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Volume 89 DECEMBER 1975 No. 4

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Editorial

THE MUSEUM AND LIBRARY

IN this, the last *Journal* of the Centenary Year, our thoughts should turn from publications to two other aspects of the work of the Institution, the Museum and Library.

The RE Museum "will contain patterns of uniforms and equipment; military engineering material and models; sketches, plans, etc; photographs; letters, books, manuscripts and printed matter connected with the work or campaigns of the Corps; regimental or personal relics and trophies of war". *Bye-Law 25.*

"The object of the RE Libraries shall be to enable Members to refer to the works of the best authorities in any of the multifarious duties which they, as officers of the Royal Engineers, are liable to be called upon to perform, such works being necessarily more numerous and more expensive than an officer can be expected to possess or carry with him." *Rule 34.*

A visit to the Museum and Library will show how well the Institution has fulfilled its role in the first hundred years of its existence. Although the Rule and Bye-Law quoted are framed differently, both the Museum and the Library have a common aim:– to provide information on the development of the Corps and of military engineering. Understandably they present the facts through different media. It may not be realized that the books and exhibits on display are only the tip of the iceberg; there is a mine of useful information in books, letters, plans, photographs, etc., which have to be stored separately to preserve them. All this information is available to Members whether they are studying some detailed technical or historical problem or looking for guidelines for the future from the performances of the past.

Both the Library and the Museum largely depend on Members for the majority of their acquisitions. Books, papers, documents, maps, swords, uniforms, medals, equipment, etc., and many other items have been lent, given or bequeathed. The interest and help of Members in years gone by has resulted in a useful service being available to Members now.

What of the Future?

The Library and Museum can only continue to play a useful and valuable part in the life and work of the Corps if they are not allowed to stagnate. The lessons of the past show that both will continue to need the assistance of Members to develop. Not only must the missing pieces of the jig-saw of the *Past* be filled in as far as is possible but every effort must be made to complete the picture of what is, at the present, the *Present* to provide the service for the *Future.*

Most Members have some items somewhere which are of interest to us. If you have the slightest doubt about the disposal of any item, please get in touch with us. If the item has a wider National, rather than Corps interest, we can put you in touch with the appropriate Museum or Library. If it is of no value to anyone, we will say so! However most things that have some connection with the activities of the Corps will be of interest, whether as exhibits or as additions to the reference collections. Especially useful are original manuscripts such as letters (though the censor has made this a less valuable source than in the past), sketches and plans as well as photographs which will help to make more comprehensive the pictorial record which is already in being in the Library. Members with particular or specialized interests might also be willing to help studying and identifying items already in the Museum and Library with a view to researching to prepare displays, or to improving the catalogues and indexes.

Real progress will only be maintained by the continuing support of Members, if you can help in any way we would be delighted to hear from you.

The Alexander Early Warning System

COLONEL G C L ALEXANDER, OBE, TD, (LATE RE RTD)

WITH the advent of high speed trains on British and other Railways it has been necessary to up date the tried and true methods of giving early warning to men working as platelayers on the track or indeed to the many other Railway and Contractors employees working near it. This was brought home to the author whilst running a contract connected with the Electrification of Southern Region tracks between Woking and Bournemouth in the 1960s, when a newspaper train from Waterloo killed the lookout man and injured one of the gang when they were working at night near Micheldever.

As a result of this accident considerable thought was given to the matter by the Author and his ex-Regular Gunner brother, a partnership was formed, Patents were applied for and British Railways were approached with the idea of a Radio-telemetry link. After a full scale Mock-Up demonstration had been given to illustrate the principle an order was given by British Railways to supply one system for trials. This was done but during this short evaluation period it was decided to build a professionally constructed unit which would satisfy the S & T Dept "Fail Safe" Specification. This was done successfully and further demonstration has resulted in further orders from British Railways.

The equipment, known as *The Alexander Early Warning System* comprises: a device to detect the presence of a train; a radio-telemetry link to transmit the information to a lookout man stationed with the work gang up to three miles away: equipment to receive this information, which is attached to the lookout man's jacket, and generate a distinctive warning. The functions of each equipment is clearly defined but the operation is integrated one with the other.

RADIO-TELEMETRY LINK

The radio-telemetry link comprises a train detector, a transmitter, and a receiver which is described in some detail in the following paragraphs.

The Train Detector

The train detector (known as the Activating Switch) comprises an accelerometer which senses vertical accelerations in the railway track to which it is clamped. The device has a clearly defined threshold and produces no output unless vertical accelerations exceeding a preset *g* level are sensed. If the trigger level of the sensor is exceeded the device produces an electrical output corresponding to the frequency and amplitude of the vibration in the track. These signals are then processed to see if they conform to the frequency and amplitude spectrum characteristic of a train. By this means the detector can positively identify trains moving on the protected track at speeds up to 250 km/h and yet can discriminate between them and other sources of vibration including fast moving traffic on adjacent tracks. If a train is detected the activating switch causes the transmitter to transmit a train warning signal in place of the test pulses. This takes the form of an interrupted modulated carrier signal which is maintained for at least fifteen seconds. When no train is detected, the test pulses are used to verify the correct functioning of the activating switch circuits. If, because of failure of the control circuits, the test pulses are not fed to the activating switch, the self checking circuits inhibit the transmitter output until the fault is rectified. This also happens if the activating switch itself fails or if the connecting cable is severed or if the switch is dislodged from the rail.

The Transmitter

The transmitting section of the telemetry link comprises a 5 Watt UHF FM transmitter and some control circuits. Because the system must warn the approach of a train and also continuously indicate the operational status of the complete equip-

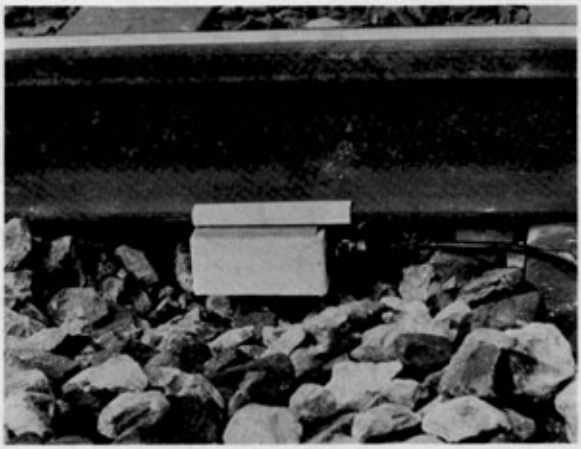

Photo 1. Activating Switch, spring clipped to foot of flat bottomed rail.

ment, some form of self-checking facility has to be provided. This is done by the transmitter control-circuits which generate a test pulse every three seconds. The test pulse causes the transmitter to radiate a modulated carrier signal of short duration every three seconds which is used to check the viability of the radio link. This test pulse is only generated if the transmitter and the train detector (which is connected to it by a multi-core cable) are working correctly.

The Receiver

The receiver is a compact ultra high-frequency FM device which detects and demodulates the transmitted signals. When no train is detected the received test pulses are used to operate the audible and visual warning devices and thus indicate to the lookout man that the system is functioning correctly. The test pulses are also applied to the receiver self checking circuits which generate a "fail" signal if any of the following conditions are detected:

(1) loss of all signals;
(2) cessation of modulation;
(3) break-up of the received signal due either to outside interference or a fault at the transmitter.

The "fail" signal is applied to the audible and visual warning devices and, under "no signal" conditions also operates a battery economiser circuit which cycles the receiver to conserve battery power. A further circuit continuously tries to reset the self-checking circuits so that the "fail" signal is quickly cancelled if a short duration loss of signal is experienced due to screening of the receiver.

WARNING DEVICES AND MECHANICAL CONFIGURATION

Received signals are applied to an audio transducer so the lookout man hears either the regular pulses or the train warning signal in the form of short "blips" or an urgent interrupted tone. These signals are also used to give a visual indication by

The Alexander Early Warning System (1)

means of a light emitting diode. The "fail" signal is generated at the receiver and consists of a continuous audio tone.

The transmitter is housed in a robust metal case and when operationally deployed is clipped to the lower section of a four-section lightweight plastic mast which carries the antenna. The activating switch is clipped to the underside of the rail between sleepers and is connected to the transmitter by a 100 ft cable. All connections are by water resistant plugs and sockets. The receiver and its associated battery pack are fastened to the front of a "dayglo" jacket worn by the look-out man. The equipment can be deployed and the mast erected in a few minutes and when dismantled, is easily transported by one man.

GENERAL SPECIFICATION

Transmitter

Size: 30·5 cm × 25·4 cm × 9·2 cm
Weight: 5·5 kg

Photo 2. Aerial, which extends to 10ft and has directional antenna giving a 25° angle of embrace to the transmission to eradicate interference.

The Alexander Early Warning System (2)

Photo 3. Receiver on Lookout man. Note the short aerial and miniature speaker on his left shoulder. Batteries are in the box on his right.

Receiver
Size: 2 cases each 7·6 cm × 7·6 cm × 20·4 cm
Weight: (total) 3·63 kg
Batteries
Nickel Cadmium rechargeable.
Operational duration: 8 hours continuous operation with 50 per cent safety margin.
Electronics
Medium scale integration TTL logic used throughout peripheral circuits.
Temperature
−20 deg C to + 70 deg C

FUTURE DEVELOPMENT

(1) Provision has been made to develop the existing system to accept an activating switch connection from each of the two approach tracks of a four-road system and to be able to identify the track whose activating switch has been operated.
(2) When operating single line working:
(a) To be able to tell from which direction the train is approaching; and
(b) To know that it is receding when, having passed the work site, it operates the other direction's activating switch. This will obviate the necessity for the Lookout man to keep a log.
(3) When working in areas of difficult radio conditions such as may occur in hilly places, in cuttings or tunnels, a repeater may be used. This device will simply pick up the signal and re-transmit it.

The Alexander Early Warning System (3)

(4) Shutting off generators, compressor motors etc. automatically through the use of a second receiver with modified associated gear.

(5) Visual warning for the track gang where a horn or siren would cause nuisance as, for example, at night in a built-up area.

Investigation has now been given to the use of the system over a section of reversible signalling including giving warning from two directions on any of four tracks and a decision has now been made to use this system. It is anticipated that the system will first come into use on the Paddington–Cardiff run over which the first high speed trains will run.

We gratefully acknowledge permission to use the photographs illustrating this article which were provided by British Railways (Western Region), Chief Civil Engineer's Office, Photographic Section.

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DCRE Nepal

MAJOR D A JOHNSON, RE, MA, C Eng, MICE

INTRODUCTION

A POSTING with the Brigade of Gurkhas in Nepal is an unique experience. Alas in a short article it is impossible to give full justice to the grandeur of the country, the charm of the people or the detail of the job. This article is an attempt to describe a little of the country and the type of work undertaken by DCRE Nepal.

Geography

Nepal is an independent Kingdom on the southern flanks of the Himalayas sandwiched between Chinese Tibet to the north and India to the south. Although relatively small, it is 500 miles long and between 100–150 miles wide, the country is naturally divided into four "longitudinal" strips. From the south the Terai is a 20–30 mile strip of the Ganges plain, which at one time was a malaria infested forest and a natural barrier between the plains of Northern India and the hills. Now the forest is fast disappearing and it is a rich agricultural belt. In the second strip are the central hills. For fifty miles the foothills of the Himalayas stretch in ridges and deep valleys, the ridges 6–8,000 ft high rising up to the snows. The hills are the home of the Gurkhas and are intensively cultivated wherever there is water. Through these very steep valleys and ridges the only means of communication is by walking. The third strip is the main Himalayan range and the fourth the Trans-Himalayan Zone where a number of river valleys cut through the main range and rise to the Tibetan plateau beyond.

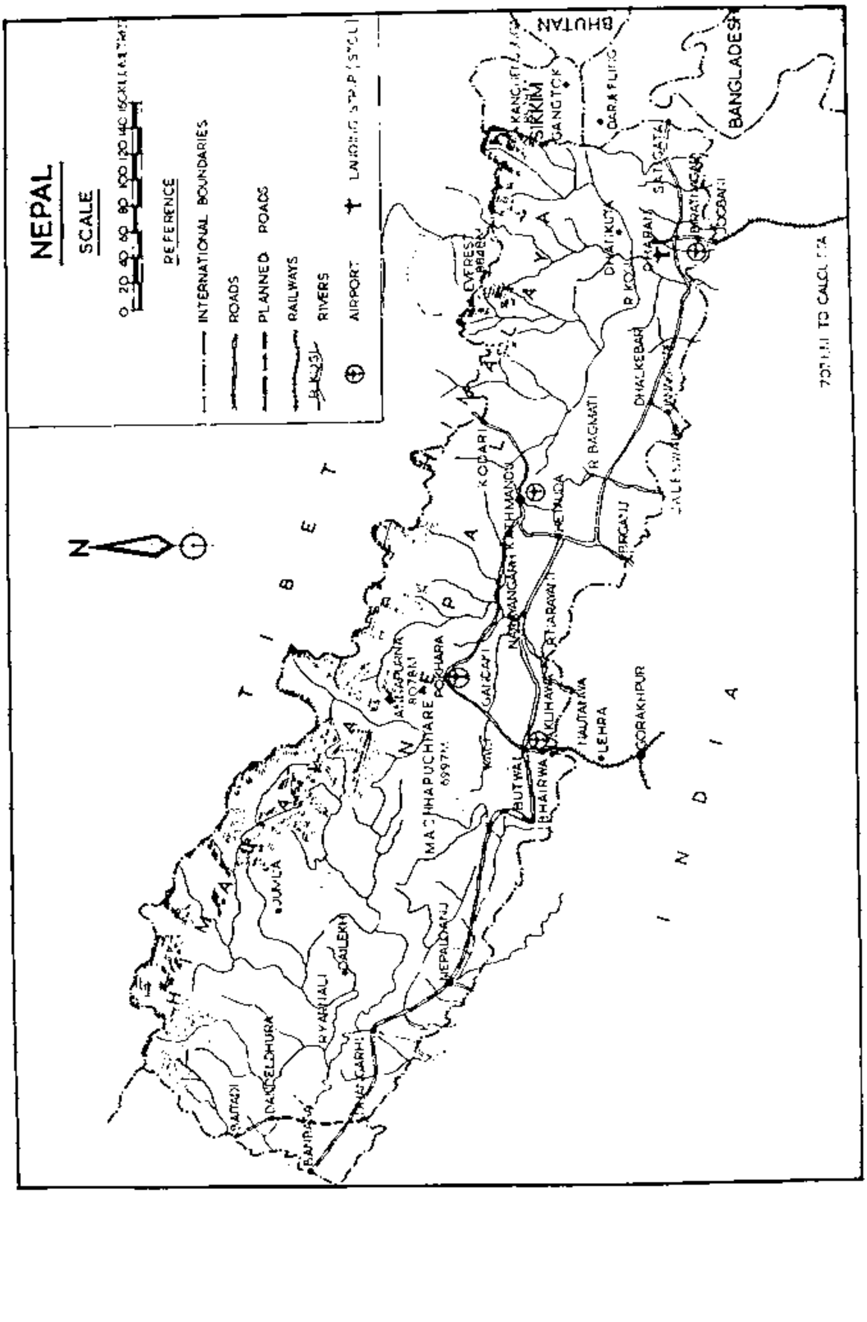
In the central hill region lies the valley of Nepal. It is a flat lake bed some 300 square miles in extent and the rich soil is well cultivated. Here is Kathmandu the capital, the cultural and administrative heart of the country. Further to the west is the similar but smaller plain of Pokhara.

Climate

The climate of Nepal is varied as the height varies from 400 ft on the Terai to 29,000 ft in the Himalayas. On the Terai the winter is sunny and dry, spring follows hot and dry with temperatures rising to 100°–120°F in April and May, summer is hot and wet with the monsoon lasting from June to September. The hills are cooler and the snow line is as low as 7–8,000 ft in winter.

History

This then is the land of the Gurkha soldier who has served Great Britain since 1816. Before this the East India Company had been much troubled by the Gurkha Army, which by the end of the eighteenth century, had conquered large areas of Northern India. Eventually the Company declared war on Nepal and in 1815,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HETAUDA
POKHARA
BUTWAL
BHAIRWA
GORAKHPUR
LEHRA
NAUTANWA
NEPALGANJ
JUMLA
DAILEKH
DANDELDHURA
BAITADI
BANBASA
TO CALCUTTA

General Achteriony defeated the Nepalese Army after a hard fight. A treaty of peace was signed in March 1816 and since that time Nepal and Britain have been allies.

From 1816 Gurkhas have served in the East India Company forces and later in the Indian Army. Nepal remained a closed country and the Gurkhas made their own way into India for recruiting. This method of recruiting remained the same until Indian Independence when, in 1947, the Gurkha battalions were split between the Indian Army and the British Army, and the British Gurkhas had to set up their own recruiting depots in India. A British Gurkha Recruiting Depot was established in January 1948 at Jalapahar one mile from Katakpahar which had been a pre-partition depot for the eastern recruits. Seventeen miles from Jalapahar, and just inside Nepal, a recruit collecting post was set up each year for recruiting. In the western area, prior to partition, the depot was at Kunraghat near Gorakhpur. A second British Depot was formed here and after various schemes failed it moved to Lehra in March 1950. The Lehra Depot was thirty-seven miles north of Gorakhpur and to support it a recruit collecting post was established at Paklihawa again just inside Nepal. This was a tented and camp structure camp which was only used during recruiting periods. A staging post was established in Banares (Varanasi) and used as a food halt for Gurkhas travelling between Lehra and Calcutta by train.

After partition a permanent site for Headquarters of British Troops in India was obviously needed. Eventually a site was found at Barrackpore, north of Calcutta, and at a cost of £150,000 the camp was established there in October 1949. The Barrackpore Camp contained the Headquarters British Troops in India, Transit Lines, an Ordnance Depot and DCRE.

In Nepal there was growing political awareness and the country was being opened more to foreigners and in 1951 the ruling Rana family was overthrown and a constitutional monarchy with a democratic government established. The party system did not survive and since 1960 there has been direct rule by the King with a system of democracy based on village panchayats or councils. The overthrow of Ranas opened the way for the establishment of recruiting depots within Nepal, at the same time India, as an emerging "Non-aligned" country, intimated that, as British Gurkha troops were being used against communists in Malaya, bases on Indian soil were no longer acceptable.

In 1954 negotiations were begun and the search for a base within Nepal was underway. In August 1954 the first examination of Dharan was made by the DCRE, Major H W Baldwin. Dharan is in Eastern Nepal on the Terai plains thirty miles from the Indian border and at the foot of the Mahabharet Lekh—the first range of Himalayan foothills. The DCRE's first recce was during the monsoon and the thirty mile journey from Jogbani to Dharan took three days and included a river crossing by elephant! (The journey now takes forty minutes along a good tarmac road). There were many further visits to the site and schemes were prepared for a cantonment at Dharan. The construction was planned in a number of phases, the first being the reconstruction of the road from Jogbani to Dharan. The original mud track was improved and a 9 ft carriageway constructed. Work on the road started in 1955 but the 9 ft carriageway soon proved inadequate. It was reconstructed to a higher standard in 1957 by contract and DEL, the work being supervised by Captain R Wheatley. The actual site at Dharan was handed over on 15 December 1956 and Phase 1B was let to contract to be completed in twelve months. This contract was terminated after 2¾ years in August 1959! Originally Calcutta consultants were to supervise the work but in July 1957 it was agreed that Royal Engineers would take over and supervise all construction. A temporary camp was built at Phusre, two miles north of Dharan, and CRE British Gurkhas India was established with 19 Officers, 23 Warrant Officers and Staff Sergeants, 13 Rank and File, 11 Gurkhas, and 158 Civilians. The first CRE was Lieut-Colonel Baldwin. The construction of the main buildings of the camp took place between May 1957 and May 1960. Work on Phase V—amenities such as the swimming pool, squash court and paltan bazaar-continued into 1961. In September 1960, when the cantonment was ready for occupation, HQ British Gurkhas India

moved to Dharan from Barrackpore. The construction camp at Phusre was vacated in March 1961 and the CRE was reduced to DCRE one month later.

THE PRESENT POSITION

Organization

In 1975 the DCRE establishment consists of four Officers and six senior ranks, all RE MES Works posts. The DCRE is the Area Officer Nepal of DOE Property Services Agency and is directly responsible to the Regional Director in Hong Kong for all works services in Nepal. The Garrison Engineer is responsible for all B & CE work and for estimating. The E & M Officer is responsible for the water and electricity supply and all M & E work. The Administrative and Stores Officer is a resources trained QM who is responsible for stores, contract procedure, financial control and general administration.

There are two Clerks of Works Construction, one in Dharan and one currently in Kathmandu, the latter will become Clerk of Works Outstations when the work load in Kathmandu drops. The Clerk of Works E and Clerk of Works M are both based at Dharan. An MPF is responsible for the running and servicing of seventy-one items of transport and plant and is also responsible for the maintenance of thirty miles of road. A Draughtsman Sergeant is also based in Dharan. Some new married quarters have been allocated to DCRE and now only the Clerk of Works Outstations and E & MO are on nine month unaccompanied tours. All others are on two years accompanied tours.

The Royal Engineer staff is only the tip of the iceberg as all work is by direct labour. The labour force has varied over the years from 100 suggested in 1960, to nearly 1,000 in 1968, to our recently agreed establishment of 39 Non-Industrials and 447 industrials. In addition casual labour is employed for Part I or large Part II jobs, at present 150 are so employed. Many of the staff have served since the camps were built and a few have served even longer, transferring from Barrackpore, Lehra and Darjeeling. In both Dharan and Paklihawa the DCRE is the largest employer and offers the best wages. Turnover is very low and the labour force is a loyal but ageing one.

As many men are approaching retirement age a boy trainee scheme is being started to train young tradesmen, in the hope that they will be able to fill the vacancies caused by retiring men. A total of twenty-two trainees will complete three-year courses and will then be tested in their trade and given a certificate which, it is hoped, will be recognized throughout Nepal. Trade training is in its infancy in Nepal and we are working with the International Labour Organization, in trying to produce national standards for tradesmen.

Dharan Cantonment

Dharan Cantonment is a modern camp with all services and facilities. It is the Headquarters of British Gurkhas Nepal and there are transit and resettlement facilities. 13,000 pensions are administered and paid and the recruits from the east are also selected here and given some basic training. There is an extremely good BMH, probably the best hospital in Nepal, that caters for many Nepalese as well as for the cantonment. The most prevalent diseases are TB and fractures (from falling out of trees when cutting firewood!). The camp is ¼ square mile in extent and contains some 300 buildings including offices, married and single accommodation, the hospital, power station and sewage farm.

Power Station. The power station has four English Electric 300 kW diesel generators. Over the years the electric load has steadily increased and now peaks at almost 700 kW. With new Gurkha scales calling for more air-conditioning and other works services in hand, the power station has become overloaded. A study is now being undertaken to plan a possible rebuild for the station as the switch-gear and transformers are obsolescent. If this is put in hand another base load generator will be included.

A recent problem has been fuel shortage partly because of the world fuel crisis

Photo 1. Aerial View of Dharan Cantonment.

and partly because the supplier changed from Burmah Shell to the Nepal Oil Corporation. NOC took over POL distribution in August 1973. Anticipating the difficulties of such a changeover EFHE(s) fabric tanks were flown in to boost storage to three month supply. The temporary tanks are now being replaced with permanent storage. Lubricating oils are also a problem. To make matters worse Burmah Shell fuel was delivered to the cantonment but now it has to be collected from the Indian Oil refinery at Barauni 250 miles away.

Water Supply. The water supply for the cantonment comes from a river five miles away. The supply is brought from the catchment by buried 6 in victaulic pipe. The pipe line was built during construction of the camp in 1956 to provide water for construction. After the failure of two bore holes within the cantonment the construction pipe line was extended to provide a permanent supply. The source provides a minimum of 250,000 gals per day in the dry months of April and May and considerably more for the rest of the year. The consumption is 300,000 gals per day so there has to be rationing in the dry weather. The exceptionally high consumption of approximately 300 gals/head is mainly due to the Gurkhas traditional use of running water and the difficulty in imposing a strict water discipline.

The pipe line is maintained by a foreman and six linesmen who live on site. Although the buried victaulic joints give some trouble (about twelve a year have to be replaced), the eighteen-year-old pipe is in good condition. The main catchment lies above some very unstable slopes and two geologists have separately predicted a severe slide that will carry away a large section of the pipe. A bore hole is to be sunk south of the camp to provide an alternative source of water. On geologists' advice an exploratory well will be sunk at the Seoti bridge some five miles south of the camp. The location is 400 ft lower than Dharan and should be close to the water bearing terai alluvium of the Gangetic plain. If the exploratory bore is successful production wells will be sunk and a pipe line laid to the cantonment.

Works Services. As with any camp there is a continual requirement for new works and improvements. For the past few years an interesting and varied works programme has taxed the ingenuity of the DCRE. The construction of ten new quarters (completed in 1974), has been a rewarding task. The basic earthquake proof reinforced concrete structures were designed in Hong Kong, but the detailing and many design variations were completed by DCRE. Built by DEL one of the first tasks was to

Photo 2. New Type IV Quarter at Dharan.

recruit and train steel benders and fixers. There was plenty of time for training as the steel was delayed for three months. A precasting yard was expanded to make the wall and partition blocks, paving slabs, roofing hollow pots and drainage components. Much of the steel work was manufactured on site, including roof trusses and lamp standards. All woodwork was also made on site, there are no ready made flush doors or window frames in Nepal. The estate was finished on schedule despite the delays and frustration of waiting for the delivery of stores.

There is no lack of work for this year although the works programme has been cut by 20 per cent and maintenance by 10 per cent. Part II Services include installation of 3 × 10,000 gal underground fuel tanks, the design and construction of a swimming pool and of a fully automated laundry for the hospital. There is a total Part II works programme of £113,000 and a maintenance budget of £270,000, these figures including work at Paklihawa, Pokhara and Kathmandu.

Grounds Maintenance. When Dharan was built landscaping and tree planting was not forgotten. Now the trees and shrubs are mature and the cantonment is a riot of colour. With the establishment last year of a Grounds Maintenance Foreman and extension of the Nursery, more trees and shrubs are being planted and existing trees are properly pruned and maintained. More fruit trees are being planted and it is hoped that the quarters will soon have a selection of lime, litchi, peach, avocado pear, mango and papaya trees in their gardens. The nursery also supplies trees and shrubs to Paklihawa, Pokhara and Kathmandu and, increasingly now, outside agencies come to ask for cuttings and seedlings.

Paklihawa

Paklihawa, which means "mad wind", is aptly named for in March and April it is plagued by hot dusty winds from Northern India which push the temperature up to 120° F. For most of the year Paklihawa has a climate similar to, but a little hotter than, Dharan. From the days of the Lehra Depot Paklihawa has been transformed. Then it was a tented camp with a few camp structures. When Dharan was established it was intended that Paklihawa should be a collecting post occupied only during the cold weather recruiting period. However in 1959 £16,500 of works services were put in hand to build six Nissen Huts, tent plinths and main services. Since then the camp has grown in a haphazard manner with temporary buildings, bazaar shops and tents. In 1972 the DCRE put in hand a programme to "Stop Topsy", and now

Paklihawa is a permanent camp with well planned buildings although tents are still used occasionally for extra transitees. Next year it is planned to replace the last two of the original nissen huts, which will then complete the modernization programme.

For works services in Paklihawa there is a direct labour force of 150 under Garrison Works Superintendent, Captain (Retd) Harkabahadur Gurung, Gurkha Engineers.

Power Station. In 1972 a £35,000 Part I Service was initiated to replace some ancient Crossley sets with four 100 kW Dale Electric sets. The modernized station was commissioned in July 1973. Paklihawa now has an efficient, steady electric supply with enough generating power in hand to take care of the improvements and additions which are planned for the next year or two. However if full airconditioning services are to be provided at Paklihawa further generating power will be required. Fortunately there is room in the existing power station to install another Dale set.

Water Supply. Water supply at Paklihawa is far easier than at Dharan. In the Paklihawa area on the Terai there is an underlying artesian basin. A well was sunk in 1968 and this has provided artesian water for the complete needs of Paklihawa Camp. Unfortunately the output of the artesian well has been steadily decreasing. The reason for this is thought to be the silting up of the strainer at the base of the bore. It is intended to sink a new well at Paklihawa this year which should fully restore the water supply.

Pokhara

Pensioners have been paid at Pokhara for many years as this is the centre of the western recruiting area. Until 1973 pensioners were paid by a Pension Paying Party once each year. These were paid in a small field which had been leased and had minimal camp structures to assist the pension paying party. In 1972 the Indians completed a road from Paklihawa to Pokhara which made access much easier and it was decided to establish a small permanent pension paying post at Pokhara. At about this time a party of Sandhurst cadets had erected a Nissen Hut on the site. Improvements include the construction of a QGO's quarter, an office block, a stores block, a small hardstanding and MT Garage and the demolition of some of the temporary camp structures. This work was planned by DCRE in 1973 and has now been largely constructed. The building was by local contract in the attractive stone found in the Pokhara area. The pension paying post must now rank as one of the most beautiful settings for an army camp in the world. The Annapurna range is to the north and the valley is dominated by the 6,997 m peak of Machhapuchhare (the "Fishtail"). All that remains to be done is to replace the "Sandhurst" hut with a building more in keeping with the local architecture. Services provided at Pokhara include water and electricity tapped from the town mains. Construction and maintenance at Pokhara is administered by the Garrison Works Superintendent at Paklihawa aided by frequent visits from members of DCRE staff from Dharan.

Kathmandu

British Gurkhas Transit Camp. In 1972 it was decided to start air-trooping from Hong Kong and Brunei direct to Kathmandu. This replaced the previous system by which Gurkhas had to travel from Barrackpore to Nepal by train. The 750 km journey to Jogbani took at least thirty hours and to Paklihawa over two days. With air-trooping the difficulty in Kathmandu was that often there would be one or two Britannia loads of Gurkhas having to stage over-night. At first the plan was to have a small temporary camp on or close to the airfield with camp structures and a tented camp. After numerous areas had been examined and rejected no solution was found in the area of the airport. After much searching of Kathmandu an old Rana palace was found that was both suitable and available. Many of these old palaces dot the Kathmandu landscape. Since the fall of the Rana regime, many have been taken over as Government offices or are lying empty. The one selected is at Jawalakhel, a suburb of Kathmandu some three miles from the Airport. When taken over at the

Photo 3. British Gurkha Transit Centre, Kathmandu, formerly the Rana Palace of Bikram Bhawan.

end of 1972 the top floor was occupied but the ground floor was a pig sty and hen house, maintenance of the building was non-existent and there were no services at all. A provisional estimate for setting up the transit centre of £5,000 quickly escalated to a final £17,000. The transit centre, which is on lease for a period of five years, can now house a maximum of 250 Gurkhas including their families for short stays. The building has been transformed from a wreck into a well painted and good looking palace. Additional services required included ablutions and toilets, built in a Twynham Hut in the grounds, electricity and water. Water supply remains a problem as the town water main which runs to the palace has an insufficient and intermittent supply. The temporary solution has been to employ a tanker truck bringing water from the British Embassy but at the height of the trooping season this requires between eight to ten trips each day. No real solution to this problem is foreseen during the tenancy of the palace.

Warehouse Facilities. In 1973 the airtrooping to Kathmandu was extended to include the carriage of MFO. This was due to start in December 1973. However, when details of the quantity of stores arriving were given to the airport authorities, they stated that they had no facilities in which to examine the goods whilst in bond, and without these would be quite unable to allow the service to start. We offered to build a bonded warehouse for the airport authority on their ground provided that we could have exclusive use of it whilst airtrooping continued at Kathmandu. This was agreed and in the very short space of nine weeks a 2,000 sq ft warehouse was constructed. It was finished one day before the first Britannia freight flight arrived. This is now working well and fulfils completely the Nepal customs requirements.

British Embassy. Work services for the FCO in Nepal have in the past been administered from Delhi. When the DCRE's commitment in Kathmandu became evident with the inception of BGTC, it was decided that it would make far more sense for the FCO work in Nepal to come under the DCRE and the Area Office Nepal and DCRE took over all work services for the British Embassy and FCO in Nepal in October 1972. The British Embassy in Kathmandu consists of a typical compound containing the Chancery and Embassy offices, the Ambassador's residence, seven houses, the MT garage, DOE workshop and radio transmitter office. A

full survey was undertaken and a considerable number of works services were agreed upon. This fitted in well with our staff which had been stationed at Kathmandu for conversion of the Rana palace. The work is largely completed, the last services being the construction of a store shed and commissariat in Embassy grounds. The Clerk of Works in Kathmandu has now been withdrawn and will be stationed from now on in Dharan. He will visit Kathmandu when Part II Services or important maintenance tasks have to be undertaken.

An interesting part of the FCO estate in Kathmandu is Kakani Bungalow. This is a small property given to the British Resident in Nepal in 1858 by the Maharaja of Nepal. It is situated some twelve miles from the city of Kathmandu on the hills surrounding the valley. From there, one gets a magnificent view looking south over the Kathmandu valley and looking north to the main range of the Himalayas. It is naturally a very popular picnic spot and is used quite frequently by the Ambassador and the Embassy staff for weekends. The accommodation there has recently been improved by providing an extra bedroom and building new servants' quarters.

Aid Projects

DCRE has been involved in aid projects ever since the camp at Dharan was built. The largest aid project remains the maintenance of the Jogbani–Dharan Road. Over the years there have been a succession of both small and large projects, some have been official projects funded by ODA, and some small projects completed from within the resources of DCRE and funds from the Brigade of Gurkhas.

Dharan Water Supply. In 1968 the DCRE was asked to assist the local town of Dharan in improving its water supply. A scheme for the improvement of the source of water, reservoir and filtration plant and a distribution system for the town was planned. A grant of £50,000 was provided by ODA for Phase I of the project. This was the construction of a catchment in the Sardu Khola, sedimentation tanks and a main pipe line from the catchment to the reservoir above the town. This pipe line had to cross the Sardu Khola and a suspension bridge was designed for this. A 300,000 gals Braithewaite tank reservoir was constructed together with filtration and chlorination plant. The scheme was completed in 1972 and opened by the Ambassador. Unfortunately no money has been forthcoming for Phase II of the project, the distribution system within Dharan. The old distribution system is still in use and an estimated 60–80 per cent of the water is wasted from broken pipes, stand pipes without taps and unauthorized tapping into the main line. This means that outlying areas of Dharan are without water. One particular area of interest to Brignepal is the village of Ghopa which lies immediately to the north of the camp.

Ghopa Water Project. Ghopa village is largely populated by ex-servicemen and has been growing fast for a number of years. It is very short of water during the dry season, and in the past the villagers have come to the camp to ask for assistance. Some two years ago during one particularly dry period an angry crowd broke into the camp and demanded water from our supplies. We provided three stand pipes within our green belt to supply water for the village. This is of course inadequate, and takes badly needed water from our supplies. The Commander had tried for some time to obtain funds to provide a water supply for Ghopa. £10,000 was finally granted after the Quarter Master General's visit to Dharan in 1973. Water is now taken from a small river above Ghopa and piped to the village by high density polyethylene (HDP) pipe. A reservoir and a number of water points have been constructed within the bounds of the village. This project was completed in June 1974 and all the residents now have an adequate water supply.

Village Water Projects. The greatest need in most hill villages is a water supply. Villages are usually on a ridge and in the dry season water has to be carried from the rivers as much as 3,000 ft below the village. A number of small water projects have been taken on in villages with a high ex-service population. These projects mainly consist of supplying material and supervising local labour in constructing the water supply. Extensive use has been made of HDP pipe as this is comparatively cheap,

easy to handle and most important in the outlying areas, light in weight and easy to carry.

Other Projects. Other projects which have been undertaken have been concerned with the repair and construction of bridges, many of which are log cantilever or rudimentary suspension bridges. Where possible these have been strengthened and repaired. One of the national "failings" in Nepal is the inability to understand the need for maintenance. In the 1930s many suspension bridges of excellent construction were provided but these have been left to decay and we have tried to bring these back into a safe state. These small projects provide an interesting and rewarding change from life in the Cantonment, and most of the British Staff have been actively engaged in one or more of them during their time in Nepal.

Resources

One of the greatest headaches in works services is the provision of building stores. Nepal proves to be no exception. The Stores Officer has a staff of twenty and carries a stock of over 15,000 items. These must cater for all expected replacements and breakdowns for a period of two years. All building materials must be ordered well in advance of any works programme. The main source of supply is UK, where the quality is excellent but the time in transit is anything between nine months and twelve months. Goods from UK are shipped to the port of Calcutta, from Calcutta, after Customs clearance, they are brought forward on the Indian Railways. From Calcutta to Jogbani, on the Nepal border, they have to be trans-shipped three times as the railway changes gauge and crosses the Ganges. At Jogbani they pass through the Indian–Nepal customs post and finally the last thirty miles is by road to Dharan. During the trip from UK to Dharan, all stores are subject to pilferage and damage and it is rare that a packing case, or piece of plant, arrives in Dharan complete. An example is a Motor Grader which arrived in Dharan in February 1973 some twelve months after it was ordered. It was beautifully crated and no marks were seen on the crate. When it was opened, a starter motor, generator and every dial in the cab and numerous other fittings were missing. Replacement items, being too heavy for airfreight, had to come by sea, which meant a further nine months delay before the grader was put on the road.

One could fill a book on the resources problems; British and Indian Standards, recovery of cash deposits on orders which have had to be cancelled, import licences which expire before the materials are delivered, export licences to return substandard items, all these and many more over and above the normal breakages and pilferage.

To alleviate some of these difficulties we are now looking to other markets. Possibilities include Hong Kong, (although we still have the problem of movement through the port of Calcutta and rail to Jogbani), Singapore, (we already get most of our refrigeration requirements from there), and Bangkok. In Bangkok there are many American and British Agents and high quality building materials are in good supply. These are all being investigated. It would appear that airfreight from Bangkok is likely to be cheaper than ordering stores directly from UK. One factor which has increased the efficiency of our resources organization, is that the resources officer is now on a two year accompanied tour. Previously these officers were on nine months unaccompanied tours and the supplies they ordered never arrived during their tour of duty.

Cantonment Life

Dharan Cantonment is an oasis in the barren land around Dharan. One excellent feature of its planning was the landscaping and planting of trees when the camp was first built. The trees have now matured and there are beautiful avenues of colourful Flame of the Forest, Jacaranda and Cassia. This makes for a very pleasant living environment, with no traffic hazards for children. However, there are certain problems to contend with; snakes, scorpions, jackals and "monsoon drains"!

There are many facilities for outside activities; a swimming pool, pony club, golf

Photo 4. Landing at Pokhara with Annapurna in the background.

course, tennis and squash courts. Within the camp there is plenty to do. Families find shopping somewhat restricted but we have a canteen in the camp which stocks NAAFI goods which come from Singapore. Outside the camp there is Dharan Bazar with a good market for local produce once a week. Fresh supplies come from Calcutta and we now have a Thermoking refrigerated container which means that our meat supplies arrive in a reasonable condition. There is also a farm on the Cantonment which supplies pork, poultry and eggs, although the egg supply in Nepal is virtually non-existent during the monsoon. The DCRE's staff all have the opportunity to see more of the countryside of Nepal. There are works visits to Kathmandu, Pokhara and Paklihawa and most of the staff have taken the opportunity to trek into the hills, many going as far as Namchi Bazar and Mt Everest Base Camp. Families are also encouraged to either accompany their husbands on works visits or to spend a weekend in Kathmandu or Darjeeling which is only eight hours landrover drive away from Dharan. There is also a holiday scheme now which enables us to visit Kashmir once during a two year tour.

CONCLUSION

The job of DCRE Nepal is a fascinating and rewarding one. Sometimes reminiscent of the old days of Royal Engineers Works Services with Royal Engineer Staff and large DEL labour force. The local labour, the difficulties of supplies and the isolation of Dharan all produce their own problems, which often require ingenious solutions. I think everyone who has served with DCRE Nepal has had a high degree of job satisfaction and a rare opportunity of living in the "Land of the Gurkha", dominated by the great mountains of the Himalayas.

Sappers and Miners

MADGE WOLFENDEN

Miss Wolfenden, for many years Assistant Archivist for British Columbia, is the daughter of Richard Wolfenden who was posted to BC with the main body of Colonel Moody's detachment of Royal Engineers early in 1859 and remained in the Colony as superintendent of printing when the detachment was disbanded.

The Hudson Bay Company have generously given permission to reprint this article which first appeared in their magazine The Beaver.

The photographs appear by courtesy of the Provincial Archives, Victoria, BC.

"BULWER is a good sounding name for a Mountain; Lytton would be appropriate to a River", enthusiastically wrote the commanding officer of the Royal Engineers, shortly after his arrival in British Columbia. Nevertheless, his suggestions were not adopted; instead, a little hamlet situated where the blue waters of the Thompson River mingle with the silty grey Fraser, received the honour of perpetuating the name of Sir Edward Bulwer-Lytton (afterwards Lord Lytton) who was, at that time, the far-seeing Secretary of State for the Colonies. Richard Clement Moody, Colonel of Royal Engineers, had been chosen by Lytton to begin the task of colonization.

It is indeed fitting that British Columbians should look upon the author of *The Last Days of Pompeii* as the guardian of the first days of British Columbia, for it was at his recommendation that "Her Majesty (Queen Victoria) was graciously pleased to add (it) to her colonial possessions".

A backward glance is necessary in order that the sudden happenings of the year 1858 may be placed in their right perspective, and the urgency of the situation understood. Although by the Oregon Treaty of 1846 Great Britain and the United States of America had agreed upon the 49th parallel of north latitude as the dividing line between the two nations, no steps had been taken to mark this boundary. When gold began to be discovered on the bars of the Fraser River, the Hudson's Bay Company was still exercising its privileges of exclusive trade in that untamed and vast wilderness known as "New Caledonia".

Between the end of April 1858, and the inauguration of the colony of British Columbia, on November 19, thousands of adventurers directed their footsteps to the "Promised Land" while James Douglas and Sir Edward Lytton carried on an almost frenzied correspondence between Victoria and faraway London. From these voluminous despatches it is possible to visualize the complex problems which faced the Governor of the nine-year-old colony of Vancouver's Island (whose capital, Victoria, was the only port of entry by ship or steamer) adjacent to the extensive domains so attractive and so alluring on account of their new found gold.

James Douglas, who was also Chief Factor of the Hudson's Bay Company west of the Rocky Mountains, was authorized by Sir Edward Lytton under the necessity of the case "to perform the duties of Governor of the unorganized Territory, pending the passage of the organic Act, and his own formal and legal appointment as Governor". Concurrently with Douglas's request for a military force as a protection against the "wild and adventurous spirits" who were arriving almost daily, Sir Edward revealed his own plans for sending a company of Royal Engineers to the new colony.

Sir Edward's decision to send the Sappers and Miners, instead of an ordinary regiment of the line, shows both his perception of the great amount of work to be done and his confidence in the aptitude and skill of that particular branch of Her Majesty's troops. In writing to Douglas he outlines his reason for the choice by saying:

"The superior discipline and intelligence of this force, which can afford ground for expecting that they will be far less likely than ordinary soldiers . . . to yield to the temptation to desertion offered by the goldfields, and their capacity . . . to provide for themselves in a country without habitation, appear to me to render them especially suited for this duty".

He concludes by expressing the belief that they will "establish themselves in the popular good-will of the emigrants by the civil benefits it will be the regular nature of their occupation to confer".

Writing to Moody a few days later, he stresses the point of discipline and good-conduct, and lays emphasis upon the "civil nature of their duties". He had already explained to Douglas that the "force is sent for scientific and practical purposes, and not solely for military objects".

Amongst the varied instructions which Colonel Moody received were: "To give immediate attention to the improvement of the means of communication by land and water; to report upon unification of British interests on the Pacific; to report upon the harbours of the Colony and upon the existence of all minerals, especially coal and on the fisheries, timber, soil and agricultural prospects". In addition the commanding officer of the Royal Engineers was "to send full reports upon the permanent settlement, as the Home Authorities wish to introduce responsible government as soon as conditions permit".

It was no mean task which confronted Colonel Moody and his subordinate officers, and on this account and because service abroad of necessity implies hardship and long-term absence from home, volunteers were called for in order to make up the Corps.

In commenting on the formation of the Columbia Detachment, as it came to be known, *The Times*, of London, on September 13, had this to say:

"None but the most robust and skilful men among the Royal Engineers have been allowed to volunteer for this service, as the work they will be called upon to perform will be not only attended with some degree of hardship, but will also require a great amount of skill. With this view they have been chosen from the various trades and handicrafts of which the Corps of Royal Engineers is made up".

A few days later, *The Times* had more to say, reporting on the departure of the Royal Engineers for British Columbia, and gave details as to the stores and supplies which were being sent in the barque *Briseis*. The list is quite an astonishing one for it includes an electric telegraph apparatus and wires, a printing press and photo-graph apparatus, as well as "portable boats", and "an immense assortment of mining tools, and . . . tools for carpenters, smiths, bricklayers, etc".

By a stroke of misfortune the *Briseis* was burned at sea, which accounts for the fact that another supply ship, the *Euphrates*, sailed the following January with a substitute cargo of supplies and provisions.

The Corps was made up of Colonel R C Moody; Captains J M Grant, R M Parsons and H R Luard; and Lieutenants A R Lempriere and H S Palmer; and Assistant-Surgeon J V Seddall. The rank and file consisted of 150 non-commissioned officers and men, about thirty of whom were married, and who were allowed to bring their wives and families. Included in the overall numbers were two Royal Artillerymen and two Hussars, present for the purpose of forming the nucleus of an artillery or a cavalry corps should the necessity arise.

In order to expedite preparations and to save time, Captain Parsons and twenty men, chiefly surveyors, and Captain Grant with twelve, who were mainly carpenters, preceded the main group, travelling by way of the isthmus of Panama in two separate parties. Colonel Moody and his family, who also travelled by the same route, formed a third party, and were accompanied by Captain W D Gosset, to whose lot it fell to establish and superintend an assay office and colonial mint.

The main body sailed by way of Cape Horn in the clipper ship *Thames City* which had been chartered for the purpose. Thus by the time that the official inauguration and proclamation of the Colony of British Columbia was effected on the 19th of November, Captain Parsons and his party, and Captain Grant and his party, were already on the scene, and the commanding officer and the main group were on the high seas *en route* to join them. Colonel Moody and family reached Victoria on Christmas Day, and the *Thames City* dropped anchor at Vancouver Island on April 12, 1859.

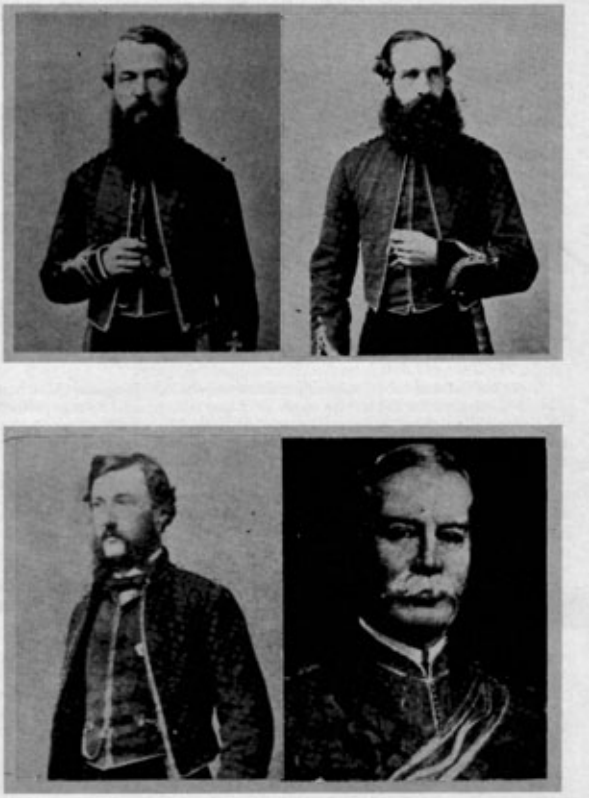

Photo 1. *Top Left:* Colonel Richard Clement Moody, commanding officer of the Columbia Detachment of the Royal Engineers in British Columbia, 1858–63. *Top Right:* Captain Henry Reynolds Luard who was in charge of the main body of the Royal Engineers that sailed in the *Thames City* 1858–59. *Btm Left:* Lieutenant Henry Spencer Palmer served under Captain Parsons in the Survey Department. *Btm Right:* Captain John Marshall Grant, second in command of the Royal Engineers in British Columbia. From a photograph of an oil painting by his daughter who was born at the RE camp.

Sappers and Miners (1).

The first object to claim the attention of Colonel Moody upon taking up his duties in the colony, was the founding of a capital city. Governor Douglas had chosen the site of old Fort Langley for this purpose, and had already caused a townsite to be laid out there which he renamed Derby. Captain Grant at once condemned Derby as being unsuitable for military as well as for commercial purposes by being, amongst other factors, on the wrong bank of the river. He reported his adverse findings with which Colonel Moody was quick to concur. Instead, the present site of New Westminster, on higher ground, and farther from the international boundary, was deemed desirable from every point of view.

Moody, as a loyal soldier of the Queen, wished to commemorate Her Majesty in some special way, and so chose "Queenborough" as being an appropriate name for the capital. For some months he and Douglas, who insisted on "Queensborough", spoke of the capital each in his own way, until the matter was referred to Queen Victoria herself, who settled the question by naming it "New Westminster".

It is neither possible nor desirable in the space of this short article to endeavour to give in detail the innumerable tasks and achievements accomplished by the Sappers and Miners during their five years' sojourn in British Columbia. The late Judge F W Howay has already done this in his admirable *The Work of the Royal Engineers in British Columbia, 1858 to 1863*. The Judge's own summary provides an excellent resumé and this paragraph from his book is well worth quoting:

Photo 2. Sapperton, as the camp of the Royal Engineers was generally known, with Colonel Moody's house on the extreme left (later Government House). The Provincial Penitentiary at New Westminster now occupies the camp site.

Sappers and Miners (2).

"Taking stock of the work of the Engineers up to the end of 1863, we find that all the important explorations in the colony were performed by them; the whole peninsula between Burrard Inlet and Fraser River was surveyed by them; all the surveys of towns and country lands were made by them; all the main roads were laid out by them; some of these, including portions of the Cariboo Road, the Hope-Similkameen Road, the Douglas-Lillooet Road, and the North Road to Burrard Inlet, were built by them; practically all the maps of the colony and of sections of it were made from their surveys, prepared in their drafting office, lithographed and published by them at their camp; they formed, in 1862, the first building society in the colony; they designed the first churches (Holy Trinity Church and St Mary's Church, New Westminster) and the first school-house in the colony; they designed the first coat-of-arms and the first postage-stamp in the colony; they established the first observatory, and to them we owe the first systematic meteorological observations in the colony, covering a period of three years; they formed the Lands and Works Department, the Government Printing Office, and printed the first British Columbia Gazette; they aided in the maintenance of law and order; and their commanding officer was the first Chief Commissioner of Lands and Works, as well as the first Lieutenant-Governor". (He held a dormant commission as such).

Vancouver residents owe a debt of gratitude to Colonel Moody for it was at his instigation that the large tract of forest now known as "Stanley Park" was reserved when the first surveys on Burrard Inlet were made by the Engineers under his command.

Passing reference must be made to another body of Royal Engineers who were also in British Columbia during most of this same period, namely, the officers and men under the command of Captain J S Hawkins, who comprised the North American Boundary Commission, and who were engaged in defining and marking the line of the 49th parallel of latitude ("Boundary Journal," *Beaver* Winter 1955 and *RE Journal*, September 1973).

Not only did the Engineers contribute to the material welfare of British Columbia in a very practical way, but they also supplied intellectual and cultural stimulus, generally so lacking in new settlements. For instance, a library of some 2,000 volumes was purchased in England by the men of the corps, and personally selected by Sir Edward Bulwer-Lytton. Upon their departure from British Columbia in the autumn of 1863, this "small but complete library" was transferred to the Mechanic's Institute of New Westminster, and so formed the foundation upon which a public library was gradually built. Morley Roberts who, some twenty years later whilst engaged in railway work, enjoyed these books, makes special mention of them in his

Western Avernus.

Her Majesty's soldiers and sailors, throughout the Commonwealth, have always been known to enjoy amateur theatricals, and the Royal Engineers were no exception. While on their way to British Columbia in the *Thames City*, they formed a small theatrical group, which was quite active on board ship when weather and opportunity were favourable. Upon reaching New Westminster they continued to produce plays for themselves and the settlers, and even built a small theatre at their camp, where entertainments were held regularly.

Colonel Moody maintained his sincere and genuine interest in the development of British Columbia for many years after departing from New Westminster, as is evident in his letters to the late Sir Henry Crease (who was Attorney-General for British Columbia in the 1860s). He had faith in its future and at the time of his death in 1887, *The Times* remarked "his name will ever be associated with the fortunes of our rising dependency in the Western Pacific". It is appropriate, therefore, that at least one place-name in our province, Port Moody at the head of Burrard Inlet, should commemorate this conscientious, congenial, and cultured soldier.

Owing to differences of opinion between Governor Douglas and Colonel Moody as to policy, and because the monetary resources of the colony were insufficient to

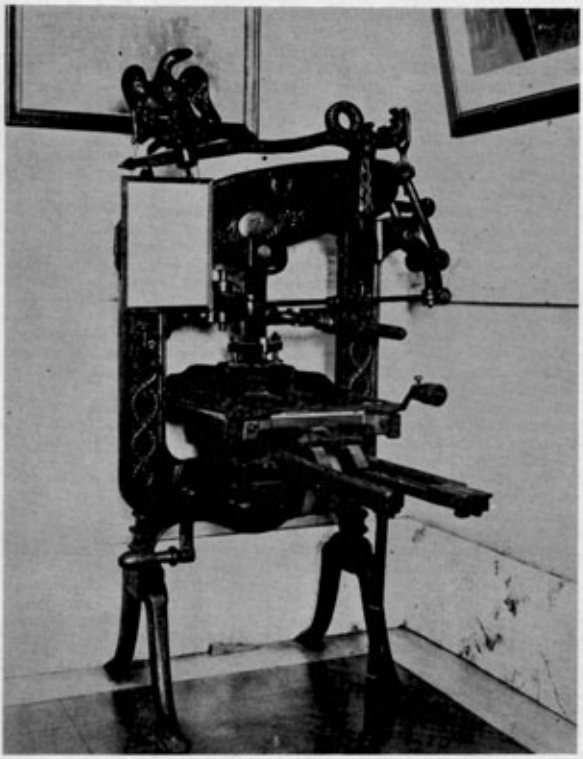

Photo 3. The Printing press first used in 1860 by Corporal Richard Wolfenden RE. On it were printed reports of surveys and the BC Government *Gazette*.

finance the expenses of the Corps (as had previously been agreed upon by the Colonial Office and Douglas) the Governor brought pressure to bear upon the home government early in 1863, with the result that orders for the withdrawal of the Royal Engineers were given, and preparations were made for their disbandment in the ensuing autumn. The original period of service was to have been six years, and at Imperial cost for a limited time only.

In reference to this Judge Howay has commented:

"Whether the policy pursued by Governor Douglas enabled the colony to obtain the full fruits to be expected from the presence of such a body of trained men during its toddling days may well be doubted; and it may be questioned as a consequence

Sappers and Miners (3).

whether the full measure of success hoped for by Sir E(dward) B(ulwer) Lytton was attained".

Nevertheless, it is generally conceded that throughout their service the men had borne themselves according to the best traditions of the British Army, and had acquitted themselves in all they did, whether at work or at play, with a deportment that merited nothing but the highest praise.

When the time came to break up the Columbia Detachment, the officers and their families, and about twenty-five or thirty of the sappers, returned to England, while the remainder, to each of whom had been granted the usual 150 acres of land, engaged in civilian occupations, thus forming a unit of hard-working and eminently desirable settlers for the colony.

It has been said of their commanding officer that "he earned the good-will of the colonists and the approbation of the authorities at home". He, himself, said at the farewell dinner tendered to the officers of the Corps upon the eve of their departure: "We have simply striven our best to do our duty. That is what a soldier has always before him. It is his highest ambition to do his duty well". In referring to his service in British Columbia he continued: "It was an experiment . . . a novelty, mingling thus military and civil duties. How far it has met what was sought for by the Government is not for me to say". He passed lightly over "the peculiar trials, difficulties, and embarassments" when referring to his term of office, and parted from the remainder of his Corps and the settlers with feelings of sincere respect, friendship and admiration, which were expressed on all sides.

In retrospect, a century after the stirring events which took place in the new colony, in which the Sappers and Miners were privileged to participate, it is revealing to read Sir Edward Bulwer-Lytton's address to his constituents at Hitchin (Hertfordshire, England) as reported in *The Times* of September 28, 1861:

". . . we have been laying the foundations of a new and mighty colony . . . I speak of the colony it was my duty to advise my sovereign to found . . . I mean British Columbia. That colony, with its neighbour Vancouver (Island) . . . gives to England her only possession on the Pacific Ocean. But that possession is the key to the Pacific, and had I still been in office . . . I venture to think, one line of British settlements would have sprung up to connect the Pacific with the Atlantic".

Further on, in the same address, Lytton referred to the future status of British Columbia as being destined to be the "wealthiest of all that now speak our language". He concluded by alluding to the part which he had played in bringing about the colonization as "that act in my own special administration of which I am most proud".

Were he alive today, he would indeed be gratified to observe the verification of his sanguine and far-sighted hopes for Canada's most western province, verily a monument to his perspicacity.

"Ubique Quo Fas et Gloria Ducunt".

* * *

Articles for RE Journal

NEARLY three years ago an appeal was made to Members to submit articles with a view to their subsequent appearance in the *RE Journal*. The response was quite magnificent and we still have articles in "the bank" which have not yet been published. There is, however, a shortage of material dealing with the present and future in particular and very soon history will predominate unless some action is taken.

Please act now—in the publishing world 1976 is nearly upon us!

Early Days

MLC

"THAT a gold medal be presented annually by the Corps for the best essay on a given subject connected with their profession . . . the Subject of the essay to be decided by the Committee of the Royal Engineer Institute . . ." Such was a resolution agreed at the same AGM in May 1875 which set up the Royal Engineer Institute and the organization to run it. The subject for 1875, published in the July 1875 *Journal* (in fact chosen by the Inspector General of Fortifications as the new Institute Committee was not, by then, "fully operational") was "On the attack of Fortresses, in the future, taking into consideration the experience gained during the War of 1870–1." Entrants were bidden to bear various factors in mind, including the composition of the Artillery and Engineer siege trains, the use of wall pieces, breaching by curved fire, stationary balloons, telegraphic communications, trench railways and the organization of working and covering parties.

No doubt all good essay stuff. However, one is reminded of the passage from an article in the *Pall Mall Gazette* (recorded in a previous instalment of this series) in which the author, in seeking for an explanation why Engineer factors seemed to have been neglected in planning for the Ashanti War, stated "Possibly the Engineers have themselves somewhat to answer for, if their own arm has hitherto been almost ignored in our field operations. The Corps has the tradition of Sebastopol, if not of the Peninsular, and still seems to think war will be a long succession of sieges".

There was no issue of the *Professional Papers* in 1875 as the 1875 edition was held over and published in 1876. The Editor explained that an issue of the papers, which did not contain a comprehensive account of the Engineer operations in the Ashanti War, would have been "looked upon as incomplete". However, the comprehensive account, included in the 1876 Papers, had taken so long to clear through the War Office, that it had not been possible to go to press at the proper time in 1875. The paper in question was written by Sir Garnet Wolseley's then CRE, Major Home. Home says in his preamble:

"There were two ideas which I felt convinced were at the root of all successful military engineering and I determined to make these ideas the guide of my actions in all things:

(1) That the engineering must be adapted to the country, not the country to the engineering.

(2) That a rough, ugly erection, ready when wanted, and answering its purpose, was of far greater value than a neat artistic production, which was only ready after the necessity for its use had disappeared."

He goes on to comment on the meagreness of the information on the nature of the country and of the resources available to overcome the material difficulties. In any event, he seems to have determined that not only should local labour be used to the full (which was fair enough) but also that only the very minimum of supervision for such labour need be arranged. For instance, the main engineer effort was to be provided by 28 Field Company, but this unit was only disembarked in the Theatre after much of the engineer work had been completed. Home seems to have had the construction of the Torres Vedras lines in mind, when a handful of RE Officers and never more than eighteen Royal Military Artificers were employed in the construction of this "vast and formidable defensive position", on which over 7,000 Portuguese labourers were employed.

Home was faced with preparing an administrative base at Cape Coast Castle, and a route forward for the force for some 150 miles to Coomasie, the Ashanti capital. The advance was to be through large tracts of impenetrable forest, interspersed with low and marshy ground and intersected by many streams. Labour was likely to be scarce and bad and the climate was very unhealthy for Europeans (one reason why British—as opposed to local—troops were landed as late as possible. This included

the Field Company). Besides the innumerable streams there was one major river, the Prah, to cross.

Home, as indicated above, concluded that the very minimum engineer personnel and material should be taken. There was, as he expressed it, to be no need "to throw up field works after an impetuous attack, but the humbler tasks of making roads, bridges and attending to the sanitary wants of the Army." Home freely admits he under-estimated in all respects. For instance, he made no provision at all for a telegraph, or signalling apparatus, to keep the advancing troops in touch with the base. This was largely remedied by improvization and frantic telegraphing back to England for extra stores.

Criticism is, however, all very easy. What if the first demonstration store hut (prefabricated timber huts were brought out from England) had to be put together by the CRE himself. What if the crib piers for the Prah bridge were constructed and launched (since the river was nearly 200 ft wide, swift flowing and 10 ft deep in parts, this was a formidable operation) mostly by carpenters and other tradesmen hastily assembled from the Naval ships which had accompanied the expedition. What if Home drove himself, and such Engineer supervisors as he could muster, to the point of exhaustion and even death. What if the margin between success and failure was narrow indeed. Home provided the Commanding General, Sir Garnet Wolseley, with all that he asked for and on time.

Home returned from the operation with unbounded admiration for the General and the way in which he gave the RE an unimpeded and free hand. "He (Sir Garnet) said clearly what he wanted, and when, and he left me to deal with the means at my disposal . . . By thus knowing what devolved on me, I was enabled to organize the labour and material at my disposal, and to effect far more, and at a far smaller cost, that if I had been situated differently. I felt sure of support; I worked accordingly and I believe such a system is at the base of all proper military organization, whether in peace or war. Constant interference only irritates and frets men . . . An attempt to dictate and direct from day to day about every trifle, simply converts an intelligent subordinate into a blind tool"!

Excellent comment indeed, but the British Army has not always been noted for such an attitude.

In the February and March *Journals* appeared two long articles on All Arms Tactics, designed to help those officers preparing for promotion exams. The author was Major Hale, Instructor in Military History at the SME. Hale was clearly one of those who wished (Major Home's comments not withstanding) to see the British Army less rigid in outlook. The increased range of both artillery and infantry weapons demanded improvements in tactics—such as open and loose order skirmishing. Any one Commander could control a less number of men and, as Hale puts it, intelligence must be brought more into play "even down to private soldier". Wider fronts—or, alternatively, deployment of units in greater depth on a narrow front—inevitably meant that a commander in a given area might have to command a mixture of units. "A British comment is to the effect that one must be careful not to mix units as the British Soldier does not take kindly to being under the orders of a stranger officer". "If we are to credit the accounts of actual warfare, the sooner the British Soldier is broken to the willing obedience of stranger officers, the better". Hale recognizes that the inevitable mingling could develop into the character of disorder. Although disorder in war was a necessary evil, every step should be taken to guard against it. A little more flexibility of mind was one such step. "The penalty is soon paid by poor use of cover if intervals and distance are strictly kept."

The Germans are held up as examples of the right approach. "The leading traits are a high standard of intelligence in both officers and men, independence of action and self-reliance in the individual, combined with the strictest discipline and closest obedience to orders". The Germans, according to Hale, held that open skirmishing demanded a "trained intelligence to make up for loss of control; there must be a desire for independent action within a framework of a closely co-ordinated plan".

Although he does not say so, Hale seems to imply that the British Army clung far too long to the virtues of steadiness and exactness, as exemplified by the Infantry Square and the delivery of a controlled short range volley. The myth that the strictness and rigidity of Prussian discipline were similarly as evident or even more so, in the application of tactics on the battle field as on the drill square, had also died hard with the British. Hale was clearly anxious to put the record "straight". It would have been interesting to know Hale's opinion of a "Memorandum on Intrenching Positions", which was issued by the Field Marshal Commanding in Chief (the Duke of Cambridge) and which was reprinted in the August 1875 *Journal*.

The Memorandum laid down exact rules. Among these were that the responsibility that the different positions were in "harmony" was that of the Commanding Engineer, who was also responsible for the general superintendence of the intrenchments. Executive orders were to be issued by the AQMG. Positions were, whenever possible, to be continuous and fields of fire were to take precedence over concealment. A second line was to be provided "not for the first line to fall back on but to break the strength of the enemy should he succeed in forcing the first line". Men should be 2ft 6in apart with 5,600 infantry to the mile with about another 1,400 in general reserve. Each battalion should carry 100 picks and 100 shovels. The Engineers, assisted by the reserve troops, were to dig the second line. Clearing fields of fire should have priority over the construction of trenches themselves. Finally, and perhaps most important of all, there was to be no digging except on Government ground otherwise tapes were to be used!

However, if there was some disquiet as to whether the British Army was, or was not, sufficiently flexible in thought there was no such disquiet in another activity with which individual Royal Engineers Officers at that time were closely concerned. This was the Prison service: In 1875, at the Social Science Congress at Brighton, Lieut-Colonel du Cane RE, then Chairman of Directors of Convict Prisons, stated in no uncertain terms, "This country presents to the view of the philosopher many institutions of anomalous growth, that he may regard with something of despair the realization of his dreams of reform. He may however take heart on reading the history of the growth of our present criminal administration. Out of chaos has been developed a system of which the social reformer of this country may be proud . . ."

Lieut-Colonel A R Currie, OBE, DSO, BE(Civ), MNZIE

COLONEL COMMANDANT ROYAL NEW ZEALAND ENGINEERS

ON 3 September 1939 the New Zealand Army permanent staff boasted four officers and three NCOs who were responsible for training territorial engineers and staffing works matters. Lieutenant A R Currie BE NZSC, as Adjutant of 3 Field Company NZE, was one of this select group. He also held the appointment of District Engineer Works Officer for the Southern Military District which covered the whole of the South Island.

Russell Currie served with distinction through World War II, first as OC 8 Field Company until July 1942, then taking over from Major Moore RE, as Chief Instructor and Officer Commanding 8th Army School of Minefield Clearance. After Alamein, he rejoined the NZ Division as an SORE 2 on the CRE's staff before returning to NZ. He was wounded on three occasions and was awarded the DSO during operations in Italy.

After the war he continued to serve as the NZ Army's senior engineer, first as Director of Fortifications and Works until 1949 and then as Chief Engineer until 1960.

The Official History of the NZ Engineers has many references to Major Currie.

One concerns a short-lived moment of glory driving a captured Italian tank to show off at Brigade HQ when he was relieved of it by a British tank unit. My favourite, however, concerns an exercise for which 8 Field Company produced some practice mines by replacing the charges from EP Mk 2 mines, with small carefully measured amounts of black powder (for smoke) and gelignite (for noise). The first batch of mines was successful but for the second batch there was some excess of enthusiasm in measuring out the powder and a complete lack of it for marking one of the practice minefields with the result that several cars and trucks were immobilized at a time when vehicle tyres were very scarce. There was "a bit of an enquiry" but the CRE rescued the sappers by slating the Division for not being mine conscious.

Since retiring from the Army Colonel Currie has attended Sapper activities throughout New Zealand. RNZE is proud to welcome him back to an official position as Colonel Commandant.

Lieut Colonel A R Currie, OBE DSO BE (Civ) MNZIE

Some Views on an Attachment

CAPTAIN G C SEDMAN, RE, C Eng, MIMechE, MIPlantE

THE Professional Engineering Training of the Corps conjures up different pictures in the minds of Members of the Institution. Hard work it is, but it can also be a very pleasant experience. This first of two articles is concerned with the social and environmental side of a tour; the second will deal with the technical aspects, equally interesting but possibly of more limited appeal, and therefore shorter!

In January of 1972, whilst attending the academic phase of my long engineering course at Chatham, now more correctly designated Professional Engineer Training, I was told that I was to be sent to the USA for eighteen months. The attachment was to be with the US Corps of Engineers based at Savannah, Georgia on the South Atlantic coast. One and a half years of professional engineering training in mechanical and electrical engineering divided between design and site work was the general aim behind the attachment.

The months between January and June were filled with forms. Biographical data on all five members of the family was required by the United States authorities. Medical histories were compiled and despatched to obscure addresses. Banking facilities were arranged—one question asked how many cars I intended buying! Passports and visas were acquired and contact established with the Corps of Engineers Administrative Officer in Savannah. Boxes were packed and sent off, booklets were received describing life in the United States and the pitfalls to be avoided. One brochure included a dictionary of American terms which I subsequently found to be rather inadequate for the Southern States.

Entry to the USA

Early in June the VC 10 took off from Brize Norton bound for Washington DC. The brilliant weather during the daytime flight allowed wide eyed views of Newfoundland, the New York skyline and Boston prior to arrival at Dulles International Airport some thirty miles outside Washington DC. After the formalities of customs we were whisked along a six-lane highway in a standard size of American limousine which easily carried all our baggage, three adults and two children, (one child at boarding school would join us for holidays only). In minutes we were deposited in a hotel in Washington, where we were to stay for three days, some ten minutes walk from the British Embassy. During this time all the necessary administration regarding pay, claims, leave and reporting was completed. These arrangements were to work efficiently and promptly for the next eighteen months. This enclave of Britain gave the most courteous service for the whole of my stay in the USA.

The weekend in Washington was intended to serve as acclimatization and allow some sightseeing before continuing to our final destination. The day-time is really the only time for walking around Washington. Evening saunters are an open invitation to "muggers". With two small children, sightseeing for two days was exhausting and yet exhilarating. The long wide boulevards on the North bank of the Potomac River; The US Capitol building; the Washington Memorial, a 550 ft obelisk, from the top of which one has an unparalled view of Washington; the Lincoln Memorial; Pennsylvania Avenue; the White House; the Potomac from the White House; the Jefferson Memorial; the huge Pentagon building; the Arlington National Cemetery; all were visited or seen in the hectic two days prior to our flight to Savannah.

The Deep South

On 13 June, a mere two hours jet-time south of Washington and in a temperature of 85°F, we landed in Savannah. We were met by the Deputy District Engineer and his family who gave us a wonderful welcome and arranged everything for us until we were settled into a two bedroomed apartment some few days later.

Savannah, the city which was to be our home for eleven months, was founded in 1733 by General James Edward Oglethorpe. King George II had commissioned General Oglethorpe to establish a fortress and settlement on the South Atlantic seaboard as a British outpost and so halt the spread of Spanish influence from Florida. The city was founded on a bluff overlooking the Savannah River which forms the present-day State Line between Georgia and South Carolina. The old part of the city was laid out in a strictly geometrical pattern with roads laying East–West and North–South in a symmetrical plan relieved by squares which originally were rudimentary areas for water wells and bake ovens. These squares are now landscaped parks forming small green oases separated by quiet rows of renovated town houses. This old part of the city is now zoned; a code of building development and renovation is strictly enforced to ensure that modern vulgar architectural styles do not encroach.

The city has grown considerably over the past three decades. The old city has spread to the South and the East; industry has developed particularly on the South bank of the Savannah River and Savannah is now one of the largest ports on the South Atlantic coast. Savannah is in Chatham County which is predominantly swampland. There is little that can be grown in the surrounding areas other than pine, which grows in the semi-tropical climate at a remarkable rate and pulpwood is probably the primary product of the natural resources of the area.

Land is not as expensive to buy as in many other parts of the United States. Houses in the South of the city of Savannah are generally set in generous plots, often single storey construction, surrounded by trees, lawns and shrubs. From the air it is difficult to appreciate that it is a city of 200,000 people. In April and May the city greenery is emblazoned by azalea, magnolia and dogwood.

So far the description has been of the appeal of the area, but there is discordancy. There are still areas between the old city and the new urban development which contain many old clapboard two-storey houses. Unadopted roads with poor dirt surfaces surround them, paint is peeling, flyscreen netting is torn and uncollected trash and part stripped automobiles give the impression of poverty and dilapidation. There are also areas where one meets the expected sights of Americana, garish neon lighting highlighting hamburger joints, service stations, supermarkets and car lots.

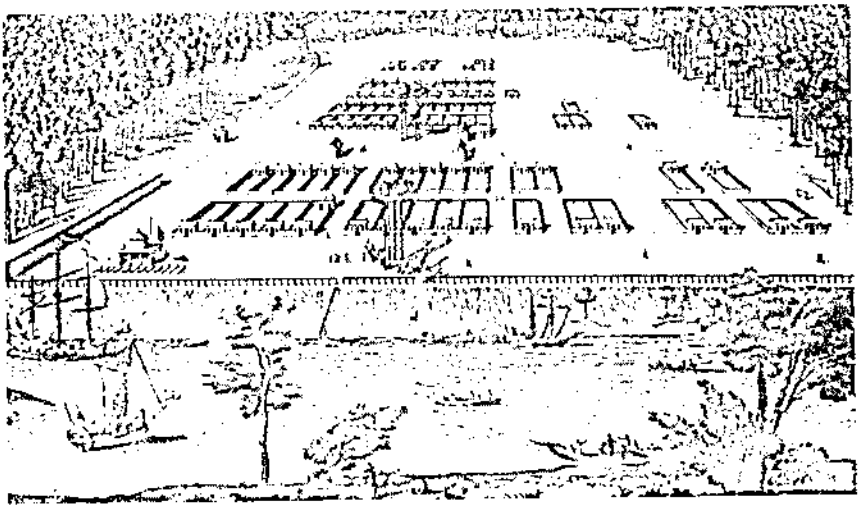

Photo 1. A drawing made by settler Peter Gordon a year after Savannah's founding in 1733 shows the settlement being carved out of dense forest. Oglethorpe's plan with squares is beginning to show.

Southern Folk

The city of Savannah, containing new and old, beautiful and bizarre, rich and poor is matched only by the contrasting peoples. The first obvious delineation is black and white. About 30 per cent of the population is black and, as in other cities, tend to live in specific areas The introduction of "bussing" for schoolchildren in the early 1970s has caused some decentralization of these areas but the integration of black and white communities is far from complete and it will take many years before there is total acceptance There are still many of the older, black citizens who speak their local dialects of "Geechee" and "Gulla". These dialects are English-based but so loaded with local expression and pronunciation that understanding by an Englishman is virtually impossible.

As in other parts of the United States the white community of Savannah consists of a polyglot of people from a varied ethnic ancestry. There is an English group, an Irish group and a thriving St Andrew's Society. The St Patrick's Day Parade is second only to the New York occasion. The beer is dyed green, road markings are over-painted green and on one notable occasion even the Savannah River flowed green. The speech of the South Eastern States is slow and deliberate. Away from the frenetic rush of the large cities, the pace of life is in keeping with the speech, gentle and slightly languid. Hospitality is almost a religion and an invariable parting comment when leaving shops, offices or homes is "Y'all come back now y'hear", this seems to epitomize the genuine interest people take in one another. Perhaps in my case it was curiosity in the different speech and ways of a foreigner but, none the less, was instrumental in giving a most homely feeling about the place and people.

Georgia and the Carolinas are often termed the "Bible Belt". In the city of Savannah alone there are 200 churches, most churches encompass the Christian faith the most predominant being the Baptist Churches. It is impressive to see that the Church is so well supported, people take a very active part in their Church affairs, indeed most families set aside a percentage of their income to support their own church. Much of the social grouping in this part of the United States centres around the Churches. As an Englishman I found the Baptist Church a little too urgent for a conservative palate. The complete lack of formality in these churches led to an extremely friendly atmosphere but the privacy of one's religion held by many Englishmen, made our family prefer the slightly more formal Presbyterian or Episcopalian church.

Most of the people with whom I was associated at work were in a salary range of £5,000 to £10,000 per year. The cost of living seemed to be about 20 per cent higher than in Britain overall, yet the standard of living of middle class America seemed to be about 80 per cent higher. Homes were larger in plan area, fittings seemed more luxurious and, in the warmer climate, air conditioning in homes and automobiles was considered a necessity. Two or three cars to a family is commonplace and household chores are eased considerably by garbage disposal units, motorized lawn mowers, automatic dishwashers and many other labour saving devices. Parties are frequently held and, because of the climate, outdoor barbecues and beach parties are popular ways of getting together. The complete informality of such parties bring the most surprising people together. Venezuelan diplomats rub shoulders with irascible Geordie poets and British Army Captains chat with Cherokee Indian Chiefs.

Americans are often labelled as brash and outspoken, these facets were not apparent in the South East, perhaps the only occasions where these traits showed were in shops and service stations. It seemed that the customer was always right and American customers, in requesting service, were insistent that this maxim was followed. This has resulted in a much more personal service being given and the attitude of indifference that one encounters in some British shops is virtually non-existent in the Southern States.

Unfortunately there is a fairly high crime rate, from petty crime to serious crime. Many weeks were to elapse before one could accept all policemen carrying gunbelts and pistols. The shriek of police sirens often assail the ears and a family without fire-

arms in the house is the exception rather than the rule.

Time Off

The area of Georgia and South Carolina together is about the same area as England and Wales with only about one eighth the population. A typical day visit from Savannah was to Charleston, 110 miles to the North in South Carolina. The beautifully preserved Southern homes and historic Fort Sumter were particularly attractive and interesting. A walk in the old slave market and in Catfish Row of Porgy and Bess fame brought to life many impressions of the deep South gleaned from books. In this part of the world the Confederacy is still very much alive and the Revolutionary War is still referred to with wry humour as "the War of Northern Aggression".

A Change of Scene

After eleven months in a medium sized American city we moved West across the State of Georgia to the Alabama Georgia State Line to live for seven months in a small American town called West Point some ninety miles South West of Atlanta. This small American township should not be confused with the West Point Academy, its military notoriety is mainly attributed to the action fought by General Tyler on behalf of the Confederacy which occurred some days *after* the end of the Revolutionary War. Due to the benign influence of a retired State Senator, who had become a friend, we were able to rent a fully furnished house set in its own grounds. With our ex-Senator friend as a neighbour another period of wholly enjoyable Southern living was assured. This new abode was in about as deep South surroundings as one could wish. Indeed at seven in the evening even the sidewalks in the town were "rolled up and put away" for the night. The expression infers that the town closes down so completely that the pavements are not even used by window shoppers and the town is dead until the following morning. The magnolia trees and dogwood in the garden together with the indecipherable chatter of Zach, the negro gardener, who came on Saturday mornings to assist with the gardening all contributed to my being called Beauregard by my family. Meals of waffles laden with Vermont maple syrup, deep fried catfish and hush puppies at fish fry parties, pecan pies brought in by friendly neighbours all helped to Americanize us for this seven month period. There were frightening moments at times amidst all the pleasure. There were often warnings of tornadoes and, though we were fortunate during our stay, there were occasions when exceptionally high winds associated with tornadoes played havoc with high tension wires passing through the foliage of trees at the side of the road. Just to the North in Alabama are the foothills of the Smoky Mountains rising into Tennessee. The earth is deep red in colour and there are both peach and pecan orchards set amidst miles and miles of pine. Corn and some cotton is also grown here.

Contrast the easy life of the rural areas to nearby Atlanta, the State Capital; bewildering ribbons of concrete motorway interlace with the concrete jungle of high rise hotels, apartments and stadia. The unfortunate stranger driving into Atlanta could easily be condemned to a lifetime circling the city at seventy miles per hour frantically searching for an exit. About 200 miles South of Savannah, on the coast of Florida, lies St Augustine, the oldest city in the United States, founded in the sixteenth century by Ponce de Leon. This city, as with many parts of Florida, is geared for the tourist. St Augustine is quite beautiful, many of the old streets and houses are preserved for the enjoyment of visitors. Many houses were constructed of "tabby", a durable form of concrete consisting of lime, gravel and sea shells. Many of the names in the city are of Spanish or Moorish origin but some British names are prominent, due perhaps to the fact that the city was sacked twice by the British in the seventeenth century and occupied by them for some years. Just an hours drive South and inland from St Augustine, near the city of Orlando in Central Florida, is a vast 2,700 acre engineering miracle called Disneyworld. This undertaking is a paradise for all adults and indeed some children have also been known to enjoy a visit there.

Photo 2. The house in West Point.

Only the many quaint names which have remained remind one of the historical background of the State of Florida, Old Southern names like Dixie, River Suwannee and old Indian names like Osceola, Ocala and Seminole.

There are restaurants to satisfy the most fastidious and a considerable variety of night clubs for the nocturnal. Bohemian and historical devotees can have their appetites whetted in underground Atlanta, an area of the city below street level of reconstructed Atlanta at the time of the Civil War.

During the stay of several months at West Point the opportunity of a three week leave period arose. With friends living in the mid-West and the West Coast the obvious method of travel, and to see as much as possible, was by car. The round trip taking in a northerly route to California and return by a southerly route was 6,400 miles and on a full day of driving an average of about 700 miles a day was covered, much of the driving being done on motorways. The large American cars with air conditioning, power brakes and steering makes driving easy and even with three children in the car there was adequate space to ensure comfort during the journey.

One could go on for ever on the enjoyment experienced on this leave, suffice it to say that this memorable holiday was the highlight of our attachment and prepared us for the last few months in our Southern home prior to return to England.

Reminiscences

The lasting impressions of this country are ones of pleasure and wonder. The size of the country with so many States, each at least the size of England, is such that it would be impossible even with many years of constant touring to see all there is to see; there are mountains and plain, desert and swamp, crowded cities and ghost towns, extreme heat and extreme cold all in one country. People, grouped under the single description of "American", are just as diverse as the country in colour, creed, language and temperament. Eighteen months passed all too quickly in the country to which my family and I became attached.

Some views on an Attachment (2)

An Engineering Attachment on the Columbia River, USA

MAJOR M C TRAVERS, RE

INTRODUCTION

THREE British Officers have now served with the North Pacific Division, US Army Corps of Engineers. The Division is responsible for Civil Works in Alaska, Washington, Oregon, Idaho, and the western part of Montana. The main river in the area is the Columbia River and its main tributary is the Snake River. The British Officers have worked in the Hydro-Electric Design Branch in the Divisional Headquarters, Portland, and then transferred to a field job at a dam. I was fortunate enough to gain my field experience at Ice Harbor Dam, Washington on power-house extensions.

COLUMBIA RIVER DRAINAGE BASIN

The Columbia River is the largest snow-fed river in the USA outside of Alaska. It drains an area of 259,000 square miles of which 39,500 square miles is in British Columbia, Canada. (Fig 1). Each year the run-off from the melting snow in the mountains reaches a peak in June and is controlled by storage reservoirs which can

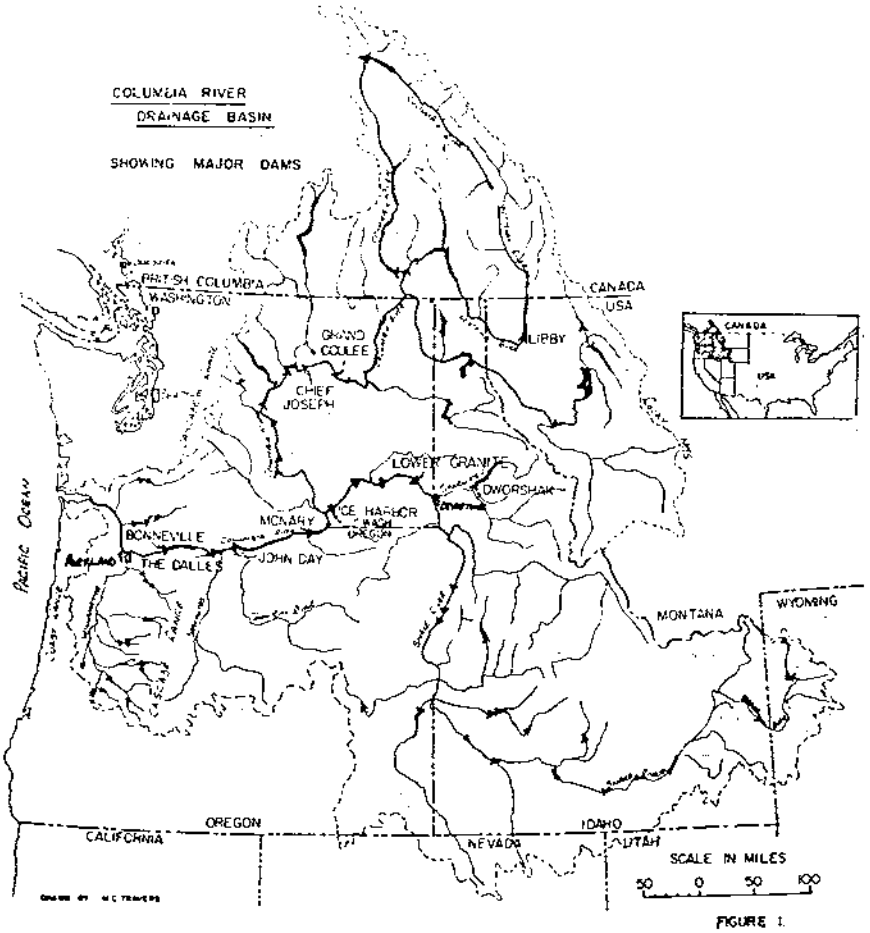

FIGURE 1.

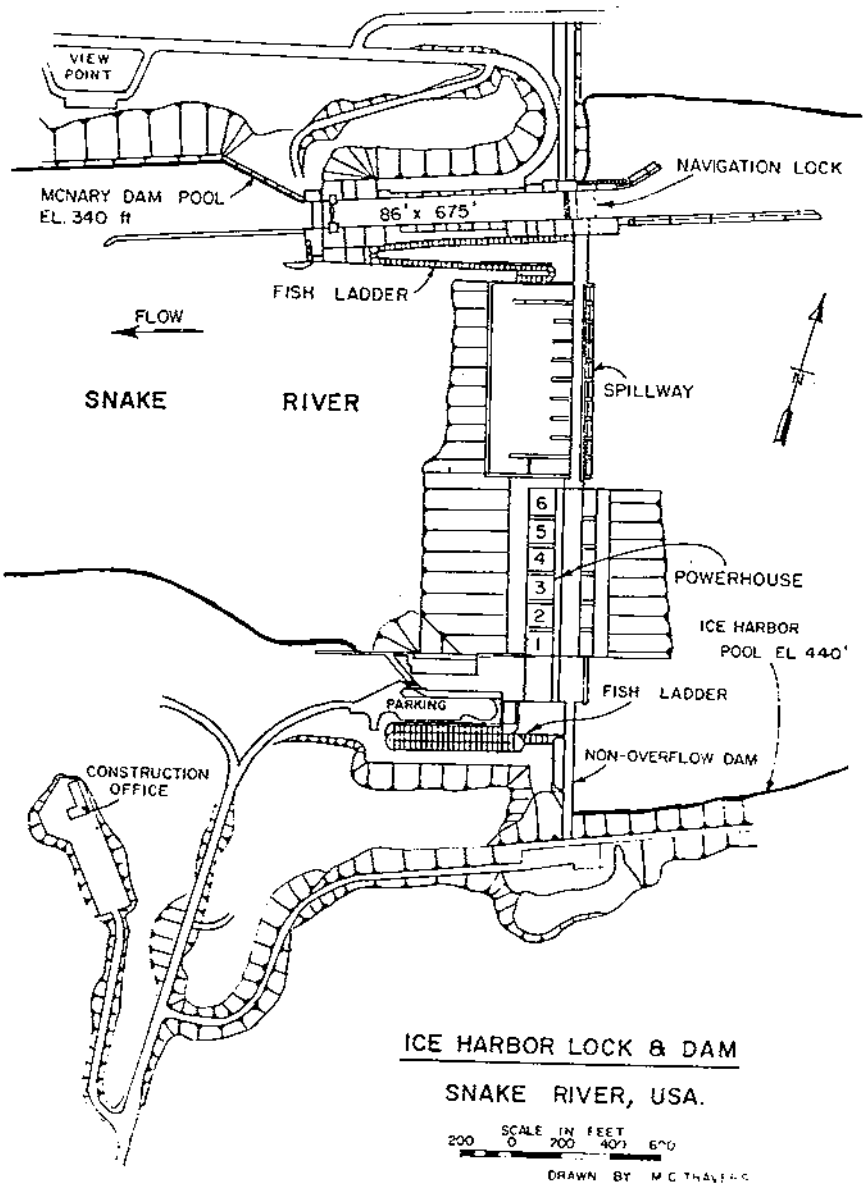

FIGURE 2

hold about 24 million acre-feet of water. The water leaving the mouth of the river averages 180 million acre-feet annually. There are seventy-seven major dams and hydro-electric projects in the Pacific Northwest and the US Corps of Engineers is responsible for all the water and flood control, all navigation, and the construction and operation of twenty-nine of these dams.

The other considerations are irrigation, water quality, recreation, and fish and wildlife management. The installed electrical capacity is 20·9 million kilowatts which produces 100,000 million kilowatt-hours annually. The flood control in 1972 protected property worth over $230 million and the irrigation, in this arid area, waters

crops worth $600 million annually.

The lower four dams on the Columbia and the lower four on the Snake are all low head, Kaplan turbine, hydro-electric dams built on similar lines.

ICE HARBOR DAM

Ice Harbor Dam is situated nine miles upstream from where the Snake joins the Columbia. It was completed in 1962 with three 90 MW generators and three empty bays left for new units when the upstream reservoirs had been constructed to provide the additional water during the low run-off periods.

The main components of the dam system are the spillway, power-house, navigation lock, earth filled abutments, fish ladders and visitors' facilities. Fig 2 shows the layout with the river flowing from East to West. The water level drop across the dam is about 100 ft. Twice a year salmon and steelhead (a sea-going rainbow trout) head up river to spawn. Water discharged from a channel at 2–3 ft per sec attracts the fish off the spillway and powerhouse discharge and guides them into the two fish-ladders on their migration runs upstream.

The navigation lock at McNary (Fig 1) handles about 3·6 million tons of freight in a year of which 1·2 million tons passes Ice Harbor. Most of the barge traffic consists of petroleum products taken upstream and wheat brought downstream. In 1974 the pool was filled at Lower Granite Dam opening barge traffic up to Lewiston, Idaho. This will create an increased river traffic through Ice Harbor Dam.

The dams from Lewiston to the Ocean are called "run of the river" dams and create slack water all the way. The pool of one dam backs up to the tailrace of the

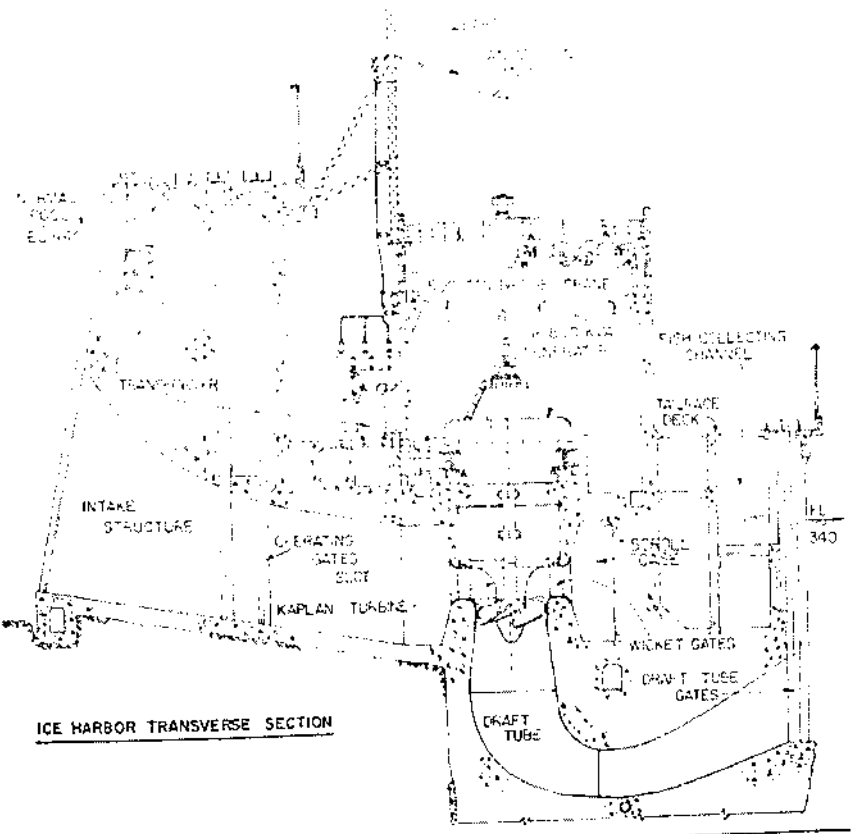

FIGURE 3

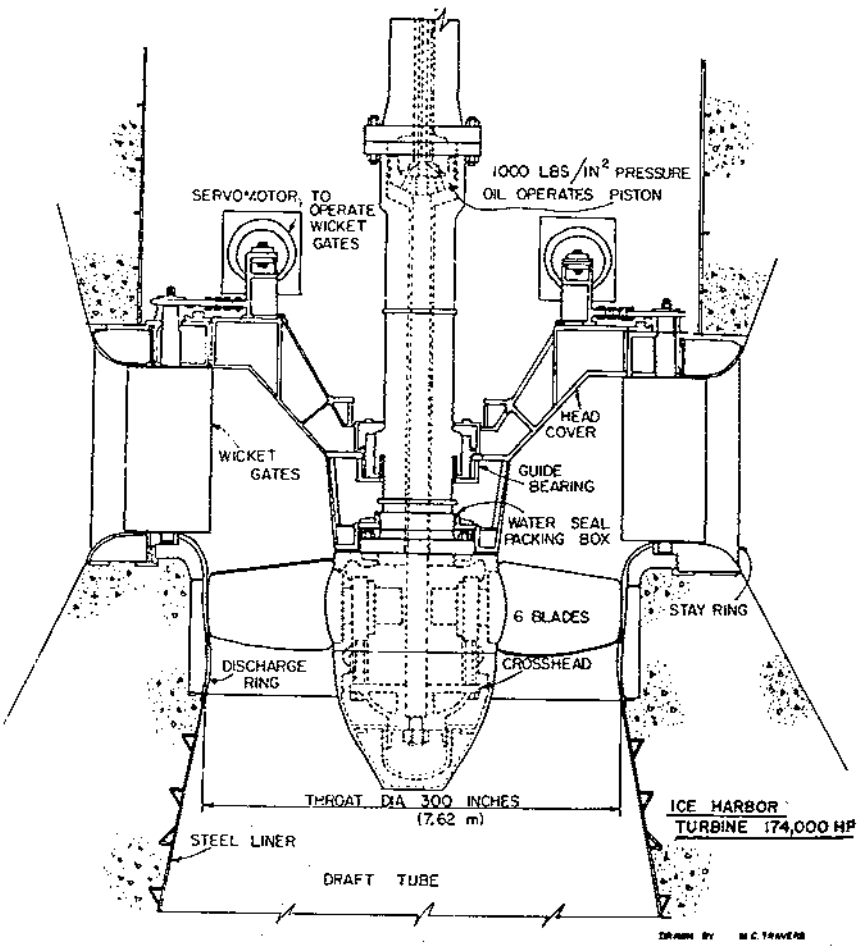

FIGURE 4

next and their transverse sections are similar. The Ice Harbor transverse section is shown in Fig 3. Water from the pool enters the intake at a very low velocity and passes into the scroll case which distributes it evenly round the turbine. The water enters the turbine through twenty wicket gates with an angular velocity. At this stage the potential energy of the water in the pool has been converted to kinetic or energy velocity of the water striking the blades. The energy is imparted to the rotating blades of the turbine and then the water drops down the draft tube against tailwater pressure. The quantity of water passing the turbine is controlled by the wicket gates. The operating and draft tube gates are closed for maintenance when the turbine has to be un-watered.

The turbine drives the generator which generates at 13·2 kV. The voltage is stepped up to 115 kV by the transformer and fed out on transmission lines to the local substation.

Turbine

Kaplan turbines, looking something like propellers, are used for low heads (up to 180 ft) and large quantities of water. Francis turbines operate up to 1500 ft heads; these turbines have bucket shaped blades mounted in a cylindrical runner. For high heads Pelton turbines are designed; these consist of nozzles directed at buckets which are mounted on a wheel.

The Ice Harbor Kaplan turbine is shown in Fig 4. The quantity of water entering the turbine is controlled by the wicket gates. This regulates the output of the turbine. The generator is connected to the grid and runs at a constant speed of 90 revolutions per minute. The electrical output is proportional to the shaft torque at this constant speed.

For different heads and different loads the blade angles have to be changed to obtain the maximum efficiency for the turbine. The blades are rotated by moving the

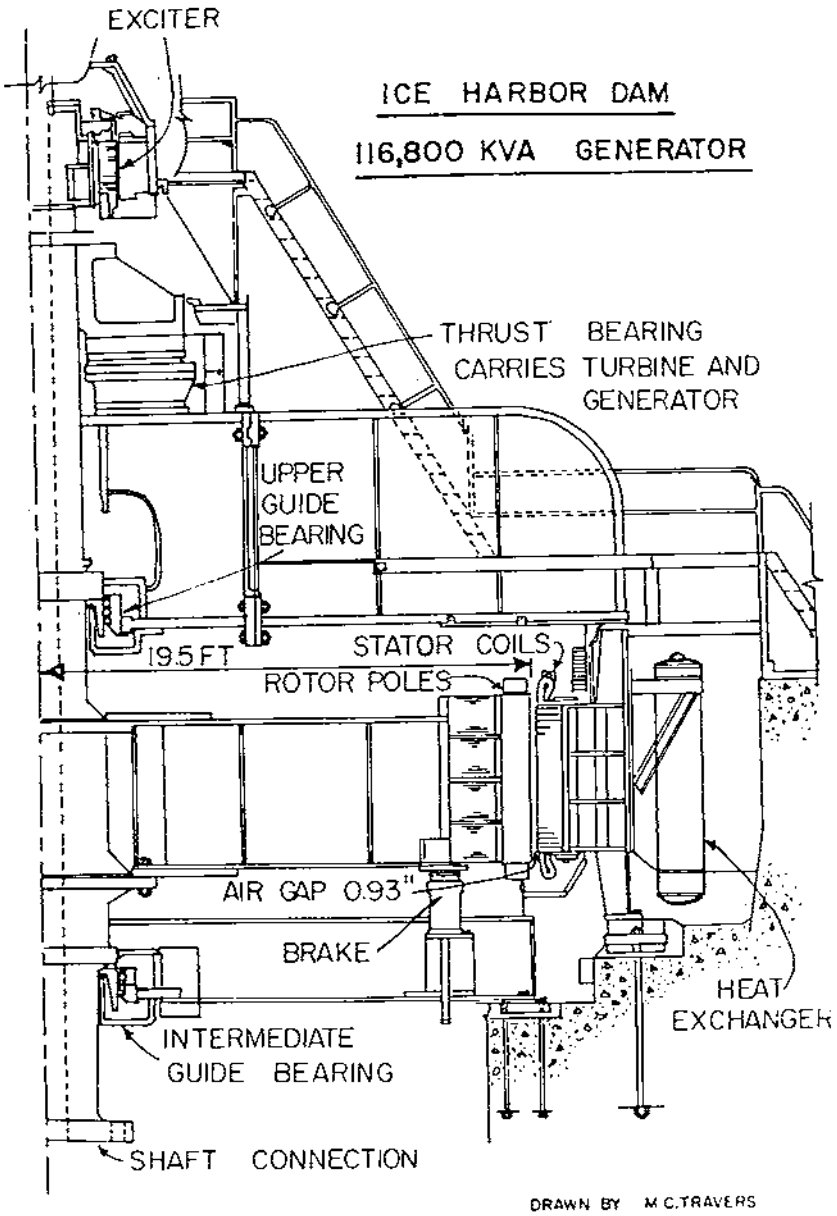

FIGURE 5

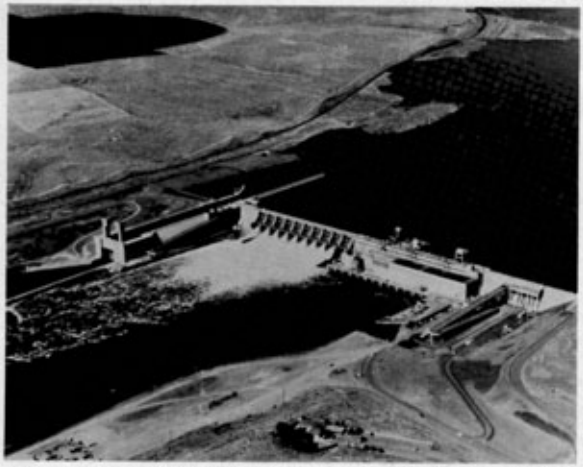

Photo 1. Ice Harbor Dam. The navigation lock, two fish ladders, spillway and power-house have been operational since 1962.

crosshead up or down. A governor is used to sense the head variations and the load demands and uses oil pressure to adjust the output and efficiency of the turbine. Oil pressure pumped to either side of the piston moves the crosshead. Oil pressure in the servomotors operates the wicket gates.

The weight of the turbine runner is supported by the thrust bearing above the generator and the alignment is maintained by the lower guide bearing mounted in the head cover.

Generator

The turbine drives tne generator rotor and causes the magnetic field from the rotor poles to cut the coils of the stator. Electrical power is induced in the stator coils and fed to the transformer. Electrical power to energize the rotor poles is provided by a small generator also mounted on the shaft called the exciter. By controlling the output of the exciter the output of the generator is regulated.

A half section of the Ice Harbor generator is shown in Fig 5. The thrust bearing above the generator carries the full weight of the rotating parts. The turbine runner weighs 295 tons and the generator rotor weighs 425 tons. There are three guide bearings on the length of the shaft, two in the generator and one in the turbine. The generator is cooled by passing air through the laminations of the rotor and stator, through the heat exchanger and back to the rotor again.

When the generator is taken off-line brakes are required to prevent the thrust bearings being wiped at slow speed. There are eight compressed air brakes mounted under the rotor.

Controls

Ice Harbor has a typical power station control room but requires only one operator on duty at night and weekends. This is because the powerhouse control is remoted to McNary Dam. McNary Dam controls Dworshak Dam and the four lower Snake

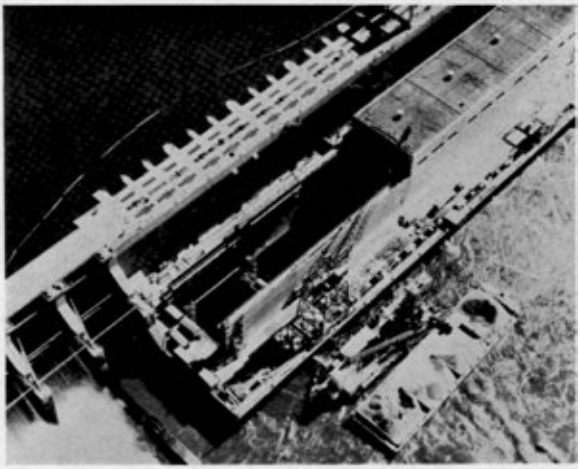

Photo 2. Ice Harbor Dam. The power-house is being extended to take three new 116 MW generators. The batching plant is mounted on a barge alongside the tailrace deck.

River Dams. These have an installed capacity of 2530 MW which is to be increased by a further 1320 MW when all the four lower Snake powerhouses are extended. In the 1980s McNary Dam will have a new powerhouse adding 1200 MW and Dworshak Dam can be increased by a further 700 MW.

The dams are linked with a microwave communication system which enables the McNary operator to select, run up to speed, synchronize, and load any generator in the system. He is also able to trouble-shoot, and by remote radio can often inform the operator at a dam what is going wrong if that operator is performing duties outside the powerhouse, such as locking through a barge.

SUMMARY OF ATTACHMENT

As an engineering attachment the Division offers an engineer a wide field of electrical, mechanical and civil engineering. This starts with the design stage in the Hydro-Electric Design Branch where the latest types of computer design and analysis of new powerhouses are made. Experience is gained in the letting of contracts and the engineering problems connected with them. The important subject of control of hydro-electric plant is covered in greater depth in the Pacific Northwest than anywhere else in the world.

The field attachment to a powerhouse extension enables an engineer to see how a large contract is handled, how a contractor operates and how Union labour works. Faults in design, problems in assembly of very heavy components, and the accurate control of installation are all common everyday occurrences.

The British Officer is readily accepted by everyone on site and helped as an engineer to gain a wider knowledge of engineering. Quite apart from engineering the Pacific Northwest is a friendly and wonderful part of the world for a tour of duty.

* * *

Loeng Nok Tha 1975

COLONEL I T C WILSON, MBE, MC,
DEFENCE ATTACHÉ, BANGKOK

IN the middle 1960s, a name which featured in almost every Sapper publication was "Operation Crown". This codeword covered the construction of a 5,000 ft airfield in the North Eastern part of Thailand, close to the Lao Border some sixty miles north of the provincial capital of Ubon Ratchathani.

Many Sappers were involved over the years 1963 to 1966 in the construction of the airfield which, on completion, was handed over to the Royal Thai Armed Services. Subsequent to the completion of the airfield project, a proposal was made by Major-General R L Clutterbuck, then Chief Engineer Far East Land Forces, that a further project should be undertaken to provide additional urgently needed engineer work in the area. A British military base existed, plant and construction equipment was on site and the opportunity offered excellent training in practical construction work. Thus "Operation Post Crown" was born. For a further two years until November 1968, planning and construction of forty kilometres of road from Loeng Nok Tha to Ban Nong Phok was undertaken by sapper squadrons from Malaysia and Singapore.

Various articles have already been published about both projects and it would be superfluous to go into the detail again here; except to mention one point. In 1965, the Loeng Nok Tha District was regarded by the Communists as a "liberated area". Local government officials were unable to journey more than a few miles from their District Headquarters for fear of attack. Armed bands existed. There was the classic pattern of subversion and intimidation at village level, and assassination of teachers, village leaders and policemen was running at the rate of up to ten a month. Construction of a road would therefore be a military project to provide political economic and security benefits to an extent not easily equalled in any other area.

I was therefore eager to revisit Loeng Nok Tha as soon after my arrival in Thailand in early 1975 as the various other commitments of a Defence Attaché's life made it possible. An opportunity in June to combine a trip to the North East and Central parts of Thailand with such a visit gave me the chance I had been looking for.

The Chief of Loen Nok Tha Province is a Mr Chalerm Prakop. As a junior Government officer he had been appointed to the Operation Crown project as the Thai Liaison Officer in the early days. He remembered Lieut-Colonel Harry McIntyre well and obviously had happy memories of his time spent with the Sappers. As a matter of interest, the Head of Chancery of the British Embassy, John Sharland, also had connections with Operation Crown. He worked for a time as interpreter when he was here previously as a junior officer learning Thai. Mr Chalerm's command of the English language was not much better than my Thai, but we managed a very satisfactory conversation and he was most courteous and hospitable, and touchingly pleased with the small gift of an RE cypher ashtray, which I left as a souvenir of his Sapper connections. He gave me a lot of his time, showing me around the airfield and escorting me along the road as far as his district boundary with Roi Et Province. His report of the insurgency situation was an encouraging proof of the value of roads to the peace and stability of a remote area. There is still an amount of Communist propaganda in the district, there are still infiltrations from Laos, occasional incidents still occur, and an attack had recently been made on one of the bridges along the road, but overall security has improved greatly. There are no armed bands, other than a few small groups of thieves, and assassination has virtually ceased. Government officials and police can travel around safely though, of course, they remain armed. Schools have been built and function, medical care is available in a limited way and trade and travel are much easier for the population. It is still a very poor area by European standards, but the improvements to the quality of life of the villagers along the road has been significant and they realize it.

Photo 1. Loeng Nok The Airfield looking South, "The airfield itself is in good order".

Crown Airfield is deserted and unused, except by water buffaloes who have left their "calling cards" all over the pavement, and occasional villagers who use it as a pathway to town. The remains of the camp present a dismal picture of rusting corrugated iron; one hut has been blown down by the wind, and even the hut where the caretaker lives is ramshackle. The airfield itself is in good order. The airfield markings are faded but visible, the only weeds are on the verges and the overshoots, and there is little growth which would obstruct use. It would require very little work to make it a completely usable airfield again. I drove along the length of the landing strip and tried the old-fashioned test of serviceability for use by aircraft by driving a Landrover flat out. Only one of the RC slabs at the extreme southern end appeared to be distorted. The evidence is clear that the work was done well and has stood the test of time. It is a pity that the airfield has been so little used, but there are stories of its clandestine use by aircraft from across the border.

Photo 2. "Only one of the RC slabs . . . appears to be distorted".

loeng Nok Tha 1975 1 & 2

Photo 3. Bridge No 12—The damaged trestle has been repaired.

The rains in Thailand start in June and it was raining as I motored along the Post Crown Road. At least it cut out dust and it gave a realistic look at the road serviceability. Time did not allow for a completely thorough inspection. Clearly both road and bridge had received maintenance, but there were some omissions. For a start, the

Photo 4. Bridge No 9—Damaged and displaced capsill on the abutment trestle resulting in distorted end dam.

loeng Nok Tha 1975 3 & 4

Photo 5. Bridge No 9—The effect of the distorted end dam is a four inch drop on to the bridge surface.

dedication plaque at Loeng Nok Tha has disappeared from its concrete plinth. The road was in regular use by two wheel drive vehicles, only in one place was there a mud patch which was a potential problem, culverts showed very little erosion and wearing surfaces on bridges had been replaced. Despite the rain, the road was firm with little mud, and a 30 mph speed was comfortable. The most interesting site was Bridge No 12 where one trestle had been burnt by bandits (Communists?) in the early part of 1975. The damage had been repaired quickly and it was difficult to see the actual extent of the attack. The fact of the speedy repair is a tribute to the value of the route. In the time available, I concentrated my inspection on those bridges of which photographs feature in the Operation Post Crown report in the *RE Journal* September 1969. It is perhaps not surprising that none now look as neat as those photographs show. But the dilapidation is largely superficial. Handrails have been broken and not replaced in some cases, and there is some erosion behind abutment side walls. Some timbers show their age and others have obviously been replaced. The Bailey bridge at Ban Hong Khong has developed that pronounced sag familiar to Bailey bridges in use for a long time, but all the pieces were there. With one exception, the roadways were firm and still capable of withstanding the pounding of the large Japanese lorries loaded with produce which hammer along the route. Bridge No 9 showed a distorted end dam and abutment at the eastern end caused by a badly cracked and split capsill on the abutment trestle which had torn clear of its retaining bolts and slipped on its supports. The result was a four inch drop on to the bridge surface from the abutment and the resulting hammer effect of traffic is rapidly making it worse. I was asked if the English were coming back to repair it!

I spoke to a number of villagers along the road, most of whom remembered the "English soldiers" who worked on the road which has now entered so much into their way of life that they appeared bewildered to think again what life was like without it. Perhaps the biggest but unsaid tribute to the opening up of this part of the country was the thriving township of Ban Nong Phok at the far end of the project, which now sprouts a minor forest of TV aerials.

It was a very happy experience to make the journey and to acquire a reflected credit which I had not earned. The lessons of construction have long since been brought out; the value of the work is very obvious and I hope this article will bring satisfaction to those who earned the credit.

* * *

Loeng Nok Tha 1975 5

Soldiering and Economics

CAPTAIN J D R STREETEN, RE, MA

IF the potato crop in Ireland is good, the Irish eat less potatoes. Now this may sound rather Irish, but it is the kind of conundrum on which students of the LSE cut their economic teeth. The theory is that when potatoes are in abundance they will be cheaper. If they are cheaper, the Irish peasant spends less on them, and he can then afford to supplement his diet with a bit of meat occasionally. He therefore eats less potatoes. There may be some doubt that this actually happens, but it is not difficult to see some grain of logic in the argument. Unfortunately, not all economic riddles are as simple, and thus there has evolved that inscrutable breed of specialist—the economist. His activities include all the typical things a specialist does—like write books, develop theories, teach and argue at length with colleagues—but his main role is that of counsellor. For years his ilk has advised businessmen how to make money and politicians how to spend it, and in this way the economists have played a major part in shaping our world of today. Whether or not they have done a good job is open to question but that debate lies well outside the scope of this article.

In the Services, economics has played a less significant role in our everyday lives. Although defence planners have always had to be guided by economic considerations, as soldiers we are relatively free from the economic restraints which dominate the lives of many of our civilian counterparts. Profit hardly enters our vocabulary and we have the luxury of being guided more by a sense of integrity and duty, than by pounds and pence. How long will this last? Recent restrictions on fuel, vehicle mileage, training ammunition and overseas exercises seem to indicate that the economist is creeping into our lives at unit level! The purpose of this article is to suggest that we might prepare to face the infiltrator by arming ourselves with some knowledge of his techniques and problems, and an ability to talk his language. If we do this might even be able to reach some sort of negotiated peace.

Economics is a practical science concerned with using mankind's limited resources to meet his unlimited wants. As these resources are clearly insufficient, some comparative evaluation of the different ways we can use them is required if we are to gain most benefit from them. The economist is able to achieve a comparison by using the common denominator of money. For example, he can compare different ways of using the same resources by expressing the benefits in each case in terms of cash. He can thus compare the merits of attracting labour into coalmining or car manufacturing. Likewise, by expressing resources in money terms, he can compare different ways of achieving the same benefit; he can deduce whether it is more "economical" to build a nuclear power station or a coal-fired one to produce a certain quantity of electricity.

Expressing resources and benefits in money terms does not present too many difficulties in the world of commerce. A firm's resources—its real estate, capital, machinery, labour force, stocks and even goodwill—can be valued. Its activities can be costed and in the final analysis the net benefit it reaps is in the form of a cash return. Selection of the best way of using its resources is automatically achieved by maximizing profits. In a non-profit making organization like the National Health Service the benefits of its activities may not readily be expressed in money terms. You can assess the cost of constructing a general hospital, but how do you assess the benefits? The process of choosing the best way of using resources is therefore not so easy.

In the Services it is even more difficult. We are responsible for consuming a large amount of resources (in the form of a defence budget) yet the benefits of defence cannot be expressed in money terms. We do not issue half-yearly dividends to reassure our shareholders—the taxpayers—that we are a good investment; and unlike a general hospital, security cannot be seen. It is a sad paradox that the greater the degree of security achieved, the less the apparent need for defence; in peacetime

there will always be a debate over our defence budget—as long as there are schools and hospitals to be built. As our national resources become more limited, great justification for all defence expenditure will be demanded.

At the highest level, decisions on defence spending are made by politicians. They must assess our commitments in the light of the threat, and give due consideration to other sectors of our economy which are interrelated or in competition with defence. Along with other "experts" the economist is called in to give his advice. Although he cannot complete his balance sheet by quantifying security, he can be useful in two ways. Firstly, he can make some assessment of the costs or savings involved in adopting a course of action—like building a fleet of nuclear submarines, or abandoning a missile development programme. Secondly he can make a comparative evaluation of different ways of achieving a certain objective; for example he can compare the cost of building and equipping them, and the cost of training the crews. Secondly, levels it may well be the serviceman who makes the decisions. He might be responsible for anything from developing a main battle tank to deciding on officer training policy. Military considerations will probably be paramount, as long as they remain within the financial bounds imposed by those above, but most "courses open" will require some financial appraisal before a decision can be made. Therefore at all levels of defence spending we may assume that some sort of economic analysis will be required. The type and depth of analysis, and who does it, will depend on the nature of the project under consideration. However there are a few techniques which form the basis of most economic evaluations.

To examine these techniques let us look first at a problem. There is a requirement for a fleet of through-deck cruisers. Someone must decide whether we meet his requirement or not and will no doubt want to know the price of such a project. How can we assess their cost? Firstly the initial costs of providing the ships must be assessed. These could include expenditure on research and development, on design, the cost of building and equipping them, and the cost of training the crews. Secondly, we must take into account the costs of keeping them: of fuel, maintenance, repairs and refits; of feeding and paying the crews; of replacing equipment, of training new crews. Thirdly, when we have established these costs, they have got to be lumped together in some way to give a set of figures which mean something to the person making the decision. Obviously it is no good just adding up all the costs without taking into account when they occur; a £100 spent today is more expensive than spending it in a year's time. The reasons for this, inflation and interest, tend to be considered together but they are very different in character.

Interest is a measure of the usefulness of money as a resource. If you borrow a spade from your next door neighbour for a day you can use it to dig over your vegetable patch. Along with the land, a packet of seeds and your own effort the use of that spade for a day is one of the resources required to grow vegetables. At the end of the day you return it in the same condition to its owner. He has lost nothing except the opportunity to use it himself. If he decided to offset this "loss" by hiring the spade to you, his charge would probably depend on how much you were prepared to pay, the demand for spades, and number of other spade owners in the neighbourhood. However if he thought you were likely to break it or run off with it he might want to charge a little bit more for the risk he is running in hiring it to you. Money is lent in a similar way and the hire charge is termed interest. Supposing your next door neighbour lends you his car for a year. When you return it to him it will have depreciated. He will have lost not only the opportunity of using it but its value will be less. This is what happens to money, but the amount it depreciates is dependent on time and not use. The rate at which depreciation occurs, is inflation. The factors influencing it are more complex than risk, supply and demand, and it is quite difficult to measure. It does have some influence on interest rates by affecting the supply of and demand for money.

Let us return to the problem of the through-deck cruisers. We can get round the

thorn of inflation by expressing all the expenditure involved in "real terms". In other words we assume today's prices will prevail throughout the life of the project. For example we may say the cost of a refit after ten years is £100,000, although we know the actual bill at the time could be double this. Although we are underestimating by a factor of two or so, this is acceptable for appraisal purposes. After all, the defence budget in that year in money terms might well have doubled, and probably the price of most other resources will have increased by a similar factor.

The effects of interest must now be dealt with. They will depend on when the expenditures are made. For example, it does not cost the same to have a refit every five years as it would to have one every ten years at twice the price. One way of dealing with this is to work out the lump sum required at a certain time (normally the present) to finance the whole project throughout its life (the proportion of this sum which is not spent straight away is assumed to be invested until it is needed). This technique, termed "discounted cash flow", involves expressing the annual expenditure for each year during the life of the project in the present day sum required to cover it. If the annual expenditure in year seven is £100,000 a sum of £56,400 will, together with the 10 per cent per annum interest it will earn, cover this £100,000 in seven years' time. When we have added up all the discounted annual expenditures we can say "the through-deck cruiser project will cost £X million". Alternatively we could express this figure as a constant annual sum (at present day values) spread over the whole period of the project. Using this "annuity" method we could say the fleet "will cost £Y per year". By applying these techniques we can compare the costs of the fleet of through-deck cruiser with those of, say, introducing a new battle tank or building a new barracks. Such a comparison may not be all that useful but we can also compare different approaches to the same project. We can deduce whether it is more economical to build cheaper ships requiring more repair and maintenance, or ones that are more expensive but require smaller complements, or . . . the possibilities are many.

The mathematics of these methods are straightforward and require little skill to apply—providing one knows the necessary information! Unfortunately this is rarely the case. How long will the fleet of cruisers last before they become worn out, obsolete, or no longer needed? What should the discount rate be? Even if these questions could be accurately answered, the estimate of expenditure in years to come must always be conjectural.

Foretelling the future is the most difficult part of any economic analysis, and the economist needs to be something of a prophet. It might seem strange that economics is defined as a practical science yet it embraces the element of prediction. However, the way the economist goes about foretelling the future is perhaps more scientific than any other. Firstly, he can draw on man's experience. He is fortunate in that in his field, the experience is in the form of statistics and can thus be processed. From these figures he can predict trends and also identify those parameters which will probably remain fairly constant. Secondly, he is guided by established "laws" which reflect various patterns of economic behaviour. There is for example the Law of Demand which states that when the price of something falls, the demand for it expands, (assuming no other factors change). These laws usually hold good and thus they give the economist some idea of what to expect in the future. Thirdly, he can process his figures in certain ways to take into account the elements of chance and uncertainty: by applying the theory of probability he can hopefully avoid the extremes of pessimism and optimism. Fourthly, he can work out which variables will have a major influence and which can be disregarded. The cost of nuclear warheads is probably insignificant in providing a Polaris submarine fleet, but the cost of providing ammunition for a Chieftain tank throughout its life is clearly a major expenditure.

Prediction of future costs involves the examination of existing evidence and interpreting it in the light of experience. It does however still include an element of human judgement. What evidence should be examined, and what importance should

be attached to particular factors? So, like politicians, economists do not always agree. Moreover, sometimes they are wrong in their predictions—and they would be the first to admit it.

In the Services two attitudes towards the economists seem to prevail. There is the view that they do not know what they are talking about. Most of us can cite at least one example where the economist's axe has actually resulted in greater expenditure. The other attitude is that the economist has some kind of infallibility, that he must be right because he is an expert. How often the cry, "it's all to do with economics" is used to dismiss a contentious point in an argument. Such a remark usually starts heads nodding with resigned approval. Of course we tend to adopt either view depending on how we feel and our criticism of, or agreement with, the economists is usually justified. But sadly many of us at the lower levels regard the economist's influence on our lives as absolute. Too often we tolerate wasteful practices or put up with penny pinching, even though common sense tells us that the best use is not being made of certain resources. But could we do anything about it? Have we any influence over the way in which our limited defence budget is being spent? Clearly, at unit level we do not take much of a part in decision making on defence spending, but whether we like it or not we do have a role to play. Let us re-examine the economics of a defence decision.

Let us suppose there is a requirement which can be met in a number of ways, each of which gives the same end result. As the effectiveness of the choices is the same, the best way of meeting the requirement will generally be the one which consumes the least resources. An economic evaluation will therefore be required. Assuming the requirement is to be met over a number of years both cost and time will have to be taken into account. The time element could be handled by applying DCF methods. The future expenditures however, must be estimated and it is here that things can go wrong. This prediction of future costs and receipts is based on available evidence, and if this is inaccurate or misleading, the prediction also will be inaccurate and misleading. This is where we come in. We supply, indirectly, much of the data on which such predictions are based. Although we do not have much to do with procurement, it is at our level that many resources are consumed. For example, a study of future GS vehicles for the US Army revealed that for a twelve year life operating, manning and maintaining the fleet would account for 83 per cent of the total cost.

Unfortunately we corrupt much of the evidence of how we use our resources. We over-indent for stationery, we blast off excess ammunition at the end of a day on the range, we hoard clothing, we misemploy soldiers, we misapply stores, we consume votes needlessly in case they are reduced in the future, and we all tend to over estimate the time it takes us to do a job, albeit in the interests of the Service. Even a data collection system as excellent as the REME *Forward* is not faultless in providing reliable evidence. However, we cannot take the blame for all inaccuracies. Very often the economist has very little evidence on which to work. In some cases he has no option but to base his figures on a manufacturer's specification; in other cases he must just guess. Who could have accurately foretold the accident rate of the German Starfighter, the repair costs of the Chieftain tank engine or the commercial potential of the Bailey Bridge?

The economics of soldiering are beset with problems and uncertainty but are of concern to us all. Jather and Beri in their book *Elementary Principles of Economics* state that "a sound knowledge of economics is of great significance to the statesman, the businessman and worker . . ." We are no longer an army enjoying a period of pleasantly boring peace while we wait for the next war, but are just as much in business as any one else. Time is short nowadays and so are our resources, but just because we never experience the threat of bankruptcy does not allow us to waste them. As individuals we are rarely in a position to influence the allocation of defence

funds, and we are not expected to offer our own brand of economic appraisal on every decision that is taken. But we can contribute by recognising the difficulties, understanding the problems, and appreciating the need for economics in our profession. We should bear the economic restraints with grace, yet be prepared to act when resources are being wasted. Economic appraisals can be based on false information and thus mislead the decision maker. When this happens we are often the first to find out and should speak up: there is no finality in economics. But if we do get involved we should bear in mind that economics is a difficult subject in which things are not always as simple as they might appear. Remember the Irish potatoes!

Breakfast in Bangalore

MAJOR G HORNE, RE (Rtd), C Eng, FICE

CAPTAIN IRWIN's interesting reminiscences (*A Madras Sapper Returns*—March 1974) together with Colonel Pat Easton's excellent series of articles (*The Indian Sappers and Miners—Some Aspects*—June 1974 to March 1975) will have sparked off many happy memories among ex-"Suffering Miners". If they have been "Madrassis" one such memory will be that of that first breakfast upon arrival, for the timetable of the Madras and Southern Mahratta Railway ensured that, from whichever direction one came, one always arrived, usually after two or three days of grimy, sweaty travel, at Bangalore in time for breakfast.

My first "Bangalore Breakfast"—and it is always the first that one remembers best—was after journeying south from Bombay where we had docked at the end of six weeks in a crowded trooper on a voyage broken once only by an unforgettable five days at Cape Town; a stay during which we had learned, among other things, that the tune of *Hurrah for the CRE* is based on South Africa's Boer War song *Marching to Pretoria*. As the early war-time reinforcements for the Indian Army and the British Army in India were being sorted out on arrival we —thirteen Sapper Subalterns—had been interviewed by a Major of our Corps (Neville Chesshyre, as I was to learn in later years) enquiring as to which Corps of Sappers and Miners we would like to go. Although all of us had just experienced nearly a year of war-time England, had been to some extent involved in the withdrawal from Dunkirk and the subsequent anti-invasion scare and had witnessed, in the blue skies of Kent, the opening stages of the Battle of Britain all such warlike activities seemed far and remote from the garish and still peaceful East, so that our minds had reverted to a boyhood weaned on *The Boys Own Paper* and to such celluloid epics as *The Drum*, *Lives of a Bengal Lancer* and *Gunga Din*. Thus it was that, as with so many before, the historical lure of the North West Frontier had taken hold of us and with the desire to get as far north as possible the vacancies for King George V's Own Bengal Sappers and Miners based at Roorkee in Saharanpur and then the Royal Bombay Sappers and Miners at Kirkee near Poona had been quickly filled. I, however, though equally keen and adventurous had family connections with the South Indian station that was the Depot of Queen Victoria's Own Madras Sappers and Miners, and had therefore cheerfully accepted a posting to Bangalore, along with four less happy frustrated frontier addicts.

Thus God's gift to the Army of British India had set foot on her coral strand wearing "candle-snuffer" pith helmets and clad in narrow-legged shorts; though at least we had been spared the Wolseley helmets with their lining of silver-paper and the Salonika shorts with which many of our British Service colleagues were inflicted. We committed all the traditional mistakes such as asking baggage-coolies "how much?"—whereupon they had to be beaten off by little policemen wearing round, yellow hats and carrying umbrellas—and expecting the locals to understand the *Hindustani* or *Urdu* we had learned on the boat; we got in a mess with taxis and parted from our baggage—however, all of us eventually managed to assemble,

complete with kit and a dog whom one of our number had brought from England, in the famous Taj Mahal Hotel on the Apollo Bandar where we were scheduled to spend a night or so until train reservations to our various Depots were available.

Although two very fine Indian Divisions were already in the Middle East, many Indian units were moving to strengthen the garrisons in the Far East and dinner-jackets had replaced mess-kits, the great changes wrought by war that were destined to sweep through the Indian sub-continent were as yet a mere trickle; even so part of that "trickle" had caused the crowding of hotels so that we were packed several to a room. This was, however, luxury after weeks of cramped and crowded blacked-out cabins in tropical heat—it was also "luxury" in the Indian tradition with a stream of bearers, barbers, *dhobis* etc, and even a remover of corns, all flocking in to see to the comfort and needs of the young *sahiblog*.

There is nothing in life that ever quite compares with the first discovery of the East, the genuine, flamboyant, garish East. The sense of having entered another world with different values is a never forgotten experience, and was particularly so to those lucky generations who were young before the advent of television, air-travel and "instant" everything removed so much of the joy from anticipation and discovery. Thus in wonder we had feasted our eyes on the new sights and harkened to the new sounds of that swirling colourful city half beautiful, half tawdry with its crowded streets and green gardens with thousands of crows wheeling and croaking above the trees and a railway station built very much like a cathedral in the grand Victorian style; a city known as the "Gateway of India" and so aptly described by Rudyard Kipling as:

Royal and Dower-royal, I the Queen
Fronting thy richest sea with richer hands—
A thousand mills roar through me when I glean
All races from all lands

And then with multitudinous new sights, sounds and smells still clogging our senses we had loaded them even further as for two whole days there passed before us, viewed from the leather covered bunks of the Madras and "Southern Mahratta", the pageant of rural India. The land had drifted by in its repetitive hugeness—patches of *jangal* and clusters of palm trees and everywhere the eucalyptus with the grey shine of its leaves looking like a coating of Indian dust; open scrub and the flat brown acres in which green, cultivated fields blazed suddenly, browsing water-buffalo and the ubiquitous bullock-carts dragging their dust with them along the country roads; and then the mud-brick villages with the dung drying for fuel on the house walls and the smoke rising from the evening cooking-fires to spread between the houses and drift, like trailed blue scarves, across the fields where the children were driving the cattle home.

From time to time there had come the stations, all seething with the shrill concentrated life of miles around for the railways were still the life-lines of the country as they once had been in Victorian Britain. Here was gathered a kaleidoscope of colourful humanity many of whom seemed to be permanently encamped on the platform; here also, amid the scents and sounds of browning *chapattis* and bubbling *ghi*, were the *charwalas*, the vendors of *pan* and dealers of rice and curries served on plates of banana leaves, the sellers of fruit and, as always, the wailing procession of beggars and the scurrying, scavenging "pi" or *pariah* dogs.

I was destined to make many long railway-journeys across India and they never failed to fascinate me as I watched the widely differing aspects of life or was fortified at selected long halts by that famous railway institution—Spencer's Restaurant—with its inevitable menu of "brown e' soup, *murghi* (chicken) and caramelli custard". All this washed down by a whiskey and bottled soda which was lingered over until the Guard arrived to announce that—"the train is ready to go, but not to hurry, *Sahibs*." This most considerate attitude of railway servants was, however, to fade somewhat as the pressure of war grossly overcrowded the trains.

I did hear one delightful tale of pre-war days and of a solitary Englishman finishing his leisurely meal at a rural station when the Stationmaster burst in to ask—"are you travelling on the Delhi train, *Sahib?*"

"Yes I am, why?"

"I am afraid, *Sahib*, that those foolish, ignorant fellows have let it depart."

"What the devil do you mean, they can't have, my kit is on it . . . !"

"It is all right, *Sahib*, not to worry, they are bringing it back!"

During our training we had been lectured to by a number of retired officers who had all obviously enjoyed telling us "young fellas" what soldiering had been like in their day. One I particularly recall who had addressed the whole unit rather obscurely one afternoon, his main theme appearing to be the need for a sense of humour. This philosophy had been illustrated by a number of rambling reminiscences concerning various outposts of Empire, the highlight being a long tale of Africa culminating in a rhino charging out of the bush and knocking one of his native porters for six. This we gathered had seemed so funny to our raconteur that he had nearly killed himself laughing—thereby proving the benefit of a sense of humour. None of us had dared, under our Colonel's steely gaze, to get up and ask the question that was uppermost in our minds—"had the thumped porter also a sense of humour?"

India, needless to say, had featured prominently in such tales and much had been said concerning the germ-carrying propensities of the Indian Railways plus the various geographical tummy-complaints rife in that great continent. Thus when we had set forth on the night train for Madras—change at Guntakal next day on to the narrow-gauge for Bangalore—we were all convinced that even if we did not expire from some dreadful malady *en route* we were bound to be flattened by "Bangalore belly" upon arrival. Nevertheless we had retained enough confidence in the survival of at least some of our party to send a telegram informing those at Bangalore of the good fortune about to come their way, and in this we had first used the abbreviation that was to describe us for some time to come—"BO's" However, with the prospect of two hot and dusty nights in a train there were those among us who had felt that the letters were going to be more applicable to that well known soap advertisement than to "British Officers".

Life is full of popular misconceptions—Pont of pre-war *Punch* drew a wonderful series of them—and in those days before Mr Peter Sellers and the Indo-Pakistan invasion of this country the misconceptions concerning British India were very firmly established. Aboard our troopship there had been, returning to India, a number of British officers of the Indian Army who had been hastily called to Norway by General Auchinleck in order to try and instil into the ill-fated Expeditionary Force some principles of mountain warfare as practised on the Frontier. During the voyage they had not only attempted to teach we new boys some *Hindustani*, but these quiet spoken, pleasant, healthy looking Indian Army officers—the first we had met—had shattered our pre-conceived conception of red-faced shouting Colonels from Poona. Now our second illusion of tall, bearded soldiers in high turbans (we had not yet learned to call them *pagris*) faded at the sight of the short, black, clean-shaven Madrassis in "stove-pipe" hats (we had not yet learned that they were known as *dooptas*) who loaded our baggage into a lorry while David Reid, then a senior Captain, who had come to meet us ushered us into his car.

Among the men of the North there were indeed, as we were to find out, many tall, bearded, turbaned soldiers, but our men were of the original inhabitants of the peninsula—the dark skinned Dravidians—with their main languages of Tamil, Kanarese, Telegu and Malayalam completely different from the Persian-based *Hindustani* or *Urdu*, the *lingua franca* of the Indian Army which they as well as we had to learn. Also different, compared with most of their northern neighbours, was their blackness; with one exception that is, for the fair-skinned, finely-featured, Malayalam inhabitants of the Malabar Coast had inherited the blood of sea-faring Arabs in their veins. As to the "stove-pipe" *dooptas* which they wore instead of the widely used turban, this headgear—made up of one-third of a starched *pagri*-cloth

stretched over stiff cardboard—was, as we were soon to be told, a cherished battle-honour.

In 1843 the Government of India had been engaged in a war with the Emirs of Sind, and on 17 February a force under Major-General Sir Charles Napier attacked the Sindians at Meeanee a few miles from Hyderabad, Sind. Napier's whole force consisted of under 3,000 including C Company of the Madras Sappers, less a detachment of thirty Sappers who were with the army of General Pollock in Kabul. The enemy numbered about 20,000 and was strongly posted in and beyond the dry bed of the Fuleli River, a small tributary of the Indus, with flanks resting on patches of *jangal*. Napier made a frontal attack with 1,600 men supported by artillery and after fierce fighting routed the Sindians with the bayonet. During this battle the Sappers were mainly engaged in making tracks for the guns and destroying walls to improve fields of fire, and though only a few had firearms they gallantly joined in the general assault. Their whole bearing throughout this campaign was greatly praised by the General and eventually—for they were not awarded until 1854—resulted in the honours "Meeanee' and "Hyderabad" for their Corps. Fighting also at Meeanee was the British 22nd Regiment of Foot (subsequently the Cheshire Regiment) who, after the battle, fraternized with their Madrassi comrades-in-arms and, in honour of their bravery, gave them British shakos to wear. Later the Madras Sappers adopted this type of headgear though subsequently it became the famous *doopta*, shaped like a shako minus the peak.

It was at the conclusion of the Sind campaign that Napier was reputed to have sent his famous message—*peccavi*.

But to return to that first breakfast at Bangalore.

David Reid took us up the long drive to the low, white mess-building with its deep verandah full of cane-seated chairs, the arms of which had a section that swung forward so that one's legs could be rested on them, thereby ensuring a cooling circulation of air; a luxury more necessary in those stations which were not, like Bangalore, 3,000 ft above sea-level. Friendly, sun-tanned officers made us welcome, one of whom—Desmond Hibbert—just back from local leave added an exciting touch of the Orient by displaying a cheetah he had shot, then we first partook of one of those leisurely Indian breakfasts of several courses with soft-footed bearers to minister to our needs and *Civil and Military* or *The Times of India* propped up on a rack in front of us.

We did justice to that breakfast.

During the morning we were transformed from "British officers in India" into "officers of the Indian Army", two very different things, our "candle-snuffer" pith-helmets being replaced by neater and more compact products of the Bangalore Hat Works with QVO Madras S & M badges on the front and RE flashes on the side of the neatly creased *pagri* cloths. Also a local *darzi* not only replaced our narrow-legged shorts by the wide, cool and comfortable Indian pattern but also completed, before the evening, a well made dinner-jacket for the one member of our party who had omitted to bring with him that most important item of kit. Then, from an approved group paraded by the Mess Butler, we selected that most necessary appendage of British–Indian life, our bearers; though probably it would be truer to say that they "selected" us, for as far as I can remember we had little say in the matter.

Whereas the other four all got Madrassis I was taken over by the one Northerner present—Mohammed Akbar Khan, a tall, fair, hook-nosed, *mustacchioed* figure with *khol*-rimmed eyes who certainly lived up to the popular conception with his loose clothing and tall *pagri*. He was of that generic group of *Pushtu* speaking tribesmen from south of the Hindu Kush who are loosely called *Paithan*, or in English Pathan, and was I believe more specifically a *Panchi*. From a bundle wrapped up in a large handkerchief he produced numerous chits, or *chitthis*, from previous employers all, needless to say, extolling his virtues. We were soon to learn how much the Indian valued these much folded pieces of paper, many bearing regimental crests and some, I regret to say, containing rather unkind, double-meaning humour that unsuspecting

owners failed to appreciate. We ourselves were to write many such *chitthis* for all who gave service to the *sahiblog* liked to have it duly recorded and of course, as we were to learn, such testimonials always found a ready market in the *bazaar*. Akbar also informed me that he could obtain quite cheaply a second-hand white mess-uniform as required by all officers' bearers. I, still innocent in such matters, thereupon paid him for the "purchase" of that which, unbeknown to me, his previous master had given to him and which, in due course, I would also give to him for sale to his next unsuspecting employer—a traditional bearer's "perk" this.

The bungalows allotted to us were of the old, thick-walled, flat-roofed variety with large and impressive entrance porches and verandahs. Each was surrounded by a fairly overgrown garden and it was in these that we first met that most ubiquitous of India's small creatures, the tree squirrel of which it is said, by all devout Hindus, that the three white stripes on its back were caused by the caressing fingers of Sri Rama, the seventh incarnation of Vishnu. In these ancient buildings we prepared to spend our first night for some considerable time enjoying the luxury of a bedroom to oneself plus the unaccustomed space of a sitting-room.

Darkness falls quickly in the tropics, the long twilight of England being replaced by a brief period of tranquility after the harsh glare of the day, when the palm-fronds stand still and the hawks wheel in a sky first orange and then violet; soon there comes the soft warm night with its stillness broken only by the chirrup of the crickets and the whistling of the tree-frogs while the velvet blackness is pierced by the flash of the fireflies. Such was that first memorable evening in Bangalore, with the acrid smell of wood-smoke betokening the heating of bath water in the eternal four-gallon tin. Soon I was squatting in my small, square, canvas camp-bath set up on the concrete floor of a *ghusl khana sans* plumbing and then dressing in a high-ceilinged room, fanned by a whirling *pankha* and with small white lizards clinging on to the colour-washed walls. Akbar displayed a skill in the tying of a black tie that I had never truly acquired and then, after a final brush and inspection, he led me on to the verandah where there awaited the *chaukidar* holding my hired bicycle—its oil-lamp already lit.

A leisurely ride through the wide, dark streets of the European residential area, a salute from a patrolling police sepoy, the long approach drive to the well lit mess-verandah, a muffled figure materializes from the outer darkness to remove the bicycle, a smart "good evening, sir" to the senior officer present, a drink and then we are led in to dine by a very junior Mess President—a role we all were to undertake in turn. The Mess, aglitter with silver and gleaming white linen, has an Edwardian atmosphere and its walls are covered with trophies of war and the chase while behind us mess servants, reinforced by bearers including Akbar, are immaculate in their starched white uniforms with sapper cummerbunds and "Madras" badges on their *pagris*. After dinner we toast "the King Emperor" whose portrait gazes down upon us, and then as the port is passed and cigars are lit our new found comrades-in-arms, not a red-faced shouting one among them, make we new boys feel at home. On one evening during our week in Bangalore we have our first formal dinner-night when the pipes and drums march and countermarch in the long drive, watched from the verandah by the assembled officers and their guests.

After dinner there comes the ride home through the quite streets, deserted save for the occasional huddled figure of a sleeping *chaukidar*. A sleeping night-watchman may seem rather an anomaly, but as we were to learn it was tradition for house-holders to be happy to employ one for not to do so would have resulted in inevitable burglary—the *Chaukidars'* "Union" would have seen to that. On the other hand, to insist that one's *chaukidar* did not sleep was, in fact, a greater evil for he would cough, spit and "hoik" all night long just to let the *Sahibs* know that he was awake. At my bungalow the *chaukidar's chhokra*, a small boy, emerges from the bushes and spirits away the bicycle. My room has been "flitted" with the bed turned down and the mosquito-net unfurled and tucked well in under the mattress, even so a persistent intruder lurked within and had to be despatched by slapping shut an open book. A

hurricane *batti* placed alongside the bed so as to save getting up to switch off the light gave sufficient illumination for reading as one lay in the security of a little white world, while all sorts of unimaginable flying things thumped on the outside of the protective netting.

"*Chhe baje hain, Sahib*—it is seeex o'clock. *Chhota hazri taiyar hai*".

Akbar with the "small breakfast" of tea with fruit or toast is awakening me.

Another day has started.

Bearers were invariably persistent in waking their masters, as well they had to be if the *Sahib* had been out late or the sticky, stifling, summer heat of the plains had kept him awake until those brief couple of hours before dawn when even the hottest areas cooled down slightly. One well known sapper colleague of later years was particularly dormant in the mornings, requiring much effort on the part of his servant. When he finally awakened fully he always shouted for fresh tea as the original was obviously stewed and cold. One morning, however, when he did wake properly on the first calling and reached out of his mosquito-net to pour himself a cup he found the pot clean and empty—the actual making of tea was obviously always saved for that routine "fresh brew".

Soon after each dawn of that exciting first week we were out on the parade ground of the Training Battalion, then still at Nilsandra Lines, working up an appetite for that looked forward to large, or *bara*, breakfast after first parade. Getting to know the men with whom we were going to serve—the hard-working and cheerful little Madrassis with tongue twisting and repetitive names that caused the rank and file, as with Welsh regiments, to be called by the last digits of their army number. Strange at first this practice soon became second nature and it was amazing how quickly a number took on a personality.

The Sappers also used this system among themselves.

"*Yo*! ninety four, *yinga va*!"

This Tamil call to "come here" was usually emphasized by that forward and

Photo 1. Left to right, 63, 51, *Jemadar* Vankertasen, 92, 44 and 17

Breakfast in Bangalore (1)

Photo 2. Havildar 71—A fine soldier.

Photo 3. Outpost of Empah!

downward sweep of the hand, peculiar to Indians, which we normally associate with "go away!"

Many Madrassi names end in *swami* (it also means a religious teacher) and this was often used as a nickname for the race, but in the Corps the more affectionate *Thambi*, meaning "young brother" and similar to the North Indian *Bhai*, was widely used. An affectionate name born of high regard for, as we were quickly to find out, the "Madras" Officers did indeed have "high regard" for their men who were magnificent sappers.

"*Yo! thambi, yinga va seegram! seegram!* Come here quickly."

These were some of the facts of Indian Army life we were beginning to learn as we started to get our knees brown, or more correctly painfully red—particularly the backs, on the sunbaked square. We also met and started learning to deal with that "back-bone of the Indian Army" the Viceroy Commissioned Officers—the *Jamadar Sahibs, Subadar Sahibs* and lordly *Subadar-Major Sahibs*. An early "clanger" was to omit the *Sahib* when referring to or addressing them, and it was quickly pointed out to us that *Jamadar* on its own could in fact mean a sweeper.

As our confidence increased with the passing of the days we began to explore the evening joys of Bangalore, even to the extent of venturing aboard that universal means of Indian transport the *tonga*, the two-wheeled traps whose ribby ponies had a disconcerting habit of "blowing off" with considerable odour. We discovered good cinemas and excellent Chinese restaurants plus the fact that, unlike in war-time England, unless one was properly introduced there was little chance of finding a partner to dance with at the Wednesday dance in the BUS Club.

Also during the week we were taken to the "Monkey House" (as it was known to all Madras Sappers) and presented in turn to that most famous of Commandants with whiskers on his cheeks and the disconcerting habit of first staring straight at one with unwavering eyes, and then darting his glance from side to side.

Breakfast in Bangalore (2 & 3)

"Don't drop your eyes—Old Boy!" was the final piece of advice given before being ushered into the presence.

It was a nerve-racking experience for a fairly new Second-Lieutenant.

Then our five postings were made known.

These must literally have been decided by the proverbial pin for there was nothing to choose between us—or at least nothing that could have become apparent in so short a time. It was, however, a pin which sent one to ultimate death in a Japanese prisoner-of-war camp, one to lose a foot in East Africa, one to stay initially—with much protest—in the Depot and two of us back north; the owner of the dog to join 9 Field Company in Lucknow and I to be "first on the Frontier" with 57 Field Company, then being formed by "Mac" Lillie at that most famous of cantonments that stood guard close by the entrance to the Khyber Pass—Peshawar.

In the Indian Army of those days there was an excellent institution called a "Form E" whereby an officer travelling individually received in advance (British Paymasters please note the "in advance") cash to the value of three times the first-class fare. Armed with what to us was untold wealth—even after buying our tickets—the two of us plus Ben the dog and our newly acquired bearers retraced our steps to Bombay. For me there was to be further trips to, and breakfasts in, Bangalore and I was also destined, in later and more senior years, to spend a period at the newly formed Training Wing at Jallahalli; but it was that first visit that has always stayed most vividly in my mind together with the fact that it was then that I met that most popular breakfast dish of the Indian cook—*anda rumble tumble*.

At Bombay I bade adieu to my two companions, human and canine, and set forth alone save for the guiding hand of Akbar who was, of course, pleased to be returning to his native North. At the time I marvelled at the coincidence that had caused the one available non-Madrassi bearer to link up with the only officer going to the North West Frontier Province. However as I came to know India better I merely wondered what ingenuity and how much bribery had been expended in order to enable Akbar to have prior knowledge of, or even to influence, the movement of that all important pin!

Photo 4. The ubiquitous bullock-carts dragging their dust with them along the country roads.

Breakfast in Bangalore (4)

Two main lines ran north out of Bombay, the Great Indian Peninsula, or GIP, going across to Calcutta to link up with the East Indian Railway, and the Bombay, Baroda and Central India covering the centre and the West. It was therefore a BB and CI train that we boarded that evening and as Akbar got the coolies to load my kit into the reserved compartment I noticed with a thrill the nameboards—"Frontier Mail".

Although, in the true tradition of Indian railways, the third-class accommodation was packed solid with people and baggage the war-time crowding of the first-class had not yet started, and for two nights and days I lived in solitary state in a roomy four-berth compartment with its own toilet annexe. In these one used one's own bedding-roll on the leather bunks, carried personal toilet accessories in the universal and invaluable *chalamchi*—which was an enamel wash-basin with a round leather cover—and had the luxury of electric fans and windows which could be adjusted to give any combination of open, tinted-glass, fly-proof netting and ventilating slatted-louvres. Bearers travelled in an adjacent servants' compartment and moved in to minister to their *Sahibs* or to guard possessions during the long halts when meals were taken at the strategically placed station-restaurants. One nice further touch of *sahibs*' luxury was the mug of hot shaving water inevitably purloined from the engine by one's bearer; it was said that on occasions British Regiments on the move had immobilized trains by their massive demand for *garm pani*.

Once more I watched with fascination the passing pageant of Mother India as we steamed north from the hot and garish countryside of palm-trees and *jangal* and crossed into the vastness of Rajputana. Then, after passing through Imperial Delhi, we entered the Punjab, whose name means "the land of the five rivers", with its most ordered of administrations and where the once useless deserts had been turned into the granary of India by the skills and dedication of generations of British irrigation engineers, both civil and military; a land of blazing hot summers, healthy brilliant winters and sturdy peasants whose sons formed so much of the Indian Army. With Lahore behind us we rumbled across the great long bridges that spanned the Ravi, the Chenab and the Jhelum and then moved onto the tracks of the North Western Railway passing through Rawalpindi to reach Attock on the evening of the second day.

Apparently the Attock Summer was a season of some notoriety and in days past intercession used regularly to be made in the churches of North India "for the souls of them that are at Attock". However, summer had departed and the evening air was cool and crisp, a sharp breath coming out of Central Asia, while the short twilight was no longer soft and blue as it had been down-country, but iron hard like the nearby mountains and the people of this harsh land. Here, we stretched our legs along the platform, moving briskly to keep warm, while some of the small British community indulged in the social high-light of the day, that of meeting the evening "Mail" to see if any friends were aboard, for this was still very much a pre-war India with a close-knit family of long-service exiles as her servants.

As darkness fell we crossed the Indus on the double-decker road and rail bridge with its guard towers at each end and, with the engine's giant head-light cleaving the night, steamed the last short lap to Nowshera and then Peshawar. Here a little group had gathered at the station to indulge in that Indian Army custom of meeting the "new boy".

I had reached the Frontier, that exciting world of the lean brown men, where much of interest was to happen, but this is a tale for another time.

* * *

The Vivian Thompson Stereo-planigraph

PROFESSOR E H THOMPSON, OBE, MA, ScD, FRICS

This paper is reprinted with minor alterations with permission from the Photogrammetric Record. *It describes a design, hitherto unpublished, for an automatic stereoplotter conceived by Captain Vivian Thompson RE in 1908. Captain Thompson is no relation to the author of this paper.*

MAJOR F VIVIAN THOMPSON, DSO, ROYAL ENGINEERS

Vivian Thompson was born in 1880 and commissioned into the Royal Engineers in 1898. He was awarded the Distinguished Service Order for reconnaissance work during the battle of Loos (1915) and was three times mentioned-in-dispatches. He died in October 1917 of wounds received in action whilst in command (as acting Lieut-Colonel) of a battalion of the Essex Regiment.

SOME 35 years ago, the author of this paper saw in a War Office (now Ministry of Defence) file a short minute by Captain F Vivian Thompson, Royal Engineers, in which he put forward a suggestion for a fully automatic stereoplotter which he described as a "Stereo-planigraph". It will be recollected that Thompson constructed a stereoplotter, which he described in the *Journal* of the Royal Geographical Society (F V Thompson, 1908); but that this instrument (an example of which can be seen in the London Science Museum) was not fully automatic in that the distance of a point had first to be found (by stereoscopic measurement on the pictures) and then set at the required scale in the instrument. The War Office minute was extremely tantalizing for it gave no clue to a design which must have predated Pulfrich's solution of 1910.

Recently a collection of Thompson's private papers was given by his son to The Royal Engineers' Museum at Brompton Barracks, Chatham. These were made available to the writer for study. Among the papers was a pencil sketch headed "Stereo-planigraph" and dated 29 January 1908 which is reproduced as Photo 1. It is probably a preliminary diagram, certainly not a final drawing, of the instrument mentioned in the War Office minute.

Fig 1 illustrates the simple geometry that this problem requires. The image p of a point P in space is formed on the equivalent vertical positive by a camera whose vertex is at S and whose principal distance is f. The space point is plotted at a scale reduced such that its distance from S is less than f. (This is not necessary, but should make the instrument easier to understand.) We refer the space point to a co-ordinate system $SXYZ$ with origin at S, X-axis horizontal and Z-axis normal to the picture plane. The image p is referred to a system of co-ordinates in the plane of the picture with origin at the principal point n and x- and y-axes parallel respectively to SX and SY. It follows at once from similar triangles that

$$X = \frac{Z}{f}x, \qquad Y = \frac{Z}{f}y.$$

The Thompson Stereo-planigraph in effect simulates these two equations mechanically. Since they both require that Z should be known, the instrument incorporates an automatic means for its determination.

Fig 2 is an attempt at a three dimensional reconstruction of the Stereo-planigraph from Thompson's sketch (Photo 1). Since the elucidation of the sketch depends on pencilled notes which are not easy to read when reproduced, they are given below the photo with reference numbers added. Fig 2 carries the same letters and, where possible, the same annotations as the photo, but additional numbers have been added to help the description.

The pictures (1, 2) are set vertically. The right-hand picture is fixed and the left-hand picture can be moved left-to-right horizontally by a means to be described. A stereoscope (3), formed from a pair of microscopes, is free to move horizontally,

parallel to the surface of the pictures along a bridge (4) which may, itself, be moved vertically by an elevating gear (h) (drawn to the left for clarity). The latter may be disconnected, allowing the bridge to float (Note 3, Photo 1).

A slotted arm (5) is pivoted at (6) and is activated by the lateral movement of the stereoscope through a pin (7) (Note A at end of article). The pivot (6) is a distance *f* from the plane in which the pin (7) moves. A parallax curve (8) is free to slide normal

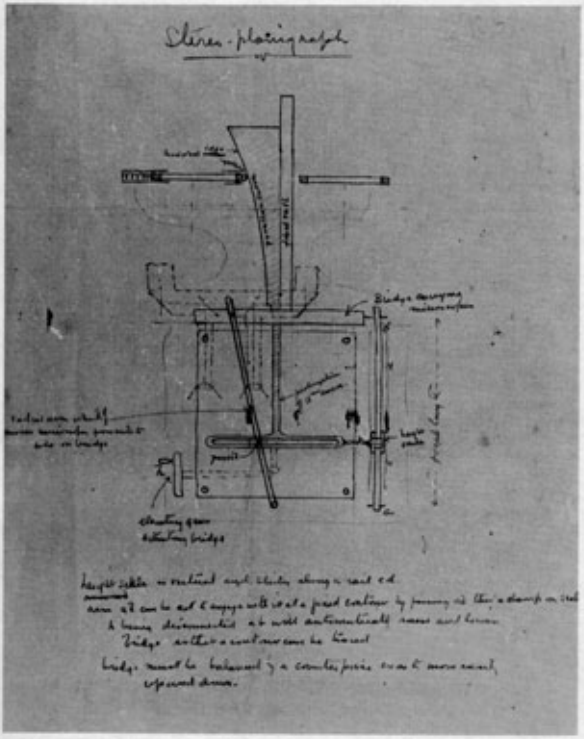

Photo 1. The Vivian Thompson Stereo-planigraph of 1908. The pencil notes under the sketch read:

"1. height scale is vertical and slides along a rail cd
2. arm ab can be set to engage with it at a fixed contour by passing ab thro' a clamp on scale.
3. h being disconnected ab will automatically raise and lower bridge so that a contour can be traced.
4. bridge must be balanced by a counterpoise so as to move easily up and down."

The Vivian Thompson Stereo-Plaingraph (1)

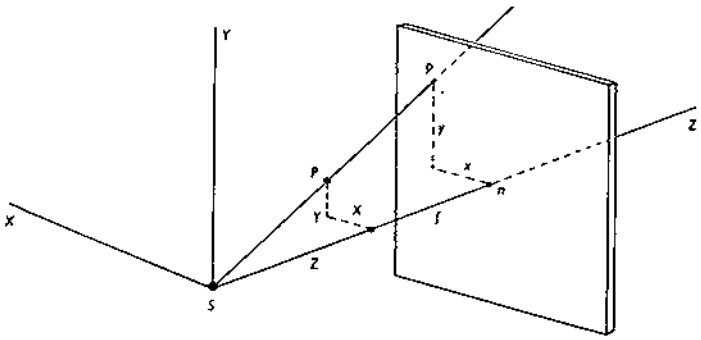

Fig 1. Illustrating the simple geometry of the problem.

to the picture plane on a fixed rail (9). A slotted T-piece (10) is attached to a prolongation of the parallax curve. A member (11) attached to the left-hand picture carries a roller (12) which bears against the parallax curve (Note B). As the latter is displaced normally to the picture plane along the fixed rail, the roller (12) is moved laterally displacing the picture and changing the parallax. The parallax curve is so constructed and adjusted that, when corresponding image points are sighted ("floating mark on the ground") the slot in (10) is at a distance Z from the pivot (6), that is

$$Z = \frac{fb}{p}$$

where p is the parallax ($= x_1 - x_2$) and b is the base length at the plot scale.

The intersection of the slot in (10) and the slot in (5) will, at the same time, have been displaced laterally by $X\ (= (Z/f)x_2)$. A pencil passing through the intersection will then plot the plan position (X,Z) of P at the drawing scale.

Heights are obtained by a mechanism on the right of the photo and Fig 2. A lineal (15) is pivoted at (a) and engages with a pin (b) on the bridge. The distance of (a) from the plane in which (b) moves is the principal distance (focal length) f. A height scale is engraved on a post (14) attached to a carriage that slides on a rail (cd) (Note 1, Photo 1). The carriage is moved by the T-piece (10). A block (13) is free to slide on the post (14) or be clamped to the post by a clamp (p). A pin on the block engages with a slot in the lineal (ab). It is clear that the height of the pin above the pivot (a) is the height $Y\ (= (Z/f)y)$ of the point sighted. When the block (13) is clamped to (14) at a chosen height and the elevating gear disconnected (Note 3, Photo 1) the ordinate $y\ (= (f/Z)Y)$ will be that of the images of space points lying in a plane Y—constant and when the floating mark is kept on the ground a contour at height Y can be plotted.

Now it is evident that Vivian Thompson's sketch has a number of mechanical and practical defects and omissions that would effectively prevent the successful operation of an instrument in precisely the form shown. However, Thompson had, by the date of his sketch, developed a workable plotter and we can assume that he would have made the necessary modifications had he been able to develop the new instrument. There are, on the other hand, two defects that are basic to the design. In the first place, the plot scale must be such that the co-ordinate Z of the most distant point from the base, at that scale, must be less than the principal distance. (There is always the temptation to say that "the plot scale must be less than the photo-scale", but the latter is so variable with terrestrial pictures that the statement has no meaning.) Secondly, and this is perhaps the more important defect, the parallax curve is fixed and must be such that it generates a parallax fb/Z when b is the base length at the plot scale. It follows that, for a given value of f, if we select a plot scale, the base length in the field is not at our disposal or, if we select a base, the plot scale is not at our disposal.

This last characteristic would have ruled the instrument out for all practical purposes. What then is the importance of the design? We are nowadays so familiar with the technique of contour plotting that it is hard to understand that it ever presented any difficulty. In order to comprehend the problem, we have first to appreciate that the plotting of detail and the *determination* of heights of selected points are operations fundamentally different from the plotting of contours. (Anyone associated with the design of digital plotters will take the point.) A contour is the intersection of a plane Y = constant (Fig 1) with the ground surface. How do we find this curve of intersection? If we sight a pair of photographic images, we can certainly plot the plan position of the space point (X,Z) and determine its height (Y) but the point will almost certainly not lie on a contour which has a pre-chosen value of Y. That there are conceptual difficulties we can see from von Gruber (1932) (a)) where it is said:

"Already in September, 1908, von Orel had made a new suggestion for rendering the drawing of the contours more automatic. Instead of maintaining the intersections on lines representing constant heights, he proposed to substitute electrical devices as an aid to the setting of the height lineal. The observer himself had to see to this setting, being warned by a bell when he departed from the correct position in height. The apparatus was thus reconstructed in the summer of 1909. A motor was then provided to relieve the observer by giving slow, uniform displacements to the lateral traverse slide. The trial followed at the end of October, 1909. In practice the work depended excessively on the smartness of the assistant, and the demands on the observer were also by no means small.

"During the testing of the new model von Orel made the important proposal for coupling the height lineal with the cross lineal by means of a pin, set along the cross lineal (bridging piece or bridge) to correspond to the height of the contour to be drawn. On displacement of the bridge, this then gives an automatic re-checking of the height lineal and also of the heighting slide; the observer did not need any longer to give his attention to the setting of the heighting slide.

"This was a mighty stride in advance. On setting this pin to correspond to a given altitude, the observer was constrained, if he did not wish to abandon the mutual contact between the space-images of the mark and the object, to bring the two

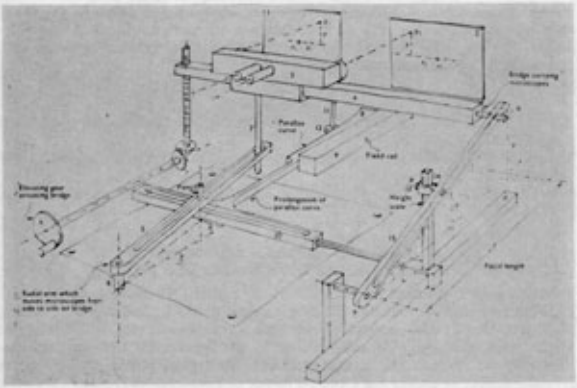

Fig 2. Three dimensional reconstruction of the Stereo-planigraph from sketch in photo 1.

The Vivian Thompson Stereo-Plaingraph (2)

space-images into coincidence along the curve of section of the object—or the landscape—by a horizontal plane corresponding to this altitude.

"What was now lacking was the automatic communication of the motion of the parallax lineal to the bridge, in order to make the assistant superfluous. Pulfrich shortly thereafter suggested the solution of this problem, which was brought about in like manner by coupling the parallax slide with the bridge, the action proceeding from the bridge through the medium of the parallax lineal. But in consequence of the fact that the distance lineal was rigidly attached to the lateral-traverse slide, provision had to be made for the point of contact between the distance lineal and the bridge to allow it to travel along the latter."

Thompson's sketch shows that he realized precisely what had to be done. It is to ignore the ground surface and to incorporate a mechanism that enables the instrument to be set so that only *points lying in the chosen plane can be plotted*. It is then easy to select, from among those points, those that also lie on the ground. He thus predates Pulfrich's design of 1910 (von Gruber, 1932 (b)) by nearly two years.

In case readers should raise the point, Note C explains why Vivian Thompson's Stereo-planigraph of 1908 can be said to have priority over Edouard Deville's plotter of 1902.

NOTES

A The Thompson sketch says that the radial arm moves the microscopes but, when the pencil is between the bridge and the pivot (6), it is mechanically more satisfactory that the arm (and, thus, the pencil) be moved *by* the microscopes. If, however, the drive *is* to be through the arm, it would be more logical if the elevating gear were to operate the block (14) and not the bridge. The block would then not require a clamp and it would be unnecessary to disconnect the elevating gear for the plotting of contours.

B Photo 1 shows the left-hand picture sprung directly against the parallax curve through a roller. This is an over-simplification for it does not allow of the pictures being placed at a suitable height above the base of the instrument.

C The earliest completely automatic plotter was constructed by Edouard Deville and described in the *Transactions of the Royal Society of Canada* in 1902 (E H Thompson, 1965). However, Deville's instrument was not optically rigorous in that it relied on the depth of focus induced by restricting the pupil of the eye. In general there was visual parallax between the mark and the virtual images of the photographs. On the other hand, Thompson's solution was rigorous in every way: geometrically, mechanically and optically.

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THE INDIAN SAPPERS AND MINERS

BY LIEUT-COLONEL E W C SANDES, DSO, MC

THIS 700 page well illustrated book covers the period 1759–1939.

It is a very readable narrative which will appeal to any student of Indian history, whether soldier or civilian. One of the main attractions of the book is that the sketch maps (well over 40), are included in the appropriate Chapter and were drawn by the Author. The labour must have been great but is justified by the resulting facility in finding the locations of any places mentioned.

A limited number of these books are available to Members at £2·25 each.

Mister Fung

BRIGADIER G MACLEOD ROSS, MC, C OF ST J

A POSTING as ACRE Tientsin in the early nineteen thirties was an experience fraught with the unexpected, the bizarre, and the completely illogical. To savour its full flavour required an attitude of mind conditioned to accept the absurd seriously, while welcoming the whole topsy-turvy bewilderment as perfectly normal. The climate alone affected the individual, on occasion he could be completely irrational, remaining thus for weeks. Others, who perhaps had lived down this curious affliction, were impervious and quite normal.

Although the British part of the International Settlement was little more than a square mile in area, (perhaps this "confinement" affected the mentality), the differing nationalities at the school numbered over one hundred. Outside the Settlement, which was on delta soil, was the City, with a population of nearly two millions and the stench of their raw sewage abused the nasal organ as it slowly slimed its way to the river.

To appreciate the polyglot nature of the British Concession, consider its most famous international law suit which was tried soon after my arrival. It was E C Spirides versus the British Municipal Council, wherein an Italian subject, born a Turk, but really a Greek, came to a British Court, with an American laywer and a Russian interpreter, and admitted he made Scotch whisky in China out of Japanese spirit, in a distillery and labelled it: "*Au Grand Chateau de la Paix*".

From a Sapper's point of view the most important Chinese gentleman he encountered, immediately, and continuously, was Mister Fung. His full name was Rung Fung Hsiung and he was the faithful RE Triennial Contractor for the military buildings in Tientsin and Peking. Mister Fung had come to notice first during what he called the "the Boxe", in other words the Boxer Rebellion of 1900, when he was loyal to the British contingent of the International Force and in consequence was awarded a large and literal "gong", as well as an impressive scroll recording his integrity. Physically he was a big man; six feet tall and nearly square. He qualified with ease for that visible sign of success the employment of two rickshaw boys to pull him about! In silhouette he resembled an immense tea-cosy or cloche, but then so did most North Chinese gentlemen of substance, whether physical or financial. Most usually his ample form was enveloped in a large black robe which reached to his ankles, whilst on his head was perched the black skull cap of the Mandarin with its red button.

Mister Fung did not call upon you on your first day in the RE Office. Considerately he gave you time to acclimatize yourself to the strange surroundings and his visit was delayed until perhaps the third or fourth morning. Thereafter he did not attempt the steep stairs which led to the office, for they were undoubtedly fatiguing. I never actually watched the ascent, but know that Mister F was invariably propelled by several cohorts, both from the rear and the front. On reaching the landing, a few moments were needed to regain his breath. On this, his first state visit, he brought his Number One Boy, Wang, who acted as his foreman of works, interpreter and general *alter ego*. Number One, his propulsion-activities completed, had to go back and return with a large carton which he placed on the side of my desk next to the now-seated Fung. There followed the usual pleasantries: broad smiles followed by sundry grunts of goodwill and bonhomie. Next Mister Fung would open the carton and draw out from its jumbled contents a series of Christmas cards which a succession of Sapper officers had sent him during and since their tour of service and going back to the turn of the century. Suitably arranged in chronological order the contents of the carton would have furnished as accurate a list of the RE hierarchy in Tientsin as would AG7. Here was a card from Jimmy James while, near the top of the pile, that from the last incumbent: Eustace Tickell.

The cards duly read, admired and re-examined; those, from officers whose names

I knew, being meticulously set aside for expressions of wonderment, the *piece de resistance* would be produced. Wreathed in smiles which wrinkled his usually expressionless face, he displayed a parchment scroll and a huge medallion. More gurgles of admiration in spite of which Mister F was not entirely certain the full meaning had reached me, so that in a loud voice he would proclaim "The Boxe! the Boxe!" There followed the lengthy but careful descent of the stairs.

After this state visit of welcome, it would require a matter of the first order of importance to persuade him to attempt another ascent of the office stairway. For example when the summer camp at Shanhaikuan was to be opened he would appear to request the loan of a number of miniature Union Jacks. These were to be sewn on the overalls of his caretakers while opening up the camp. It was these same caretakers, protected as they were by the awesome might of Britain, who would repulse the attacks by our Allies—French, Italian, Japanese and even American—on the sacred metre-gauge tramway which ran from the South Manchurian Railway station to the sea, at the point where the eastern end of the Great Wall enters it. This tramway was another token of British Sovereignty, for while French and Italians were permitted to run their trucks over the line—duly distinguished by the flag of their nation—the British, as builders of the line invariably took priority. Any foreign truck encountered by a loaded British truck had to retreat to a passing loop, or leave the rails.

When the Queen's Regiment wanted an Olympic-size swimming pool, financed from regimental funds, it was Mister Fung who personally presented his bid at a figure almost farcical in its insignificance.

It so happened that during my curtailed tour at Tientsin, the Triennial Contract expired. I always felt that tendering for this contract gave Mister F another opportunity to humour his sense of the ludicrous. After all, he had won the contract on ten previous occasions. Why should be fail to win it now? But of course some pretence of opposition had to be made. When the only rival tender was opened, its rates were so grossly underbid by Mister Fung's that it was hard to believe that the whole transaction was not a clumsy attempt to jolly the government's hide-bound regulations. On the other hand Fung could not afford to lose; the loss of face would have been too awful.

Although direct dealings were more fitful, it was impossible not to feel that his influence pervaded a number of circumstances which tended to make life more agreeable; even relaxing. It is only a suspicion. No tittle of evidence ever appeared to suggest that the reason your house servants were loyal and efficient was due to his patronage. All around wealthy "boxwallahs" were forever bemoaning the lapses of their boys. Nor did it seem to be his ukase which enabled you to summon one of the bearded Fathers of the Société des Lazaristes, your landlords, to bicycle up in a long flowing soutain and topi (with all the risks of getting the former caught in the chain of the bike), the instant your steam heating system threatened "Everything all go pop inside" as Number One boy warned so breathlessly.

In my short stay of thirteen months there was only one overt, yet determined attempt to subvert me. It occurred at the second Christmas. On the previous occasion a selection of dwarf apple trees in profuse blossom had been insinuated into the house, forced no doubt, in one of the many paper-covered charcoal-heated greenhouses which abounded in the Concession. On the second occasion the circumstances were more sinister. Two of Mister Fung's henchmen arrived on bicycles at the back alley behind 404 Ma Fung Loo. It was from hence in the early morning that cries of "dirtee water" heralded a vendor of a revolting form of breakfast cereal beloved of the servants in the row. Strapped to the carriers of their bikes were two portentous looking wooden boxes. I recall their arrival induced a certain air of suppressed excitement amongst our servants. There was an unusual amount of sock-shuffling on the hard wood floors. Even Dar Jewah (meaning "the great master"), the cook came up for air from his basement kitchen. This was unique. Somehow the suspicious boxes were shuffled into my living room and duly opened to display their ghastly

contents. Then, when Mister Fung's Number One had duly made the presentation, followed by the broadest leers and shaking of hands, only then was I persuaded to peer inside and examine the contents; all this in semi-privacy, which means accompanied by constant gliding in and out of the room by old Wang, who was fascinated by such a magnificent gift, yet was equally curious to see my reaction.

The "gift" turned out to be the most amazing collection of tired, scratched and useless hotel plate. Not just articles of every day use, such as cutlery, jugs and trays, but a large proportion of fittings such as flower holders made to fit hotel furnishings. Crude and unlovely as was the whole collection, the worst, nay the most embarrassing aspect, was that every piece—and there must have been a hundred—was very badly engraved with a *gunner* grenade and the motto "Ubique" beneath it. Perhaps it will be understood that I did not have the slightest difficulty with my conscience in politely refusing the gift and ordering Wang to get the awful junk back whence it had come at the double. This incident was politely ignored by both sides hereafter. Only now, some forty years later, have I stopped to ponder that probably I was far from the first in a long pedigree of Sapper officers to whom this revolting "cumshaw" had been offered.

Mister Fung did make one other appearance and a rather startling one at that. His men were pouring the concrete for the swimming pool mentioned above. Lamble, the Clerk of Works, who had followed me from Catterick to China, insisted that the pour be a continuous operation. Thus, true to China, the excavation and surrounds were clothed in coolies. I was observing the progress when a massive figure appeared, immaculate in sharkskin suit, tie and white topi, a sturdy Chinese oak stick in his hand. I had never seen Mister Fung clothed in anything save his normal Chinese dress but this apparition almost beggared belief. Our greetings over, he returned to watching the coolies sweating in the excavation, when all of a sudden a most blood-curdling scream was heard; repeated at short intervals. It turned out to be Mister Fung encouraging his coolies to redouble their efforts.

I offer no apologies for this short memoir of Mister Fung. Those Sappers he served will feel with me that somewhere in the archives there ought to exist some slight record of a loyal friend to the British in general and the Corps in particular. A record of one who displayed all the best characteristics of the Northern Chinese: integrity, industry, reliability, dignity and above all a pervading sense of the ludicrous, all in one immense frame.

* * *

"ENGINEERS IN THE ITALIAN CAMPAIGN 1943–1945"

OBTAINABLE FROM INSTITUTION OF ROYAL ENGINEERS—PRICE £0·25

MAJOR-GENERAL COXWELL-ROGERS in his foreword emphasises that this is not a complete history of engineer work during the Italian Campaign. It does not describe the great achievements of the American Engineers nor does it include an account of the work of engineer units of the Survey and Transportation Directorate. It does give a general picture of the tasks which confronted British, Canadian, South African, New Zealand, Indian and Polish Engineers and describes in some detail certain of the more interesting episodes.

The book is a "paper back" with over 60 photographs and sketch maps. Although essentially factual it makes very interesting reading particularly when concentrating on local production of engineer material.

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THE HISTORIC ROLE OF THE ROYAL ENGINEERS

Sir,—In examining the history of the Ordnance, the searcher naturally comes across the question of the role of the Royal Engineers, because until the year 1855 when the Office of Ordnance was abolished they were Ordnance troops. Only after that time did they look to the authority of the War Office and become what they have since remained, a military supporting arm.

The previous period was not an insignificant one. The Engineers were a principal branch in a department of state which played a leading part in the growth of the British Empire and which survived from Henry VIII almost to the moment of imperial zenith. Many of the engineers appear in person in the Dictionary of National Biography—Sir Richard Lee, Sir Jonas Moore and Sir William Green respectively from the sixteenth, seventeenth and eighteenth centuries. In the scale of contribution to the national cause the Sappers did as much when they were "Ordnance" as they have done since they have been "War Office".

In some respects the Official History of the Corps does not cover the earlier time. The detail is formidable but the perspective is foreshortened. It was inevitable that it would be. Lord Panmure revoked the Letters Patent of the Ordnance in 1855. Whitworth Porter's two volumes were dedicated to the Memory of the Prince Consort in 1889. Even though he brought to his writing a conviction which places him in the school of his great contemporaries, Sir John Fortescue and Sir Julian Corbett, and although he imposed, as they did, his own historiography on his subject, the shape is not fully outlined.

Major-General Whitworth Porter describes the Ordnance and recounts the chronology of the Corps but he does not combine the two together, nor does he attempt—as far as I can see he does not intend—to place the two in the framework of the defence constitution of the country. As a result some of the landmarks have lost their silhouette and some points are unclear. The nomenclature and the meaning of the terms used to describe formed bodies, what might be called the "staff duties" of the business, raises points of discussion.

When was the word "corps" first used? In what sense does the Official History in Volume I on page 143 talk about a "regular Corps of Engineers" being formed with an establishment of twenty-eight in 1716? The name could have been a contemporary one or it might have been transposed from the later time of writing as a convenient term to apply to the earlier period of the event. The "corps" was very fashionable at the end of the nineteenth century because von Moltke had used that formation to win the Franco-Prussian War.

When did the Sappers first become Ordnance troops? Both can trace their antecedents into the Middle Ages but not necessarily in combination. It is not clear that they married up until the reformed instructions issued for the Office of Ordnance by Charles II in 1683. That Office caught its dynamic as a department of state when the Lieutenant was first appointed in 1537, with the casting of the first iron cannon in 1543 in Sussex. And it probably established its dominating authority in the defence councils of the nation with the defeat of the Armada in 1588, when cannon smashed the accepted practices of naval warfare. But the Engineers for their part, who had fortified the country since William the Conqueror, had no natural link with the gun. The purpose of unification was not obvious even though the need for close association on the other hand was clear. The deployment of that weapon had changed the design of fortifications and the methods of siege. Ballistic techniques demanded new forms of transport, of exposition and of gun carriage. During the process of evolution who did men like Lord Pelham and Sir Bernard de Gomme "report to"?

What were the relations of the Engineers with the Navy? It seems that Englishmen took to the sea after the expulsion from Angevin France because the ship provided far and away the best gun platform and the most generative economic unit in the early days of capitalism. The Sappers provided a vital link in the fortification of bases, the mounting of artillery and the management of inshore operations. They became as it were an amphibious body to match the corporate seafaring evolution of the country. There are a number of examples of the naval role. Cornelius Drebel designed a submarine. Ordnance engineers taught hydrography to Captain Cook at the siege of Quebec in 1759. Captain James Moncrief, Royal Engineers, fought the guns of a man-of-war in 1777.

The Duke of Marlborough and his immediate successors founded the Royal Artillery in May, 1716 and at the same time gave a decisive impulse to the Royal Engineers. However

although the two occurrences went together and seem similar they were probably in nature different, seem likely to have sprung from separate causes and to have been the consequence of contrasting developments. By that time the cannon had emerged from the laboratory. The increased mobility introduced by Gustavus Adolphus and by Marlborough himself made disciplined uniformed reaction more important than technological comprehension. A formed unit was needed as a strategic reserve based at Woolwich to support the principal ornaments of the Treaty of Utrecht, the garrisons at Gibraltar and Minorca. The Royal Engineers on the other hand appear to have had a different role. From the posts established and their number and station, they were created to be a central imperial—or, perhaps more accurately one should say a colonial—staff, an arrangement which was to give them in due course the function of strategic adviser to the Cabinet.

How much did the Engineers contribute to the growth of Civil Engineering? The Institution of Civil Engineers was founded in the Industrial Revolution which from the point of view of chronology was fairly late, and followed, rather than anticipated, the laying down of that groundwork which was needed to make technical revolution possible. The Oxford English Dictionary suggests a military origin for the word "engineer"—"one who designs and constructs military works" is the first entry in the Concise Oxford Dictionary for the term in the 1964 edition. Perhaps the Sappers contributed their own original title to the English language. The use of "civil" for public works of utility suggests a military lead or at least an operational precedence.

Shakespeare employs the word in that sense in Hamlet (Act III, Scene 4, line 206)

> For 'tis the sport to have the engineer
> Hoist with his own petard: and't shall go hard
> But I will delve one yard below their mines,
> And blow them at the moon.

These points might emerge from a closer and more intelligent application to the Official History. On the other hand it may be better to air them since they may follow a line which in terms of interpretation is fundamentally incorrect.—Yours sincerely, A B T Davey

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OUR ARCTIC CAMPAIGNS

Sir,—As one who served in a very minor capacity under Brigadier Stokes in Norway in 1940, I have read his Narvik article in your September issue with the greatest satisfaction. Among the numerous accounts of the ill-starred 1940 campaign it is outstanding in honesty, humour and succinctness; with this I am sure all who took part, and have weathered thirty five increasingly unpalatable years, will agree. I believe also they will applaud, as I do, the fine tribute at the end of the article to the late Sapper Major-General P J Mackesy, a hardly-used commander if ever there was one.—Yours faithfully, Gordon Simpson.

Major L C Roberts, BSc, C Eng, MIMechE, FIEE
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NUCLEAR CATERING IN THE 80's

Sir,—As a "Senior Citizen" I am naturally worried about the escalating cost of fuel; so I suppose it is not surprising that when I opened my September *Journal* and spotted the heading on page 177 (repeated on page 179) "Nuclear Catering in the 80's" my mind leapt at the prospect of being able, in the near future, to disconnect all my electric kitchen equipment from the mains, go out and buy a half-kilo of radio-active material, and—but alas! more careful inspection revealed that the article was all about making holes in the earth; and so another fond dream was promptly shattered! —Yours faithfully, L C Roberts.

Editor: No printable comment!!

Book Reviews

MACHINE GUNNER 1914–1918
EDITED BY C E CRUTCHLEY

(Published by Bailey Brothers and Swinfen Ltd. Price £4·75)

To old soldiers the pages will awaken vivid pictures already etched deeply in their memories. Those who were not born when these stirring events took place will read between the lines of the grim determination which actuated the men of the Machine Gun Corps.

First published privately in 1973, this book has proved so popular that a new, expanded and fully illustrated edition was widely called for. Where other Corps and Regiments have long records from which to cite their achievements, the Machine Gun Corps possesses only three years of history. These years are an epic of patience, cheerfulness, endurance, courage and comradeship. *Machine Gunner 1914–1918* is written in the words of the soldiers themselves—unemotional narratives that bring home with devastating effect the awful realities of combat in World War 1.

It is full of stories and incidents like that of the driver at the Hindenburg Line who, the target for every hostile gun, shot through the stomach and belching blood, still managed to deliver his load of precious ammunition to the beleagured line. There was the lad at Arras who crept forward in the darkness, captured an enemy stronghold single-handed and turned the German machine-gun against the enemy line.

And there are many more, set in places as far apart as the Western Front, Mesopotamia and Palestine, telling of what became known as the "Suicide Club" and its part in the most ghastly of modern wars.

EEP

ORIGIN OF A SOLAR SYSTEM
ALEX AIKEN

(Published by Alex Aiken, 48 Merrycrest Avenue, Giffnock, Glasgow. Price 60p post free)

Since the French mathematician Pierre Laplace (1749–1827) presented his *nebular hypothesis*, barely half a dozen others have had the temerity to take up the problem from where he left it. All the theories attempting to explain the evolution of our solar system—including Weiszacker's "whorls within whorls" and Hoyle's "lines of magneto hydrodynamic force"—have been torn to ribbons by the critics; all have foundered on the rocky fact that the planets possess 99 per cent of the system's angular momentum, whereas it would be mathematically elegant for the sun to have the lion's share of this quality.

Now a 45-year old Scots civil engineer (late Captain RE in Reserve Army), has rushed into print with his solution to the age-old problem. Unencumbered by much knowledge of his predecessors' work, he has proposed an initial state of affairs in which the sun appears to have no angular momentum at all. The clues that put him on to this particular trail were:

(1) About one in every five stars are double or "binary" stars.

(2) Some of these binary bodies are so close to each other that they revolve in a common cloud of hydrogen pulled out by tidal action.

(3) If the planet Jupiter were slightly more massive it would start to shine like a star.

On these slim foundations, using mathematics that a schoolboy could follow (given the calculations, which we are not), our office-chair astronomer has created the entire solar system—to his satisfaction, at least.

EEP

RAILWAYS AND WAR SINCE 1917
DENIS BISHOP AND W J K DAVIES

(Published by Blandford Press, London: Price £1·90)

Railways and War Since 1917, featuring World War II, is a fascinating sequel to the previous volume which covered the early history of war on rail from the American Civil War to the closing years of World War I.

The book contains over one hundred illustrations, mostly in colour, followed by descriptive notes which deal not only with technicalities but with such subjects as camouflage, casualties and other aspects of modern warfare.

EEP

THE MAP MARKET IN GREAT BRITAIN

(Ordnance Survey Professional Papers, New Series No 28, Obtainable from Ordnance Survey of Great Britain, Romsey Road, Maybush, Southampton SO9 4DH. £2·50)

This paper differs from others in the series of Professional Papers published by the Ordnance Survey in that the work it describes was undertaken not by the OS professional surveyors or cartographers but by the British Market Research Bureau Ltd and the Office of Population Censuses and Surveys.

The object was to discover how many householders owned maps; what kind of maps they owned; which members of the household bought them; where and when they were purchased; which members used them and for what purposes. In addition demographic information about individual household members was also collected so that the characteristics of map users and non-users could be evaluated.

No conclusions on any of the subjects covered by the research are drawn in the paper itself, the purpose of which is solely to report its findings. That many conclusions can be drawn will soon become apparent to the readers of this very interesting publication.

EEP

IN THE STEPS OF STANLEY

JOHN BLASHFORD-SNELL

(Published by Hutchinson and Co Ltd, London: Price £3·95 UK only)

This illustrated journal of the Zaire River Expedition 1974–75 is based on the official log kept by the leader, Major J N Blashford-Snell, MBE, RE. The terse dramatic narrative is heightened by the interpolation of extracts from the diaries kept by Henry Morton Stanley in the course of his exploration a century previously.

The fact that this very readable book is written in the form of a log does not detract from it. The reader is made to realize that the two expeditions, a hundred years apart, were plagued with similar hazards. I found the reiteration of the financial problems of the 1974–75 expedition a little irritating as, although they were obviously very real, they gave the impression that the author was attempting to excuse the performance of the expedition. It can be no picnic to lead an expedition of many nationalities and professional disciplines and to weld them into a team—so much can go wrong—there were times when even I felt as frustrated as the leader.

The vivid descriptions and the author's sense of humour and fun will keep the readers' attention as the "true" adventure story unfolds. My one real criticism, and it is a relatively minor one, is that such a good book should be printed on such poor paper. First impressions do count, even in these days of high publication costs.

BP

ROYAL ENGINEERS

DEREK BOYD

(Published by Leo Cooper Ltd, London. Price £4·95)

This short history of the Corps is one of the *Famous Regiments Series* edited by Lieut-General Sir Brian Horrocks. For those who order their copy through the leaflets which have been distributed in the *Supplement*, *Journal* and *The Sapper*, the price is reduced to £3·95 and the Institution will receive a donation from the publishers in gratitude for the research carried out in the preparation of the book.

Very few histories can be described as compulsive reading. The author has taken infinite care with his selection of material, has written intelligently and with conviction and has produced a very readable short history. It is not, indeed it could not be, an abridged version of the nine volumes of the official *History of the Corps of Royal Engineers*. It is a book in its own right.

It will be criticised because it has omitted this, given too much attention to that—this is unavoidable in a book of some 162 pages which covers a 900 year period, virtually every campaign the British Army has ever fought in, for as a fighting arm the Corps has been engaged in every major battle, as its motto Ubique signifies.

The author in writing of the strengths and the weaknesses of the Corps gives a balance to the book which a less courageous writer would have avoided. The text is supported by Notes and Appendices which are grouped together at the end of the book to avoid slowing down the narrative with detail.

The book whets the appetite and should encourage many readers to move on to the official Corps History. It makes one proud to be or have been a Sapper. What more can one say.

EEP

Back Numbers of Royal Engineers Journal

IS YOUR SET OF JOURNALS COMPLETE?
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SOME 800 issues of the *Journal* have been published. Of these some 750 back issues are available for sale to Members of the Institution of Royal Engineers.
In broad terms:

a Between 1872 and 1904 the *Journal* was published monthly and combined the functions of both the *Journal* and *Supplement* as we now know them. In appearance it was rather like a foolscap version of the present *Supplement*.

b Between 1905 and 1922 it changed and became very like the *Journal* of today although it was still published monthly.

c Since 1923 the *Journal* has been published quarterly.

The earliest issue available is No XIV published in 1872 (one copy only) and despite its age every word is readable. Some of the covers of early issues are faded and dusty and show their age. The value of these back numbers on the open market would vary from pence to pounds, depending on the content, rarity of issue and the degree of acquisitiveness of the prospective buyer.

As sales are to be confined to Members only, a flat rate of 50p per copy will be made regardless of the open market value.

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