach navigation difficult. The only other estuary, the Wash, is exposed, and lacks in all essentials for a base of operations, besides being a mass of shoals and sandbanks. So the Humber has a special significance, as being in itself a suitable place of refuge, and affording a valuable connecting link between the two great naval fortresses of the Nore and the Forth.

The estuary itself has none of the natural advantages of either of these places. For the Nore is guarded by channels of intricate navigation, and the Forth has islands placed in extremely convenient positions. But the Humber has at its mouth what neither of the others has — a long curving peninsula, within the sheltering arm of which lies a shallow bay with certain definite useful features.

Probably about a thousand years ago the Humber was a naval position, for the invading danes had every reason to make use of it; but for many centuries its activities have been wholly commercial, as highway to two great and busy seaports — Hull on the Yorkshire coast, and Grimsby on the Lincoln side — and a navigable waterway inland for nearly forty miles.

It is true that in the latter part of the last century Hull had a small fort, called Paull-on-Humber, to guard it against possible hostile naval attack, and submarine mines in the adjacent river secured its safety still further. Also some two years before the War, it was decided to construct two forts, one on either bank of the estuary, with a view to keeping hostile marauders at a distance from the oil tanks at Immingham. These works were practically finished by 1914.

The whole country on either bank of the Humber is flat, and in need of embankments, drains, and sluices to prevent the encroachment of the sea. At the extreme south-east corner of Yorkshire lies a little mound, once evidently an island, both from its name, Kilnsea, and from the low marsh that girdles it on the land side. On this, so late as the days of King George IV, there was a little village and church. All are now gone, and the sea cuts directly across the low line of red clay cliffs. From Kilnsea there stretches the Spurn Peninsula, a spit of sand and gravel nearly 4 miles long, with an average width of about 100 yards. From this sandy breakwater, within whose protective arm lies a wide sheltered bay, it is reckoned that six million tons of gravel are annually removed by the tidal currents working south. Its importance to the navigation and security of the Humber is obvious, and the department of the Board of Trade which is concerned with the protection of our coasts from erosion, naturally devotes much care to its preservation. Consequently protective groynes at regular intervals project from its whole eastern course. This remarkable peninsula resembles on the map a snake, issuing from the mainland at Kilnsea, and this appearance is increased by the configuration of its termination, which is like a serpent's head, flattened, elliptical, and regular.

At the outbreak of the War, this enlarged end of the peninsula was inhabited by a small colony of lighthouse keepers and lifeboat crews. The tall lighthouse, which is so conspicuous a feature to passing navigators, is not quite at the end of the peninsula, however, probably owing to better foundations being obtained on its present site.

In early June of 1914 there assembled at Hull a group of naval and military officers belonging to the Home Ports Defence Committee. There were two admirals, representing the Naval Intelligence and Naval Ordnance branches, and three generals,

representing the General Staff, the Artillery and the Engineers. Their principal object was to visit the new works for the defence of the naval oil stores, to consider whether they were sufficient as regards armament, position, &c., and incidentally to have a look at the entrance to the estuary and consider possibilities there. The visit to the two new forts did not take long. A few alterations and additions were proposed, and pronounced to be quite within practical limits. Then followed a longer voyage over the opening estuary, past Grimsby with its monumental accumulator tower and its busy shipping, to the quiet waters of the bay behind the Spurn lighthouse. The water at high tide, clear and sparkling, was far too shallow to enable their dinghy to reach the shore, and both admirals at once removed boots and stockings, rolled up their trousers, and carried the generals on their backs, with many jests about the privilege of the Navy to convey the Army overseas.

Then charts were produced and the possibility of defending the mouth of the estuary discussed. The serpent's head was an ideal place for a coast battery of heavy guns. Round the seaward edge, both to east and west, was a bank of high ground, covered with rough grass, dwarf shrubs, and many wild flowers, and enclosing a flat grassy vale, eminently suited for the dwelling places and recreation ground of the garrison. The position gave a very extensive arc of fire for artillery, and the lighthouse buildings afforded excellent observation posts. The Lincolnshire coast, however, was far away, and deep-water channels of approach were beyond range, except when visibility was good. The admirals were not content with this, and asked whether it would be possible to locate on certain sandbanks island forts like those at Spithead. One of these banks, called Bull Sand, was about a mile off. It had 11 or 12 feet of water at the lowest tide, and the tides there run at 3 knots. It was exposed to the full "fetch" of the North Sea. Was a fort there possible?! Another shelving shoal ran out for some distance from the Lincolnshire shore along a spit called Haile Sand, dry at certain tides. Surely this was possible, and if both could be furnished with island forts, the entrance to the Humber would be effectually closed.

The Artillery general thought there might be difficulty in providing the guns, but this was not considered insuperable. The engineer remembered that, many years before, he had played a small part in building a big bridge over the Ganges at Benares, where the current of the river was swifter than any North Sea, tide, and the sand of its bed of unknown depth. He thought island forts were possible. The Staff general did not like it much, but the admirals were urgent in their recommendations. So they generally agreed to the scheme to be presented to the Government, and they took their departure. On the way home they stopped at the old fort at Paull. Here the two people most concerned, the Staff general and the engineer, found they had forgotten their passes to enter fortified works, and, much to the amusement of the other members of the party, were refused admittance by the sentry on duty. It did not matter: they were old comrades, and had served on the staff together, with many interests in common. They had much to discuss, and the time passed quickly while the others rambled about the works and found little of importance to consider. The place was really no longer required, and could well be abandoned. The party then returned to London, and made out their report, which they felt would be, like many other similar reports, consigned to oblivion in some official pigeon-hole.

Five months later the admirals were both afloat, one in command of a battle cruiser squadron of the Grand Fleet, the other in an important but a less distinguished command. The Staff general was with the Army in France, where he rose from step to step to the rank of Field-Marshall and a European reputation. The Artillery general was grappling with the stupendous task of providing more and more guns and ammunition and weapons for the new army. The engineer was in sore anxiety about defensive positions in the French Channel ports, about getting engineer plant and stores to his comrades fighting at Ypres, and with the increasingly difficult task of housing the new armies.

Late one evening in the month of November the Engineer general was summoned to the room of the Chief of the Imperial General Staff, Sir James Wolfe Murray, who had recently taken over that important task. With him was the First Sea Lord, Admiral of the Fleet Sir Henry Jackson. Both these distinguished officers have now passed away. The former was seated at a table with a shaded lamp and papers before him, the latter was pacing up and down. After the usual salutations, the Engineer general was asked whether he adhered to his opinion, expressed in the report

on the Humber, that it was possible to build batteries on Bull Sand and Haile Sand, as upon this depended certain momentous decisions.

When one has to give an answer to an important question fraught with far-reaching consequences, small external matters often make an indelible but indefinable impression. The engineer looked out of the window on Whitehall, where the lamps — not yet darkened by authority — were reflected on a wet stormy street, and the lashing rain seemed to warn against any rash assumption of success. As he paused, the First Sea Lord spoke of booms and nets near Grimsby, and of a good contractor who was doing this work. He said it was of the utmost importance to have a line of forts across the mouth of the channel, and his tone was one of great emphasis.

The engineer turned to the Chief of the Staff and said, "It *is possible,* sir, but the work will be costly and difficult."

"Go and do it then."

Half an hour later, armed with a chart and rough sketch of the proposed work, the Engineer general was in a taxi-cab hurrying off to the office of the contractor mentioned by the First Sea Lord, the address having been communicated to him from the Admiralty. The firm of contractors was not one he had had any dealings with previously, but the report from the Admiralty was most reassuring in its praise.

It was then pretty late, and the messenger who answered the general's bell said that the head of the firm had gone, but that his son, "Mr Arthur", was in the office. To "Mr Arthur" therefore, he sent his card, and found himself in the presence of a man in the early prime of life, with a strong resolute face and determined chin, evidently a man of experience, and certainly of courtesy. This was the beginning of a varied and pleasant comradeship in important work.

He summoned his chief engineering assistant, and the three gathered round the chart and the proposed plan. The general explained that he had heard that they were doing work for the Navy already in the Humber, and that he wished, and the Admiralty concurred, that the fortification work also should be undertaken by them, but that whether they undertook it or not, the urgency of the work was such that it must be put in hand without delay by someone. That the work consisted of batteries and barracks on the Spurn Peninsula — a difficult enough task in itself, but mere child's play compared to the two island forts, especially that on Bull Sand, owing to the depth of water, the velocity and rise of the tides, and the great exposure. The fort there would be a huge drum of steel and concrete, about 80 feet in diameter and 40 to 50 feet above high water. It would have the guns and observing posts at the top, the defence electric lights, officers' quarters, and offices on the floor below; the men's quarters for a garrison of 200, with magazines, shell stores, &c., below this; and on the lowest floor, the electric generating plant, water-tanks, and other storage. That the other fort at Haile would be similar, but both the armament and the garrison would be smaller, and therefore the diameter of the work would be on a correspondingly reduced scale.

"And how," asked the contractors, "do you propose to found such a work on a submerged sandbank."

"By means of a double elliptical steel caisson, with barges on either side, anchored fore and aft, with mechanical diggers excavating within the caisson, and concrete filling it. Possibly two or more circular caissons might be used instead of one large one, and the whole bunch connected by a reinforced concrete cap."

The contractors conferred for a short time, and then said that this method appeared to them exceedingly risky in such an exposed position. For even if the barges could be adequately secured and connected together, it would be almost impossible to ensure that the caissons would be sunk truly vertical. They strongly recommended steel interlocking piles. They thought the work, though full of difficulty, was practicable; but they said they could at the moment do no more than report the whole case to the head of the firm, whose great experience in these matters would be of the utmost value, and who in any case would have to be the deciding party as to whether they could undertake the work or not.

Within the next few days the head of the firm came to the War Office with his son. The father was an old man of wide experience and knowledge, gained in a long life spent on carrying out different works in many parts of the world though latterly he had specialized on harbour and dock work. A strong resolute face confirmed the reputation he had, and which the War Office found well deserved, for straight dealing, integrity, and energy. He was in no sense a sleeping partner in the firm, and although in the course of the following years he seldom appeared, his was the

hand that guided the helm: nothing was done without his advice by other members of his firm, and daily reports went to him of progress, difficulties, materials, and wages questions, &c. A valuable ally indeed.

He laid great emphasis on the danger of scour from the very first interference with the sandbanks, especially Bull, where the tidal current was so strong. He considered that success would largely depend on continually depositing chalk round the spot and inside any excavation, such chalk being temporary until it could be replaced by concrete blocks, or concrete laid *in situ*. Another important point was that the works should be so designed that the effect of a storm should not be too disastrous, and for this reason he thought a caisson too risky, too much of a staking all on one big venture — rapid, perhaps, but in the circumstances not prudent.

After much conference, it was decided that the foundation should take the form of two concentric octagons of interlocking steel piles, the least diameter of the outer octagon being slightly larger than the huge drum of the fort, and the inner one about half that size. That each of the eight corners of the octagons should be connected by additional lines of interlocking piles, thus making eight quadrilateral spaces, which when complete would be filled with concrete. The hole would be covered with a reinforced concrete cap, and on this the fort would be built. The piles would go down into the sand for a depth beyond any possibility of scour, and thus the fort would be founded on an immense inverted bowl or bucket made of steel and concrete, and enclosing within its circumference a great cylinder of sand. For sand, contrary to the popular opinion, is an excellent foundation, if it can be kept from shifting. The scour that would shift it was the main danger, and that could be guarded against, first by masses of chalk, and eventually by concrete blocks. It was decided also that the War Office should arrange for all steel and manufactured articles, and should help in labour questions.

The technical and financial arrangements for the work naturally took some little time, but considering the magnitude of the issues involved and the large cost anticipated (though no estimate could be made in the circumstances, still it was known that each of the similar Spithead forts cost half a million in the Palmerston era), the arrangements were quickly made.

"Mr Arthur" (See *Photo 1*) was to proceed at once to Grimsby as resident agent, and the resident engineer selected to represent the War Office was one who had served, many years before, with the Engineer general on difficult railway work on the North-West Frontier of India. He had therefore had to grapple with forces of nature as tremendous as, though different from, those he would now have to encounter, and he was known to be a man of cool courage, resource, and self-reliance. After leaving India he had been a professor at the Royal Indian Engineering College at Cooper's Hill, of which he was a Fellow and a distinguished *alumnus*. The War found him without special technical occupation and above military age, though still strong and vigorous. Fortunate, indeed, were the military authorities in being able to secure his services.

There was much preliminary work for him to do. Large-scale contoured plans of the Spurn Head on which to arrange the big land works, and contoured plans of the sandbanks to guide the selection of the best position for the island forts, had to be put in hand at once. Borings of the sandbanks had to be made, and long wooden boxes, thin and narrow, but very heavy for their length, turned up shortly at the War Office, giving samples of the soil at various depths.

Photo 1. Mr Arthur Wills

Haile sand showed comparatively little sand above clay and chalk, but Bull has nothing but fine sand for 120 feet, and does not reach solid chalk for a long distance. There was no compromise about the difficulties, and the old contractor admitted subsequently that it was the most difficult job he had every tackled. Where there are stout hearts and clear brains, however, the chances of success are good, and in this case were not disappointed.

Meantime events were developing rapidly in the North Sea. In the middle of December occurred the raid on Scarborough, Whitby, and Hartlepool, one of the most startling evidences to the world that no dictates of humanity, no agreements made at a Hague Conference, no considerations of the futility of using naval power except against the naval strength of the enemy, were to prevent the Germans from deeds of callous barbarity. How they escaped just retribution by our naval forces, owing to the density of the mist, is well known, and has been recently related. The admiral too commanding the patrol at the Humber started from his headquarters with any force he could gather, but only saw the enemy disappear into a bank of fog — "like rabbits bolting into holes in a bank," he said.

There was one small crumb of comfort. Hartlepool battery, the only coast defence work that was engaged on our side during the war, did admirably. Curiously enough, a year or two before, the officer commanding the North-East Coast defences had been thinking out what afterwards was known as *camourflage*, and it occurred to him that he might try experiments on the subject at Hartlepool, which of all his batteries he thought the least likely to be seriously engaged, and therefore if the experiment was useless no great harm would be done. The result was that although the big bullying German battle-cruiser came within 2000 yards and fired away at the battery with heavy projectiles, she did hardly any damage to the works, and little injury to the garrison; whereas they inflicted, even with their comparatively light armament, most serious damage on the enemy, whose massive bulk they could hardly miss at so short a range. Evidence from German sources since the war has revealed that on board the battle-cruiser the attacker's losses were very severe — a ghastly record altogether out of proportion to the military damage which they inflicted, which indeed was negligible.

Then in January 1915 came the battle of the Dogger Bank, which indeed was not based upon the Humber, nor directly affected the situation there. But the general liveliness in the North Sea did have its effect. It made the construction of temporary batteries for quick-firers and defence lights at Spurn Head a necessity, and the erection of huts among the sand-hills for the armament crews had to be undertaken simultaneously. So it was not long after the contract agreements for works there had been signed that works began to take actual shape.

The weather which had so sheltered the fleeing Germans at the Scarborough raid seemed to be entirely on their side too in connection with the starting of the works at Bull. The first step to be taken was to sink wooden piles round the proposed site in order to build up a temporary platform for cranes, concrete-mixers, &c., and to provide dining and sleeping huts for the workmen. Now it requires no technical knowledge to realize that to drive even one pile from a floating platform one must have moderately calm water. In stormy water the timber pile is dashed hither and thither, the blows directed on it miscarry, and control is impossible. For months in the early part of 1915 there was never one moderately calm day on which any start could be made. For the greater part of April, the whole of May, and part of June an east wind was blowing, and heavy rollers were sweeping over Bull Sand. Everything was ready; nothing could be done.

At last a few piles were driven in successfully, braced together, and a platform built. Then a little sleeping hut was put together on the platform. It had barely been completed when "Mr Arthur" and his chief foreman, going to inspect and supervise, were cut off by a sudden gale, which entirely prevented them from re-embarking on board the boat that had brought them, and which was in danger of being dashed to pieces against the now straining piles. There they had to stay all night, wave after wave causing their resting place to quiver and groan. Several times a bigger wave than usual made them think the end had come. But the piles held, and the storm abated next morning, and they returned in safety.

After December 1914 the enemy did not again attempt to raid our shores with surface craft. Whether he realized that he had only escaped by the merest accident of weather, or whether the rough reception he got at Hartlepool was the cause of this abstention, we cannot say; but in 1915 we had no reason to suppose that he would not come again. And it then appeared, to those

concerned with policy, that a very vulnerable spot was left at Kilnsea. Without some work there, a hostile ship might easily keep out of reach of the guns at Spurn Head, and bombard the craft sheltering behind the sheltering arm of the Spurn Peninsula. Or even a landing party might get ashore and do some damage to life or property in that corner of Yorkshire.

So it was decided to build a powerful battery at Kilnsea, the site for which, selected in the summer of 1915, was behind — ie to the west of — the mound alluded to above, where the sea has already encroached to a great extent on the east.

A railway of the usual gauge was built to connect this new site with Spurn Head, which now became the centre of defence works, and was also the most convenient base of operations and supply. A long and commodious pier had been built there, so it was no longer necessary for admirals, or any one else, to wade ashore.

It has been stated above that the sea has encroached on the little hill of Kilnsea, leaving a line of red clay cliffs. It was thought that as these cliffs might afford shelter for a landing-party in a west wind, and in any case the foreshore was invisible from the fort, it would be well, first, to protect the base of the cliffs from being undermined further, by building a low retaining wall, and second, to erect a small blockhouse or "caponier" projecting from the retaining wall, to be held by a small garrison on the lookout for landing-parties, and connected by a subterranean passage with the centre of the fort. This wall and blockhouse were accordingly built, and then the sea, after one storm of special violence, scoured out the foreshore so severely as to endanger the stability of the hole. As a remedy, wooden groynes were run out at right angles, and after the next storm the accumulation of shingle was so great that not only were the groynes buried, but the piles of shingle round the blockhouse were so great as to render it almost useless.

Such are the little vagaries of coast erosion. On the landward side, during 1916 and 1917, Kilnsea gradually developed into a trim little military post. There was the diamond-shaped form, with its huge guns in their concrete emplacements, with magazine, shell-stores, and the usual accompaniments. There was the guarding parapet and ditch, the flanking posts, and the high observation towers (which nothing could disguise). There was the small parade ground, and the infantry barracks with officers' quarters and mess, neat little cottages round three sides of a trim grass plot, looking out on the waters of the sheltered bay. And there was a hospital, with fairly up-to-date equipment, ready for emergencies, though never in use except for minor ailments. It was an ideal place for a summer camp for boy scouts or similar organization, and not a bad place for studying natural history, for it has long been the haunt of many kinds of birds from land and sea.

Spurn Head, too, in the same period, had changed in a similar way. The mounds which fringed the sea on the eastern side had given shelter to a battery of large guns, and cunningly concealed along the shore were lines of infantry trenches, covered with reinforced concrete, and bristling with wire entanglements. The southern edge had its quota of smaller quick-firing guns and searchlights. The western mound had been changed into groups of flat-roofed quarters, built of concrete blocks from the shingle and sand which is there, very substantial and comfortable; and in the hollow flats between them and the batteries, was a grass plot big enough for football, where the soldiers constantly were playing that cheerful game. A little beyond this terminal fort was another enclosure for the infantry garrison, with a tower, which from the sea resembled one of the lighthouse buildings, and was the port war-signal station and observation post. At intervals along the peninsula were anti-aircraft batteries and searchlights, some conspicuous and dummy, some concealed and real. For the enemy had raided that part of England with aircraft on several occasions, and had done much damage to innocent people. That, however, is another story.

All these works along the Spurn Peninsula and at both ends of it were complete long before the island forts of Bull (*Photo 2*) and Haile were finished. Progress on these, though delayed in starting, went on steadily in 1916 and 1917. Round the outer perimeter of each was a substantial group of timber piles supporting a broad platform above. On this ran a small circular railway, on which moved a portable crane, which fished out from barges the materials required for the work, or the chalk to be deposited in the quadrilateral compartments of the steel piling. In the centre of the works was another group of piling, connected with the outer group by strong crossbeams, and on these passed to and fro a powerful steam pile-driver, which lifted up and then drove home

home the massive steel interlocking piles.

On the outer platform was a sleeping hut for the workmen, not very luxurious and perhaps not quite of the regulation cubic space allowed for such buildings ordinarily, but quite suited to its purpose, and accepted without complaint. There were offices for the supervising staff, and stores for material and tools.

Access to this scene of activity was, in rough weather, not very easy. There were vertical iron ladders here and there, and the usual way to get to them was to stand on the paddle-box of the little supply steamer as it tossed alongside and catch hold of the ladder at a favourable moment. This involved at times the possibility of hanging by the arms over the deep end, while the feet sought a slippery hold below. The alternative — sometimes used for visitors — was to get into the lowered bucket of the crane, and be swung above like a bag of cement or a box of rivets. To guard against accidents a boat was always on duty, and it is pleasant to record that in the whole course of the work no lives were lost.

Yet at times the sea showed its terrific power. On one occasion one of the quadrilateral compartments had been made ready for its concrete, the chalk having been grabbed out and the cement concrete ready for deposition, when a tremendous storm came on. When it calmed down the huge steel piles, each of which was of girder section, and capable of carrying — had it been built into a bridge — enormous loads, were twisted and crumpled as if they had been made of pasteboard. To remedy this was no small task, and in future powerful crossbracing had to be introduced before the concrete was put down.

Then the scour had to be carefully watched. Every month contoured plans of the sea-bed were sent to the War Office, showing remarkable scooping of the sand both above and below the site. Also, very singularly, the sand was piled up not very far off, so that whereas there had been formerly a uniform depth of about 11 feet at the lowest tides all over the bank, there were now places where the water was so shallow that men could wade in it, wetting little above their ankles. Chalk was steadily dumped into the holes, and though some was no doubt carried away, yet the bulk of it spread out into a protective girdle.

Then at last all the quadrilateral compartments were finished, and the great reinforced concrete cap was put on, bound with bands of steel and radiating from the centre. Here were located the storerooms and water tanks of the work, below high-water mark, but dry, solid, and strong.

A well-bore had been driven into the sea-bed, and at about 100 fathom's depth in the chalk below struck a stream of clear pure water in ample quantity. This was great luck, for at Kilnsea, only four miles off, borings of twice that depth failed to reach water.

Once the foundation work was thus complete the super-structure of the huge drum, with its many intricate rooms and passages, would have proceeded rapidly under ordinary circumstances. But we had now reached a stage in the War when unexpected difficulties presented themselves. The need for all able-bodied men had its effect on the labour employed, all of whom could not be exempted. Steel, too, was not to be had for the asking. It was under the control of a Ministry who were, rightly, jealous of its issue. The Navy had legitimate demands on the previous metal, and the Munitions Ministry, while admitting the claims of that important department, looked askance at any branch of the War Office, claiming its share. This rationing of steel, following the other vagaries of the Munitions Ministry in the matter of labour, retarded the work grievously. For the whole of the forts were planned on a skeleton of steel — a great spinal column in the centre of vertical stanchions, from which radiated on four separate floors ribs in the shape of steel girders, bound together with reinforced concrete carrying heavy guns at the top, searchlights in projecting sponsons at the sides, magazines with special protection below, and much valuable and vulnerable machinery fitted into convenient places throughout.

Yet by dint of pressure at headquarters and resolute work on the spot, the materials came and gradually were worked into their places amid the ceaseless clangour of riveters and the grind of concrete-mixers. Gradually the accommodation for the garrison emerged, with careful attention to sanitation and comfort, central heating, ample baths, ventilation, and light, specially selected and cunningly devised beds, the latest devices for cooking, and recreation. The entrance to the fort, from the octagonal base, was at the sheltered side, opening on a broad easy staircase of reinforced concrete leading to barrack rooms of curious shape but undeniable comfort: indeed, with a better standard of comfort than ordinarily obtained in barracks.

Finally, the outside of the forts, instead of

Photo 2. Bull Sand Fort

being painted, were "rendered" with the latest American invention, the "cement gun" which covered the exterior with rough cast — or "harling" as we say in Scotland — a better protection to steel than any paint, and much more permanent.

Then the timber piles were extracted by a machine specially devised, a sort of huge dentist's forceps. The sale of the timber — good greenheart — not only paid for this, but as the price of timber had risen enormously, paid for the original piling.

At Grimsby meantime immense blocks of concrete, each weighing 100 tons, were manufactured and shipped to the spot. These were quietly deposited in the sea round the forts in places especially where scour threatened.

It is calculated that the weight of concrete and steel on Bull Sand, in the fort and around it, amounts to 40,000 tons.

Each of the Spithead forts, in the years 1860-70, cost half a million sterling, in the days when labour and materials were far less than in 1915-18. But (as far as the writer's memory serves him) the cost of *both* the island works at the Humber, taken together, was less than half a million, and indeed, that sum represents approximately the total cost of the Humber defences, exclusive of guns and searchlights.

The work took a little more than three years, and it is safe to say that 10 per cent of this was due to the restrictions on labour and materials to which allusion has been made above. If it had been carried out in time of peace, with all the cumbrous machinery of normal account and contract procedure, it would certainly have taken longer, it might have cost more, and there would have been, in all probability, a legacy of disputes and legal controversy. All this was avoided by being able to place the work in the hands of a first-rate reliable contractor's firm.

That it was successfully and economically

completed is partly due to this procedure, but far more to the personality of the two men chiefly concerned — viz., the resident engineer and "Mr Arthur", the resident member of the contractor's firm. These two, very dissimilar in many ways, were wholly alike in cool determination, readiness of skilled resource, and indomitable energy. Men such as these are an incomparable asset to the nation. The public knows little about them, and they seek no vulgar applause nor share the craze for publicity. They have their reward not in rank or ribbons, but in the ineffable pleasure of achievement, the sense of conquest over difficulty, the bloodless victory against the forces of nature that appear at times invincible.

"Not for the gain of gold, the getting,
the hoarding, the having,
But for the joy of the task, but for
the duty to do."

Such is the brave breed of men who, at home and abroad, have built up the British Empire.

General Sir Arthur Cotton

We have received a report from the Andhra Pradesh State Centre, The Institution of Engineer (India) on the 187th birthday celebrations of General Sir Arthur Cotton. The text includes the following: SHRI T HANUMANTHA RAO, Chairman, The Institution of Engineers (India), A P State Centre, in his Presidential Address during the 187 birthday celebrations of General Sir Arthur Thomas Cotton held at the Institution of Engineers, A P State Centre on 15 May 1989 mentioned in detail how the poverty-ridden area of the Godavari delta, considered to be backward during the 19 Century, has turned into an extremely developed area of very high prosperity due to the vision and dynamism of the all-time great engineer General Sir Arthur Thomas Cotton. At one time Rayalaseema area, now being considered as backward within the State, was considered as a prosperous area with a much higher development when compared to the Coastal delta plains. In a period of 20 years between 1820 to 1840 the population of Godavari delta area was reduced from 7.4 lakhs to 5.6 lakhs. Assured irrigation waters, good drainage and flood control have brought immense prosperity to this area and with a sense of gratitude the heroic efforts of General Sir Arthur Thomas Cotton are remembered even today.

The Institution of Engineers (India), A P State Centre has decided to celebrate General Cotton's birthday every year in the future. Such a celebration will enthuse the younger engineers to achieve greater heights in their chosen fields of activities. General Sir Arthur Thomas Cotton had to face many odds and bottlenecks mostly from the unresponsive British bureaucracy of his time.

Mr Hanumantha Rao had stressed the need for the young engineers to develop a certain amount of fortitude so as to face odds and difficulties and come out successfully instead of getting frustrated. The experiences and example set by Sir Arthur Thomas Cotton would be an inspiring guidance for youngsters for all time to come. At the meeting, an address was delivered by Dr C Des Bouvrie, Senior Irrigation Engineer, World Bank, the text of which has been lodged in the Corps Library.

Memoirs

BRIGADIER J A NOTLEY MBE

Born 6 March 1924, died 24 March 1989 aged 65.

JOHN ANTHONY NOTLEY was the son of a Gunner who had served in both world wars. John himself was educated at Haileybury and commissioned into the Corps in 1943 from OCTU at Newark and joined 59 Field Company in Italy. APdeTD, his Company Commander at the time, writes of him: "He appeared at first to be rather young and inexperienced but he very soon dispelled this illusion by his dedication. He soon won the admiration of everyone by his sheer enthusiasm and expertise." He took part in many actions in Italy including the celebrated Amazon bridge on the Rapido and went with 59 Company to Greece for operations against the communists.

He returned to England for the formalities of training on the Supplementary course and the short course at Cambridge, a process which, with his experiences behind him and his active and practical attitude to life, he doubtless found irksome from time-to-time. Then followed a career largely in field units and sapper appointments as Second-in-Command 27 Field Squadron, GSO2 (Int) Persian Gulf, OC 12 Field Squadron, Second-in-Command of 4 Armoured Division Engineers, CO 74 Engineer Regiment, full colonel's appointments in MOD and BAOR and finally in command of Engineer Support Group as a brigadier.

The tributes from his friends and colleagues in this career tell of a thoroughly practical, forthright field Sapper with a gift for command. PRH: "... with a robust sense of humour and a generally irreverent view of authority. He exercised command with a light touch and got the best out of his Sappers."

From Gulf days GTEW remembers: "... he brought sanity to the devious, sensitive and sometimes dangerous politics of the Gulf States at that time. Later, the intelligence that he was able to provide was a major factor in the Oman operations. He was happiest when his staff work took him into the field and I have a cheerful recollection of a spirited drive with him (as the driver) across the Oman desert tracks, still at that time sprinkled with mines. We missed them."

As OC 12 Squadron, DJW recalls: "He was the epitome of the robust sapper commander at that level. He needed all these qualities when sent with half his squadron to Belize to sort out the shambles from *Hurricane Hattie*. A town blown away by 200mph winds and then covered with 6 inches of mud from tidal waves was daunting to a degree. With no plant for several weeks and nothing but air-freighted toolkits, wonders were performed under his personal supervision." FGB, one of his troop commanders, recalls how: "his leadership and the indefatigable way he persuaded, bullied and cajoled the MPBW, the inhabitants and government officials to provide what was needed" was the hallmark of the success of that operation and his time as a squadron commander. He was awarded the MBE for this operation.

EMM tells of his time in BAOR to which, in an international headquarters he brought both tact and knowledge with an engaging cheerfulness. "He was a hard worker who always got results. His epitaph could be 'He was a good Sapper' — difficult to describe, but you know one when you meet one."

John retired to Greece in 1979, the home country of his first wife Mirka whom he had married in 1947. She died in 1986. He is survived by his second wife, Ann.

DJW, EMM, CPC, FGB, MET, GTEW, PRH, STB, APdeTD

Brigadier J A Notley MBE

MAJOR K G BAILEY BEM RE(V)

Born 7 September 1935, died 20 June 1989, aged 53

MAJOR KEN BAILEY BEM died on Annual TA Camp with 111 Engineer Regiment (Volunteer), the Regiment to which he had devoted so much of his life over the past 22 years. He was taken ill while on the ranges and passed away five days later at the Royal Infirmary, Edinburgh.

Major Bailey started his long service with the Corps as a National Serviceman in October 1955, and served on Christmas Island during the nuclear test period. On completion of his National Service, he joined the Territorial Army. At the time of the TA reorganization in 1967, he transferred from 490 (Sussex) Field Squadron RE(TA) in Eastbourne to join 120 Field Squadron, 111 Engineer Regiment (V) which was a part of HQ AER (Field and Works). Transferring as a Sergeant, he then began his long association with the Regiment that was to be his virtual home and second family. He was promoted Staff Sergeant in 1969, and while at Annual Camp in September 1971 he was thrust without warning into the post of Squadron Sergeant Major of 120 Field Squadron.

In 1973 Warrant Officer Class 2 Bailey was awarded the BEM and this was presented to him by Lieut General Sir John Read at a Regimental Parade on Annual Camp at Wyke Regis. Those who were there remember that day for the foul weather on the Hard, the proceedings having to adjourn to the Training Wing and later the Warrant Officers and Sergeants' Mess. Ken developed his association with the Royal Engineers Association at this time, and in the early seventies was Secretary of the Hastings Branch. In 1973 he attended the All Arms Drill Course at Pirbright, and in 1974 was awarded the TA Efficiency Medal. It was in April 1977 that he was promoted to Warrant Officer Class 1, and assumed the appointment of Regimental Sergeant Major of 111 Engineer Regiment. He was a truly outstanding Regimental Sergeant Major with the ability to know every man in the Regiment, and to inspire by example. He devoted a tremendous amount of time to the Territorial Army as Regimental Sergeant Major, and in 1980 he was commissioned.

On commissioning, he first commanded the Central Volunteer Headquarters Royal Engineer Territorial Army training team, and then in 1985 became Quartermaster of 111 Engineer Regiment, the job he was still doing when he died. In August 1988 he was promoted to Major, and on 10 June 1989, just ten days before his death, he completed the required service to become eligible for the award of Territorial Decoration, thus becoming a member of that very select few qualifying for both the Territorial Decoration and the Efficiency Medal.

In civilian life, he started his career as a plumber, becoming a supervisor for Llewlyn Contractors before recently being appointed Apprentice Training Manager for the London Borough of Ealing. In his spare time, after the Territorial Army, Ken was a sea angler, an ornithologist and member of the Royal Society for the Protection of Birds.

Ken Bailey was a fine soldier whose devotion to duty and high standards have been an example and inspiration to so many over three decades.

Anyone who ever received a "stiff talking to" from him were well aware of the fact, for Ken did not mince his words. He loved the Royal Engineers, and 111 Engineer Regiment in particular, and this was reflected throughout his long career by his open and sincere concern for his men, the Sappers. He was a gentleman in the old fashioned sense, and valued tradition. Those who met Ken never forgot him and those who held his comradeship feel privileged indeed.

As a final tribute, 330 officers and men of 111 Engineer Regiment were drawn up at Redford

Major K G Bailey BEM RE(V)

Barracks, Edinburgh, as Major Bailey's hearse was led around the Parade Square by a piper playing a lament, and escorted by a bearer party of twelve Senior Non-Commissioned Officers slow marching. It was for all a moving and sad farewell to a Territorial who had devoted so much of his life to public service.

CJH, MFK

BRIGADIER F W L McC PARKER CBE

Born 21 August 1898, died 7 July 1989, aged 90

BRIGADIER F W L McC PARKER — known as 'Joe' or 'P' to his friends, was the perfect example of the gentleman blessed in full measure with the integrity and quiet firmness that had to be respected throughout his service days and long retirement.

The son of a Colonial Service Judge, he was born in Cyprus. His efforts to join the Navy when under age during World War I were spotted, and he was returned to Winchester — where he was a Scholar. His love of Kipling's writing drew him towards India and the Army and he was commissioned into the Royal Engineers from the Royal Military College, Woolwich in 1918. In 1919 he joined the expeditionary force supporting the White Russians when he was Mentioned in Despatches. Based on Salonika, he travelled with this force through the Dardanelles to Batum on the Black Sea and thence over the mountains around Tiflis to the Caspian Sea.

In 1920 he volunteered for India where, apart from returning to read Mechanical Sciences at Jesus College, Cambridge and to attend the Staff College, and later for service in World War II, he was to serve until Independence in 1947.

He had returned to Europe just before the outbreak of war and was on the staff of 44 (Home Counties TA) Division involved in the withdrawal from Belgium to Dunkirk when he was again Mentioned in Despatches. Here he had the task of blowing the last bridge at Courtrai and took part in 44 Division Engineers' rearguard action on the Mont de Cats holding the position successfully for 36 hours before withdrawing to Dunkirk.

In 1941 Joe Parker joined the British Military Mission in Washington returning to Europe as Chief Engineer 12 Corps with whom he remained until 1945 a period which included one of the first full Bailey crossings of the Rhine at Xanten. He was awarded the CBE in 1945 for gallant services.

His India service had stretched from the mountainous wastes of Chitral — the meeting point of three empires — to the south of India. He had a particular affection for the Madras Sappers and Miners, with whom he served in many posts, ultimately as Commandant. His firm but understanding touch is not only remembered by both British and Indian officers who served with him, but is also recognised by the officers of today's Madras Engineer Group as substantially contributing to the sound foundations of one of the most efficient elements of India's modern army.

He was a gifted polo player and enjoyed fishing the mountain rivers of India and of the British Isles.

After a final tour of duty at Headquarters Rhine Army he retired in 1950. For many years was very active in local affairs of the Blackdown Hills in Somerset. These included serving as Church-warden, the Home Guard, the British Legion and achievement of some success in local horticultural shows.

In 1933 he married Lorna Joyce Clarke, who survives him.

WJP

Brigadier FWL McC Parker CBE

LIEUTENANT COLONEL (QM) GORDON RAMSEY MBE

Born 19 December 1924, died 5 April 1989, aged 64

GORDON RAMSEY had a remarkable career of almost 50 years' service to the Army. He joined pre-war as an apprentice boy. He was a glider-borne lance corporal in the Sapper attachment to the Oxfordshire and Buckinghamshire Light Infantry which captured Pegasus Bridge in Normandy in 1944 and, years later, was a guest speaker to Staff College battlefield tours studying that event.

Subsequently he served in Palestine in 1947 and, as a section corporal in 3 Parachute Squadron, which later became 9 Independent Parachute Squadron, he was selected with a few other outstanding NCOs as a temporary acting unpaid lance sergeant. He served with the squadron in Egypt and, after a tour as Permanent Staff Instructor in 131 Parachute Engineer Regiment (TA), had three tours as Squadron Sergeant Major. He was in Cyprus with 18 Field Park Squadron then 33 Independent Field Squadron where he was granted the acting rank of Warrant Officer Class 1 as Camp Sergeant Major in a camp with two other units; and later on, in 1961, back with 9 Squadron. He was much admired as a Squadron Sergeant Major for his example and his firm and fair discipline. In 1962 he became Regimental Sergeant Major of 38 Engineer Regiment, where he was awarded the MBE, and then commissioned.

Gordon Ramsey was a great Corps character particularly well-known in airborne circles. He was one of the first to achieve lieut colonel rank both from 9 Squadron and the equally talented team of senior ranks in 33 Squadron. He retired in 1979 but was still in harness as Station Staff Officer Münster when he died quite suddenly. He is survived by his second wife and their son. *ITCW, DAB-W*

Memoirs in Brief

Brief Memoirs are published below on a number of distinguished men whose deaths have been notified recently in the national press and who served in the Royal Engineers at some stage in their careers.

COLONEL F D DURKIN TD died, while on holiday at his daughter's home in Worthing, on 25 May 1989.

He was commissioned into the Durham Light Infantry in 1939 and served during the War in North Africa and Italy. After the War he joined the TA as a Royal Artillery Officer in Horden, County Durham and, on the reorganisation of the TA he was re-badged as a Royal Engineer. He commanded 118 Engr Regt RE (TA) from 1962 until 1967 when he became Commander, 28 Engr Gp.

A R O (BILL) WILLIAMS OBE, died in May 1989 aged 84, was a celebrated mining engineer who was CRE in command of the tunnelling companies in Gibraltar during World War Two. *Corps History* (Vol VIII) asserts that the Gibraltar tunnels "may well rank with the Rhine bridges as outstanding achievements of the war". Williams returned to his old firm, Consolidated Gold Fields, after the war becoming managing director in 1974.

COLONEL GRAHAM ALEXANDER OBE died recently aged 77. He was a railway engineer and served in the 1939-45 War with the Royal Engineers; Anti-Aircraft Searchlight Unit 1939-40, construction of the Haifa-Beirut-Tripoli railway 1941; helped double the capacity of the Assam railways and ports 1942. Later took over the running of the Egyptian State railway system in the Canal zone. Chief instructor Transportation Centre RE; head of Transportation Service, BAOR; commanded unit responsible for military railway operations in Britain 1959-63; then head of Transportation Services in the Engineer-in-Chief branch at the War Office; retired 1964, OBE 1953.

Lieutenant Colonel Gordon Ramsey MBE

Correspondence

Ex Market Star

From Colonel I T C Wilson

Sir, — I was delighted to read an up-to-date account of Corps freefall parachuting and much enjoyed Lieutenant Bill Bilous' article in the August *Journal*, and congratulate him on progressing to BPA Category 10 in 22 jumps.

There are a few points to put the historical record straight. The first RE freefall display was in 1961 at the (then) Annual RE Demonstration at Gordon Barracks Darland Training Area. It was led by Sergeant Mick Turner who also represented Ireland in the World Freefall Championships that year. It was not until 1971 that Barclays Bank were persuaded to sponsor the "Eagles".

The principle of Accelerated Freefall (but perhaps not the name) has also been around for a long time. The US Army High Altitude Low Opening (HALO) courses in the 1960s made use of long delay drops right from the start to train freefallers, albeit with qualified military parachutists, and went on to give up to two minute delays. Similarly the French Army Parachute School at Pau believed that the easiest way to learn control in freefall was to allow the student as much freefall time as possible each jump even if he was not already a parachutist. I remember the CSM of the Guards Independent Parachute Company making his first freefall jump at Pau in 1966 with a delay of 30 seconds. An attempt made in the British Parachute Association Council to recognise the training value of long delays for inexperienced students met with little response, probably because of the difficulties of mounting a comprehensive programme in British weather.

I endorse the remarks about the exhilaration of skydiving as a sport and offer my best wishes to the Corps Team. — Yours faithfully I T C Wilson, *Bryony Cottage, King's Somborne, Hampshire, SO20 6PH.*

Editorial — August 1989

From Colonel C M Davies MBE

Sir, — May I express complete agreement with your sentiments on the sword in the last Journal. Let us lead the field and remove this useless accoutrement from our (RE) dress requirements forthwith. It may take a little time to convince the Footguards who, strangely, retain 17th century uniforms for ceremonial occasions yet insist upon their soldiers carrying the wholly incongruous SA 80 rifle. However the rest of the Army would surely as ever, be quick to "Follow The Sapper."

While we are at it why not go the whole hog and get rid of the Sam Browne too? This was an admirable invention of a one-armed officer to suit his needs. But that was 150 or so years ago. I dispute its value in the 21st century. Quite apart from anything else, having removed from our soldiers the need to bull anything more than four square inches of toe cap, it seems anachronistic to retain what is a significant leather-polishing chore for officers. A cloth belt, or no belt at all, would be quite satisfactory in our modern, unostentatious times. — Yours faithfully, Chris Davies, *Military Director of Studies, Weapons and Vehicles Division, The Royal Military College of Science, Shrivenham, Swindon, Wilts, SN6 8LA.*

Swords

From Major R J Wade

Sir, — Thank you for saying, on page 118 of the August *Journal*, what I have been thinking (and sometimes saying too) since about 1945. About the only thing which might have dissuaded me from remaining in the Corps in 'peace-time' was the eagerness of the pre-war 'old codgers' to re-assume their swords and spurs at the earliest opportunity.

(The other thing, which still rankles, not only with me, was their insistence that Active Service Before the Age of 21 was worthless, and must not be allowed to count as commissioned time.)

If you can make this small contribution towards giving the Corps an up-to-date image, by abolishing swords *and* spurs — I for one will admire you! — Yours very sincerely, James Wade, *9 Catherine Close, Shrivenham, Swindon, Wilts, SN6 8ER.*

Monkton Farleigh Mine

From Emeritus Professor Sir Alan Harris

Sir, — Rumour has it that this job contained probably the first prestressed concrete beams manufactured in this country.

The rumour came to my ears in 1949 when I returned from three years with Freyssinet in Paris to be Chief Engineer of the Pre-Stressed Concrete Co in London, then a subsidiary of Monchel. The story was that the beams had been designed by Dr Mantner of Monchel, were pre-tensioned and were manufactured by the Vibrated Concrete Co whose director was a Frenchman, M Semet and whose engineer, Willey, became a good friend on later jobs.

My impression is that they were between 20 and 30ft span and were used as a floor for stacking ammo.

Had I thought at the time, it would be more than rumour — but in those days I was more concerned with the future! — Alan Harris, *128 Ashley Gardens, Thirleby Road, London, SW1 1HL.*

Hindustani Words

From Major R H J Nash

Sir, — I have a small contribution to add to Nevil Miller's article on Hindustani Words (April *Journal*). As a young subaltern I was once told by my CO to get something done 'ek dum'. I hadn't a clue what he meant, but it was obvious from his tone, that what he wanted should have happened yesterday. Like the good Legionnaire, I replied 'Oui mon Capitaine' and left thinking my boss was a classical scholar; many years later I discovered I was in error.

(Editor's Note: Ek dum means at once). — Yours faithfully, Hilary Nash, *HQ 11 Engr Gp, Minley Manor, Blackwater, Camberley, Surrey, GU17 9JU.*

Hindustani Words

From Major A G Marsden (Retd)

Sir, — Having waited in vain for those better qualified than I am to add to the linguistic delights of Major Miller's article in the April 1989 Journal, may I add the following?

GROUP 1

THUG: The *thugs* were murderers who used to kill travellers in order to rob them. The practice of *thugee* was all but stamped out in the nineteenth century.

GROUP 2

KACHA: The opposite of pukka.

BABU: Clerk, usually in the derogatory sense of one who sticks strictly by the book, and will on no account use any initiative.

KOI HAI: Literally, "who is?" In the days when there were no doorbells, one went to someone's bungalow and shouted, "Koi hai?" "Is there anyone there?" Hence, somehow, it came to mean someone of importance in the local community.— Yours faithfully, A G Marsden, *21 Pledwick Lane, Sandal, Wakefield, West Yorkshire, WF2 6DN.*

Hindustani Words in the English Language

From Mrs E D Battye

Sir, — I have only just seen your April number, and I cannot resist taking up your offer of more 'linguistic delights' to further Major Nevil Miller's delightful article.

Straight to mind, of course, comes *kutcha* (rough, badly made), as the opposite of his *pukka*. My *munshi* (teacher) taught that *wallah* was a person, a man, hence *box-wallah* for a European office worker. I think the major is misinformed on *Wilayati*. We always called it *Bilayati* for British, hence Blighty, and *puttees* are from *putto*, cloth made from goat's hair.

Here are some other words used in this country which hardly need translating and are mostly to be found in the Oxford Dictionary:

dinghy	small boat
ayah	child's nurse, lady's maid
baba	baby
bargo	to bolt
chup!	shut up! be quiet
dacoit	armed robber
gup	bazaar rumour, gossip
jungli	greenhorn
nullah	ravine or dry water course
shikar	hunting, shooting
tope	grove of trees
tamasha	show, entertainment

and so forth and so on! — Yours sincerely, Mrs E D Battye, *20 Murray Court, Sunninghill, Ascot, Berks, SL5 9BP.*

Irregular Thoughts

From Major T D Clifton

Sir, — I sympathize, and support Captain Salmon's views (Aug 1989) on the problems of TA training and their resultant effects on retention.

The need to plan weekend training in some detail up to a year, or more, in advance creates difficulties: few people can raise enthusiasm for something of such relatively minor importance so far in the future, and the problems of the

current weekend's training, or the PRI audit have a much higher priority!

During my time as 'Ops/Trg' Officer with 143 Plant Sqn (V) I came to appreciate the Western District Training Team, whose value was limited only by its small size and the team's members' inability to be in more than one place at a time.

The problems of weekend training could be greatly reduced, and hence retention much improved, by the expansion and development of the District Training Teams; a detachment, with appropriate equipment and some regular staff, could be based at each of the training areas around the country, so that a TA unit would book a 'package', turn up with weapons and vehicles on a Friday evening, be trained and exercised, and go home on Sunday having gained maximum training value for minimum administrative effort. This idea is not new, for example Porton, and to some extent Wyke Regis already follow the pattern I suggest; only its much wider application, and availability to the TA at weekends would be different.

Given enthusiastic and competent Training Team Detachments on the training areas, TA unit planning for all types of training could be reduced to negotiating dates and requirements; and the training would be so much more effective. — Yours faithfully, T D Clifton, *33 Engineer Regiment, (Explosive Ordnance Disposal, Lodge Hill Camp, Chattenden, Rochester, Kent, ME3 8NZ.*

Reviews

LIDDELL HART AND THE WEIGHT OF HISTORY

JOHN J MEARSHEIMER

Published by Brassey's Defence Publishers Ltd, 24 Gray's Inn Road, London, WC1X 8HR — Price £15.95 ISBN 0-08-036701-1H

JOHN J MEARSHEIMER has carried out a considerable service to those interested in the military profession or students of military history in his excellent book. The name Liddell Hart and terms like the 'indirect approach' have been banded about at military colleges for many years with few students or members of the directing staff for that matter, having read a word of Liddell Hart's early work or understood how his work influenced or did not influence military tactics and strategy in the 1920s, 30s and beyond. Was Liddell Hart the father of *blitzkreig* and were the German generals of the *Wehrmacht* of the Second World War his pupils or not? The popular myth that exists today is that he was. Mearsheimer sets out skilfully to demonstrate that not only was this myth hopelessly inaccurate, but was generated after the war by Liddell Hart himself after his widely promulgated ideas in the 1930s concerning the superiority of the defence and the relative capabilities of the German and French Armies had been widely discredited by the German Offensive into France in 1940.

Mearsheimer charts the reader carefully through Liddell Hart's early career as an infantry officer and military writer. He shows how Liddell Hart was influenced by the military intellectual and thinker J F C Fuller in the 1920s. In this respect the latest excellent and superbly written book by Dr Brian Holden-Reid, *J F C Fuller: Military Thinker* (London: MacMillan, 1987) is first class complementary reading for Mearsheimer's work.

Although civilian strategists are common today, Liddell Hart was one of the first important civilian defence experts in the Western World. He was a fervent critic of the generals in the First World War and the British military elite thereafter. I feel that Mearsheimer goes slightly too far in defending British Military leaders of the day. If they were as capable as Mearsheimer claims, how was Liddell Hart able to get away with such outrageous criticism, able to develop such contradictory and confusing philosophies on attack and defence and obtain such a position of influence with the popular War Minister of the 1930s, Hore-Belisha, without being comprehensively counter-attacked in print from any senior officers in a position of influence of the day. Perhaps the same argument could be raised today over the importance of civilian military strategists. Are we, as officers today, so concerned with trivial detail of the moment that we are unable to think on a grand enough scale to gain the intellectual initiative on military strategy from the civilian expert? As Mearsheimer says, "A healthy national policy process depends on independent-minded defence intellectuals (military and civilian) challenging the government and one another".

Liddell Hart's work in the 1920s, when he was interacting with Fuller and developing ideas on mobile warfare, was almost wholly progressive and constructive. It was in the 1930s when he became involved in the influence and development of British foreign policy and resultant military strategy that he came badly unstuck. Almost every idea and concept that Liddell Hart published in the 1930s was proved wholly wrong. He championed the defence over the offence, he fought hard to prevent any military involvement in Continental Europe and thereby undermined all efforts to modernise and expand the British Army, he was proved wrong about the results of the Spanish Civil War and its consequences, he opposed appeasement without supporting the logical alternative of committing forces to Europe and then strongly opposed standing up to Hitler when policy changes were made.

General Montogery-Massingberd, who became CIGS just after Hitler assumed the chancellorship, no friend to either Fuller or Liddell Hart and described by Liddell Hart as, "the high priest of humbug who is only positive in stamping out originality", said in a speech just prior to the German strike in the West,"We have now got three expeditionary forces and it is largely due to him (Liddell Hart) that these forces are not as fully equipped as they should be. I should be very sorry to be in that man's place and to have that on my conscience. He accuses Earl Haig and the British generals of losing lives in the last war, but I wonder how many lives are going to be lost in this war because of the teaching of that man".

How Liddell Hart managed to turn this tarnished reputation around after the war, achieve a knighthood and make himself the "high priest" of *blitzkreig* makes fascinating reading indeed. I strongly recommend anyone who is interested in the wider aspects of the military profession to read this book. It is easy to read and not overly long. Together with Brian Holden Reid's book on Fuller, Mearsheimer's piece on Liddell Hart gives the reader an insight into military thinking (or lack of) in the 1920s and 30s and gives far greater understanding of the advantages and limitations of drawing lessons from history. Why study this period in history? Because in many ways history is repeating itself now with the development of the attack helicopter occurring at the same time as a concentration on arms control and force reduction. Let us hope we do not make the same sort of mistakes as made in the past, without sufficient knowledge and understanding it is all too easy to do.

RM

EXPLOSIVES, PROPELLANTS & PYROTECHNICS

A Bailey & S G Murray

Published by Brassey's (UK) Ltd, Headington Hill Hall, Oxford, OX3 OBW — Price £19.95 Hardback ISBN 008-0362494 £9.95 Softback ISBN 008-0362508

The fact that energetic materials are an integral part of weapon systems is taken for granted. However, few people understand the science and technology of such materials. This book explains today's explosives from simple theory to practical use and considers what the future may hold.

SALERNO REMEMBERED

Geoffrey Curtis

Available from The Queen's Royal Surrey Regiment Museum (to which cheques should be made payable) at Clandon Park, Guildford, Surrey, GU4 7RQ. Price: £9.40, incl postage and packing, proceeds of sales go to Museum

Six Territorial Army battalions of the Queen's Regiment landed at Salerno in September 1943. This is their story, but one with a difference. It is recounted by Geoffrey Curtis, who won a MC in the beachhead as a 2nd Lieut in 2/6 Queen's, and is very much a worm's eye view of events. He has put together his own recollections and woven them into the stories of others involved in what was the first major assault on the mainland of Europe.

Though primarily an infantryman's account, what makes this book particularly interesting is the way it portrays and fits together all the various facets that lead to the smooth functioning of a unit in war. Ammunition resupply, hot food, emergency rations, casualties, courage, all arms support, are all covered, as well as the tension, the fatigue and the exhileration. It is all brought to life and, as such, it ought to be read by every professional soldier, be he officer or sapper. It is also a highly readable book, though it would be even better if only the maps were improved.

GLCC

THE DOOMED EXPEDITION

The Campaign in Norway 1940

Jack Adams

Published by Leo Cooper Ltd, 191 Shaftesbury Avenue, London WC2H 8JL — Price £14.95 ISBN 0-85052-0363

This book is a carefully researched factual record of the Norwegian Campaign of April to June 1940, of which the author, serving in the South Wales Borderers, saw a good deal at first hand. The Army's operations are covered in considerable detail, and the Naval and Air sides are dealt with on a broader basis.

The plan to mine the Norwegian coast to prevent the shipment of iron ore from Sweden to Germany was almost immediately overtaken by Hitler's invasion of Norway. The Norwegians, although taken by surprise, resisted bravely and the Quisling *coup d'état* failed, whilst the Allies, with minimal pre-planning, came to the Norwegians' aid. British, French and Polish troops were committed in the Narvik area, in Namsos and Aandalsnes, but in May the expedition was overshadowed by the German invasion of the Low Countries and France.

The weaknesses in the political direction of the British War effort at that time are brought out, and also the failure of the three armed Services achieve proper co-ordination and a unified command structure for the expedition. The difficulties experienced by the troops are well covered. Apart from the regular units, many suffered from a lack of training. With the

exception of the Chasseurs Alpins and the Polish troops, they had no experience of mountain and winter warfare, and were poorly equipped for it, so that most units were unable to operate away from roads. For the most part, the Germans had air superiority and the debilitating effect of this is shown.

The administrative side of the operation was confused by frequent changes of plan, with men and stores being loaded and off-loaded and equipment mislaid. In the circumstances it is most creditable that the troops did as well as they did. The particular problems of the RE units, due to inadequate transport and stores, are mentioned — and also their ingenuity in overcoming these difficulties.

The lessons of the doomed expedition were rapidly learned and an effective political and inter-service structure was set up by Churchill. At the same time, adequate planning staffs were assembled, and in 1941 studies for the invasion of Europe began.

The accounts of events would have been easier to follow by providing clearer fold-out maps to help those readers who are unfamiliar with the geography of Norway. This book deserves to be read, not only for its historic interest, but also to remind us how things can go wrong when operations are launched with inadequate notice, planning and training. The "ten year rule" between the wars had reduced the three Services' capacity in these matters, and it is important that we do not fall into the same trap again, under pressure of economics.

JCW

MR LINCOLN'S FORTS

A guide to the Civil War Defenses of Washington

BENJAMIN FRANKLIN COOLING III and WALTON H OWEN II

Published by White Mane Publishing Co Inc, PO Box 152, Shippensburg, PA 17257, USA — $29.95 Hardback, $18.95 paperback
ISBN 0-942597-05-2 hardback
ISBN 0-942597-06-0 paperback

AT the start of the American Civil War, Washington, the capital, lay open to an attack. Almost completely without defences, the city lay sprawled along the low-lying banks of the muddy Potomac, threatened if not dominated by high ground in nearby Virginia to the south. Clearly the city needed fortifying rapidly for, if the Army of the Potomac was the 'sword', a series of fortifications around the capital would be the 'shield'. The first step was to occupy the heights and then, in August 1861, Major (later Brevet Major General) John Gross Barnard took charge of the construction of a ring of detached earthwork forts with batteries and supporting troops in the intervals. By the end of the year a total of forty-eight defensive works encircled the city, rich in variety and shape, each designed to take the maximum benefit from its site. In form they were more like redoubts than what we normally think of as forts. Mostly irregular in shape, they remind one of the works built at Torres Vedras half a century earlier, but the detail plans were up-to-date, mostly provided with broad gun platforms firing forwards, the faces sometimes protected by bastionettes or caponiers and, in one case, by fully flanked bastions. The model was Dennis Hart Mahan's *Treatise on Field Fortifications* which Barnard used and acknowledged for the setting out of his profiles. In fact, Chapter Two of this book consists of Barnard's report on the defences of Washington giving full and useful information about profiles, revetments, bomb-proofs, gun platforms, embrasures, blockhouses and many other features of contemporary earthwork construction. A commission set up in October 1862 came to the conclusion that twenty-five thousand infantry, about nine thousand gunners and three thousand cavalry were needed to garrison the capital and support the fortifications. The weak link was the river estuary where, should Britain and France come into the war against the Union, a fleet could easily penetrate the defences and bombard Washington. Two forts were constructed facing each other across the river, mounted with 200-pdr, Parrotts, the type of rifled guns which had, a decade earlier, deterred the allied fleet before Kronstadt.

By the end of 1863, sixty forts, ninety-three batteries and 830 guns encircled the city with the intervals covered with batteries of artillery and rifle pits. The perimeter stretched some thirteen miles and 1,421 guns had been emplaced — a formidable undertaking and much to Barnard's credit. At the end of the war it was nearly all scrapped for, unlike Europe's capital cities and enclosed camps which remained engirdled by permanent forts, some still in being. Washington returned to the status of an open city.

Barnard was an interesting engineer for, in

addition to building this ring of fortifications, his most important task, he wrote books on coast defence and the use of iron for defensive purposes. In the past somewhat neglected by historians, he now takes his place amongst the important military engineers of the nineteenth century largely as a result of the writing in this excellent book. The main body of the text consists of a tour around the sites of the various forts and is illustrated with numerous contemporary photographs and excellent engineer drawings which give it a value far beyond that of local interest. Sometimes it is difficult for a stranger to appreciate the full extent of the works for the military map at the beginning of the book is too small for the details to be read and, although each section of the book has a sector map, it would have helped to have a simplified diagram showing all the forts with their names. But this is minor criticism for an otherwise excellent publication.

(We are indebted to Fort *and Dr Quentin Hughes MC for permission to use this review).*

MODERN CONSTRUCTION MANAGEMENT
Third Edition
FRANK HARRIS and RONALD MCCAFFER

Published by BSP Professional Books, Osney Mead, Oxford, OX2 0EL — Price £14.95
ISBN 0-632-02369-4

THIS well established text is aimed at aspiring construction industry executives and students of civil engineering, building and surveying. The book is divided into three parts. The first two sections deal with site experience and then head office activities. The third section contains computer-based training games to give an understanding of those techniques featured in the first two sections and to provide a training tool.

The third edition has been extensively revised and expanded to include two new chapters on budgetary control and contractual procedures (including new developments in contracting methods) and new sections on valuations and cash flow, the effects on estimating of the increasing use of sub-contractors, means to improve estimating accuracy, cost benefit analysis, life cycle costing and financial modelling and computerised production analysis methods. Most chapters have been updated to reflect the increasing impact of computers, and the games and computer exercises have been revised to run on modern computers.

FORTIFICATION
Its Past Achievements, Recent Developments, and Future Progress
SIR GEORGE SYDENHAM CLARKE

Published by Beaufort Publishing Ltd, PO Box 22, Liphook, Hants, GU30 7PJ — Price £25.00
ISBN 1-85512-005-4

ORIGINALLY published at the end of the nineteenth century, *Fortification* was, in effect, the first layman's guide in English to what was then considered an esoteric branch of military science. Huge sums had been, and were being, spent on fixed defences and Clarke felt that, like war itself, it was too important to be left to the soldiers. It was not a technical book in the textbook sense, but an historical review of fortress warfare designed to extract the essential principles of successful defence works.

The author, who later became Lord Sydenham of Combe, served in the Corps from 1868 to 1905 when he retired to become Governor of the Bombay Presidency. Throughout his life he was a prolific writer on military subjects.

Clarke's views were strongly held and trenchantly expressed so that at first this book was regarded, in his own words, as "dangerously heretical". However, in time it gained an influential following and contributed to British defence thinking in the first half of the twentieth century.

Besides its historical value, its non-technical analysis of siege warfare makes *Fortification* highly prized by historians. This reprint from the expanded second edition makes a rare and important work available once more.

GWAN

THE VITAL LINK
The Story of Royal Signals 1945-1985
PHILIP WARNER

Published by Leo Cooper Ltd, 190 Shaftesbury Avenue, London, WC2H 8JL — Price £18.50
ISBN 0-85052-8828

THIS book is written from the view point of giving an historical perspective to the campaigns in the period and to include personal accounts of an individual's view of events.

It opens with an historical review of the Origins of Signals from REs up to the start of the 1939

War. There is a long opening Chapter on the hitherto classified material from the 2nd World War, thereafter dealing with theatres and events in Chapters which are unbalanced and sometimes the narrative is out of sequence, although the book is intended to run onto 1985 frequently a chapter peters out. Many of the personal accounts were contributed by senior officers, and there is only limited coverage of some major campaigns which lasted several years.

In the second part of the book there is very good evaluation of the development of the new range of communications — *CLANSMAN — BRUIN — PTARMIGAN — SKYNET.* This should be required reading for all those going to technical appointments or involved in equipment development.

Maps which do not show places referred to in the text or are so badly drawn that locations are shown wrongly do not help to follow the story and some pictures are wrongly captioned. There is a classic remark which I cannot avoid repeating to delight all Sappers.

"All those serving in Korea had a very high regard for the gunners — particularly the Royal Artillery".

General Porter was right when he wrote the foreword to History of the Royal Engineers Volume I — in my opinion the writing of the history could only be satisfactorily undertaken by someone who had a proper feel for the Corps by having served in it.

It is a pity that a distinguished historian in writing *The Vital Link* does not do full credit to the work of The Royal Signals from 1945-1985 or give a balanced account of their activities.

JBW

FORTRESS

EDITED BY ANDREW SAUNDERS MA, FSA SCOT

Published quarterly by Beauport Publishing Ltd, PO Box 22, Liphook, Hants, GU3 07P. Subscription rates: £18 UK, £20 overseas — ISBN 1-85512-001-1

Fortress is a new journal devoted to the subject of fortification through the ages. It reflects a growing interest in these often very conspicuous monuments of the past. According to a recent review by Simon Pepper in the *Times Literary Supplement* medieval Western Europe was studded with castles. As many as 14,000 have been listed for the German-speaking parts of the Continent while conservative estimates for France, Italy, Spain and Britain place the probable grand total somewhere between 75,000 and 100,000.

There are many groups and individuals studying the design, construction and use of fortifications together with methods for their attack and *Fortress* offers an extremely high class and well presented forum for discussion. The first issue includes articles on Hadrian's Wall, the Crusader Castles, the Bermuda Forts (many of Sapper origin) and Timber Castles. There is also a conference report, and a section covering news and reviews. The style caters well for the general reader as well as the expert.

GWAN

COURAGE REMEMBERED

The story behind the construction and maintenance of the Commonwealth's military cemeteries and memorials of the wars of 1914-1918 and 1939-1945

MAJOR EDWIN GIBSON MBE AND G KINGSLEY WARD

Published by HMSO Books, Room 2CO3, St Crispins, Duke Street, Norwich, NR3 1PD — Price £13.95 net — ISBN 0-11-772608-7

WHILE this is not an official history of the Commission *Courage Remembered* tells the story behind the construction and maintenance of its cemeteries and memorials for one and three quarter million war dead in 140 countries and territories. The authors pay tribute to its remarkable founder *Fabian Ware* and to the many members of staff who have contributed to its proud traditions since the early days in 1917.

After a foreword by Field Marshall the Lord Bramall and an interesting introduction from Major F A Tilston (a holder of the VC with personal memories of burying comrades in the fields of battle) the book provides a brief historical background to the two world wars. The authors then describe the fascinating story behind the establishment of the then Imperial War Graves Commission and its continuing business and responsibilities today.

For reasons which may be historical or personal, a growing number of people now wish to pay their respects to those who fell in the two great wars and to see the places of their burial. With this in mind, Kingsley Ward and Gibson have ensured that their work can be used as a practical guide

for the visitor. Appendices list the major cemeteries and memorials by country and highlight the commemoration of VC and GC holders as well as providing a breakdown of numbers of war dead by Force. There is a useful glossary of Commission and military terms and a list of the principal offices and agencies of the Commission around the world.

The book has been beautifully produced which ensures that the humour stories are not lost among the remarkable facts of this extraordinary organisation.

REJ

MOUNTAINS OF THE SUN

EVELYN HART

Published by Century Hutchinson Ltd, Brookmount House, 62-65 Chandos Place, London, WC2N 4NW — Price £12.95
ISBN 0-712602597-6

THIS splendid book — easily her best to date — appeals immediately to all those lucky enough to remember the India of the 1930s. She portrays with almost uncanny accuracy the world of a crack Corps of the Indian Army — the formality and the humour of the Officers' Mess and ceremonial parades, the grim reality of British officers and Indian troops bound to each other by the ties of common regimental traditions.

The scene shifts to the timeless beauty of Kashmir or to the arid tracts of the North West Frontier, but all this is only a background to the romantic story, with many unexpected twists, of "Talwar" Sword and his friends — all of them real people with very human faults and feelings.

The regiment comes through the campaigns in North Africa and Burma with distinction and then has to face up to the unnecessary horrors of Partition which no-one really believed would happen and which is bitterly regretted to this day. Old comrades in arms are turned overnight by the machinations of politicians into implacable enemies. Gruesome details of the slaughter of innocent villagers have to come in, but are mild compared with what actually took place.

British officers who have devoted their lives to the Indian Army find there is now no place for them. Talwar has a holiday with his father in Kenya, where he meets Clavdia again, the White Russian orphan whom he knew as a precocious child, but he cannot face life in England, resigns his commission and makes his way back to India. He finds the regimental spirit has survived Partition on both sides of the Frontier, and settles down to a fulfilling life with Clavdia and his old friends far away in the mountains. All the way through he keeps in touch with a wise and kindly *sadhu* — a perfectly plausible character to those who know India.

For those who do not, the map will be a disappointment. Although it is marked "not to scale", even an approximate scale would have given some idea of the distance involved in trekking from Srinagar to Gilgit for example, and the *de facto* frontier between India and Pakistan, known as the Cease Fire Line, has completely superseded the Partition Line shown on the map.

But on the whole a memorable book, to be treasured and read again and again.

WGAL

FIELD ARTILLERY AND FIREPOWER

J B A BAILEY

Published by the Military Press, 92a Church Way, Iffley, Oxford, OX4 4EF — Price £25.00 ISBN 0-85066-810-7 (hard cover) £14.50 ISBN 0-85066-811-5 (soft cover)

IT is, perhaps, surprising that one should find a book on Artillery being reviewed in the Royal Engineers' *Journal*. However, the discovery of gunpowder added another dimension to the interests of the already established King's Engineers while, at the same time, precipitating the birth of the Royal Regiment. Since then, despite a degree of healthy competition, the two Arms have soldiered in productive harmony wherever the Army has campaigned. It is appropriate, therefore, for each to study the business of the other. (Of course it may be that the book was "aimed" at the *RA* rather than *RE Journal* and that it "missed" — situation normal!)

Jonathan Bailey set out to provide a novel analysis of the principles of field artillery tactics, how these have been developed with experience against a background of changing strategy and technology, and what the future may hold as a consequence. The result is, perhaps, the only compendium of Artillery philosophy and employment in existence in English. As such it is an invaluable guide for those who need to understand the fundamentals which govern the deployment and use of this battle-winning Arm. It

should be recommended, if not compulsory, reading for officers of any Arm who seek to command operational formations in war.

The author's thorough and dispassionate analysis is well-supported by his detailed research. This is brought pragmatically to life by the quintessential ingredient of clear thought against the background of his own operational experience. He has identified a number of areas where the tendency in peace is to forget the hard-earned lessons of war. This has been to our cost, in probably every campaign we have undertaken. He points out, for example, that, as manoeuvre is easier to demonstrate in peace, it gains the ascendancy over firepower. In war, of course, it is firepower which is the dominant requirement in the manoeuvre-firepower equation. Sadly this is a truism which is reinforced by current operational manoeuvre philosophy in BAOR. Given that the judicious use of Artillery is, perhaps, the most influential ingredient in the success of any operation, the wider Major Bailey's book is read, and remembered, the better.

One minor criticism of the book is the plethora of footnotes which tend to distract from the flow of reading. I would have preferred these to have been grouped at the end of each chapter. But this is a personal preference and an insignificant criticism of what is an excellent book. I strongly recommend it as essential reading for all officers in the study of their profession.

CMD

August 1989 Journal Awards

THE Publications Committee announces the following awards for articles of special merit published in the August 1989 *Journal*

ENGINEER RECONNAISSANCE IN SUPPORT OF THE BATTLE GROUP IN NO 1 (BR) CORPS
by Captain J A H Welch — £80

NO 1 WELDING PLATOON RE AND THE CITROEN TRUCK
by Major R B Croft — £35

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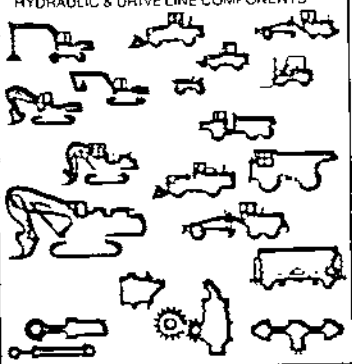

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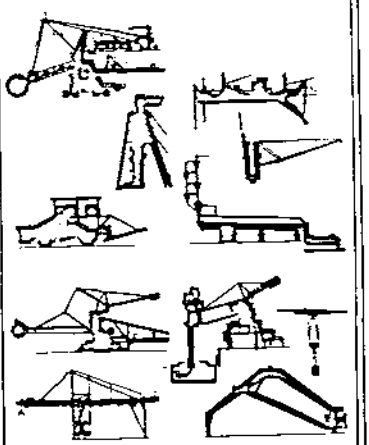

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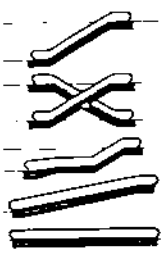

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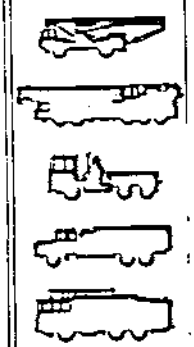

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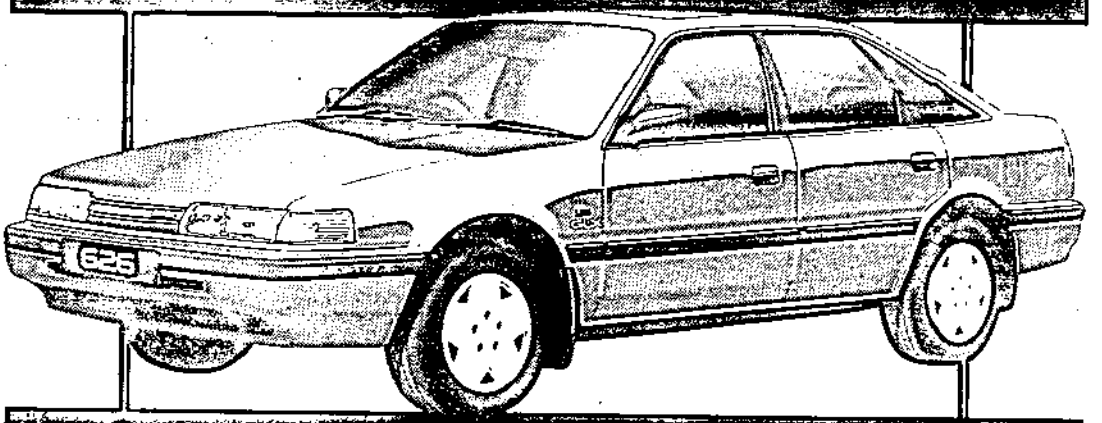

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