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**MARCH 1986** 

No 1

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MAJOR GENERAL C J ROUGIER MA

MAJOR GENERAL JEREMY ROUGHER took over as Engineer-in-Chief on 2 December 1985. He was educated at Mariborough College and then went to RMA Sandhurst where he was awarded the Queen's Medal. He spent three years reading for an engineering degree at Pembroke College, Cambridge. His military education has included Staff College, the Joint Services' Staff College and, more recently, the Royal College of Defence Studies. On graduating from Cambridge he served with 38 Corps Engineer Regiment on Christmas Island, in support of the UK nuclear tests followed by a year in Ripon. He then formed the Arabian Peninsula Field Troop and took it to Aden for a year's operational tour. His next engineer command was 11 Independent Field Squadron in the Commonwealth Brigade in Malaysia, during which he spent six months commanding the Post Crown project in NE Thailand building a laterite road where none had previously existed. He subsequently commanded 21 Engineer

Much of his thirty-two years of commissioned service has been spent in the training field. He has had two tours at RMA Sandhurst, first as an instructor and then as a company commander, has been a member of the Directing Staff at Staff College and was Commandant at the RSME. More recently he spent almost three years as Director of Army Training, responsible for officer and soldier training policy Armywide.

His other appointments, outside the Corps and the training field, have included Military Assistant to the Master-General of the Ordnance (General Sir Charles Jones), senior staff officer to the Chief of Defence Staff and, more recently, Chief of Staff in Northern Ireland.

He and his wife, Judith, have been married for twenty-one years. Their eldest son is at Durham University, two other sons are at Marlborough and a fourteen year old daughter completes the quartet.

2

Major General C J Rougier MA

# **1984** Corps Annual General Meeting

#### ADDRESS BY ENGINEER-IN-CHIEF

AT the Annual General Meeting of the Corps, held on 23 October 1985, the Engineer-in-Chief, Major General M Matthews CB, spoke on Corps Affairs.

#### INTRODUCTION

"This is the third and last time that I address the Annual General Meeting of the Corps as Engineer-in-Chief. There has been much to report on each occasion but my major concern and the external factors affecting our lives have been different each year.

"You will remember that in 1983 our major efforts were devoted to the military works area in the Falklands, and our numbers in the South Atlantic reached their peak. I was able to report last year the completion of the military works area but the continuation of the Corps' contribution to works in the Falklands and South Georgia. I was proud to pass on the letter of thanks I had received from the Quartermaster General. However, at the time of last year's meeting, the activities which were most exercising my mind, and those of my staff were a series of studies each of which could have had a profound effect on the shape, size and nature of the Corps. I believe I did not exaggerate when I said that the existence of the appointment of Engineer-in-Chief was at risk. The words I used then, and for once I quote myself, were 'I would not like to speculate aloud on what will be said on this subject at next year's AGM or by whom.'

"Well at least you know the answer to the second question! Because it was of such concern last year, I shall devote the first section of my report to this subject of studies and their aftermath. In the second section I would like to give an outline of the scope of the many activities and tasks performed by units and members of the Corps all over the world. I never cease to be surprised at their variety. This year I shall include the Falklands as part of the World.

"In the past years I have not said much about our equipment, and I believe this aspect deserves more attention. Our future achievements depend increasingly on our having the right 'kit' and enough of it in the right places, and I personally do not believe that we are getting our fair share.

"Although 'manpower' in the sense of human 'horsepower' is a waning factor, the quality and numbers of our officers and soldiers has never been more important. I must obviously tell you how we stand here.

"Our Corps affairs, in the sense of the totality of the activities of all our members, serving or retired, regular or volunteer, on and off duty, are of course what the AGM is all about. I shall mention just some aspects not covered by other speakers, and include sport.

#### STUDIES AND THEIR AFTERMATH

"LAST year the first study I mentioned was the study into the individual training organisation. This is now being examined and implemented in three stages by Commander Training and Arms Directors (I have more to say about him later) and the Director of Army Training

a. *Phase I*, an examination of our basic military training. The main effect on us has been the decision to move the Junior Leaders Regiment and to, combine it with the Army Apprentice College at Chepstow. This will not now take place before 1990, the delay being caused by quartering considerations.

b. *Phase 2*, our combat training including armoured engineer, amphibious engineer, driver, plant operator mechanic, signaller and combat engineer is still under review. The signs are not good and we may well be forced into transferring more of the training load to the field army. One thing however that is firm is that driver training to Group A level will be by civilian contract from 1 April 1986 but remaining under the auspices of 11 Engineer Group. A two year study into the feasibility of contract HGV training is under way. I mentioned last year that signals training might be moved to Bovington. This will not happen and we will retain the signals wing at Chatham,

c. *Phase 3*, trained soldier training including artisan training. This has yet to get under way. Fortuitously at the end of last year we completed a major review of our general engineer capability and the artisan training needed to meet it. The results of the review will provide us with a sound footing on which to develop our plans.

"One other change I should mention here is the move of the Royal Engineer Diving Establishment. The tri-service working group directed that RN and RE diving training should be colocated. We therefore had to find a new home. They move to HMS Vernon, Portsmouth, next month where the Royal Naval Diving School is already situated. This colocation will, I am sure be to the mutual benefit of both schools.

"Next I come to *LEAN LOOK*, the series of studies to reduce manpower in the support and training organisations and transfer them to front line combat units by the end of the decade. The studies have now been finalised and promulgated. On balance we lose some 200 RE capbadge posts and gain a slightly lower figure including some armoured engineers and some for EOD.

"I had no doubt that the study that overshadowed all others last year as far as the Corps was concerned, was *SHARP SWORD*. It is now complete and the decision endorsed by a process which I did not mention last year; MINIS (Management Information System for Ministers and Top Management) which I will describe briefly.

"The end result you see standing before you. The Engineer-in-Chief survives, he remains a major-general and retains his status as an MOD Director. Not all Arms Directors came off so well, but none was dis-established or reduced in rank. DRAC, DRA, D Inf and DAAC are no longer MOD Directors. Those Arms Directors, who remain MOD Directors have retained broadly the same responsibilities. What has changed, is the chain of reporting, whom I report to on what subject. This has been affected not only by SHARP SWORD but also by the general reorganisation of the Ministry of Defence.

"The Secretary of State's acceptance of SHARP SWORD, his acceptance of the status of Arms Directors was given subject to MINIS, which is a system for presenting and costing management functions first introduced by Mr Heseltine when he was at the Department of the Environment. The Arms Directors, and many others, prepare annual reports which are analysed and briefed up to Ministers. The Secretary of State, or the Minister of State then interviews a selected number of 'Reporting Officers'. I was interviewed by the Minister in July and my status confirmed also that of the Deputy with no change in titles.

"In the past the EinC reported on Army matters directly to the Vice Chief of the General Staff. That appointment, VCGS, no longer exists as a result of the MOD reorganisation. A new post of Commander Training and Arms Directors (CTAD) has been created partly as a result of *SHARP SWORD*. Whatever advances these changes may eventually be shown to have produced towards a taut chain of command and responsibility they have not made it easier to explain. The simplest wording my staff could come up with, and that used in my MINIS report is, I quote: 'EinC(A) reports to CGS through CTAD for certain matters and directly as an MOD Director on others. He is adviser to the Air Force Department on technical control and execution of military engineering tasks in support of the RAF. He also reports to CNS and CGRM when appropriate and, on occasions, directly to the Defence Staffs. He is in addition, responsible to QMG for engineering aspects of logistic support including sponsorship and management of associated equipment. These responsibilities are executed on a day to day basis by D Engr Svcs (A).'

"The position of CTAD himself is not simple to explain. As Commander Training he reports to the Commander-in-Chief United Kingdom Land Forces and is 'Supremo' of the Individual Training Organisation, though he delegates many aspects to the Arms Directors. As Commander Arms Directors he reports to CGS and has a separate staff (separate from his training staff). In this latter role he leads particularly on



Photo 1. HQ EinC in relation to other MOD Staffs.

Tactical Doctrine. You may well ask how does it work in practice. For once I would answer with a double negative. The system is not unworkable.

"Another study which had not started last year is known as ROTE, for Review of Officer Training and Education for the 1990s. It is headed by Major General Jeremy Rougier so I have no doubt that you will hear an expertly informed analysis next year. It takes into account other studies already completed, including Sir Hugh Beach's. The aim is; 'To define the essential common training, including education, required by regular officers during their careers and to recommend a programme for that training which is balanced, progressive and cost effective.'

"The ROTE team is considering the essential common training that is needed by officers from the time of their initial selection and pre-Sandhurst training to the time of taking up higher formation command and senior staff appointments as brigadiers. RCDS is excluded from the study. The final report is due at the end of the year.

"I have commented on the interim report and the improvements proposed appear to be evolutionary rather than revolutionary.

#### WORLD WIDE ACTIVITY

"As I said in my introduction this year, for the first time we should consider the Falkland Islands as part of the World, though I will give them pride of place. 37 Engineer Regiment maintained a strength of two field squadrons on roulement until March this year (1985) when the regiment disbanded and the Falkland Islands Field Squadron formed from a field squadron on roulement with increments as required. They have been kept busy so I will outline just a few of their tasks to illustrate the scope of their work.

"Stanley Airfield. Airfield Repair (ADR) and routine maintenance of the Stanley Airfield is the principal responsibility of the UK based roulement field squadron. This involved a minimum of one troop permanently deployed to task. The dispersal used by Hercules aircraft and Bristows helicopters was extended to allow a larger number of aircraft to be accommodated on the ground. The runway crossing point had to be moved and rebuilt. A new bowser park was constructed.

"Emergency Hospital. Following the fire which destroyed the memorial hospital on 10 April 1984 it was decided to convert the new RMP post on the Canache amenities site into an emergency BMH. Additional portakabins and MODUS units were used to create two wards, an operating theatre, an intensive care ward, an X-Ray facility and storage space. This was completed in two weeks.

"A new petroleum depot was required in the Canache area to replace the old facility on the eastern outskirts of Port Stanley. The task involved the construction, using hardcore add geofabric membranes, of 16,000m<sup>2</sup> access roads and hardstanding, and some 600m<sup>2</sup> of concrete hardstanding complete with foul water drainage to a fuel interceptor. A four bay Packaway was erected to provide laboratory and administrative facilities.

"Two PQE majors have been attached to the PSA supervising the construction of the new airport at Mount Pleasant and the associated report at Mare Harbour since November 1984. A fuel line from the oil tanker to the shore covering a distance of some 550m was constructed.

"A detachment of seven men commanded by a sergeant has continued to support the garrison at Grytviken in South Georgia.

"A detachment of 33 Engineer Regiment (EOD) including members of the TA have continued to work from Port Stanley. At the beginning of the year the emphasis was still on the clearing of positions and searching surrounding areas. As well as areas around Stanley (both the town and airfield), this type of work was undertaken in other parts of the Islands: including Fox Bay, Fitzroy, Bluff Cove and Mount Kent. The present priority for work is searching BL-755 cluster bomb strike areas. Recent areas include Sapper Hill, Mount Longdon and the now defunct Moody Brook Satellite Station.

"Part of the route for the Mount Pleasant Airfield roud was searched prior to the contractors beginning earthworks. Over fifty items of UXO were discovered along its proposed alignment. 700m of minefield fences have been receted near RAF Stanley and this has enabled a large area to be opened to the public. The total area cleared during the year has been 2457 hectares. 76,548 items of explosive ordnance have been found.

"No minefield clearance has taken place in the Falklands since August 1983 when it was decided that any further clearance would have to wait until a guaranteed method of detecting all types of mine safely is found including the low metal content Argentine FMK 1: Anti-personnel mine and the Spanish C3B Anti-tank mine. The minefields are fenced and maps showing their location are widely distributed. Meanwhile, research has continued to find a safe and reliable method of finding plastic mines.

"From the Falklands I will move on and mention just a few of the other places where members of the Corps are active: As usual they are spread all over the Globe. I shall go round in a westerly direction this year. First to the Bahamas where the



Photo 2. EOD in the Falklands.

# Engineer in Chief (2)

1984 CORPS AGM



Photo 3. Mexico City September 1985.

Commonwealth Heads of Government meeting has just taken place. A joint Police/Army detachment including members of 33 Engineer Regiment (EOD) were flown out to perform their increasingly frequent role of search in support of police security operations.

"Next to Belize from where 32 Field Squadron (the current roulement squadron) deployed a reinforced field troop under command of Major Derek Webb to Mexico to help the authorities after the earthquake on 19 September. Their main task was to secure and prevent further damage to the international telephone exchange in Mexico City enabling vital international communications to be resumed. They were flown in on 22 September and left on completion of their task on 11 and 12 October. In the meantime to ensure support for HM The Queen's planned visit to Belize on 9, 10 and 11 October, the Spearhead Troop of 8 Field Squadron was deployed from the UK to Belize to cover for the troop deployed to Mexico. They returned to UK on 25 October 1985. There has been a good deal of Sapper activity in Canada since the last AGM, ceremonial, combat training, and projects. In July 1984 five members of 12 Field Squadron visited Nova Scotia to celebrate the Squadron's origin there and take part, in period costumes, in the Nova Scotia tattoo. Twenty-four members of R Mon RE took part in Canadian military exercises and celebrated 100 years of Sapper involvement in Vancouver. At BATUS (Suffield), engineer field and armoured engineer troops took part in all seven MEDICINE MAN exercises in support of battlegroup training. Also at BATUS RHQ 23 Engineer Regiment and 25 and 39 Field Squadrons deployed to carry out range maintenance, which involved realigning main battle runs. As part of the annual Waterleap exercises 20 Field Squadron undertook a major project to construct ammunition bunkers for the Canadian Air Force at Cold Lake, Alberta, from May to September last year.

"A long hop now to the Solomon Islands where from February to April this year a team from 33 Engineer Regiment (EOD) cleared the site of the battlefield around Henderson Airfield, (Guadalcanal) so that the runway could be extended. A total of 36 hectares was cleared of unexploded ordnance. The team also trained the Solomon Islands Police Force in battle area clearance techniques.

"North west now to Hong Kong, starting with anti-illegal-immigrant operations. Boat Troop Queens Gurkha Engineers continued to provide support to the infantry deployed on border duty. At any time up to twelve boats operated from two forward bases in the border area providing regular coastal patrols and quick reaction lift. Night Raiders, Sea Riders, Assault Boats, Geminis and Combat Support Boats are all in use.

# Engineer in Chief (3)



Photo 4. Construction work on Lantau Island.

"Major exercises and projects have frequently been combined by the Queens Gurkha Engineers. 67 Gurkha Field Squadron deployed to Brunei and in addition to jungle training and range work completed project work. A troop of 67 Gurkha Field Squadron deployed from October to December 1984 to Papua New Guinea and completed a new company headquarters building for the Papua New Guinea Defence Force at a base in Vanimo. The troop also constructed a 10m wooden improvised bridge on the nearby Goldie River Training Area.

"You may remember last year that I mentioned the major project on Lantau Island. It involves the construction of an access road to a new training camp, Lantau is the largest of the outlying islands, 10km due west of Hong Kong Island. The task requires the construction of a five span reinforced concrete bridge and 1500m of concrete surfaced road. Bridge piers and abutments are complete but the delivery of the prestressed RC beams from the civilian contractor has been delayed and they are still awaited. Boulder clearance above the road alignment continues and plant work to bring road to formation level is also making progress.

"A long haul now to Kenya, where I myself was able to visit in January, and their senior engineer officer came to see us in England this July. Kenya provides unique opportunities for our training and I am most keen to keep up our contacts. In October and November last year a troop of 34 Field Squadron supported 1 KOSB on an exercise and undertook the construction of a classroom and a pig sty. From January to April this year, another troop of 34 Field Squadron followed by a troop of 69 Gurkha Independent Field Squadron deployed with infantry battalions and carried out engineer tasks at Nanyuki showground. There is an annual exercise in Kenya which I have mentioned before called *LARCHPOLE*. This year 48 Field Squadron continued with the construction of the Kenya School of Infantry at Isiolo.

"Across the border is Ethiopia. From November 1984 we had a two man team from 9 Parachute Squadron assisting with water supply problems at several locations.

"I was in Cyprus this July. We have a resident squadron there 62 Support Squadron, and an UNFICYP detachment, currently from 9 Parachute Squadron, previously 20 Field Squadron and 69 Gurkha Independent Squadron before that. In addition we mount twice a year from outside the so called operation *LONE LINE* which is track maintenance for the United Nations Force. A troop of 49 EOD Squadron did this from October to November 1984 and a troop from 24 Field Squadron in June and July this year. There are also frequent visits and exercises by UK based troops.

### Engineer in Chief (4)

"This brings me back to mainland Europe, but leaving Germany until last. In Denmark, 22 Engineer Regiment and 74 Engineer Regiment (V) supported United Kingdom Mobile Force; 59 Independent Commando Squadron and 32 Field Squadron have also trained there. In Norway, 59 Squadron trained in arctic warfare and supported the Commando Brigade on exercises. At the other extreme of the continent, Gibraltar, troops or detachments of several units deployed for training or projects. These included twenty-four soldiers from 30 Brigade Headquarters, a composite section from 34 Field Squadron, permanent staff from our Diving Establishment and a troop from 60 Field Support Squadron. Men from the resident Fortress Specialist Team deployed for combat engineer training in UK last autumn and were temporarily relieved by a troop of 24 Field Squadron.

"From so much significant activity in our large garrison in Germany it is difficult to pick examples. As I believe everyone is aware the highlight of the year was Exercise LIONHEART which I visited last September. I think little more remains to be said.

"Finally to the United Kingdom and that part of it which is still an operational zone: Northern Ireland. We continue with our now traditional Sapper tasks. Our resident units are still 33 Independent Field Squadron and 325 Engineer Park, in support of 8 and 39 Brigades. There is still also a roulement search troop. An additional squadron on roulement is deploying next week to carry out the work required to strengthen the protection of security forces bases against mortar attack. The level of search operations in the province remains high and this includes river and sea search by divers.

"Scotland provides excellent opportunities for challenging training which also contributes to the life of the community. 69 Gurkha Independent Squadron took advantage of this for their pre-Falklands training this year.

"For one example of our work in England, I will pick the one which brought us the best press, and the thanks of the Secretary of State. The fence at RAF Molesworth in February (12½ kms of fencing was erected in one night and part of a day). The operation was commanded by Brigadier John Wilks. The *Daily Telegraph*, in the person of General Eddie Fursdon called it the biggest Sapper operation since the crossing of the Rhine forty years earlier." [A full report appeared in the RE Journal in June 1985.]

"Perhaps now needless to say in every place I have mentioned in my trip round the world our Postal Branch has been not only present but active. They have been, and are still in a great many other places including Sinai and Ethiopia. In fact, I doubt if there is anywhere on earth where two or three British servicemen are gathered together where Postal is not amongst them. I will just mention that a fully operational Forces Post Office was opened at Mount Pleasant (Falkland Islands) on 28 August.

"I will give the last word in this section to Military Survey who as well as being everywhere are bang up to date. They are carrying on our innovative traditions by developing and using the latest techniques in the field of digital mapping. As well as maintaining all the traditional mapping products, Military Survey is dedicating an increasingly large part of its resources to the production of digital databases and products in support of a host of modern weapon, communication and display systems.

"In addition to this database production military survey is also using its expertise in management information systems to generally improve its financial management control, very necessary in this cost conscious era.

"I do hope you will understand that in my report I cannot mention every unit, every location and every activity. The ones I have selected are not necessarily the most significant, I have sought contrast and diversity. I hope no one will be offended at not being included this year.

#### EQUIPMENT

"I SAID in my introduction that I was not convinced that we as a Corps get our fair share of the kit we need. I should perhaps qualify that remark both for clarity and also to show that I am in no way attributing blame or pointing fingers. One can 'categorise' equipment in any number of ways, but for the purposes of today I am talking about three sorts. There is kit common to all or many soldiers, small arms, B vehicles, NBC kit and such like. For this we are treated in the same manner as other arms, and there is not much to say.

"Then there are the major equipments which the Corps operates in combat support of other arms and the other services, in our mobility and counter mobility roles. Bridging, mine clearance, mine laying, the mines themselves, to give examples. These are sponsored, bid for, in competition, throughout 'The System' on the basis of operational requirements. It is principally in this field that I believe our needs are not always sufficiently understood. Then we have equipment which is specifically engineer (in the sense of Sapper), like Engineer Construction Plant and C vehicles. For these 1, as EinC, am the delegated sponsor, on behalf of ACDS (Land) and 'The System' is somewhat different; we have rather more control over it and in this field, in my view we come out rather better. I shall therefore concentrate on the group I mentioned in the middle.

"Armoured engineers play, literally, a leading role in mobility and bridges launched from armoured vehicles are their primary equipment. The No 8 and No 9 are the current in-service bridges. One development soon entering service is the treatle. This is a fixed height device which is fitted instead of the leading ramp sections of the No 8 bridge and therefore can be used to help provide a combination bridge capability over longer gaps, such as canals. It cannot be seen as the answer to every problem but is still a very valuable addition to our capability. The second equipment of the Armoured Engineers is the AVRE. For the present the Centurion AVRE soldiers on. Everyone is aware of its very considerable limitations in support of Challenger and we wish to replace it with a Chieftain AVRE as soon as possible. Here we run into the usual difficulties! The first difficulty oncerns the availability of funds for conversion. The second involves the quantity and facilities required on a future AVRE. We are therefore looking at the problem in two phases:

"Firstly, to replace the existing Centurion AVREs with Chieftain AVREs converted from Chieftain main battle tanks, in excess of the number immediately required to produce a war maintenance reserve. We would remove the turret and provide a top rack capable of carrying trackway or fascines. The vehicle could have either a plough or dozer blade and could, of course, tow and fire Giant Viper or tow the AVRE trailer. Hence we see this as a very important vehicle for providing the mobility which formations now require.

"Secondly, in the longer term the Army may feel that there is a strong case for



Photo 5. Chieftain AVRE.

Engineer in Chief (5)

increasing the number of AVREs. These could help overcome some of the difficulties we foresee in the coming years in protecting Sappers working on the battlefield from artillery and CBW attack. The equipments provided on the AVREs in the second phase may differ slightly from those in the first phase but they will improve our ability to support infantry, in built-up areas and withdrawal operations.

"Another aspect of mobility which concerns us is the clearance of scatterable mines. Active development has started on suitable equipments for the job but for the next few years reliance will have to be placed on improvised methods. Where scatterable mines fall on a unit which is harboured or static, hand clearance of exit routes and tracks will be necessary and we have developed an SOP for this.

"Now I would like to turn to countermobility. Our current mine is the barmine. Entering service in the next two years will be additional fuzes which will be permanently fitted to some barmines so as to cause them to explode when disturbed. The barmine system should prove to be one of the most effective and lethal mine systems available. All versions of the mine are laid by the barmine layer which is capable of laying at a rate of 300-400 mines an hour and we foresee all tactical minefields will contain a mix of fuzes. To complement barmine we have the Ranger anti-personnel mine and its launcher and the French off-route mine for use in blocking routes and in close country or urban terrain. In due course we hope to replace the French off-route mine with Lawmine which is an off-route mine based on light anti-tank weapon.

"This family of mines allows us the key advantage of laying extensive pre-planned minefields before battle starts. The drawbacks are well known: we are laying mines which may hinder our own movement and we are putting minefields where we only think the enemy may come, and because of this many will never confront him. However, I emphasise the deflecting and canalising effects of minefields. Mines are doing their task even if the nearest enemy is the device which has warned his main body to keep away. What we lack is the means to lay mines 'reactively' when an enemy threat is identified. For this we seek a scatterable mine system. In view of the development time which will be required now to produce a British system and the urgent need for scatterable mines, it is possible that a foreign system will be procured. The most promising starter can be used in two versions, one scatterable by artillery and another, a purely engineer scatterable version. There is some argument as which should have priority if funds are not available for both.

"Lastly, I would like to mention anti-tank ditching. We are just bringing into service heavy mechanical excavators for digging anti-tank ditches and this they can do at the rate of approximately 70m per hour. We are also looking for means of rapidly laying in a trench a pipe, and a means of filling the pipe with explosive either before or after laying to produce anti tank ditching rapidly. We are also looking at an alternative method of blowing a series of interlinked craters using compressed air.

"The other major role in battlefield support is protection. Here there are two developments. The first is the split hairpin shelter. This consists of sheets of corrugated iron which are bent in a curve at one end and interlock to form an arched shelter when placed in a slit trench and covered over with earth. Similar sheets can be used for revetting the open part of the trench. Arguments continue over the provision of money to purchase such sheets.

"There is also a project under way to provide digging machines to infantry and artillery units to enable them to dig in more quickly. The general type of machine likely to be chosen is not unlike those in use by most small builders. There are difficulties over providing manpower for these machines. The Royal Engineers also provide digging support to infantry and artillery units, using a range of machines to dig the various sizes of excavations required. It may be that if full manning cannot be found in infantry battalions to man all the machines that those units may want, the placing of some of the remainder in engineer squadrons might enable them to provide a more effective back-up service, not only to infantry and artillery, but to units in brigade and divisional administrative areas, communications and air defence posts and other units deployed in the divisional area.

#### MANNING

"A FEW words now on the vital subject of manning. Officer manning is currently sound but only just. During this year, 1985, we have seen a satisfactory number selected for Lieut Colonel and Colonel promotions, for staff training and for the long engineering and survey courses. Survey and Postal manning is satisfactory and we have arranged to put a reasonable number of officers to non-RE appointments-including some excellent jobs. And we have seen our major generals increase by three-Brigadiers John Evans, and, early next year, Ted Willmott and Graham Fawcus. However, there are significant problems developing for 1986 and well into the future. We are having very great difficulty in manning majors posts and gaps of up to a year are on the increase. The problem is one of a small rise in the number of posts and a rapid decrease in officers in the rank. At one end the previous captain shortage is moving into the major bracket. In the middle, majors are taking PVR in increasing numbers once they are pensionable at around 37-42. At the top end few majors and special list lieut colonels are serving up to 55. We shall be some sixty majors short by late 1986 and use of acting major ranks for captains prior to long courses and the maximum use of commissioned warrant officers will not solve this problem; it is our most acute. Promotions to Brigadier and General rank also concern me. Prospects for Sappers to these ranks in 1986 and 1987 are still not good enough but we are working on it!!

"Although our recruiting for all types of commissions is numerically sufficient: we got a record number through RCB last year and more than fulfilled our target, and we look like doing as well this year, we need a generally higher calibre if we are to sustain our regular officer cadre at the right level. And we need a higher proportion of graduates in the right disciplines to sustain our professional engineering and survey needs in the future and indeed to match the general academic quality of some other teeth arms.

"For soldiers, we have no real problems with adults or junior leaders; we are in the happy position of being able to meet the needs of the Corps and at the same time giving the recruits the trades they choose. In overall numbers the Corps is well up to strength and the UK regiments have a small but welcome surplus.

#### CORPS AFFAIRS

"I WOULD like now to say a few words on Corps affairs. An event which all of us who were there will long remember was the visit of HRH The Prince of Wales to Chatham in March. Although his visit was short I believe it was a great success and that he also enjoyed it. To our benefit his visit gave great impetus to the development of our enlarged museum. As many of you will know, Regimental Headquarters Royal Engineers and the Museum have now moved to the Ravelin Building.

"I think those who have seen the embryo museum will agree that it shows tremendous promise for future development. In April next year the whole of the Ravelin will be ours and this will be a further big step forward. We must not, however, underestimate the problems. Our units are extremely hard pressed and finding men to work in the Museum, on those parts which we are doing on a self help basis, is not easy. We are also facing the problem of raising £750,000 for which planning is well advanced.

"The setting up of one single Corps Band has proved another great success story. I have received many glowing comments on the playing, turnout and drill of our band. Great credit is due to the Director, BSM and musicians who have buckled down to the task and produced a band of which we can be justly proud. I only hope we get enough money to enable us to move it to our units where it can be seen and heard.

"The Chief Royal Engineer's Committee is taking a hard look at how our Corps Affairs are run to ensure that we employ our small RHQ staff with maximum efficiency. I hope we may have progress to report to the Corps on this during the next year. Plans are firming up for RE Royal 200 in 1987 when we celebrate 200 years since the grant of the title 'Royal' to the Corps. We have forged ahead in the aquisition of paintings and silver. I personally think the Falklands painting is splendid. I think too that the Northern Ireland centrepiece, which is a modern piece of silver, is magnificent and will encourage us to produce other items in a modern style. A Falklands painting showing the construction work there is on the stocks and will be ready by the end of the year. We now have a painting of General Jones in the mess and one of General Richardson has been commissioned.

"That leads me to a word on the RE HQ Officers Mess. Year by year their staff is cut. Nevertheless I find that our Corps Guest Nights are both splendid and enjoyable occasions. It is an aspect of our Corps life that we have to watch carefully to ensure that we preserve the standards we all still expect, but are more and more difficult to obtain. It is the dedication of our staff that enables us to continue to do so. I would like to take this opportunity, at my last AGM as EinC, to express my appreciation and thanks to all the long serving staff of the Corps, not only in the Headquarters Mess but in all our establishments. We would not be the family we are without them.

"Finally on Corps affairs, I would like to mention the service in St Paul's Cathedral for the unveiling of the South Atlantic Memorial by Her Majesty in June. That was a most moving occasion and gave us an opportunity to meet again the families of those killed in the Falklands.

#### Sport

"IN sport the Corps has had an exceptionally good period since the last AGM in June 1984, right across the board, so I only have time to refer to a few highlights. Last year 12 RSME Regiment won the Army Cricket Cup by beating 2LI by a leg bye off the last ball of the match. In football 40 Army Engineer Support Group have been outstanding; BAOR Major and Minor Units Champions, Army Minor Unit Champions. They were narrowly beaten by 1 Kings in the Army Cup Final (the only minor unit to reach the Major Units Final for 22 years).

"In rugby football the Corps has had some notable successes—a hat trick against the Gunners (last achieved in 1922) and the first ever double over the Oxford Greyhounds and the Cambridge Sixties Club. 24 Field Squadron won the Army Rugby Union Challenge Cup Competition (minor units) 1984/85 season. Our squash team has also gone well winning seven of their eight matches including beating the Gunners.

"We have done particularly well in rifle shooting. The Army Apprentices College team won the Junior Soldiers Unit Team Small Bore Championships (The Lord Horne Cup) for the eighth consecutive year. 69 Gurkha Independent Field Squadron were minor unit champions at Bisley. For the first time ever the Corps won the Inter-Corps target rifle match on 1 and 2 June, Major Brian Taylor having top score. He also won the Governer Generals Prize in the Canadian target rifle shoot.

"There have been consistently good results in canoeing. In the Devizes to Westminster marathon the Corps came second overall, but was the fastest service team beating the Royal Marines and SAS. The Junior Leaders Regiment won the Junior Team Competition. 28 Amphibious Engineer Regiment won the Army Senior Sprint Team Competition.

"In skiing 35 Engineer Regiment did well as usual: They came second in the Princess Marina Cup Competition. However they won the Biathlon Relay and the Patrol Race. They have five national skiers, three in the A Team. 35 Engineer Regiment are also this year's Army and BAOR basket ball champions.

"The Corps continues to flourish in the sailing world, and are recognised army experts in dinghy sailing. The Corps was selected to represent the Army in the interservice offshore race and the Sail Training Association race where we finished first UK entry in a field of seventy international yachts.

#### CONCLUSION

"WELL, Gentlemen that's it. I would like to thank those of you who have come here today to listen. My tour as EinC is nearing its end and I would like to say to the whole Corps, all ranks, as many as I can reach, my most sincere 'Thank You' for the support you have given me in my thirty-two months as EinC. The Corps is in very good heart and has achieved some notable successes at work and at play. It has survived some moves that would in my opinion have harmed it. We still have difficulty in explaining and convincing a whole range of opinion of our true worth, and the complexity of our activities, but our reputation is extremely high.

"I cannot believe there is a more rewarding two-star post in the Army than Engineer-in-Chief. Thank You Again. I wish you all, the very best of luck."

# A Harbour Goes to France Memories and Reflections

BRIGADIER A E M WALTER CBE



After the RMA Woolwich, Chatham and Cambridge, the author did a Transportation Course and an E&M Course which led to posting as E&M Officer, Singapore. His war Service included Missions to Norway and Finland, DAD Tn Middle East with special missions to Turkey and China. He then served as DDTn BAS Washington and DTn SEAC but returned to the UK in February 1944 to become Director Ports and Inland Waterways 21 Army Group. He took personal command of the Mulberry B Port Construction Force at Arromanches and his command included the Port and IWT Operating Groups RE which first discharged stores, ammunition and vehicles over the beaches and later through the captured ports and canals in France. Belgium and Germany and also the Port Construction and Repair Groups RE

responsible for all port and canal clearance and repair throughout the campaign.

He was seconded to the Control Commission in Germany and worked on quadripartite committees in Berlin and became British member of the Central Rhine Commission. On retirement he went to the Ministry of Transport first as an Inspecting Officer of Railways and later on International Inland Transport work in Geneva, Paris and Brussels.

#### INTRODUCTION

THE research, designing, building, towing across the Channel and planting of the artificial harbours, code named Mulberries, on the beaches of Normandy was probably the greatest warrime engineering feat of all time. Volumes have been written, learned papers presented to engineering institutions and many have given lectures about this great enterprise. The way in which the problems were overcome is a lasting tribute to the Navy, to the War Office and above all to British Engineering.

I had the supreme good fortune to command the British Mulberry B Port Construction Force (PCF) which carried out the Army's task of planting the harbour on the beach at Arromanches. This was the last link, the final cornerstone in this great

# Brigadier A E M Walter CBE

project which was largely instigated by Sir Winston Churchill's now famous Minute to the Chief of Combined Operations:



10, Downing Street. Schitchall.

#### PIERS FOR USE ON BEACHES

C.C.O. or deputy.

They must float up and down with the tide. The anchor problem must be mastered. Let me have the best solution worked out. Don't argue the matter. The difficulties will argue for themselves.

30. 5. 42.

What a fine start to this great enterprise-no wonder it succeeded!

For reasons explained later, the different RE units which composed the PCF only came together for the first time on D+1 when they began to arrive at Arromanches. In the days that followed, the sight of this great harbour taking shape inspired all ranks with a tremendous pride in their job, they realised they were doing something very big. After the worst summer storm in memory starting on 19 June, when the PCF fought for four long days and nights to save the harbour, the proud and exhausted force felt that they, and they only, had built Mulberry B.

However, the success of this great enterprise soon spread and before we had finished sundry sorts and types were coming along claiming to have built the harbour while we who had sailed on D Day and done the job were quietly getting on with it and claiming no glory. Consequently when it was all nearly over and units were ready to go on to their next jobs in the campaign, in order to preserve that wonderful spirit and pride held by all ranks of the Mulberry B PCF. I called them together and told them: "In future years at gatherings and parties you will meet many men who will claim to have served at Mulberry B and built the harbour. You must say nothing, just let them talk and you will know that they boast in this way because they wish they had been with us. You have the knowledge that it was you who were here and that against all the odds you built the harbour at Arromanches. Nothing and no-one can take this proud memory away from you."

I was privileged indeed to be one of them and it is my proudest memory.

Since then many of us have met people who have said they were there but alas! we never saw them at the time. For all these years we have said little but now that the Nation has celebrated Forty Years On and Arromanches in all its glory was chosen



A Harbour Goes to France (1)

for a big part in the celebrations I should like to close the tale with my own memories and reflections.

#### EARLY PLANNING

FOR me the tale of Mulberry B begins in Delhi in February 1944 where I was serving as Director of Transportation (DTn) South East Asia Command (SEAC) on the staff of Admiral Lord Mountbatten. Great plans were being hatched for the re-conquest of Burma and in Tn our part was to plan the logistics and to organise the production and supply of the necessary equipment and the build up of Transportation Units. My Naval opposite number. Captain Goodenough RN and I were mutually involved. We lived in a splendid mess in a Prince's house (Bikhanir) on Kingsway and often walked together to our work in the Government Secretariat. Normally plans lasted about a month when all was changed and we started off again anew once more. As far as I can remember we were doing no harm, certainly doing no wrong to the Japanese in any way and having a very plush war. During my time there I went back to Washington (my previous posting) once and to Calcutta a few times. Then late one evening early February out of the blue a signal arrived bidding me report to the DTn War Office immediately. I couldn't wait-I handed over to my deputy Colonel Tony Bull (later Chairman of London Transport) and as dawn broke next morning I awaited a Dakota at Willingdon airport-I couldn't get away quickly enough. This started the journey which I had done before on that wonderful war time L of C-Dakota Delhi to Karachi, Empire Flying boat (on this occasion Canopus) to Basra with its blessed air conditioned hotel and on to Alexandria; then Liberator to Gibraltar and so on to a West Country airport.

In passing, I discovered later that by virtue of serving on the staff of SEAC between certain dates, I was qualified for the Burma star! As my nearest venture to that country had been to be born in Taungoo, Burma, many years before the offer was never taken up. All who wear gongs are not heroes!

Very excited, I reported on arrival to the DTn, Major General D J McMullen whom I had known in far off days when he was Instructor Mechanical at the Railway Training Centre, Longmoor, and I was a subaltern on first posting to 10 Railway Company RE. After the preliminaries, he told me that he had arranged my appointment as Director of Ports and Inland Waterways (DP&IWT) 21 Army Group (21AGp) which was part of the second front. He said that this carried with it a very special assignment and that I should go along to see Brigadier Bruce White who was DP&IWT, War Office. Incidentally, in all this I shall use the ranks and titles of the people involved as they were at the time. I had met Bruce White in 1940. He told me that the British and Americans were engaged on a very secret project to build artificial harbours on the French coast to support the second front. The pieces for these harbours would be towed across the Channel and erected on site and that both the Army and the Navy would be involved. He explained the general composition of the harbours with their breakwaters and floating roadways and said that most of the research, design and fabrication had been done by the War Office, chiefly under him in the Ports Directorate. He said that special RE units under War Office command had been designed and formed to do the job and were being trained. He said that

(a) consideration was being given to transferring the responsibility for the construction of this harbour on the French coast from the War Office to 21 AGp and that this transfer of responsibility would be most unfortunate and could lead to failure—in his opinion it would be better if the job could be left where it had started, with the War Office and

(b) The Navy was heavily involved in the project and again this was most unfortunate as the Navy was very difficult to work with.

APART from being awestruck at the sheer enormity of this exercise and wondering what on earth this ignorant recruit could do about it, it was all rather confusing because it appeared that 21 AGp (which now included this new recruit!) and the Navy seemed to be surplus to requirements. There seemed to be a catch somewhere and I remember eating a very puzzled lunch afterwards.

After lunch I was scheduled to report to Admiral Ramsay at Norfolk House. This was encouraging as I had been a member of his Dynamo Control Staff at Dover Castle when he carried out the evacuation from Dunkirk in May/June 1940—Operation Dynamo. As the Press said afterwards, sixteen men had saved the Army, fourteen were sailors and two were soldiers and for ten days and nights we worked, ate and slept round a table in Dover Castle under the eyes of Rear Admiral Ramsay and Captain Tennant RN as they were then. The sailors moved the ships while the soldiers arranged for trains to come from all over England and Scotiand to the ports to pick up the survivors and for the necessary admin—feeding, medical, clothing, dispersal, etc. Afterwards many of us received appropriate gongs and I had last met Rear Admiral Ramsay at the Palace that summer and he had taken my wife and I out to lunch afterwards. So this was an auspicious meeting for me and it was completed by Rear Admiral Tennant looking in.

They greeted me warmly and told me a little more about the harbour project but the main theme was an exhortation to get 21 AGp to take over full responsibility from the War Office without delay. They said that the War Office was difficult to work with and that unless control on the Army side was invested quickly in an operational organisation such as 21 AGp the project would fail. My naval opposite number, Captain C H Petrie RN was present and we took to each other immediately and I have always thought that this was a considerable factor in the ultimate success because it was vital that the Army and Navy should work as one. Thus ended my first day in the new job. I felt pride in being part of the second front but quite shaken at the revelation of this incredible engineering project and my involvement in it—really chucked in at the deep end. Peaceful Delhi seemed to be another world and almost desirable!

Next day I reported to my boss, the Director of Transportation 21 AGp—Brigadier Rex Gage—an old friend with whom I had served at Longmoor and in Singapore and my spirits rose at the thought of working with him. I established my office alongside Petrie at Norfolk House and not with Gage at HQ 21 AGp at St Paul's School because Petrie and I had to keep in very close touch all the time. As the job unfolded my priorities were:

1. To set up the Directorate of Ports and IWT 21 AGp.

2. To find out what the harbour project was all about—a whole new language had to be learned dealing with strange things called *PHOENIX*, GOOSEBERRIES, CORNCOBS, WHALES, BEETLES, SPUD pontoons, BOMBADONS, etc, etc, all absolute double dutch to me.

3. To find out which RE units were to be employed on the army side of the project. Here again strange new units were introduced. Port Floating Equipment Companies; Port Construction and Repair Companies; Port and IWT Operating Companies. Some I had never even heard of and I had never met or served with any of them and I hadn't a clue as to how they were organised or how to use them. All very uphill and daunting.

4. To winkle these strange units about which I was clucless out of the control of the War Office and under control of 21 AGp so that we could get to know them and get on with their training.

This last proved to be a tough nut to crack and at one stage, Gage had to go to the very top of 21 AGp to get satisfaction. Bruce White fought a stern but losing rearguard action to hang on to War Office control. To some extent this was very understandable. The War Office had given birth to and nourished this wonderful baby and here at the eleventh hour Bruce White was being asked to hand over control to a set of ignorant amateurs like myself in 21 AGp. It took a lot of argument to get him to realise that the operational control of units working under shooting conditions could only be exercised by an operational command on the beaches and not by a remote War Office. The argument went on dangerously long and at one stage we were shaken by an

opposition War Office minute which went up to the Prime Minister himself because of course it was one of his pet babies and they had the access. Inevitably we won and I shall always rhemember the relief in Tn 21 AGp and in the Navy at Norfolk House when we could say that these units were finally under command. In spite of it all we emerged with a friendly and co-operative relationship and Bruce White was a tower of strength to me.



Taking control created an increased sense of unity with the Navy. I started calling the army contingent the Port Construction Force (PCF) Mulberry B in order to build up an identity. A little later, without anybody's approval we designed our own badge which was rather a nice red dolphin on the usual background of wavy blue and white stripes which denote the sea and we used this on many of our vehicles milling around the harbour. The title-PCF fitted in with the general cover plan of the invasion which was designed to make the Germans think that the attack would fall on the Pas de Calais because established military planning considered that the capture of one or two ports would be vital to a successful invasion. What more

natural than a Port Construction Force to repair such ports. The Americans called their organisation Force 128. Neither title gave any clue to artificial harbours.

All the above related to Mulberry B but my priorities also included getting into the plans for unloading vehicles, ammunition and stores on all the beaches and the RE Units who would do the job, but more of this later.

In those early days I often wondered what flick of good fortune had landed me in this cream of all jobs. Before the war junior officers RE had a light-hearted belief that the War Office (AG7) took a delight in posting an officer to a job about which he knew nothing and to a place to which he did not want to go—both being good for his upbringing. I fitted the first criterion perfectly but the second did not apply in this case. On reflection 1 decided 1 owed much to Admiral Ramsay and our association in the Dynamo Control as the Army wanted somebody who could work peacefully with the Navy, because, as explained above, relations between the War Office and the Navy were not easy before 21 AGp got into the act.

#### THE APPROACH TO D DAY

As Director Ports & IWT 21 AGp my responsibilities in the assault included:

(a) The planting and operation of the British artificial harbour at Arromanches.

(b) The discharge of stores, ammunition, vehicles, etc, from ships to all the beaches.

(c) The repair and operation of the small ports of Port-en-Bessin on the right flank of the British Sector and of Ouistreham on the left and the clearance of Ouistreham-Caen canal as a supply route and of Courselles.

To achieve (a) as explained above a special Port Construction Force was organised under Colonel S K Gilbert consisting of Two Port Floating Equipment (PFE) Companies RE—969 and 970, the combined companies being under command of Lieut Colonel Ronnie Cowan, their task being to plant the floating piers and to build the floating roadways which connected them to the shore. No 1 Port Construction & Repair (PC&R) Group RE—commander Lieut Colonel Donald May with 935 PC&R Company RE (Major Hinricks) responsible for the demolitions and engineering works ashore. No 5 PC&R Group RE—commander Lieut Colonel Homewood with 930 PC&R Company RE responsible for crewing and sinking the concrete caissons.

To achieve (b) six Port Operating Groups RE under Colonel Tommy Thompson

## A Harbour Goes to France

and two Inland Water Transport (IWT) Groups RE under Colonel Slim Bowen were included in the assault force.

To achieve (c) other PC&R Groups and Companies RE were included in the assault force, eg 933 Company to Port-en-Bessin, 937 Company to Ouistreham and 936 Company to Courselles.

From memory I think the total RE Transportation strength in the Order of Battle on D Day was around 7,000 all ranks of which only three RE Officers besides myself were Regular Army.

To carry out this task, the Directorate of Ports and IWT 21 AGp was organised under me as follows:

DD Tn Construction—my deputy Colonel (Daddy) A E Howarth—a distinguished civil engineer with an excellent record in WWI. He had general responsibility for all port engineering and I leaned on his experience heavily.

DD Tn Port Construction Force—Colonel S K Gilbert—mentioned above. He also was an experienced civil engineer with a lively and unorthodox mind which was not fully appreciated at times by the sailors.

DD Tn Port Operating—Colonel Tommy Thompson—mentioned above. I had met him before the war when he was in the Supplementary Reserve to which Transportation RE owed so much when war came. If ever anyone knew his job and could lead it was Tommy Thompson.

DD Tn IWT Operating—Colonel 'Slim' Bowen a master at his job whom I only really got to know on the beaches and later in the campaign.

AD Tn—Personal Deputy—Lieut Colonel Raymond Mais. He got into the act in April 1944 even later than I did. He came from Combined Operations and was sent around to get to know as much as possible about the PCF units which were unfortunately still under War Office control at that date. He was one of those ideal invaluable officers to have around who find out all about everything, ears firmly to the ground; shoot trouble, get things done and are born leaders close to all ranks. I was lucky to have him and later as godfather to one of my sons. Later he became Lord Mayor of London.

As the planting of the harbour was thought to be vital to the success of the landings, it was decided that until about D+20 I would establish my HQ at Arromanches and that the building of the harbour would be my first daily personal task during that time. In consequence it was decided to delegate day-to-day control of the discharges to the beaches to Tommy Thompson leaving me with only overall responsibility until Mulberry could be left to look after itself. He discharged this very heavy duty with complete success in spite of the awful strains. In the event I was able to tour the beaches from Port-en-Bessin to Ouistreham to oversee things for myself about every fourth day, often accompanied by Daddy Howarth.

This large force only came under command of 21 AGp at the eleventh hour, much much too late for safety especially in the case of the PCF in which some units had never even seen the equipment and never even trained with it until they arrived on the beaches. They sailed only with hope and a prayer. In some respects I think we succeeded only because the sheer magnitude of the task and being part of this great crusade inspired all ranks to a supreme effort when they got on the beaches. All stood up well to the great strains of the early days and then to the Force 6-7 gale which raged for four days and nights starting on 19 June and out of it all and in spite of it all only one very overstressed major came to me after the storm and asked to be relieved of his job. After a sympathetic chat and a drink he went back and did well.

My memories of those three months leading up to D Day are of eternal conferences, eternal planning and everlasting sailing schedules because each piece of the jigsaw had to sail from England at an exact time to reach the other side and be fitted in according to a tight programme always hoping that the sca and the Germans would not interfere; chasing around the country trying to meet units; plans changing and an ever growing sense of bewilderment at the sheer size of the enterprise. However, a few never-to-be-forgotten memories do stand out in those months before D Day. Towards the end there came a day when I think some four hundred officers were summoned to a cinema in Portsmouth to see and hear General Montgomery. Red caps were all over the place, even up on the roof because it was all of that very high grade of secrecy which we knew as "burn before reading"! and it was billed as a big occasion. This was the first time I had seen this supreme general. Clearly and concisely he told us what it was all about, what he proposed to do, how he thought the Germans would react and what he would do to them in consequence. For the first time after these long months of preparation, there seemed to be a purpose and direction to it all and after months of organised chaos, my little corner seemed to belong and begin to make sense. It took a great load off my own mind and gave me a great up-lift. He made me feel part of a great crusade and extremely proud to be a part of it. What a leader!

After the war Ronnie Cowan who as explained above commanded the PFE Companies in the PCF said that when they sailed on D Day, one of his officers was heard to say:

And gentlemen of England now abed Shall think themselves accursed they were not here And hold their manhoods cheap while any speaks

That fought with us upon St Crispin's Day.

-an apt quotation resorted to by others who landed then. Indeed, the PCF came alive for me that day in Portsmouth.

The next memory was terrifying and I can still go cold at the thought. After a long and tedious morning of meetings. Petrie took me to lunch at the In and Out Club in Piccadilly. We were going back to Norfolk House after lunch and as was the custom we took our black bags all carefully locked into lunch and for security sake put them down on the floor beside our feet and never let them go-or so I thought. After lunch we returned to Norfolk House and I found that I had left my bag under the table at the Club. My papers contained plans of the Mulberry and it would not have taken German Intelligence much effort to locate the beach. I have never forgotten the horror of that moment of discovery. Execution at the Tower would have been comforting and a welcome release but would not have lessened the damage. I rang the Club immediately and again I have never forgotten the calm voice of the Hall Porter saying "Yes Sir, a bag was found beside one of the tables and I have it here quite safe in the office". I broke the record time between Norfolk House and the Club to retrieve that bag. As far as I could see the papers were intact. I reported the incident immediately to Intelligence expecting that I would now sever my brief connection with 21 AGp and go to the Tower especially as we had recently heard on the grape vine of a senior American officer who had spoken out unwisely and had been returned promptly to the States for punishment. However, after much checking and interviewing it was decided that no harm had been done and I was returned to store in a battered condition.

Sometime early in April I had had to know the exact location of the harbour but early in May I had to be told the planned date of D Day. This was a great burden especially after my lapse of security and I was even scared of babbling in my sleep.

For the last week before D Day, my HQ moved to some rather nice empty houses down by the shore at Selsey. We took with us from Norfolk House the large model of the harbour at Arromanches—today I am told it is on display in the Mulberry museum at Arromanches and no doubt one has to pay the French to see it! We were very worried at having it down there on the shore in case we were attacked and so in addition to the permanent guards, the bravest of the clerks were assigned to die destroying the model at all costs if attacked.

#### THE HARBOUR SETS SAIL

ON Saturday 3 Junc—D-3 as it turned out to be, the main party of HQ PCF embarked on HMS Aristocrat, a shallow draught Clyde paddle steamer and the remainder of us boarded on D-2. On D Day HQ PCF came into operation and the first signal was made to Rear Admiral Mulberry/Pluto (Rear Admiral Tennant) at 1410 hours and



Photo 2 HQ Port Construction Force, Portsmouth, D Day

we moved to our position in convoy at 1430 hours. Photo 2 showing some HQ staff including myself was taken on deck shortly afterwards.

We sailed as dusk was falling and I soon began to get very worried. We passed a Rhino tag with only one ferry instead of two. These ferries were a great American invention developed from their island hopping battles in the Pacific consisting of strong oblong boxes fitted together to form a floating platform which could carry vehicles and stores from ships and be grounded on the baches. Next we passed a tag with its correct quota of two ferries but next a solitary tag with no ferries. This was disaster as it was vital to have every single ferry with its tags on the other side for the planned discharge of vehicles and stores to the beaches and here already after all these months of planning and sailing schedules, parts of the plans were missing—one could only hope and pray that worse was not in store. It was very cold that might and bumpy and Petrie gave me a real navy duffic coat such as only sailors have and it is still going strong forty years on.

We arrived at our station off shore at Arromanches before dawn on D+1. At first light through glasses to our consternation we saw German soldiery on the high ground to the west of the town. Photo 3 shows Arromanches as we saw it that morning. This meant that right at the start our plans were adrift because it had been planned that Arromanches should be ilberated by units of 231 Brigade on D Day so that the PCF units could begin to move in unopposed on D+1 and start on the very light schedule of planting the harbour. However, a little later the Survey Launch Javelin with Raymond Mais and Lieutenant Ashton came alongside to report. Mais had landed on D Day and was responsible for establishing the in-shore and off-shore markers for the floating piers and reconnoitring the beach exits and seeing that the in-shore hydrographical survey was done. The Sappers were responsible for the in-shore survey from the four fathom line at low water while the Navy was responsible for the offshore survey beyond that time. With tides øften of wenty feet this was a lot of curvey for the Sappers and it was bravely done under unfriendly conditions starting on *D* Day itself. At least this part of the job had started well.

Although volumes have been written about Mulberry B a brief description at this stage may help to understand what we set out to do. *Plan B* shows Mulberry B as it was planned. The Navy was responsible for planting that part of the breakwater (Code name GOOSEBERRY) which consisted of old merchant ships (Code name CORN-COBS) sunk in line as shown on *Plan B* and *Photo 4*. The Army was responsible for planting the remainder of the breakwaters made up of large concrete calassons (Code

# A Harbour Goes to France (2)



Photo 3 Arromanches, dawn D + 1

name PHOENIX) sunk as shown on Plan B and Photo 5 so that between us we planted breakwaters round three sides of a harbour larger than Dover harbour. The PCF was also responsible for planting the floating piere heads Photo 6 connected to shore by floating roadways Photo 7 each about 1200 yards long so that ships could come alongside the pierheads and discharge directly to shore. Finally, there was a special Landing Ship Tank (LST) pierhead on its own connected to shore so that tanks could be discharged direct from ship to shore (see Photo 8). Photos 1 and 9 show Mulberry B as built.

By about 0900 hrs the Germans seemed to disappear and then by one of those kinks that occur in life, an American DUKW with two dead Americans aboard drifted through the Piccadilly Circus of shipping on to HMS Aristocrat and the sailors made it fast. Suddenly the penny dropped and the message was taken-here was the unplanned but perfect way to get ashore with dry feet presented out of the skies. My driver, Corporal Antony, a sterling character who had driven lorries before the war, claimed to know how to drive a DUKW and so with Donald May and Sergeant Major Plenty we set off and arrived on Gold Item beach between Cabane and Asnelles. On landing there was nothing else to do but to get into the bumper-to-bumper queue heading inland and above all to keep strictly to the road on either side of which were frequent and unfriendly notice boards proclaiming "Achtung, Minen" with Skull and Crossbones to add emphasis. Again Fate took charge. After about 1500 yards we arrived at a crossroads where, in the excitement of Corporal Antony stopping and starting including the propeller, we went straight on instead of turning right for Arromanches as we should have done. Next behind us in the queue was a carrier with marines aboard (part of a marine commando was allocated to Arromanches) and this correctly turned right at the crossroads but as we drove on we saw it blown up by mines because, as we discovered later that day, that road had not been cleared. There but for the Grace of God should we have gone. After that we got connected with the map only to find that as we could not turn back we could only go forward to Ryes and then come round to enter Arromanches from the west. Traffic ahead of us dispersed and disappeared and we soon found ourselves on our own. We had no idea where the enemy was though from the sea we had seen Germans for a short time in Arromanches and so we pushed on at speed and arrived without incident. We discovered the next day when we had a skirmish with the Germans that unbeknown to us we had somehow driven through enemy-held ground.

We stopped in the 'Place' in Arromanches and Donald May went off in one direction

# A Harbour Goes to France (3)



# A Harbour Goes to France (4, 5, 6)



Photo 4 (top left) Blockships (Corncobs) scuttled to form the initial breakwater

Photo 5 (middle left) Concrete cainsons (Phoenix) forming the prefabricated breakwater

Photo 6 (bottom left) The floating pier heads

Photo 7 (above top) Floating roadways discharging directly to shore

Photo 8 (above bottom) A close-up of the floating roadways (Note, a model of these units can be seen in the RE Museum)

# A Harbour Goes to France (7 & 8)

and I in the other to look around leaving Sergeant Major Plenty and Corporal Antony with the DUKW. Up my street I soon came upon a German helmet lying in the road. We had been taught that this was a common booby trap and so with thoughts of clearing the trap and getting a prize for my 13 year old son which would place him well above his peers at school, I loosed off at the tin hat with my .38 revolver, though I was carrying a Sten gun. My sixth shot hit the buil and as it moved and nothing happened, the prize was won. Unfortunately the shooting attracted two of those elderly French women dressed in black from neck to ankle of whom we met so many in the days to come. They rushed out of a house shouting 'Boches' and pointing next door and without thinking I advanced upon the house with drawn (but empty) revolver. Fortunately for me, also attracted by the shouting and shooting out tumbled four German soldiers looking if possible more surprised than me. They promptly obliged by putting up their hands and so single handed with an unloaded revolver and having displayed the utmost courage I had taken four prisoners! It was clear we were winning the war. In fact they were of a Mongol type and turned out to be Ukrainian Russians in German uniform who were generally very happy to surrender though there were some ugly stories about them later. I returned my prisoners to Sergeant Major Plenty, connected with Donald May and went down to the sea front which we had looked at from the sea at dawn. There it was, just as on the model and on the photos we had pored over for long hours in Norfolk House and unbelievably here we were at last. It was exciting and inspiring and gave a terrific urge to get cracking without delay. The esplanade had been mined but the exploder removed. After looking around we embarked once more in our DUKW and returned to HMS Aristocrat for the first big planned event in the planting of Mulberry B-the scuttling at 1350 hours by the Navy of the blockship (or Corncob) Alynbank. Everything went wrong-she settled too slowly and the tugs failed to hold her on line as she sank and she ended up more or less at right angles to the intended line of the breakwater. This was a bad start but the Navy immediately learnt the lesson and in the following days successfully planted their part of the breakwater (Photo 4). The remainder of the harbour breakwaters were formed by the concrete caissons (PHOENIX) planted by 930 PC & R Company and the Royal Navy (Photo 5).

After this excitement I went ashore again and did a first complete recce of Arromanches with Raymond Mais and Donald May. Detachments of the PCR had been arriving all day and I met Ronnie Cowan with a party of 969 PFEC and Major Hinrichs with a party of 935 PC&R Company. Already the planning seemed to be falling into place and didn't seem quite so barmy after all. We ended the day by bivouacking in a wood to the west of Arromanches as dusk was falling. We dispersed early next morning but about mid-morning there came sounds of battle from the west of the town. Later it transpired that a party of about sixty Germans had emerged from underground passages below where we had bivouacked the night before and were engaged by such PCF troops as could be mustered who with the aid of a tank killed some but took forty-seven prisoners. So ended the capture of Arromanches on D+2 instead of D Day as planned.

By about D+3, the PCF had at long last become a living entity. For the first time all the constituent units were working on one site each on its own specialised task. To me it all came to life and all ranks soon became imbued with a tremendous spirit to lick all the odds which became greater as the days went on up to the great storm starting on 19 June. It was an unforgettable and proud experience. The story from inside the PFE Companies has been well told by Ronnie Cowan in a talk which he gave at Imperial College in June 1975 and this record of an outstanding success by RE Units in war should have a place in the Journal. Unfortunately no one has recorded the inside story of 930 PC&R Company some of whose members lost their lives crossing the Channel on the PHOENIX units under dangerous and very uncomfortable conditions while others played their parts so successfully in the planting of the caissons to form the major part of the breakwaters—a company of which the Corps can be very proud.



Plan A The Arromanches area

As in the days before D Day so now in the first months on the beaches certain memories stand out. The first is one of utter fatigue resulting from complete absorption in the job. The Germans made a few air attacks and dropped mines in the harbour but we were all too busy to care and their efforts seemed quite irrelevant to what we were doing. The second is of the horror of war. Though this was my second experience of a real shooting war, as I went along the beaches, the sight of the wounded, the dead and the lingering stench of the very dead came as a big shock and made me realise as never before the utter futility of war and what we owed to those whose weakness in preparing had let us in for all this.

Planning had visualised using the Ouistreham-Caen canal as a supply route and about D+5 Daddy Howarth and I were walking up the canal path near what has become known as Pegasus Bridge when there came 'Pht Pht' as a sniper took a pot at us—the large plastic faces of our map cases had reflected the sun and given him his target—we hit the earth so fast he gave up—my luck was holding.

On 7 July in the late evening I happened to be swanning around inland behind Sword Beach near Colville-sur-Orne when I witnessed at close quarters what we were told was a bomber raid on Caen of over 400 planes. It was an unforgettable memory watching those heroes trundle back and forth at low level through a sky sparkling with flak and those that did not drop their bombs the first time calmly turned round and came back for more—the charge of the Light Brigade had nothing on this in our opinion—what guts!

Quite early on by about D+10 the word seemed to get around that this harbour was really something big. All sorts and ranks materialised apparently from nowhere wanting to have a look. Experts came over from England who had done so much in the research, design and construction of the breakwaters, the piers and the floating roadways and, understandably, they wanted to see their babies performing. General Eisenhower, General Montgomery and Mr Churchill all came and had to be given the gen but before long the traffic grew to such proportions that I reckoned I was having to spend at least 15% of time of which I had none to spare in coping with visitors and I grew desperate. Exasperated, I signalled Rear Tn HQ in England requesting the



Plan B Mulberry 'B' as it was planned

services of an experienced tour operator from Thos Cook with the rank of major accompanied by a shapely female assistant to run conducted tours of the harbour with the proceeds going to the RE Benevolent Fund. An awful rocket came back and no assistance was offered but at least the point was taken and the traffic diminished thanks also to the storm on 19 June—it was all good fun.

Sometime in May I had met Captain A D Clark USN who was my opposite number in command of the American Force 128 which was to plant the American Mulberry A at Omaha beach. Their job was to be done entirely by the Navy which included in its organisation Construction Battalion Regiments (CB—known as Scabecs) formed from their Naval Corps of Civil Engineers—excellent units composed of engineering trades for marine work which they had developed for their island hopping battles in the Pacific. As the Royal Navy had nothing like this, we British had to bring in the Army and even then the Army had to improvise with specialist marine engineering units RE such as the PFE and PC&R Companies. This meant that both the Army and Navy were involved in planting Mulberry B and that our success was dependent on complete unity and co-operation all down the line between two Services, a risk the Americans did not have to take.

Both Clark and I had much the same tight planting schedules to contend with and inevitably in the course of our discussions a friendly rivalry grew up as to which of us would get there first. I explained to him that the Royal Engineers had never been beaten and never would be and so quite obviously we should build faster and better than the Seabees and get a higher tonnage of stores and vehicles ashore quicker than they would! We had a bet on it but for reasons explained below it was never settled. A day or two after we surfaced from the great storm starting on 19 June, I went over to Omaha beach with Mais to see the Americans at Mulberry A and we were quite shattered by what we found. Mulberry B was bent and damaged (Photo 10) but it was obvious to us that Mulberry A was finished and it brought no joy whatsoever that the Royal Engineers had survived and won because we were all on the same side and both harbours were needed for the build up of the landings. The high command soon decided to abandon Mulberry A and to transfer to Mulberry B such remaining units of breakwater and floating roadways as were left in the UK. As bad luck would have it an exceptional number of tows had sailed from the UK on 19 June and many with their crews were lost on their way over during the storm. In the event we had not even

A HARBOUR GOES TO FRANCE



Photo 9 Aerial Mosaic of Mulberry B. (Note the differences between this and Plan B, particularly the shorter third roadway, one result of the storm on 19 June)

enough to complete our Mulberry B as will be seen in the final layout in Photo 9. One enduring memory of the storm and this disaster was the wonderful way in which the Americans quickly got over their disappointment at their failure and set about enthusiastically to help us with our harbour in every way they could. The story of the storm has been well told by Ronnie Cowan (see page 26 above) but I should like to pay special tribate to my opposite number—Captain Petrie for his advice and guidance as the storm blew up—we did the right things because we had good sailors with us.

When we sailed on D Day we found members of an Army Cinematograph Unit on board and they started filming as we sailed. Just before Christmas 1944 there arrived at my office in Brussels a package all done up with holly paper wishing me good luck and best wishes from the War Office. This turned out to be two cans of 16mm sound track film duration about thirty-five minutes showing the planting of Mulberry B up to the storm. It was sent to me as a personal gift, even the cans had holly paper on them and I was quite touched even though I only appear once in the film! The title was "A Harbour goes to France" and it is now in the RE Corps Library. Another copy is shown in the French Mulberry museum at Arromanches!



# A Harbour Goes to France (9 & 10)

#### IN RETROSPECT

FINALLY, was it all worthwhile? The Monkton Commission was set up in the autumn of 1944 to try and answer this question and I gave evidence to Sir Walter himself in Brussels at that time. Much has been written since the war about this because after any great enterprise such as this there is always a host of writers and historians, many of whom were in their nappies at the time bursting to rush into print and analyse, dissect and criticise the politicians and generals who took the decisions and based them on the best appreciation of the situation which they could make at the time taking into account all the factors under which they conducted the war.

A memorandum to the Combined Chiefs of Staff at the time stated "This project is so vital that it might be described as the crux of the whole operation. It must not fail." Though at my level I naturally never saw this memorandum, the gist of it was firmly drummed into me in the month before D Day.

Afterwards G4 Staff at Supreme Headquarters Allied Expeditionary Force (SHAEF) said "Mulberry B actually did far more than the job for which it was intended and, despite storms of intensity far beyond that for which it had been designed, is the success story of a military and naval operation unsurpassed in the history of warfare".

In the vital period in the battle for Normandy, from the time it started operation on D+4 until the end of August 1944, 488,700 long tons of supplies were unloaded through Mulberry B and this was 40% of the total British stores unloadings over the beaches. During the first two days of the storm when it was too rough to unload anything over the beaches, 2000 tons of vital ammunition were unloaded at Mulberry B and sent up to the battle. One can go on and on quoting figures and making comparisons and keep happy proving anything you wish, but the fact remains that in the wisdom of the day, the Mulberries were considered to be a vital insurance to the success of Operation Overlord and that the Royal Navy and the Royal Engineers working together at Mulberry B did better than they were asked to do.

To all ranks who had the privilege to be there, of course it was well worthwhile because it gave everyone of us the greatest opportunity of our lives to serve as proud members of the Port Construction Force. Mulberry B which put Arromanches on the map and into military history for all time. For myself I learnt one important lesson. This untrained force which had had little experience of its equipment and only came together as a single unit on the beaches on D+I succeeded because we built up a high morale in all ranks. I learnt that organisation, training, high class equipment and technical skill all give place to the most important factor for success—morale.

KNOW YOUR HISTORY



# Himalayan Survey

#### CAPTAIN F S SPENCE B Sc RE

This article is a shortened transcript of the presentation given on 20 January 1985 by Lieut Colonel J A C Read MBIM, Captain J B Olley BSc and Captain F S Spence BSc

#### INTRODUCTION

BETWEEN 1982 and 1985 soldiers from the Military Survey branch of the Royal Engineers undertook a major project in Nepal. The aim was to establish a first order geodetic network—a series of precisely coordinated trig points across the whole country—on which future lower order surveys and mapping could be based. The project, which was called Exercise HIGH TRIG, was carried out in conjunction with the Nepal Survey Department. This account of the project is preceded by a brief description of the country and its people.

Topography and Climate

Nepal is an independent kingdom which lies along the southern slopes of the Himalayas. It is about 550 miles from East to West and between 90 and 150 miles from North to South—about the size of England and Scotland together. It is bounded by India to the East, South and West and the Tibet Region of China to the North. Its latitude is similar to that of Florida and the Sahara Desert. Topographically it is unique and divides into three distinct regions running laterally across the country. In the south is the Terai, in the centre is the Hill country and to the North the high Himalayas.

The Terai is flat and fertile and is only a few hundred feet above sea level. It is part of the Ganges Plain and shares the extreme heat of India. The hill country varies in height from about six to twelve thousand feet above sea level. It is crisscrossed by the lower ranges of the Himalayas and by swift flowing mountain rivers. The majority of the population live in this temperate region which enjoys an alpine climate. It is heavily forested at the lower levels but the hills become bare above 10,000ft. The High Himalayas along the border with Tibet are the World's highest mountains including Mount Everest. The climate here is arctic and the population minimal.

Kathmandu, the capital is in the central region. It lies in a flat bottomed valley completely surrounded by mountains at about four and a half thousand feet above sea level. Access to the valley is not easy and it is only in recent years that a road south to India was completed. Outside the Kathmandu valley travel is still extremely difficult and is mainly on foot. There is only one significant road—the East West Highway—and even this is not surfaced in the west. The few other roads which do exist are mainly confined to the Terai and many of these are closed for part of each year due to the monsoons. As a result Kathmandu has developed at a much faster rate than the rest of the country and life in the hills is still very isolated and primitive. *Culture and History* 

The population of Nepal is about twelve million. The people are mainly descended from three migrations—from India, Tibet and Central Asia. Religion is central to their existance and Hinduism and Buddism flourish side by side with many people worshipping the deities of both.

Civilization has flourished in the Kathmandu Valley since well before the birth of Christ. The present Kingdom of Nepal was founded in the 18th Century from a number of smaller mountain states. However, it is only since becoming a democracy in 1951, that the country has been open to foreigners to any extent. In 1962 4000 tourists visited Nepal. Last year an estimated 300,000 did so. This means that the country is being catapulted very rapidly into the 20th Century. At present it is a curious mixture of both medieval and modern.



#### HIMALAYAN SURVEY

#### Military Survey Involvement

Now a few words about how we became involved in survey work in Nepal. Prior to 1945 there was virtually no survey control or mapping in the country. During the 1950s and 1960s The Survey of India produced a series of 1 in to 1 mile scale maps and established some horizontal and vertical control on which to base them. Since then a number of other surveys have been done, but mostly of limited areas in support of specific projects. As a result, although there was a fair amount of survey control by the late 1970s, particularly in Central and Eastern Nepal, this was mainly in the Terai and was by no means the comprehensive geodetic network needed to support modern mapping, engineering and development needs.

In 1979 the governments of the United Kingdom and Nepal agreed that a team of British Military Surveyors would establish a network of survey control points across the length of Nepal using Doppler Satellite Positioning techniques. At the same time the team would make gravity observations. This work was carried out in 1980 and 1981 by 512 Specialist Team Royal Engineers who have been involved in satellite positioning work worldwide since 1963. A total of fourteen Doppler points were fixed. Some were colocated with existing stations, especially those established by Czechoslovakian teams during the 1970s whilst the remainder were in places where no control had previously existed. From this followed a further agreement with the Nepalese Government to provide a comprehensive network of primary geodetic control based on the Doppler work. At the same time additional gravity observations would be made. This agreement was signed in 1982 and ratified annually until the task was completed in 1985.

The fieldwork was undertaken by 19 Topographic Squadron of 42 Survey Engineer Regiment in conjunction with the Nepal Survey Department and the final results were computed in the United Kingdom by the Mapping and Charting Establishment Royal Engineers.

#### THE TASK

#### **Technical Requirement**

The technical requirement was to link the widely spaced satellite determined points together and to measure the coordinates of many other points relative to the satellite points.

The accuracy that we hoped to achieve was less than 10cms horizontally and less than 50cms in height at all points. The twelve satellite points were linked by distance measurements, but because of the distances involved none of the points were intervisible so we had to establish intermediate points on hill tops. The position of each of the hill top stations was determined by triangulation. Both the distances between the points and the horizontal and vertical angles were measured so that as the work progressed a network of observations connecting the survey stations was built up. Year by Year

The weather precluded deployment and fieldwork during the monsoon season between April and August so the project had to take place in the winter months. In September each year a team of about thirty soldiers deployed from Barton Stacey to Nepal and returned to the United Kingdom in March the following year.

In the first year work started in the East of the country with the project headquarters situated in the British Gurkha cantonment at Dharan. A total of sixteen survey stations were occupied this year and the distances and angles between them were measured (see Map I). As the initial deployment, this was very much the pathfinder for its two successors. Therefore work was carried out at a steady, controlled rate, while great efforts were made to establish contacts and formulate procedures appropriate to the conditions.

In the second year, work continued westward through the central region. The headquarters was now located in Maya House, Kathmandu, fairly palatial accommodation hired through the British Embassy. Eventually this was supplemented by a tented advance camp at Pokhara in the Annapurna region. We capitalised on the groundwork of the previous year and blessed by excellent weather, progress was rapid and more work was achieved than expected. In all thirty-six survey stations were occupied, four of these being a re-occupation of the previous year's stations to tie together the two pieces of work.

The project was completed during the 1984/85 season, finishing in the "far west" of the country. This year we had to work at very high altitudes—up to 17,000ft. Even compared with the rest of Nepal the hill areas of the far west are remote and very primitive. Few Nepalese, other than local tribesmen, ever go there and certainly in many cases our surveyors were the first Europeans the villagers had ever seen. Because of the remote nature of the area it was necessary to locate our headquarters, once again, in Maya House, Kathmandu, where communications and services were readily available. However, with the base camp separated from the actual work area by more than 200 miles we had to maintain three semi-permanent tented advance camps at airstrips in the far west. Two of these were in the Terai and were accessible by road, while the third lay at 8000ft in the hills and was only accessible by light aircraft. A total of thirty-three points were occupied in this final year, and several of the field parties spent an unbroken five months living in the field. Over the three years a total of sixty-eight trig points were occupied.

Obviously in a triangulation scheme with angles and distances such as this; three angles or three distances would fix the shape of any given triangle. Therefore by measuring both angles and distances we were incorporating redundancies. However, lack of time and bad weather ruled out many observations. Also it transpired that not all adjacent points were intervisible. By analysing the proposed network prior to arriving in Nepal we optimised the number and type of observations for the required accuracy. Eventually the values of all the successful measurements were fed into a computer which used a least squares adjustment process, allocating different weights to different measurements, to provide a final list of coordinates and height.

So far then, the points in the network were all fixed relative to each other. The network as a whole now needed orientating and positioning absolutely on the Earth's surface. This was achieved by two means. Firstly by the satellite fixed points observed earlier and secondly by astronomy. Observations for azimuth, latitude and longitude were made at intervals throughout the scheme.

#### Work On A Survey Station

So much for the theoretical side but what were the practical requirements for a field party on station? Horizontal angles between stations were measured using a theodolite. This instrument was also used to measure the vertical angle between stations. This value combined with the distance between them was then used to derive the difference in height between the two points.

Distances were measured using a microwave instrument. This instrument comprises a master and a remote. The master at one station transmits electromagnetic pulses to a remote set on the other station. The remote reflects the pulse straight back and, by recording the time elapsed since transmission, the master is able to translate this into a distance measurement.

Intervisibility between the mountain stations was rarely a problem as the air above 10,000ft was generally clear. However, the view from the hill stations to the low lying areas of the Indian Plain was often obscured by a layer of cloud making theodolite observations difficult. An additional problem in the flat Terai region was that the ground height never varied by more than 50 to 100ft. Therefore lines of sight, over distances longer than 5 to 10km, soon became obscured by trees and buildings due to the curvature of the earth. For this reason it was decided to use a string of tall microwave communication towers that had been recently constructed by the Nepal telephone company. The tops of the towers were fixed in position by distance measurements from the hills. It was not possible to take theodolite observations from the tops of the towers as they were not sufficiently stable. In fact, in a strong wind they are hardly stable enough to hang on to!

The optimum times of day for different types of observations should please-any


Photo 2. Observation party at 17,000 ft.

time and motion expert. Horizontal angles are ideally measured at night, just before dawn or just after dark to minimise the effects of refraction. Lights are therefore required to observe to at night. On a clear night in Nepal we had no difficulty seeing the lights over 70km away. Distances should be measured once in the early morning, once in the late afternoon and once at night. The three distances are averaged. Finally vertical angles should be measured between ten o'clock in the morning and midday. Although a light sometimes provides an adequate target during the day, a helio mirror for reflecting the sun towards the observer was found to be more useful, operating effectively over distances in excess of 35km.

Any spare time at night was spent taking observations to the stars and in case boredom set in during the day there were always plenty of technical housekeeping tasks to keep the survey team occupied. For example, one day air photography will be flown and it will be from these air photographs that future maps will be made. The individual trig points will be used to co-ordinate accurately points on the photographs, thus controlling their exact positioning. Therefore it must be possible to identify each trig point on the photographs. So shallow trenches were dug in the shape of a cross with the point at the centre. These were then filled with rocks to provide a contrast against the grass background. Witness marks needed to be selected and recorded so that if anything happens to the actual trig point, it can be re-located by measurement from there. Where there was no actual pillar, a cairn was constructed over the trig point to help identify its position in the future, while at the same time affording it protection. Finally a 360° photographic panorama, was required. This would be annotated with the names and magnetic bearings of all significant features, which will help subsequent occupants of the station to orientate themselves. Summary of Technical Achievement

The last stage of the project was to analyse all of the observations on return to the United Kingdom. A total of 1630 observations were taken between the sixty-eight trig points and, with the exception of the microwave towers, the final accuracy of the trig point coordinates was well within the original specification. The microwave towers were fixed to less than a metre. One question everyoon asks is "How high did you

# Himalayan Survey (2)

make Everest?" Unfortunately our triangulation network was designed to provide country wide coordinates and it was not intended to height Everest with any greater accuracy than several recent Expeditions. What we can say, however, is that the mountain hasn't moved and that 29,029ft is as good a value as we are likely to have for some time!

#### ADMINISTRATION

ONCE the field parties reached their stations the successful completion of the technical work was rarely a problem. With up to nine field parties spread widely over such a country, it was always the administrative and logistic side of life that caused the problems. This was particularly true in the first year when it was all so very new and in the third year when the work area was so far from the headquarters in Kathmandu and, worse still, a lot of the points were above the economical helicopter ceiling, leaving teams no choice but to walk in. This could take up to two weeks.

The project headquarters in Dharan and Kathmandu successively were in daily communication with field parties by radio. Therefore advice on technical, medical, money or labour issues could be given instantly. However, more tangible help in the form of re-supply could take as long as three weeks to get there. In addition to problems caused by the topography and the weather, there were further constraints imposed by the variable availability of aircraft and vehicles, and indeed local labour. Of course, there was always the overriding financial limitation. Therefore it was fundamental to the success of the operation that all re-supply and redeployment of teams was painstakingly planned and carefully co-ordinated.

The nature of the problem and the resourcefulness required is best illustrated by the transport used. Maximum use was made of the helicopters and light aircraft flown by the Nepalese Army Air Wing. Wherever possible helicopters dropped teams on their points or if this was impractical they would be left as close as possible. With so few roads the success of the project relied heavily on the remarkable efforts of the pilots for whom we have much admiration. However, at the other end of the spectrum there were many times when "Shanks' pony" was the only available option.

Between the two extremes lie the Landrover and some less conventional forms of transport, including local buses, rickshaws and ox-carts. River crossings were interesting. In some places we were fortunate and were able to take advantage of cable ferries. In others one just had to "trust in the Lord" and try to ford (some were luckier than others) and occasionally we had to resort to more desperate methods; namely dug-out cances and gourds. These gourds are clay flotation aids, about the size of a football, which are worn on a thong around the waist—eight of them will keep a man's head above the water. The locals took great pride in their ability to calculate the correct number of gourds required to raft a field party's equipment across the river.

#### Field Party Composition

A standard field party comprised two British surveyors—a corporal or lancecorporal in charge with a sapper assistant. However, there were times when lancecorporals or sappers as young as twenty-one were required to lead field parties—an enormous responsibility! They were accompanied by a Nepalese Surveyor, acting in a liaison role, who worked very closely with our men and was an integral part of the team. Each party also had a three-man trekking team supplied by a Kathmandu agency. The boss, called a Sirdar, was an experienced and capable mountaineer. A very competent man, he would forge a firm friendship with the British soldiers for whom he worked. The Sirdar was assisted by a cook who also acted as his deputy, and a cook-boy. The team was completed by a special porter who was always hired locally. It was his duty to haul firewood and water to the survey station, often far above the tree line and the nearest stream. These were particularly hardy men. That was the permanent composition of the field party, though of course as many as sixty-five porters were required to move teams physically onto their hill tops. HIMALAYAN SURVEY



Photo 3. Field party moving by dug-out canoe.

#### Example Deployment

An example now follows of a typical field party deployment. After arrival in Kathmandu there ensues a frantic period for settling into the Maya House Headquarters; for the lengthy business of unpacking, and for checking that all the equipment has survived the flight and is in good working order (this is as vital for non-technical kit such as Tilly lamps as it is for theodolites). Once all the kit has been issued to field parties it is time to pack for the first deployment.

The flight westward by Nepalese Army aircraft is from Kathmandu along the flat expanse of the Terai to the tented advance camp at Nepalganj Airport. This advance camp, like the others, is expertly manned by soldiers from the Queen's Gurkha Engineers who are attached to the exercise. Teams are immensely grateful for their efforts as they utilise their knowledge of both Nepal and the British Army to satisfy all needs with the minimum fuss. In Kathmandu detachments enjoyed pleasant temperatures in the seventies, now they are struggling in temperatures in excess of 100°F, in a noticeably less civilised environment. The next stop will be the advance camp at Jumla to the north, nestled amongst the mountains on the horizon; but there is a wait of four days before the party is moved completely by the tiny Skyvan aircraft. Because Jumla is at 8000ft, and has a very short airstrip, the Skyvan can only land with the minimum load, and so it takes four trips per field party and these have to be completed early in the morning before severe thermals rising off the mountains make flying unsafe. Indeed a feature of Jumla life are the beautiful still sunny mornings followed by fierce katabatic winds sweeping down the valley in the afternoon.

A further four days at Jumla may be necessary while sufficient porters are recruited. This provides an opportunity for sorting out the medical supplies into manageable packs and laying out the cold weather kit brought for the porters; also purchasing the chickens and goats that will be dragged up the mountains as meat on the hoof.

Eventually the porters arrive and immediately the ritual haggling for loads begins with much cursing and shouting and lots of picking up and putting down. The arguing may go on for an hour. All the loads are heavy, generally weighing about 600bs, and come in the most unmanageable shapes, yet once the arguing is over, the porters walk happily for as many as nine hours a day, their pace quite unaffected by gradient. Indeed one party discovered itself six porters short, so some men had to carry double



Photo 4. Farewell party at Pokhara.

loads—120lbs. For the next fascinating fourteen days the team moves up from the liberal vegetation of the river valley, to the open expanse of barren hillside and on above the snow line to the summit at 17,000ft. Finally, after three weeks, work can start.

#### Different Stations

Although the party described ended up well above the snow line, not all the points were the same. In fact no two survey stations are ever the same and this was particularly true in Nepal with its unique range of topography.

As has already been mentioned; in order to achieve satisfactory lines of sight in the Terai several stations had to be located at the top of microwave towers. Other stations in the developed areas of the Terai were not so fortunate—locals, who recognised their survey equipment, assumed that the detachment was the advance party for a road project which would confiscate their land. Field parties were relatively unhindered in the hill country both in the luxuriant forest of the lower reaches and in the microwave target areas higher up, though at one point the survey team discovered that the trip pillar had been built on top of a burial ground. Their every movement was closely monitored by the gravekeeper.

Higher still, stations were set up on barren mountainsides several days' walk from the nearest settlement and then of course, there were those above the snow line, and indeed those that were not, until the weather changed for the worse and altered the whole complexion of life. One party, equipped only for sub snow line conditions, was well and truly caught when the weather deteriorated and had to spend six weeks living and working in deep snow. Eventually they had to be lifted out by a helicopter shuttle after their survey tent was struck by lightning and one of their living tents collapsed under the weight of snow.

#### CONCLUSION

WE consider ourselves most fortunate to have participated in such a successful task and one which may well be the last first-order triangulation of this magnitude that will need to be done. We are also most grateful for the opportunity to have seen such a fascinating country at close quarters and to meet and work with the charming people who inhabit it. In particular we are most grateful for the co-operation and assistance which we received from the Nepalese Government, especially the Nepal Survey Department and the Nepalese Army Air Wing, without whom we could not have completed the task.

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# Himalayan Survey (4)

# The British Hospital At Renkioi-Part 2

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#### PROSPECTING FOR A SITE

THE newly formed Government had decided to officer the hospital with civil medical practitioners instead of Calling in the already overburdened and inadequately organized Army Medical Officers. The physician appointed during March 1855 as Medical Superintendent was Dr Parkes.

Dr Parkes was not overtly involved in the design of the hospital, as he himself commented after consulting with Brunel and inspecting his proposals. The design had already been considered and fixed and was "distinguished by the perfection of detail and excellence of method which stamped all the works of that excellent engineer. I was convinced nothing could exceed the excellence of the mechanical arrangement, and that the most pressing duty seemed to be the choice of a fit locality for the hospital."<sup>711</sup>

Dr Parkes left London on 5 April having made arrangements for the medical organization of the hospital, and requisitioned medical and purveyors' stores for 1,000 men. He arrived in Constantinople on 18 April.

Brunton's appointment

The choice of the engineer to prospect for the site and superintend the erection of the buildings was obviously of critical importance in Brunel's plan of action. He was an exacting man to work with, as some of the letters of heavy sarcasm to his backers and withering scorn to his erring assistants show. However, amongst his many capabilities was the ability to both recognize the necessary human qualities and abilities needed for the task and to develop in his assistants and supporters the trust and loyalty necessary for the functioning of his projects.

The man chosen was John Brunton. His father William was a railway engineer who had been one of Brunel's early rivals in the original selection of the engineer for the Great Western Railway works. John Brunton may have been one of Brunel's assistants, but at the time he was at Dorchester engaged in railway duties for a firm called Hutchinson and Ritson on the Wilts, Somerset and Weymouth Railway. His selection for the task was obviously a surprise for he says: "One day I received a telegram from

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Professor David Toppin

Mr Brunel requesting me to come to town by that night's mail and be at his office by six o'clock next morning." He travelled overnight from Dorchester to reach Duke Street in the early morning.

"A footman in livery opened the door, and told me in reply to my enquiry that Mr Brunel was in his office room expecting me. I was ushered into the room blazing with light, and saw Mr Brunel sitting writing at his desk. He never raised his eyes from the paper at my entrance, I knew his peculiarities, so walked up to his desk and said shortly, "Mr Brunel I received your telegram and here I am." "Ah", was his reply, "Here's a letter to Mr Hawes at the War Office in Pall Mall, be there with it at 10 o'clock."<sup>12</sup>

At the meeting with Hawes, Brunton was offered the job of prospecting for the site and superintending the works, on the recommendation of Brunel. He immediately accepted. But he could not agree to certain conditions of his duties—for the supply of materials and labour he would have had to apply to the Royal Engineer in charge of the district who in turn would apply to the War Office.

"I saw that if my hands and feet were thus to be bound with red tape the important work would never be completed either to my credit or to the attainment of the end in view. This I stated plainly, and firmly I said I must be perfectly free to act promptly on all occasions that might arise and to be in a position to employ what men I required and purchase such materials as I deemed necessary. We argued this point for at least an hour, I stuck to my colours, convinced that I was right. He got rather angry, "What were your expenses coming up here", he asked—I named the sum. He immediately wrote out a cheque, "There", said he, "is a cheque for your expenses and ten guineas for your time and trouble—you will get the cash for the cheque downstairs good morning"."<sup>12</sup>

Brunton was obviously a man after Bruncl's own kind, and as stubborn. He too was acutely aware of the conditions necessary for effective leadership. However, within a day of his return to Dorchester he was recalled to the War Office. "I told him that not only did I stand by all my previous demands as to the power to be placed in my hands, but I had others ... in addition the Commissariat should have orders to pay all accounts certified by me, that I should receive Her Majesty's Commission as a Field Officer in the Service, and be entitled to draw all the allowances, rations, etc to which that rank in the service entitled me. To which Hawes replied, "you are a hard man to deal with, but I suppose you must have it." ... On leaving and when he handed me my signed terms of engagement Mr Hawes said, "There Mr Brunton, you have now in your hands greater powers than any other Officer in Her Majesty's service. I feel sure you will not abuse them"."<sup>112</sup>

Brunton left England at the end of March with a party of thirty men: carpenters, joiners, fitters, etc, from the Army Works Corps, and after briefly attending to some hospital work at Smyrna he joined Dr Parkes in Constantinople. After consultation they decided that Brunton should start to search for a site on the borders of the Black Sea eastwards to Trebizond, and he set out on mules with a small party consisting of a dragoman and a guide.

What were the desiderata that he was looking for in a site? The original hospital plan by Brunel for 1,000 men consisted of twenty-two wards connected by an open corridor, which required at least four acres of fairly level ground for the wards alone.

The locality had to be free from all causes of endemic disease and have a temperate climate; a slight but not excessive wind was desirable. The site, while being a reasonable distance from the scene of the war, had to be situated close to the sea, and not at a distance or on a height which would have made the conveyance of materials, stores and patients difficult, if not impossible; equally essential, it must possess a good landing place, accessible at all times in all weather.

At the site itself, the ground had to be level enough to avoid terracing or major earthworks, yet with sufficient fall to carry off any rainwater. A large supply of good water was essential both for consumption and for the flushing of the sewers as no cesspools were to be allowed, with a reservoir at sufficient height to supply the wards



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

and to flush the sewers, in order to avoid the necessity of horse power to pump up the water. A good outlet with running water was necessary for disposal of the sewage. *Towards the Dardanelles* 

After some days examining various localities along the borders of the Black Sea, which were found to be unsuitable due to the absence of good water and the malarious influence of the coast, noticeable in the inhabitants, Brunton was forced to re-trace his steps; he started to search along the Bosphorus, but still to no avail. On submitting his report to Dr Parkes, Brunton was instructed to continue his searches westward, and with a small steamer at his disposal, sailed to the Sea of Marmora with more success. He found an excellent site, as far as healthiness and position were concerned, on the island of Prinkipo (now known as Buyukada), but there was a grave deficiency of water. Continuing further along the coast, he reached the Dardanelles, and a few miles west of the principal town of Chanak Keleshi (now called Canakkale) his searches ended.

"I found a splendid site combining all my requirements as to natural formation, supply of water and freedom from malaria. I ascended the rather precipitous hills lying immediately to the south and found fine springs of water. The village of Renkioi lay on top of the hills about two miles to the south west. I immediately drew up my report and sent it to Constantinople."<sup>12</sup>

On 3 May Dr Parkes inspected the site and confirmed its suitability. His only objection was its distance from the seat of war. From Constantinople it was an additional 100 miles beyond the Bosphorus, about an extra fourteen hours by steamer on half power, yet it had the considerable advantage of being in the direct line to England with transport steamers, sail and store ships constantly passing.

The Times correspondent on his first visit to the hospital, was struck by the natural beauty of the surroundings and the excellence of the site. "The village of Renkioi lies embedded in the hills at the south of the Dardanelles on the Asiatic side. The plain on which the hospital stands is about two miles off, and runs down on the slope to the coast... The surrounding country is purely agricultural and the natives seem quiet, industrious and inoffensive. The plain of Renkioi consists of a sandy loam; it is bounded by an amphitheatre of mountains, 1,000 feet high, whence an abundant supply of water is collected... The amphitheatre of hills protects the hospital against the land wind, which, however rarely blows; the rush of water between the Mediterranean and the Sea of Marmora seems to keep up a perpetual sea-breeze."<sup>13</sup> Management of resources

During this time Brunel was attending to the arrangements for the shipping of the crated hospital parts. His letters to Parkes and Brunton at this time provide a classic example of that scrupulous attention to detail which was the secret of his success as an organizer.

To Brunton on 2 April he wrote: "All plans will be sent in duplicate ... By steamer Hawk or Gertrude I shall send a derrick and most of the tools, and as each vessel sails you shall hear what is in her. You are most fortunate in having exactly the man in Dr Parkes that I should have selected—an enthusiastic, clever, agreeable man, devoted to the object, understanding the plans and works and quite disposed to attach as much importance to the perfection of the building and all those parts I deem most important as to mere doctoring."

"The son of the contractor goes with the head foreman, ten carpenters, the foreman of the WC makers and two men who worked on the iron houses and can lay pipes. I am sending a small forge and two carpenter's benches, but you will need assistant carpenters and labourers, fifty to sixty in all ... I shall have sent you excellent assistants—try and succeed. Do not let anything induce you to alter the general system and arrangement that I had laid down."<sup>2</sup>

On 13 April he wrote to Brunton again concerning the shipping arrangements and revealed a passionate concern for cleanliness, again showing how clearly he understood the reasons for the catastrophe at Scutari: "Materials and men for the whole will leave next week. I will send you bills of lading for the five vessels: the schooner Susan and barque Portwallis, the sailers Vassiter and Tedjorat and the Gertrude and Hawk steamers. By the first named steamer, a fast one, the men will go with Mr. Eassie's son. I would only add to my instructions attention to closet floors by paving or other means so that water cannot lodge in it but it can be kept perfectly clean. If I have a monomania it is a belief in the efficiency of sweet air for invalids and the only point of my hospital I feel anxious about is this ....<sup>32</sup>

Five days later he sent the bills of lading for the complete hospital and added: "I trust these men will puil all together, but good management will always ensure this—and you must try while you make each man more immediately responsible for his own work to help each other—and to do this it is a good thing occasionally to put your hand to a tool yourself and blow the bellows or any other inferior work, not as a display but on some occasion when it is wanted and thus set an example. I have always found it answer."<sup>2</sup>

Meanwhile, he had written to Parkes and revealed another of his concerns, that all his precautions could be defeated by the patients themselves, who may well have never seen a water closet in their lives. "All the vessels with the entire hospital will I believe have left England before the end of next week, that is before 21st. Finding that none of the Ordnance Stores were likely to be ready, and indeed that no positive time could be ascertained for their being ready, I obtained authority yesterday to purchase one third of the required quantity of bedding and some other similar stores and they are now going aboard with the buildings. I have added twenty shower baths, one for each ward and six vapour baths."

"You will be amazed to find also certain boxes of paper for the water closets—I find that at the cost of a few shillings per day an ample supply could be furnished and the mechanical success of the WCs will be much influenced by this. I hope you will succeed in getting this used and not abused. In order to assist in this important object I send out some printed notices or handbills to be stuck up, if you see no objection, in the closet exhorting the men to use the apparatus properly and telling them how to do so. If you do not approve of such appeals the paper can be used for other purposes and perhaps impart some information in its exit from this upper world."

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The buildings will be very quick after you; I almost fear you cannot have satisfied yourself about the site by the time they arrive."<sup>2</sup>

The first steamer Gertrude arrived on 7 May and was unloaded by Greeks employed from the local villages, and erection of the hospital began on 21 May.

Brunel had given Brunton strict instructions as to the sequence of operations when on site. Brunton was to have constructed the complete system of drainage and to have laid on the water supply before any building was to have been capable of admitting patients. Following his setting out of the ward units to suit the peculiarities of the site he had to obtain as a first condition, "a perfect system of drainage, a good supply of water, free ventilation and the most perfect cleanliness ... these conditions being assumed as essentials, preceding the mere covering in of space and providing shelter for patients."

The plain of land projecting into the sea between the two bays rose regularly and gradually from 10ft to 100ft above the sea over a distance of half a mile to the foot of the hills. Brunton was able to accommodate thirty-four units, capable of holding 1,500 sick, in three lines, each consisting of wards on either side of a central corridor, without any terracing or excavation and with considerable ease of water supply and drainage. For further expansion of the hospital to the envisaged 3,000 patients, there was sufficient space to extend the first two lines and simply repeat the system to contain a further 750 men on each line.

Brunton discovered springs two miles from the hospital complex, the first about 700ft above sea level and the other on the summit of the mountain at nearly 1,000ft. He employed a large quantity of local Turkish labour to dig the trenches and lay earthenware pipes to a large reservoir that he formed 70ft above the highest ward. From here he carried the water in iron pipes down the centre of the corridor; branching off at every ward there was a lead service pipe supplying the ward cisterns which in turn supplied the baths, lavatories and closets. This simple gravity system obviated any need for pumping the water and enabled easy flushing of the sewers. From the lavatories and closets at the ends of the wards the sewage was conveyed in wooden trunking, and discharged some distance into the Dardanelles.

Brunton was unable to find suitable local carpenters to assist his own English labour force in the assembly of the hutting framework, which had to be put together very carefully on account of the economy of the construction, and complicated by the size of the units being much larger than the largest Crimean Huts. This operation took longer than Brunel had anticipated, yet within seven weeks Brunton had the hospital ready to receive 300 patients as well as having erected a row of Officers' quarters for the arrival of the physicians, surgeons, nurses and other orderlies.

#### USE

ON 12 July Dr Parkes reported that the hospital was sufficiently complete to accept 300 patients, and by 11 August he was ready for a further 200, yet it was not until October that it was called upon to accept its initial intake. This seems surprising, particularly in view of the circumstances that led to the hospital's inception. A pithy paragraph from the report of the correspondent of The Times dated 27 September alluded to the fact that this was due to the military authorities at the front. "Permit me to express my wonder that the hospitals of Renkioi and Smyrna should be permitted to remain empty. It is well known that threats have been uttered that they should both be "starved out," and that the medical men should have no other employment than that of "picking their teeth". But the appointment of an inspector, chosen from among those who have had better taste than to countenance such expressions, and whose duty should be to apportion the cases of both sick and wounded, would remove all difficulties and be very beneficial to the soldier. Never has the head of the Army Medical Department had such materials to work with. He might have established a new era in his department of the profession. How the advantages so liberally offered by Government and the British public have been turned to account I must leave others to explain."

There was considerable hostility on the part of the Army towards the civil hospitals. The implication was that the Army could not cope with the situation. The Medical Officers felt their chances of promotion were infringed and they resented the high pay the civilians commanded. Consequently the flow of the sick and wounded to the civil hospitals was considerably obstructed.

Through the detailed reports of *The Times* correspondent at Renkioi we are fortunate in being able to evaluate the provisions intended in the design of the hospital against its actual performance in use<sup>12</sup>.

On 1 October the correspondent observed: "The Imperador steamed into sight about midday with 215 sick and wounded from Balaclava ... The ship was anchored about a quarter of a mile from shore, the sea quite calm, and the weather moderately warm. Nothing could have been more favourable. As the permanent piers are not yet completed, that able officer Mr Brunton, the chief engineer, ran out into the sea, with the help of his navvies, in the space of quarter of an hour, constructed a perfectly firm platform, between 60 and 70 feet long, and capable of supporting any number of persons who could stand upon it. Orderly medical officers were appointed to receive the sick on landing, to supply any immediate wants, and to order their conveyance to the wards, if necessary, upon stretchers. The two inspectors, Drs Goodeve and Robertson, stationed themselves at the extremity of the corridor to sort out the cases as they arrived, so that, in accordance with the admirable plan of the establishment, surgical cases, fevers of contagious nature, cases of dysentery, scurvy, etc. may be at once classified and placed under conditions most favourable for cure. Every ward had its proper surgeon or physician, with his staff of ward master, orderlies and nurses. A strong body of Greeks was marshalled as porters, stretcher carriers, etc. It will be scarcely credited that not more than one hour and twenty-five minutes elapsed between departure of the first boat from the Caradoc and the stowing away of the last patient in his comfortable and well appointed bed. The ease and rapidity with which the whole proceeding was conducted must have been most gratifying to all concerned, as it doubtless will be to those at home."

#### The weather's vagaries

By the middle of November the correspondent reported a change in the weather from baking in the Asiatic summer of nearly 100°F by day and night to 50°F by day and 40°F by night, coupled with a strong sharp northerly wind and occasional rain storms. Thereafter the hospital buildings were subjected to the vicissitudes of the weather. There were frequent and sudden changes from the generally cool and mild winter weather to hot southerly gusty winds with torrential cloudbursts, thunder and lightning. By the beginning of December the buildings were receiving major testing in the new climatic conditions. "The buildings seem to be proof against the wind. There have been several shocks of earthquakes, one of which made the houses in the village of Renkioi rattle; but they were scarcely felt in the hospital ... Many of the buildings are watertight-my own for example, but the rain had made its way into others, although the roof was covered with a layer of felt and sheet tin. It will, no doubt, surprise your readers as much as it surprised all here that water could overcome the obstacles presented by a smooth metallic surface, and even now there is some difference of opinion as to the cause, although a remedy has been discovered. Dr Robertson, one of the inspecting physicians, thinks that it is capillary attraction acting along the joinings of the sheets of metal. The engineers rather incline to the belief that the water finds its way alongside the tacks used for fixing the sheet, and by that means get through ... A coat of thick paint of white lead spread over the lines where the metal plates are in apposition and are nailed down has proved perfectly efficacious in checking this annovance."

#### The winter sets in

On 19 December the correspondent noted: "Winter weather has set in, and all are glad of fires. On the 16th snow flakes penetrated the out-houses and the less finished buildings like dust, and water froze in the pipes, which in many places burst, and caused a corresponding amount of discomfort on the 17th when the thaw came. It has been found necessary to complete with all speed the side boarding on the north aspect of the long corridor, which is now perfectly sheltered and dry. A good deal of work has been required on the roofs of the hospital to render them watertight, and to close the apertures left as ventilators during the heat of the summer.

"I am sorry to say that the sheet tin roofing does not answer its ends satisfactorily. Rain finds its way between the joinings of any accidental aperture, and the thinness of the plates renders them liable to tear upon the least strain... Indeed for the future the engineers intend to cover the hospitals with two layers of felt, instead of one layer protected by the thin sheeting. The native tiles make a better roof, as is proved by the mess house, but the general buildings are not constructed to support such material. All the buildings have stood firm, however high has been the gale; no accident from this source has happened, although it has blown "great guns", and the shipping along the coast has sustained considerable damage."

In early January the weather had become almost like an English summer. Wasps were seen about the fields, and the hillsides swarmed with the flights of goldfinches, but on the 14th of the month this mild weather broke and the countryside was covered with snow:

"During the severest time of the snow-storm of the 14th I visited the wards. The lavatories, etc, facing the blast were penetrated to a considerable extent, but all the apartments occupied by the patients were warm and comfortable. I may assert, without contradiction, that nowhere was any man exposed to circumstances connected with the sudden change from summer to winter which could in the smallest degree have given him discomfort, or increased the severity of his disease.

"The ample stoves blazed cheerfully in front of the convalescents grouped around them, and the covered corridor afforded a sheltered walk to those disposed to take active exercise. The buildings have been severely tested, when we consider the effects produced upon the wood, the metal, the iron pipes, according to the laws of expansion and contraction, by a sudden change of temperature amounting to 40 deg of Fahrenheit, attended with a violent wind and a snow-storm positively blinding."

During these months of changeable testing weather, building continued and the correspondent related:

"The utmost activity prevails in the erection of the hospital huts and in the completion of the main corridor ... roads are being constructed about the place ... The English artisans are willingly busy, the Greek workmen as usual are driven to their employment, the sound of the hammer is heard in all directions, except during the pelting of the very heavy rain when it becomes necessary to seek for shelter ... The buildings are rising in rapid succession, and are not very far from their limit longitudinally. As their numbers increase they will be erected on vacant ground already selected on the sides of the main street, if I may call it so. At nightfall the long corridor is regularly lit with lamps."

#### Railway

By 4 December the hospital was ready with 1,000 places and by the beginning of January was up to 1,500 places. During November, changes in the hospitals at Scutari and Smyrna into barracks or winter quarters for the troops established Renkioi as the central medical depot south of the Bosphorus, leading to its major intake in December and January. At the same time as the snow-storm previously mentioned, the Renkioi Railway was opened for carrying the sick the 4 mile journey from the south pier to the corridor, considerably facilitating the working of the hospital.

"It is but a single line and the trucks are drawn by horses ... As the *caique* runs alongside of the pier, the patients are raised, as they lie in their beds on the stretchers, and are deposited on the flat railway carriage, which, when full, starts at a rapid pace towards the hospital. As the line is not quite finished, a medical officer and a fatigue party were on duty at the temporary terminus to see that every facility was given to the patients for their conveyance over the short distance which remained."

At the end of December the correspondent reported a new development: "The railway connecting the north and south piers is being constructed as quickly as



Photo 6 Part of the site of the Hospital used as a camping site, summer 1972. (Photo: David Toppin).

labourers can be obtained, but the Greeks still retain a strong partiality for holydays."

And by the end of January: "The railway now runs from the pier into the corridor, where a turntable receives it, to direct the carriages upon branch lines which will bring them to the very doors of the wards. Instead of patients being carried singly upon stretchers, between two men staggering over the rough and wild countryside, with their worn out and groaning burden. S0 or 60 men are put upon trucks, covered up with blankets and galloped into the hospital along the smooth tramway in a few minutes. Never was a more successful work undertaken, and it will remain a matter of history that the first railway ever laid down in Asia Minor was on the plain of the Renkioi Hospital and used as a transport for sick and wounded soldiers during the campaign in the Crimea ... It is a fact that a single trial of a railway spoils one for all other means of transport; the speed and the order with which the men are arranged on the trucks, the ease and celerity with which they are run into the corridor, the certainty with which the military officer takes the name and regimental number of every man, and the medical officer learns the nature of the disease, that the case may be despatched to the proper ward, are advantages such as can be gained by no other system whatever."

The anticipations that Brunton and Parkes had formed of the suitability of the site were confirmed by the experience of more than a year. In spite of the sudden and great changes of temperature the climate remained generally moderate; there were few days in which the most delicate patients could not get out into the sheltered corridor for a short time during the day. The adequacy of the natural drainage of the land ensured that there was no consequent disease arising from the action of heat on the moistened soil, and there was always a plentiful supply of good water from the springs in the mountains.

There can be no question as to whether or not Brunel achieved the objective for which the hospital was designed, for example as revealed by the small number of deaths in spite of the presence of the severest forms of disease; a death rate of 0.3% as compared with the 40% at Scutari Barracks Hospital. The fact that fevers and contagious diseases did not spread from bed to bed must have been due in large measure to his adequate space standards, means of ensuring proper ventilation and the hygienic conditions made possible by the provision of the drainage system as well as the specially designed equipment and facilities. The type of construction employed with its low thermal capacity could have led to intolerable environmental conditions in the wards, in a climatic situation that changed from 100°F to freezing. Yet it is precisely these kinds of construction with their high surface insulation which respond most effectively to handling of the outer surface fabric, coupled with environmental manipulation; albeit in this instance relying upon the availability of labour-intensive assistance. The fact is—even under the range of conditions experienced in the situations described—that the environmental performance was satisfactory; and it further goes to show that the correctness of Brunel's anticipation of the problem was matched by his understanding of the means for dealing with it.

By the end of March the hospital could have accommodated, with a little pressure, 2,200 patients. In a further three months Dr Parkes estimated that the whole hospital for 3,000 would have been finished and in full activity. For this huge figure, all based on Brunel's ward and corridor principle, Dr Parkes had evolved a system of medical organization based on the principle of sub-division into self-contained hospital units, known as a Division<sup>5</sup>, each consisting of 500 patients. Each Division was to have its own kitchen dispensary, purveyors' provision, issue store, utensil store, pack store and matron's linen store. Each ward was to have its own medical officer, either an assistant surgeon or an assistant physician, who was responsible not only for treatment but cleanliness, hygienic condition and discipline of the ward. Each division had its Divisional Officer, to supervise the Ward Medical Officers, a ward master in charge of four orderlies and ten nurses as well as a lady sister to superintend the nurses and tend to the worst cases<sup>11</sup>.

Parkes was to have had in operation a daily reports system from the Ward Officers, on the efficiency of service of the ward and its hygienic condition, to the Divisional Officer who was to satisfy himself of its accuracy and attend to its points, and then forward it on to the Superintendent. The total number of patients admitted and treated by the hospital was 1,408, number of deaths 50. However the largest number of patients at any time was 642, and the Division system was never really tested, though Dr Parkes was sure from his experience that the system would have worked<sup>11</sup>.

After the signing of the General Peace Treaty on 30 March 1856, instructions were given to close the hospital down. Brunel in his characteristic methodical way, sent Brunton his disposal instructions<sup>2</sup>: "I don't want the thing to be flung into a ditch when done with, but should prefer a useful end; that each part should be made the most of and methodically and profitably disposed of. Everybody here expressed themselves highly satisfied with Everybody there and what we have done. I should wish to show that it was no spirit but just a sober exercise in common sense ..." Auction

By May the greater number of patients had been either discharged or invalided home and in July the remaining medical staff were sent home. In August, Brunton set about advertising the hospital for sale by public auction and tried to persuade the Turkish Government to purchase the whole hospital, as it stood, and use it as a military school; but to no avail.

The eventual sale of the building by public auction took place on 20 September. Prior to this a great fire in Salonica had left a large number of homeless. John Brunton recalled<sup>12</sup> "... a deputation came over to purchase some of the wards of the hospital ... for housing these homeless ones. When the Tallal or auctioncer commenced his labours the bidding for these wards was brisk, and they realised good prices. Day after day the sale went on—much to my satisfaction—till at last we came to what I called the machinery department, a list of which was published. I valued this lot in my mind at £10,000. The bidding for this lot was very slow—it reached £450—and the Tallal kept calling out this sum for a long while, and still no advance—he had orders to knock down no lot without a signal from me.

"I went to him and asked him to point out the bidder of this amount, which he did, and I at once recognised the Greek who was a sort of agent for Calvert the British Consul. I sought out Calvert in the crowd and remonstrated with him. I know that all the people of the Dardanelies held Calvert in such dread that they dared not bid against him. Calvert said, "Come Brunton, knock this lot down; you know your orders are very strict: you must sell everything by public auction." I remonstrated with him and said I certainly would not knock it down for any such price, if he wanted the lot he must boldly bid for something near its value. The shouting Tallal still went on."

"At last Calvert, calling me aside, said, "Look here Brunton, knock it down and I will give you an undertaking you shall have the profits." I was staggered that such proposition as this should come from a British Consul. "No Calvert," said I, "you have the wrong pig by the ear this time". I called out at once to the Tallal "£1,000 for this lot, I buy it in". Calvert was furious. I immediately determined what I would do and sat down and wrote Calvert an order to send down a steamer that night to take this lot of things to England where I knew I could sell them for a vast deal more than had been offered at the auction."

Back in England, Brunton had to face the wrath of the War Office for departing from instructions, and was responsible for a gave breach of duty and orders. Reluctantly he was given storage space and allowed to dispose of the items on behalf of the War Office.

A few days afterwards the Medical Department of the Government advertised for tenders for 500 water closets and a number of lavatories for Netley Military Hospital, which was then in course of erection. John Brunton related<sup>10</sup>, "In my own name I sent a tender and a sample. As I had purchased these articles I knew what the wholesale price was or ought to be. My satisfaction was great when in due course, my tender was accepted. I sent in the lot and acknowledgement came for the receipt of the same. Sales went briskly on, and at last I had only remaining 60 ventilating fans which had been sent for the purpose of ventilating the hospital wards. I could not find a customer for these and was despairing when one morning I saw an article in the newspapers stating that the stoke holes in Her Majesty's gun boats had proved so deficient in ventilation that the stokers had struck work."

Brunton proposed a scheme to the Admiralty which on testing proved successful and resulted in the sale of the fans. Thus were all the parts disposed of and Brunton closed his accounts to the profit of the War Office.

It was not to be long after this that Brunel's health started to fail and his prolific career was coming to an end. By the time of the building of the *Great Eastern* ship, the labour and anxiety involved proved too much for his physical powers, and he broke down on the day of the start of her trial trip with an attack of paralysis. Ten days later on the evening of 15 September 1859 he died. His life-long friend, Daniel Gooch, wrote of him "By his death the Greatest of England's engineers was lost, the man of the greatest originality of thought and power of execution, bold in his ideas, but right. The commercial world thought him extravagant, but although he was so, great things are not done by those who sit down and count the cost of every thought and act."

#### CONCLUSION

BRUNEL was not an architect nor had he any experience in hospital design. His work previous to the hospital was primarily concerned with the design and construction of mechanical systems, machine-based enclosures, or those in which people tended to wear outdoor clothes; yet in this work he showed in his commensense approach a highly perceptive grasp of human needs—and failings—and an understanding of the measures necessary to deal with both.

In a sense the hospital can be regarded as a unique Brunel work, since it was the only instance where the end product was an enclosure necessitating a specific environmental performance, to accommodate a direct human need. Whilst the hospital shows a form which was uninhibited by contemporary architectural morals, it may only be speculation to ask did Brunel employ this method because of the incomplete brief, or, did the method arise out of the problem? Certainly there was nothing new to Brunel, as a railway engineer, about the extendability of linear arrays. In using the linear form with pavilions on either side of a connecting corridor he not only exploited its indeterminate characteristics as a direct reaction to the problem of an incomplete brief, but he also anticipated what was later to become the conventional hospital form.

#### Design and organization

Born out of a successful response to the challenge of a crisis, it cannot be said that the hospital was an original invention, though some of the parts were specially designed. Brunel's real wit lay in seeing the potential for solution in the application of the relevant existing technology; a technology no more advanced than his understanding of its successful application and manipulation. The originality lay rather more in the conception, in perceiving right at the outset that fundamental to the undertaking was the problem of organization. The success of the project illustrates the efficacy of his powers of organization, for this was not just a collection of huts and other components modified from a manufacturer's catalogue, but a highly organized plan of action, right down to the last detail of assembly and transportation, yet with a built-in latitude, so that at no point could the plan become too highly stressed and shatter.

Whilst commonsense solutions and good management are timeless, Brunei's fantastic turn of speed was, in the end, only made possible by his own initiative and capabilities. This speed, based in some measure, perhaps, on an extremism of method and extravagance of personality, was achieved through the use of a powerful design technique, as well as by the use of a repeated element that was capable of being manufactured by industrial fabrication methods.

### Lessons

The lessons of such an exercise are various, and interrelated. Certainly, Brunel, in designing for mechancal services, did not merely look for neat ways to install them, but of setting them to work in partnership with the fabric of the building. Artificial heat, natural and artificial light, forced and natural ventilation all worked together to give an equable indoor climate. The second linked lesson is that this environmental performance was achieved without recourse to any technological novelty. Here was a building with an environmental technology, not called in as a desperate remedy—albeit called in as a remedy in a desperate situation—that was naturally in the working method brought to bear on the problem.

The successful performance of the building should guarantee it a place in the history of environmental control. Yet it is not just that it worked, rather that it worked through the application of the ultimate form of environmental, and all other, power—knowledge. For it was the overall proposition that Brunel made, which presupposed a knowledge so complete of the parts of the system and an understanding of their contributions and interactive relationships in the functioning of the whole that is the prime and outstanding lesson.

#### Brunel's prodigious powers

In the final analysis, the 'sober exercise of commonsense' may not seem enough to explain this achievement, and it is to the man we have finally to look; for whilst Brunel lived at a time when the young profession of civil engineering shone with a glow of adventure and romance, no single person imparted more momentum to the greatest social revolution in history. Quite apart from the hallmarks of genius, some mentioned earlier—streaks of precocity, scepticism towards conventional answers, freshness of vision and acuity of perception, the faculty of combining high flights of theory with a keen sense of the practical, as well as a head for generalizations and an eye for minute particulars—here was a man with truly Herculean powers. "What most distinguished him was the force which drove him to the limit of his bent and which charged his personality with that mysterious magnetic force which so often discomfited his opponents and which drew others to follow him."<sup>2</sup>

It would be interesting to speculate on, but outside the scope of this article, from what vital spring of the spirit he derived his prodigious creative powers, and on the way that the history of construction might have been written had, by some chance, the multiple potential of Brunel been lured further from works of civil engineering, as his was surely "a mind of large general powers accidentally determined to some particular direction, ready for all things but chosen by circumstances for one. It is often by a trivial, even accidental, decision that we direct our activities into a certain channel and thus determine which of the potential expressions of our individuality become manifest...

"Every decision is like a murder, and our march forward is over the still born bodies of all our possible selves that will never be."<sup>14</sup>

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# Military Bridging Materials Performance Comparison

### **Tuition Using a Simple Computer Program**

P D SMITH MA M Sc C Eng MICE and J G HETHERINGTON MA C Eng MICE



John Hetherington and Peter Smith are senior lecturers in the Civil Engineering Group, RMCS, Shrivenham. They have both been there since 1976. With the letting of the contract for the teaching function at Shrivenham to the Crafield Institute of Technology in 1984 they have become responsible for teaching on the civil engineering degree course, the Army Staff Course, Masters courses and specialised short courses. They have been engaged on several topics of militarily relevant research including cross country vehicle mobility, recovery vehicles and the response of materials to blast and ballistic impact.

#### INTRODUCTION

The military bridge designer is continually being asked to meet criteria that are ever more stringent. The conditions that were imposed in the 1960s were daunting enough but for the 1990s, requirements relating to span, load class, deployment times and economics are even more challenging. Although the performance of inservice bridges is impressive, improvements are being demanded and there must be some question as to whether practical limits are being approached making dramatic enhancements not only difficult but impossible<sup>1</sup>.

This paper describes how a simple computer program, prepared by staff at the Royal Military College of Science, permits comparison of the performance of current and potential bridging materials. The program allows bridge span, cross-section and

load class to be varied for a range of different bridging materials to give some insight into the complex interactions between these parameters. The program should be regarded purely as a teaching aid and not as a bridge designer's guide—many important aspects of the design process have not been incorporated in this simple routine which nevertheless gives a good guide to comparative performance.

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# P D Smith and J G Hetherington

#### THE ROYAL ENGINEERS JOURNAL

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Table 1

#### PROGRAM DESCRIPTION

The bridge to be analysed consists simply of a pair of identical beams over the top of which the vehicle can drive. This is a system similar to that used currently in the Armoured Vehicle Launched Bridge (AVLB). The width of the open-box cross-section of each beam is fixed at 450mm (Figure 1). Overall depth d and wall thickness t can be varied by the program operator. The program listing is given in Table I where it will be seen that four different bridging materials are available for consideration. These are mild and maraging steel, aluminium alloy and carbon fibre composite. The density (kg/m<sup>3</sup>), yield strength (N/mm<sup>2</sup>), Young's modulus (kN/mm<sup>2</sup>) and material cost (£/kg) (1985 prices) are given as data in lines 170-200. At line 240 the operator enters vehicle mass (here approximated to a point load in



tonnes numerically equal to the load class figure), bridge span (m), material selection, beam depth (mm) and wall thickness (mm) so that between lines 250 and 400 geometrical factors (centroid position, second moment or area, etc), self-weight, maximum stresses and midspan deflection are evaluated. Data for the particular system being analysed are printed (lines 420 to 470) and then results are output (lines 490-660). To allow the operator to assess the suitability of the design, criteria relating to maximum allowable stresses (here, half the yield strength of the material), maximum deflection (limited to 1/30 of the span) and the depth to thickness ratio (limited to a maximum of 20) are printed alongside the results. If the design is not satisfactory or if another configuration is to be investigated, the operator has the option of changing one or more of the current parameters at lines 710 to 830.

#### RESULTS

In preparing the following results load classes of up to and including 70 have been considered for spans of up to and including 50m.

Figure 2 presents results for a 22m span (ie, a bridge of similar span to the current AVLB). It can be seen that the use of mild steel for load classes greater than about 10 leads to bridges of excessive self-weight. Given that a load of about 10-12t is the limit of portability for current bridge launching equipment, mild steel is clearly a generally unsuitable material. [On this basis of comparison the other three materials seem worth considering.] Note that, for a zero live load on the bridges, the weight indicated is the weight of the bridge that just supports itself over this span.

Figure 3 gives a cost comparison for the



Figure 2. Bridge Mass vs Load Class for 22m span

four materials at the same 22m span. The high cost of both maraging steel and carbon fibre composite is plainly indicated suggesting that, considering also the results of *Figure 1*, aluminium alloy is the clear choice for bridges of this span over a wide range of load classes.

If the problem is recast such that the requirement is to establish how great a gap can be spanned if the bridge is to carry a Class 70 vehicle then Figure 4 shows that carbon fibre composite offers a clear weight advantage. If the requirement is to span a 40m gap (not unrealistic in the current thinking about bridge performance) then a carbon fibre bridge would weigh less than one half of an aluminium alloy bridge and approximately one third of a structure made from maraging steel. Though it should be noted that each bridge will in reality weigh more than indicated (hydraulics, connections, stiffeners, etc are not considered in this program) the relative weights will be broadly similar.



Figure 3. Bridge cost vs Load Class for 22m span



Figure 4. Bridge Mass vs Span for Class 70

When results for a Class 70 load are presented on a cost basis the high cost of both carbon fibre composite and maraging steel is once again apparent. This high cost in conjunction with the as yet unsolved problems relating to bridge construction in carbon fibre composite preclude use of this material in the foreseeable future for complete bridge structures.

Maraging steel, on the evidence of Figure 5 is even more expensive than carbon fibre composite. Given that the use of this material also incurs a weight penalty (as shown in Figures 2 and 4), doubt is cast on the wisdom of selecting this alloy for the current No 8 bridge.

However, Figure 6 shows the depth of a bridge section in each material needed to carry a Class 70 vehicle over a 22m span. This plot of 'comparative bulk' indicates why maraging steel is favoured for a vehicle launched bridge in which the maintenance of a low vehicle profile in a battlefield situation is an important consideration. The current maraging steel AVLB scissor-type bridge, in which the two bridge sections are stacked on top of each other, presents a far less exaggerated silhouette than, for example, an aluminium alloy structure.

Finally, in the case of a vehicle launched bridge, it is interesting to see how the different materials perform if the bridge self-weight is fixed at 10 tonnes, the approximate upper limit for current systems. Results shown in *Figure 7* indicated that if construction problems can be overcome carbon fibre composite holds great promise while maraging steel and aluminium alloy offer broadly similar performances. Once again for zero load the intercept on the span axis for the four materials indicates the maximum gap than can be crossed if the bridge is just to support itself.





Figure 6. Comparative Bridge Bulk for Span 22m, Load Class 70



Figure 7. Load Class vs Span for 10t Bridge

#### **CONCLUSIONS**

This simple teaching program demonstrates the relative performance of a representative range of current and potential military bridging materials. Though the program must not be regarded as a designer's guide it does allow the effects of span and load variation to be clearly illustrated while drawing the students' attention to the possible penaltics relating to self-weight and cost incurred by otherwise engineeringly attractive materials.

The program is sufficiently simple to allow its operation on desk top micro-computers as well as on a mainframe machine on which it was originally developed.

#### ACKNOWLEDGEMENTS

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# **Dexion Tower in Belize**

LIEUTENANT R J J WESSON R ANGLIAN (V)



Richard Wesson is 33 years old and was educated at Harrow and Luion College of Higher Education where he gained a degree in Geology and Geography. He served with 117 Field Squadron RE (V) and 6 Royal Anglian (V) and was commissioned in 1972. During the early part of 1985 he was Second-in-Command of Operation RALEIGH in Belize.

DURING much of my military and civilian career I have had to improvise, as often the stores needed to complete a task have not been available. It has therefore become almost a fetish to see how other minds have overcome problems when they are short of the correct tools and equipment for a particular task.

Whilst I was in Belize on Operation RALEIGH I noticed a forest watchtower near the Southern Highway. My first interest in it was its use as a place from which to take photographs, however, I soon became interested in the tower itself—it is made of



Photo 2. A view showing how the ladder is fixed to the structure

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Lieut R J J Wesson Dexion Tower In Belize



Photo I. The tower in all its glory

Military Bridging Materials Perfomance Comparison (1)



Photo 3. Typical junction and bracing

Photo 4. Corrosion

Dexion, and about 50ft high. Apparently it was constructed about twenty-five years ago but it is no longer used due to extensive corrosion at the top.

The photographs show the structure far better than words can describe. Could Dexion have other military uses? It is light, cheap (7) and takes up less space than scaffolding. Watchtowers for PW Cages, minor structures for airborne or airportable operations, improvised ladders for FIBUA and bridge demolitions, frames for improvised MEXE shelters, the list could go on.

I can only conclude with the statement that the structure is such a brilliant piece of improvisation that it speaks for itself.



# Dexion Tower In Belize (3 & 4)

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## Memoirs

#### COLONEL L G S THOMAS OBE

#### Born 26 June 1917, died 1 June 1985, aged 67

LIONEL GORDON SHERRIFF THOMAS." known universally as 'Jumbo' was born in Cardiff in 1917. He joined the TA in 1939 and received an emergency commission in 1943. He served with 284 Field Company in North West Europe until the end of the War remaining in Germany until 1948 as an instructor at the RE Training School. After his Supplementary Course and a tour of the RSME he was posted to BAOR completing his time there as a field squadron commander. He went to Malaya in 1953 as SORE 2 (Ops and Trg) HQ Malaya and in 1955 began his long association with the Gurkha Engineers joining them as 21C. After a year at Dover as 21C of the Junior Leaders Regiment he returned to Kluang as Commandant of the Queen's Gurkha Engineers in 1960. He returned to England to command the Army Apprentices College at Chepstow. His final tour before retiring from the Army was as Chief Engineer Scotland



There were many strands to Jumbo's life. First and foremost a soldier, he inspired loyalty and affection and was a champion of the old virtues. His tour in command of the Gurkha Engineers included a complete reorganisation of the Regiment into a Training Establishment, at Kluang, the raising of three independent field squadrons and the despatch of two of them, one to UK and one to Hong Kong, and ended with the outbreak of the Azahari rebellion and the start of Indonesian Confrontation. Jumbo revelled in it all. His ability to calm, cajole and laugh was invaluable; his contacts and friendships at all levels of the Army, in the Brigade of Gurkhas and in the Malayan Civil Service helped the Gurkha Engineers through an exciting and traumatic time for which he was awarded the OBE.

To the job of Commandant at Chepstow he was able to apply his particular flair for getting on with the young. Always young at heart he understood the impetuousness of youth; he knew how to simplify a problem; he was always unhurried. An episode in his final tour of Scotland typifies his energy and the force of his personality. The small fishing village of Whithorn was severely threatened by floods brought about by a combination of high tides and on-shore winds. Jumbo met the request for military help by using his powers of persuasion to acquire materials from all sources and the services of TA Soldiers (largely striking miners) to ensure that sufficient protective measures were taken which effectively saved the village.

Part and parcel of soldiering to Jumbo was his involvement in sport pursued with enthusiasm and wholehearted determination. A superb rugby player from pre-war days he made a particular contribution in rejuvenating the Chatham United Services Rugby Club soon after the war cajoling all manner of unlikely people into playing and becoming the inspiration behind the many teams that were fielded every Saturday. He had also taken up flying and in 1950 almost single handed organised the Royal Engineers Air Day attracting large crowds to Detling Airfield. All this extra-mural activity was time consuming and stories abound of how brother officers had to fill in

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# Colonel L G S Thomas OBE

for the more technical aspects of his work. He was hoist by his own petard on one occasion when his partner on a Supplementary Course exercise was away playing rugger in the final of the Army Cup. When he returned Jumbo complained bitterly that he had been forced to work for three nights and was there not more to life than rugger?

However, it is probably for his sailing that he will be best remembered. An experienced sailor for many years he became Army Chief Instructor at the Joint Services Sailing Centre at Gosport on his so called 'retirement' from the Army in 1972. Under his tutelage and eagle eye Army sailing expanded dramatically. He was a wonderful instructor, knowledgeable, patient, thorough and with the very highest standards. Nothing but the best would do and he spent countless hours and days at sea teaching and coaching sailors of all ranks. It was not easy for a soldier involved in setting up the new centre at Gosport and Jumbo's enormous talent for personal relations was fully exercised but his influence both in the Corps and Services at large was out of all proportion to his rank and his huge circle of friends helped smooth many a thorny path.

Some fifteen years ago Jumbo decided to end his bachelor days. He married Priscilla to the delight of his many friends. The marriage was a biasfally happy one. His step children adored him. It was a very hard blow to her when the illness he suffered last year was diagnosed incurable. Our heartfelt sympathy goes out to her and we share the loss of a truly gentle man who it is said never spoke ill of anyone, nor anyone of him.

GLCC, JHSB, JPG, SCC, DAB-W, WC, DHB, JIP, BAFR, ANC.

#### LIEUTENANT GENERAL E L M BURNS CC DSO OBE MC CD

#### Born 17 June 1897, died 13 September 1985, aged 88

EESDON LOUIS MILLARD "TOMMY" BURNS was born at Westmount, Quebec. He received his early education in the public schools of St Thomas, Ontario, and later attended Lower Canada College, Montreal, Quebec. General Burns enlisted in the ranks of the 17th Duke of York's Royal Canadian Hussars 14 June 1913 and served with them until 31 August 1914 when he enrolled at the Royal Military College, Kingston, Ontario. Granted a "war commission" in the Royal Canadian Engineers on 26 June 1915, he successively served as Signal Officer with 11 Canadian Infantry Brigade and on the staff of 9 and 12 Canadian Infantry Brigades. He was awarded the Military Cross for his services on the Somme.



After his repatriation to Canada Toemmy Burns held many appointments in Military Districts and at Army Headquarters, including two years when he instructed Military Engineering at the Royal Military College. On I May 1931 he became GSO2(Svy). In this position he served on many national and international committees related to surveying and the production of maps from aerial photographs. He collaborated in the development of a radial stereoplotter, and pioneered the use in Canada of the Zeiss multiplex aeroprojector. In 1935 he was awarded the OBE in part for his contribution to nerial survey and mapping. In 1934 he was elected as a councillor of the Canadian Institute of Surveying(CIS), and President in 1936. Until his passing he was CIS's oldest honorary member.

# Lieutenant General E L M Burns CC DSO OBE MC CD

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#### MEMOIRS

In the 1920s General Burns embarked on his second career, writing. Although he had many careers you would not have thought that he had any spare time. His daughter, Mary, said that he would arise early in the morning, write until breakfast, and then go to his normal daily work. The results of this regimen are seen in the books he wrote: Manpower in the Canadian Army, 1939-45 (1956); Between Arab and Israeli (1962); Megamurder (1966); General Mud (1970); A Seat at the Table (1972); The Third World War-Must Canada Join in-a comment (1975); and Defence in the Nuclear Age (1976). Canada and the Arab World, published two days after his death, contained his most recent article, "Canada's Peacekeeping Role in the Middle East".

A graduate of the School of Military Engineering, Chatham and the Staff College, Quetta, he had just completed a course at the Imperial Defence College, London when the Second World War was declared. He remained in London, as staff officer at Canadian Military Headquarters, until his promotion to Colonel and return to Canada as Assistant DCGS at Army Headquarters. Promoted, he returned overseas where he held the following appointments: March 1941, BGS of the Canadian Corps; (August 1941, returned to Canada to administer the Canadian Armoured Corps); February 1942, Commander 4 Canadian Armoured Brigade; May 1943, GOC 2 Canadian Infantry Division; January 1944, GOC 5 Canadian Armoured Division; March 1944 GOC (acting Lieut General) I Canadian Corps; December 1944, Officer in Charge of Canadian Section GHQ 1st Echelon (21 Army Group) until the end of the war. In September 1944 he was awarded an immediate DSO for his "fine leadership and drive" in the Gothic Line Operations.

General Burns began his third career as a civil servant when he became the Director-General of Rehabilitation in the Department of Veterans' Affairs. Assistant Deputy Minister in 1946 he was appointed Deputy Minister in 1950. During this period and in between writing he took up carpentry as a hobby, building bookshelves, household furniture, and eventually a wooden rowing boat. He used it for fishing until he was posted to Geneva, were he took up sailing, a sport learned at RMC.

General Burns' careers in the United Nations, peacekeeping and disarmament began in 1949 when he served as alternate representative on the Canadian delegation to the UN General Assembly. He was the National President of the United Nations Association in Canada in 1953 and 1954. He started his second military career when he became Chief of Staff of the United Nations Truce Supervision Organization (UNTSO) in Palestine and first commander of the United Nations Emergency Force (UNEF) when it was created in 1956. Writing about this era General Burns said:

"Whatever the imperfections of the organization, ... the ideal of the prevention of war... was there, in the United Nations Charter. Everyone who believed in that ideal ... had a duty to do what he could to make this aspiration into a reality, however little his effort in relation to the total problem.

When I discussed my nomination as Chief of Staff UNTSO ... these ideas were perhaps in the background. ... the idea of working for the United Nations appeared to me as an extension of my way of life as a servant, first military, then civil, of Canada. I do not wish to give the impression that at this time, or at any time since, I have regarded myself as a person 'dedicated' to the ideal of peace, or even to the United Nations. I was taking on a job that had to be done; the Canadian Government wanted me to do it."

On 1 January 1958 he was promoted to the rank of Lieutenant General in recognition of his outstanding work and leadership with the United Nations in the Middle East. Appointed Canadian Government Adviser on Disarmament in December 1959, he retired from Government employment in 1969.

On the 6th July 1967 General Burns was given the highest honour by the Government of Canada when he was appointed a Companion of the Order of Canada, in recognition of his services to Canada at home and abroad.

General Burns was a Visiting Research Fellow in the Norman Patterson School of International Studies, Carleton University, Ottawa, during the periods 1969-1970, 1971-1977 and held the Chair of Strategic Studies in 1974-1975. During the academic year of 1970-1971 he held the appointment of Skelton-Clark Visiting Fellow at Queens University, Kingston. In 1981 the United Nations Association of Canada awarded him the Pearson Peace Medal for his work as a peacekeeper.

Soldier, engineer, mapmaker, author, peacekeeper, and academic, General Burns was also a humanitarian. He will be missed by many. An Honorary member of the Institution, General Burns is survived by his daughter, Mary Burns, PhD, Cambridge, to whom we extend our deep sympathy. VC DMG

### BRIGADIER N H L CHESSHYRE CBE MA

Born 5 March 1910, died 20 September 1985, aged 75

NEVILLE HENRY LAYARD CHESSHYRE was commissioned into the Corps in 1930, having been educated at Rugby and the Shop. As a YO he went to Christs College, Cambridge. At the SME he was graded top of his Batch.

Neville was most painstaking and honest in all that he did. To a career-long friend, the outstanding memory of him is a man of total integrity, imperturbability and cheerful courage. He seemed to embody all those characteristics so succinetly summarised by Kipling in his poem—"If" which go to make "a Man". These qualities which were assuredly part of the foundation of his highly successful professional career, were abundantly evident in his happy home life. Neville and his wife, Alison, whom he married in 1939, had a wide circle of friends, with whom over many years they

kept in touch, and made welcome as guests. He had a sense of enjoyment in many things; engineering, art and literature, to name but a few. That he had great courage was evident not least from the brave and cheerful way in which he coped with much ill health in his later years. He also had great moral courage. His quiet humour, cultured mind and a courteous manner, more reminiscent of an earlier age, made him a most agreeable companion, of a kind all too rare today. He took an enthusiastic part in a number of recreational activities participating actively in tennis, sailing and skiing.

After home service with a field company, he was posted to India in 1935 on a tour that lasted for eight years, mostly with QVO Madras Sappers and Miners. He saw active service in Waziristan and was Adjutant of the Training Battalion at Bangalore. After the earthquake at Quetta, he was Garrison Engineer, Reconstruction. Early in the war, when the Indian Army was expanding rapidly, he was Chief Instructor, Workshops, at Bangalore, increasing the training facilities from three hundred to over seven thousand trainee sappers. He graduated at the Staff College, Quetta. He remained a devoted Madras Sapper for the rest of his life. Not long before his death, he completed a history of the Madras Sappers and Miners in the inter-war years.

Returning from India in 1944, Neville succeeded in his aim of getting to the War in N.W. Europe. He was a Staff Officer in SHAEF and in HQ 30 Corps, and commanded a divisional field company. Early in 1946, he was posted to the Economic Sub-Committee of the Control Commission, where he was promoted Colonel. He became fluent in speaking German. In 1949 he was posted to command the Trades Training Regiment at Chatham, where he gave able assistance to the Commandant in settling the SME back into its traditional home. In 1951, he was appointed a



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General Staff Officer to SHAPE in Paris. He qualified as an Army Interpreter in French, and graduated at the NATO Defence College.

In 1955, after a spell as CRE Seremban in Malaya, he was appointed Chief Engineer Singapore, a job that involved responsibility for rebuilding Singapore's still shattered defence infrastructure, and for major improvements to communications in Sarawak. In 1958, he became Director of Pioneer and Labour in BAOR. He was responsible for the supervision and control of the numerous and widely scattered Pioneer Civilian Labour Units of German personnel, many of them former Wehrmacht officers and other ranks. Neville appreciated how important the morale of these units was to the efficiency of the Rhine Army and paid frequent visits to them. By the time he handed over, morale was as high as it had ever been. On promotion in 1960 to Director at the War Office of the Royal Pioneer Corps he visited all units and found them mostly occupied with labour tasks in the UK. He managed very quickly to get them equipped for mechanical handling and played a major part in increasing their efficient handling. In 1962 he was awarded the CBE.

Also in 1962 he was successful in an entrance examination for the Administrative Class of the Civil Service. He retired from the Army and served in the Ministries of Transport and Overseas Development. Sadly, in latter years, Neville was handicapped by ill health. Nevertheless, he and Alison kept up wide interests, and especially contacts with their friends.

Alison survives him, with their son Robert and daughter Meg, both happily married with children. We extend our deep sympathy to them all. He was a wonderful friend, and will be greatly missed by all those who were privileged to know him well.

FEWS, RAL, CRDT, AMF, DWR, PMB

### PROFESSOR THE RIGHT HONOURABLE LORD BAKER, OBE MA ScD FRS CEng FICE MIStructE

### Born 19 March 1901, died 9 September 1985, aged 84

THE post-war generation of Sapper Officers at Cambridge will have retained a vivid memory of Lord Baker. Professor of Mechanical Sciences and Head of the Department of Engineering from 1943 to 1968. His lectures on plastic design delivered in a forceful and personal style not common among lecturers at the time, exemplified the dominance of his influence.

JOHN FLEETWOOD BAKER was born at Wallasey and educated at Rossall School and Clare College, Cambridge, where he was a scholar. After graduating from Cambridge with a first class honours degree he worked for some time on the design of airship structure, first as research assistant to the Professor of Engineering at University College, Cardiff and later on the staff of the Royal Airship Works at Cardington, Bedford where the R101 was being built.

After two years back at Cardiff as an Assistant Lecturer he was appointed to a post in the Building Research Station investigating, amongst other matters, the design and erection of steel structures. This led to his work as Technical Officer on the Steel Structure Research Committee which he continued on a part-time basis, after being appointed Professor of Civil Engineering at Bristol University.

His ten years at Bristol were marked by a number of achievements in engineering design, but perhaps the one for which he is best known was of the Morrison Shelter on behalf of the Ministry of Home Security and this demonstrated particularly dramatically the energy absorbing qualities of steel beyond the elastic limit. He was appointed to the Chair of Engineering at Cambridge in 1943 where he presided over the development of the Department in its new buildings. Whilst there he continued to pursue research and work as a consultant.

Professor Lord Baker was the recipient of many honorary degrees and medals. He served on the Council of the Institution of Civil Engineers for many years and from 1936 to 1939 on the Council of the Institution of Structural Engineers. He was elected an honorary member of the Institution of Royal Engineers in 1948 REJ

# Correspondence

The Right Hon Lord Mais of Walbrook GBE, ERD, TD, CEng, FICE, FIStructE, MSocE, DL Griffins 43A Sundridge Avenue Bromley, Kent

### MULBERRY HARBOUR

Sir,—It gave me great pleasure and considerable satisfaction to read the article written by Brigadier A E M Walter, under the title, "A Harbour Goes to France". So much has been said and written by people who were not at Mulberry and in some cases had very little to do with it. It is perhaps overdue and will certainly be greatly appreciated, that the officer who had overall responsibility for the building of Mulberry B and later for the rehabilitation of other ports throughout Normandy, into Belgium, and on to Germany itself, should now tell the story—for no one could tell it better.

As stated in the article, I joined Brigadier Walter's staff in March 1944, with a few of my officers from Combined Operations in Scotland, and we reported to 21st Army Group at St Paul's School. Before going to Combined Operations I had a short period with COSSAC—there I became very friendly with a Lieut Colonel Harry E Bronson of the American Engineers. Later I was to meet him when he was the officer responsible for the construction of the piers to Mulberry A.

Shortly after my joining Brigadier Walter's staff, we moved from St Paul's School to Fishbourne Creek on the north shore of the Isle of Wight, where the Portsmouth-Isle of Wight car ferry now operates. My job was to get to know the PFE Companies and the equipment. My first impression of the companies was that they were a very "scratch crew" and we did have our problems, but when the day came, those companies were splendid. Nothing daunted them, nothing defeated them. They kept going for up to 48 hours without sleep or rest during the height of the storm.

When we were at Fishbourne Creek I had my first sight of a piece of the Mulberry equipment, and more spans arrived during the next week or ten days. At this point it was decided that some form of exercise should take place, even though it could only be a short pier, none of the PFE company personnel had at that time put two sections together. I therefore drove to 2nd Army HQ on the mainland, to arrange with them a suitable day for a short length of pier to be built. To me it sounded a simple thing to ask. I had no idea of the difficulties that would arise. I was passed from a major in Intelligence to a Lieut Colonel, who finally said, "No, it's not possible". I asked to see a more senior officer. He went away and came back and said, "No, you can't have an exercise". Noting my somewhat mutinous expression, he sat down at his desk and asked me to sit down, after some hesitation looked at me and said, "Cannot you think of a reason why you won't be able to have an exercise?" I said, "No, I can't". Then light dawned. I left and went back to the Isle of Wight, and tried to explain why we couldn't have an exercise, why I had been unsuccessful, without giving any indication that I guessed that D-Day was imminent.

Brigadier Walter has covered the difficulties and problems which were encountered during the construction. After the storm which destroyed the American Mulberry and very nearly destroyed ours, before the orders were issued that the American Mulberry was to be abandoned, I drove down from Mulberry B to Mulberry A, and saw the officer in charge of the American pier construction. It turned out to be Colonel Bronson, to whom I've already referred. Although no orders had been issued, and he was exhausted to the point of collapse, we collected two sets of oxy-acetylene cutting plant from him and set off back to Mulberry B to use it in disentangling the twisted mass of steelwork which we had to deal with. A day or two later the official order was given that Mulberry A was to be abandoned, and Brigadier Walter and I went back to see the Americans, and found that they had already salvaged as much as possible and were ready to send any undamaged portions round to Mulberry B. Without the instant help we received from them, the loan of the oxy-acetylene cutting plant, and then their salvaged units, the English Mulberry might never have been completed in the time, if at all.

In conclusion, may I say that few other commanders had such an important task as did Brigadier Walter. Units of his force, some of which had only been in existence for a comparatively short time, and had no chance to exercise with the equipment, eventually turned out to be very seasoned and well-trained sappers. However, I feel that the factor which counted in our favour more than any other, was that every man in the construction force was determined that they would not fail. This was entirely due to the confidence and affection we all had in Brigadier Walter. May I end by saying that quite apart from his article being most readable, it does place on record for the first time the overall picture of the planning for and execution of the Mulberry project.

Brigadier Walter, in writing this article, does us all a great service. Only he had the overall experience and contacts with both the Navy, the Army and the Air Force, who were connected with the planning and execution of Mulberry.—Yours sincerely, Mais.

Major I H Johnson RE C Eng MICE 522 Specialist Team RE (Works) British Forces Post Office 110

### THE BRITISH HOSPITAL AT RENKIOI

Sir,—I have just seen Professor Toppin's article 'The British Hospital at Renkioi' Part I in the December 1985 edition of the *Journal*. I have treasured a copy of the complete article as produced in the *Arup Journal* since it was published in 1981.

What your readers will not get from the article is the fact that one of the buildings thought to have been produced for the hospital was never shipped to the Crimea. The 1982 handout of the Aldershot Military Historical Trust shows the Church of St Michael and Sebastian erected in Aldershot in 1856. A short article and two photographs published about three years ago in the New Civil Engineer showed the building as it was and also, unfortunately firemen fighting the blaze which gutted it.—Yours sincerely, I H Johnson.

> Brigadier C E F Turner CBE DSO The Colleens Lower Cousley Wood Wadhurst Sussex TN5 6HE

#### THE BANGALORE TORPEDO

Sir,—It was difficult to fault the BBC programme in the Soldiers series on 13 November 1985 except over the statement that the Bangalore Torpedo was developed by the Bengal Sappers and Miners—it was not!

During World War I when Major R E McClintock was Superintendent of Instruction at Headquarters QVO Madras Sappers and Miners at Bangalore, responsible, *inter alia*, for Fieldworks training, he had a brilliant wife whose brain child was the Bangalore Torpedo.

I feel it should not go down to posterity that the equally famous Bengal Sappers and Miners (we called them "God's Own") should be given credit.—Yours sincerely, C E F Turner.

#### THE ROYAL ENGINEERS JOURNAL

Major A B Waters CBE GM FRIBA PPCI Arb A B Waters Consulting Architects Glen House 125 Old Brompton Road London SW7 3RP

#### BOMB DISPOSAL IN WORLD WAR TWO

Sir,---You published an article by Major H Charlesworth in the June 1984 Journal about the Richmond Bomb Cemetery. I enclose a photograph showing the permanent exhibition there of the complete range of German bombs.

I also read with interest Major Hogben's article in the June 1985 issue and can add some information. Initially Major General Taylor, who was Inspector of Fortifications, was given responsibility for bomb disposal, with the added title of Director of Bomb Disposal and "IF and DBD" was established, known as "If and But". The Directorate of Bomb Disposal was later separated from Fortifications. H H Bateman who had been SOI became DBD with the rank of Brigadier.—Yours sincerely, A B Waters



## **Journal Articles**

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

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

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

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

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

. . . . .

# Bomb Disposal IN WW2

Colonel J H Frankau, MC Querns 2 Powis Lane Avening, Tetbury Glos

#### THE ROYAL ENGINEERS LIST

Sir,—The compilers of the RE List are to be congratulated on their industry in introducing a new column: "Known Name".

Surely now is the time to revive and expand some of the practices of the recent past? For instance, as late as 1975, married officers were denoted by the symbol "m". This could be reintroduced and the wife's known name be given as well. (A true sapper could be further marked by " $m_2$ " and " $m_3$ ", showing that he was also mad and methodist.)

Also in 1975, officers who had passed their promotion examination were denoted by "p". What scope there is here! The last three of an officer's Annual Reports could easily be summarized by numerals or letters; and passed over for promotion be indicated, appropriately, by "pop".

Then there could be "ss" = sports scholarship. (Perhaps these are no longer awarded; but an Oxford Blue or selected proofs of equestrian or nautical skill used to boost an officer towards Colonel or Brigadier.)

Memberships of clubs are listed in other works of reference: "Boodles" or "RORC" carry a certain cachet; "CTC" would be a contra-indication. There is plenty of room between the columns and doubtless other suggestions can be made. What about: "r" regional accent; "wwc"wife well connected? But—although both would become apparent after a few minutes' conversation—perhaps not!

It has never been clear whether the List was intended to be a family address book or a guide to form in the promotion handicap; why not make it both and do away with all unnecessary privacy?—Yours sincercly, J H Frankau



# **Book Reviews**

### FLASHBACK A SOLDIER'S ST'ORY GENERAL SIR CHARLES RICHARDSON (Published by William Kimber—Price £11.50)

GENERAL Richardson's flashbacks take the reader from his early upbringing through to the end of his military career as Master General of the Ordnance. However, his book is really about the Second World War, the great events in which he participated and the protagonists in those events whom he observed.

Charles Richardson's early life was typical of the somewhat precarious middle-class Anglo-Irish background that seems to have spawned so many of the great men who went to serve their country in the 19th and early 20th centuries, in the services and in the colonies and dominions. We are taken fairly rapidly through this and a conventional backcloth of Wellington and the Shop. Five years follow as a younger officer in India with its extraordinary opportunities for, on the one hand, fun and adventure; and on the other, precocious professional responsibility inconceivable to a subaltern caught in the straitjacket of today's serious minded Army.

The young Charles Richardson had serious enough matters on his mind, however, when in 1938 he forsook India "to break the spell" returning to England to participate, as it turned out, in the Phoney War deployment to France and Belgium and to find himself on the receiving end of the blitzkrieg, ending with Dunkirk. We sense vividly the atmosphere of bewilderment and confusion although there is little to tell us how he as DAQMG managed to provide for the units of 4 Division; somehow this seems to have been accomplished.

All that has been covered to this point in the story is very much a curtain raiser for the main drama to come which occupies all but a chapter of the rest of the book. This sense of prologue is heightened by the glimpses given of individuals who are to appear in later chapters. Notwithstanding the wisdom of hindsight it is intriguing to learn the impact made by such as 'Chink' Dorman-Smith, Harold Alexander, Bernard Montgomery and Jackie Smyth before they themselves became renowned in a wider setting.

A brief interlude instructing at the Staff College in Haifa is followed by nine months with SOE in Cairo, the strategic value of whose operations the author questions despite the sacrifices of many gallant men; and so to Eighth Army Headquarters in June 1942 where he joins Auchinleck's staff as GSO 1 (Plans). We are then taken through the stirring events of the arrival of Montgomery and Alexander and the main battles of Alam Halfa, Alamein, Mareth and Operation Husky into Sicily. At this point the author (by now a Brigadier with DSO and OBE) had joined the staff of 5th US Army as Deputy Chief of Staff (British) and so we experience Salerno, Anzio and Cassino from the unusual angle of a British Officer in an American environment.

In all this there are no real surprises. The impressions of Auchinleck and his staff, the main personalities who took part in Monty's great victories and the Americans and other Service Commanders are straightforward uncomplicated observations rather than in-depth analyses. From such a self-confessed 'Monty man' one would not expect anything but admiration of Monty himself and, despite all the volumes that have been written, General Richardson's observations have the freshness and clarity of personal knowledge and one is left wondering really whether anyone other than Monty could have brought it all off.

Not that Monty comes out of it all unscathed and there are more intriguing insights into his style, and indeed the whole business of high command, in the section (one chapter only) on the Second Front.

There then follows an absorbing account of the immediate post-war period in Berlin where the then Brigadier Richardson found himself, initially as the organiser of the British part in the signing of the peace treaty, and shortly afterwards as the Chief of
the British Military Division of the Quadripartite Control Commission. These heady days soon lead into the realities of peacetime soldiering, the accounts of which are surprisingly free from any sense of anticlimax. Perhaps to avoid this, only two pages are given to the rest of General Richardson's career from Infantry Brigade Commander to Army Board, despite his many contributions to the development of today's professional Army. He is happier to end his book with a final flashback to a visit to his old Master, Monty, and this seems an apt conclusion.

This book does not set out to be military history. Wavell is quoted as having once said to Liddell Hart "If I were to write military history ... I would concentrate on the 'actualities' of war—the effects of tiredness, hunger, fear, lack of sleep, weather, inaccurate information, the time factor and so forth. The principles of strategy and tactics, and the logistics of war, are really absurdly simple; it is the actualities that make war so complicated, and are usually neglected by historians." General Richardson has given us a rich helping of actualities and we must be grateful to those who persuaded him to set them all down.

GWAN

#### THE ROYAL ENGINEERS T J GANDER (Published by Ian Allan Ltd. Price £11.95)

MR Gander introduces his book by writing "The Royal Engineers have always been special. Even in an army as well endowed with talent and powerful personalities as the British Army the Engineers have stood out as being more talented and personable than most." That should guarantee Sapper readership. He does admit that "If I had known exactly what I was to become involved with when I was asked to write this book I would probably have declined. Now that the book is finished I am happy to have been asked." He ends with the hope "that the Royal Engineers get the due credit and recognition for the tasks that they are carrying out in all parts of the world." Wishful thinking maybe, but this is a book to be read by every student of modern warfare and left by the bedside of visitors. It will give young officers an excellent introduction and ready reference to all aspects of the Corps and remind the more specialised of the breadth of our ability.

The book seeks to encapsulate all aspects of the Corps. It begins with a short history (with one wrong date) and goes on to describe in sections the various aspects of Royal Engineering. There are those who may quibble with the balance and maybe find fault with some of the minor facts, but to do so would be mean and deny the essential message of the book which is that ours is a live, vibrant, varied and exciting Corps. Mr Gander should be congratulated.

AAW

### \* \* \* \* \*

## **Beat This**

STAFF INSPECTION REPORT

1. Date of Inspection. The staff inspection was conducted on Tuesday 26 November 1985.

2. Standard of Saluting and Dress. The standard of saluting was excellent. The effect was however rather marred when the Commandant's trousers fell down.

3. Financial Report. It was unlucky for the unit that the inspecting officer was the only one who showed any remorse after the entire party left a local hostelry without paying for their lunch.

4. Overall Impression. RETC is clearly upholding the finest traditions of the Corps of Royal Engineers.





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