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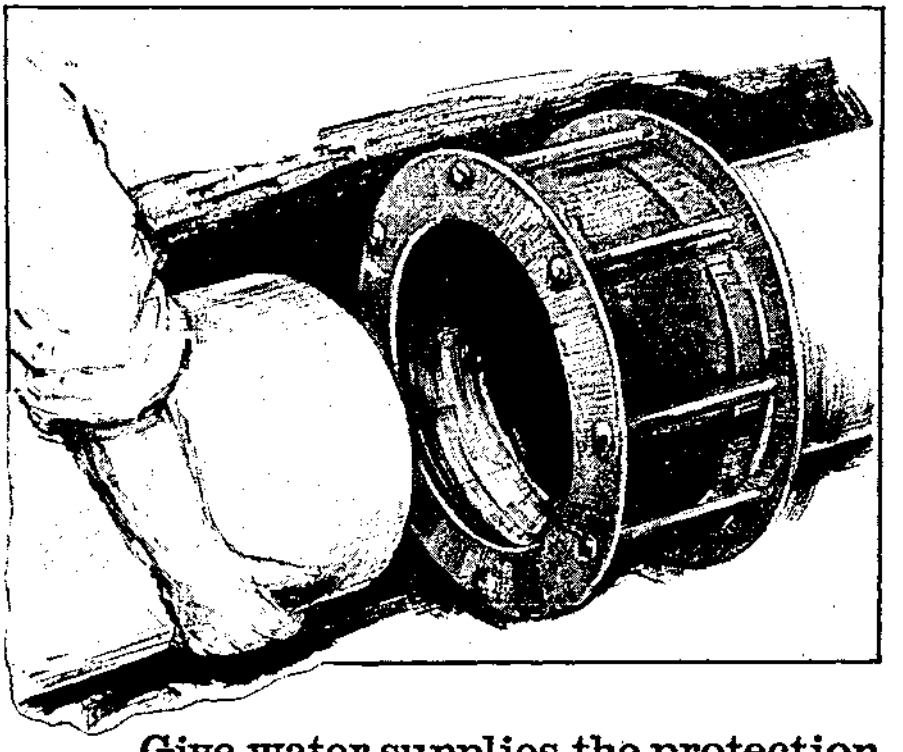

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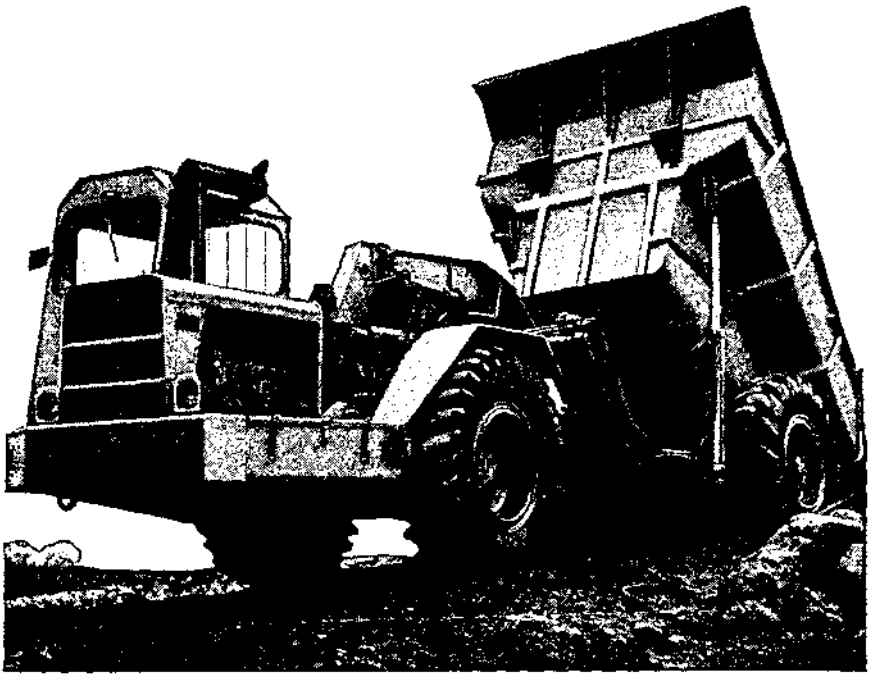

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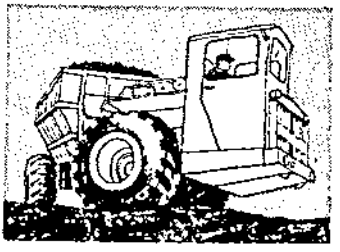

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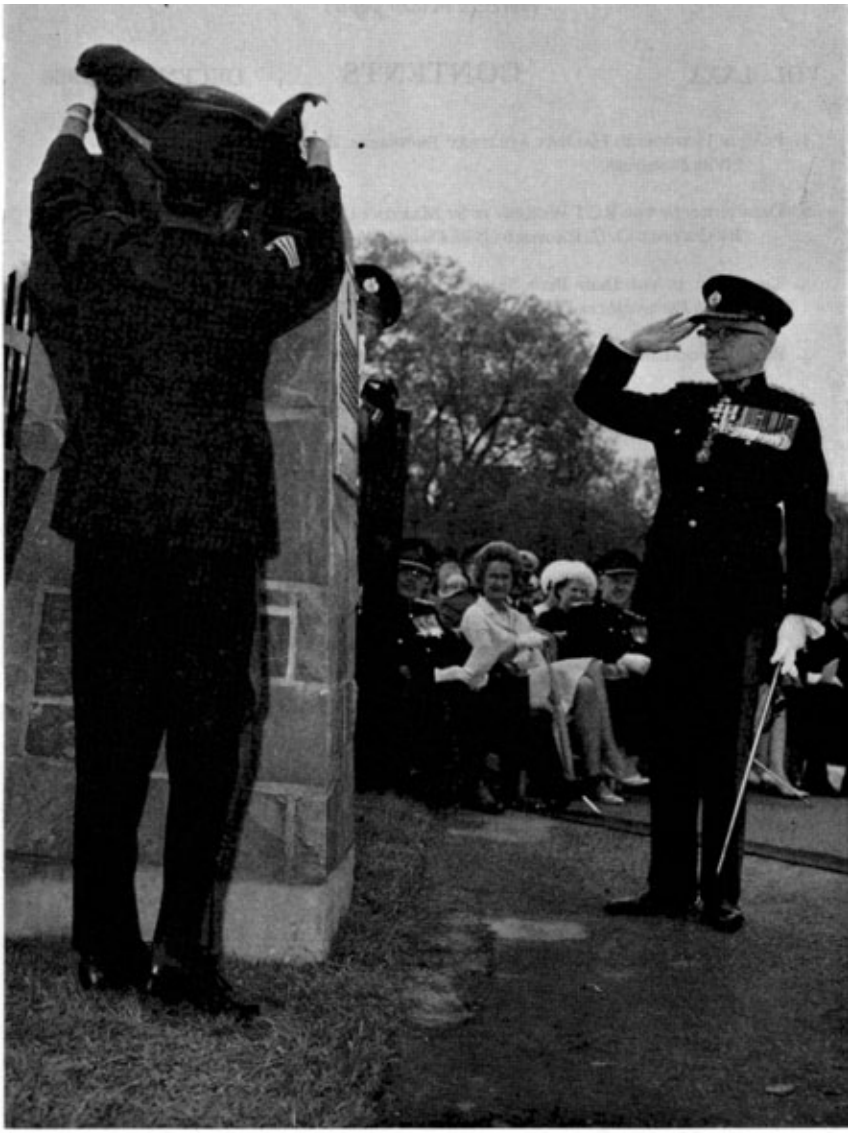


Brigadier James L. Melville, CBE, MC, ED, CD, Colonel Commandant, Corps of Royal Canadian Engineers, unveiling the plaque commemorating the long association of Military Engineers with Halifax. Royal Artillery Park, Halifax, NS, 18 June 1966

Plague Honouring Halifax Military Engineers

Plaque Honouring Halifax Military Engineers

By Colonel M. Turner, CD
Commander Nova Scotia District

A PLAQUE commerating the long association of Military Engineers with the port, fortress and City of Halifax was unveiled on Saturday, 18 June 1966, in an impressive ceremony at Royal Artillery Park. Brigadier James L. Melville, CBE, MC, ED, CD, Colonel Commandant of the Corps of Royal Canadian Engineers, unveiled the tablet, erected on a 6-ft cairn, and presented it to Royal Artillery Park on behalf of the Corps of Royal Canadian Engineers and the Military Engineers Association of Canada. He spoke briefly on the history of the Royal Canadian Engineers and commented on the long association of "Sappers" with "Gunners".

Accepting it on behalf of all "Sappers", and the Province of Nova Scotia, and the City of Halifax was the Honourable H. P. MacKeen, Lieut-Governor of Nova Scotia. He said nothing could be more appropriate than the plaque should have been erected on the opposite post from that presented in October 1965 by the Regiment of Royal Canadian Artillery. The juxtaposition of the two tablets, he said, was symbolic of the warm and friendly relationship between the two in Halifax. The 22-in square bronze plaque, mounted on a 6 ft high stone cairn beside the Sackville Street gate to Royal Artillery Park, bears the inscription:—

"Erected by the Corps of Royal Canadian Engineers and the Military Engineers Association of Canada in commemoration of the British and Canadian Military Engineers, major participants in the founding of Halifax in 1749, and closely associated with the development of this port, fortress and city from that date. Quo Fas et Gloria ducunt".

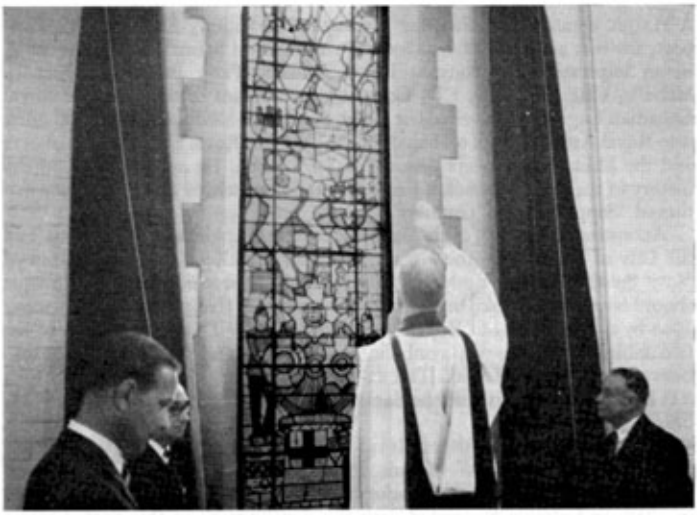
A saluting troop from 1 Field Regiment, Royal Canadian Artillery (Militia) of Halifax fired a fifteen-gun salute from Citadel Hill in honour of the Lieut-Governor on his arrival at Royal Artillery Park. In attendance were the Royal Canadian Artillery Band from Halifax and a one hundred-man Guard of Honour from 2 Field Squadron, Royal Canadian Engineers located at Canadian Forces Base Gagetown, New Brunswick. The Guard was commanded by Captain Richard Nordlund, Royal Canadian Engineers.

Host for the occasion was Colonel Malcolm Turner, CD, Commander Nova Scotia District. In addition to Brigadier Melville and the Lieut-Governor and Mrs MacKeen, guests included the Honourable R. L. Stanfield, Premier of Nova Scotia, and Mrs Stanfield; Lieut-General L. G. C. Lilley, DSO, CD (late Royal Canadian Engineers), Chief of Technical Services, Canadian Forces Headquarters; Major-General H. L. Meuser, OBE, CD (late Royal Canadian Engineers), Assistant Deputy Minister, Department of National Defence; Major-General J. N. Thomas, DSO, MC (late Royal Engineers), Director of Combat Development, United Kingdom Ministry of Defence, His Worship the Mayor of Halifax, Charles Vaughan and many serving and retired Sappers and their wives.

Following the ceremony a reception was held in the Royal Artillery Park Officers' Mess. The previous evening the District Commander had hosted a mess dinner in honour of the occasion.

Dedication of the RCT Window in St Martin's Garrison Church, Longmoor

By COLONEL O. C. RADFORD



The Dedication of the Window.
(*Left to right*) Colonel O. C. Radford, Major-General T. H. F. Foulkes, Very Rev. I. D. Neill and Major-General Sir William Roe

ON Sunday, 25 July 1966 a service was held in St Martin's Garrison Church, Longmoor for the dedication of the new window which commemorates the formation of the Royal Corps of Transport. The service was conducted by the Rev F. M. Grazebrook, MA, who as a Lieut-Colonel RE, was one-time Chief Instructor at the Transportation Centre, RE, Longmoor. On retirement in 1956 he took Holy Orders and is now Vicar of Wolverley near Kidderminster.

The window, which was a joint gift from the Royal Engineers and the Royal Army Service Corps, was unveiled by Major-General T. H. F. Foulkes, CB, OBE, Colonel Commandant RE, on behalf of the Royal Engineers, and Major-General Sir William Roe, KBE, CB, Colonel Commandant RCT, on behalf of the Royal Army Service Corps. It was dedicated by the Very Rev I. D. Neill, CB, OBE, lately Chaplain General and now Provost of Sheffield.

The standards of the Longmoor Branch of the RE Association and the Aldershot Branch of the RASC and RCT Association were laid on the altar during the service. The lessons were read by Colonel O. C. Radford (late RE) Acting Commandant School of Transport, Longmoor, and Major-General E. H. G. Lonsdale, MBE, Transport Officer-in-Chief (Army). The Very Rev I. D. Neill preached the sermon.

Dedication of the RCT window in St, Martin's Garrison Church, Longmoor

A full description of the window is contained in the article by Brigadier C. A. Langley, CB, CBE, MC, entitled "History of St Martin's Church Longmoor and its Memorials", published in *The RE Journal* of March 1965.

After the service there was a reception in the School of Transport Mess for officers and their wives, many of whom were serving or retired officers of the Royal Engineers including a large number who had served at one time or another at Longmoor, including seven former Commandants. Official guests included General The Lord Robertson of Oakridge and Lady Robertson, Brigadier and Mrs C. A. Langley, Brigadier and Mrs J. C. Woollett, Brigadier and Mrs K. H. Stevens, Brigadier and Mrs D. R. Carroll and Colonel L. G. S. Thomas.

During the reception the Imperial Service Medal was presented to Mr R. H. Tarling, who had been Officers' Mess Steward since 1934, by Major-General A. T. de Rhé Philipe, CB, OBE (late RE), Colonel Commandant Royal Corps of Transport.

The Devil in the Deep Blue Sea

AN ARTICLE ON ROAD AND AIRSTRIP CONSTRUCTION IN MALAYSIA

By Lieut-Colonel G. G. Carter, MBE, RE,
lately with the Malaysian Engineers

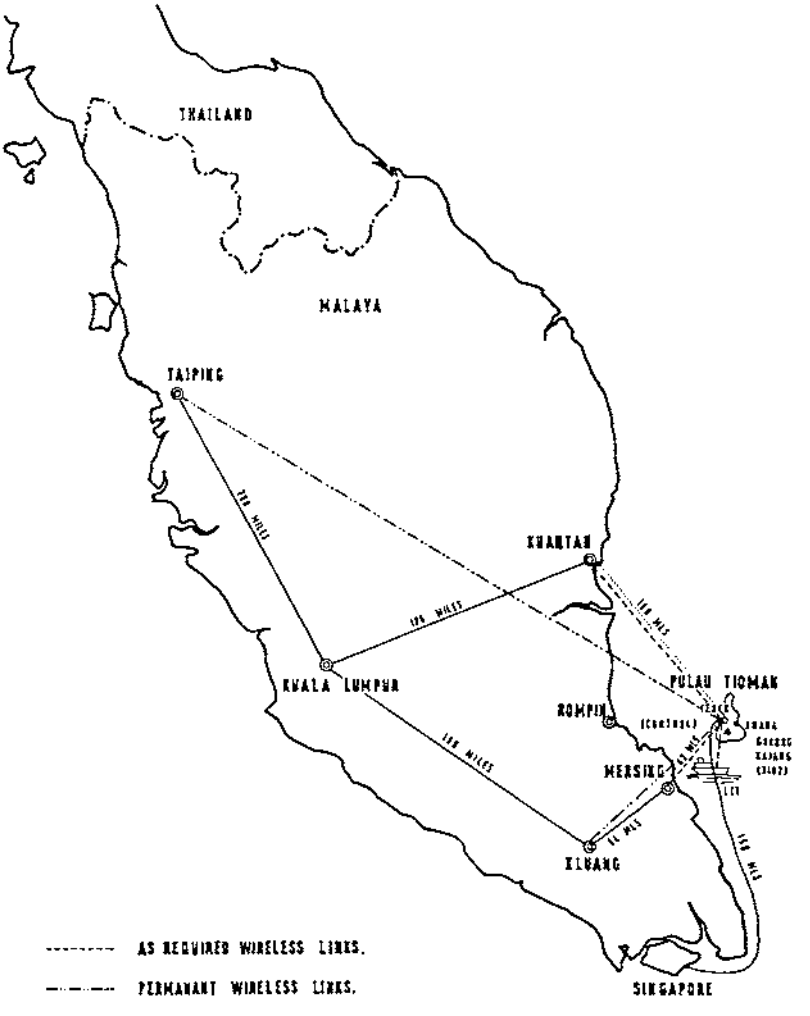
Once upon a time there was a dragon who lived with his family in Johore, in south-east Malaya. Like so many of us he had mother-in-law troubles and he was always being nagged about his lack of correct parental guidance in the upbringing of his dragonettes. One day he could stand this no more. Breathing fire, brimstone, and whatever else dragons breathe, he fled his heavily-mortgaged, confronted and infiltrated cave, leaped into the inviting ocean, and swam off into the south China seas. As he did so he was cursed by his mother-in-law who vowed that, unless he returned before sundown, he would be cast into stone. Ignoring this by now frequent stream of abuse he swam strongly on and on, anxious only to get as far away from it all as possible.

Soon he felt much better. As he wallowed around in the relaxing warm water he began to think that life wasn't so bad after all and (with remarkable tolerance) that perhaps some of mother-in-law's criticisms were at least partially justified. It would be a gesture he thought, if when he got back, he made the first overtures towards peace in this hundred year war with his omniscient relation by marriage. So in this magnanimous frame of mind he began to swim leisurely back to the mainland. As he contemplated the beauty of the setting sun he suddenly remembered the curse and, stricken with

3 ENGINEER SQUADRON - MALAYSIAN ENGINEERS

PULAU TIOMAN PROJECT

COMMUNICATIONS



panic, he swam with all his might straight for the shore. But as the sun finally disappeared below the horizon he was still some thirty miles from home and he was instantly turned into stone. And there he still stands to this day—the island of the dragon—Pulau Tioman.

Introduction

The intention of this article is to give a light-hearted account of the exploits of 3 Engineer Squadron, Federation Engineers (now 3rd Squadron, Malaysian Engineers) during their major 1964 task of constructing a mountain road and an airstrip on Pulau Tioman. There is no intention to produce a highly technical dissertation, and the only diagrams and tables included are those which are considered essential to appreciate the scope of the project, the general way in which it was tackled, and such problems and lessons which might be of interest.

3 Engineer Squadron was raised in the Federation Army on Malaysia Day, 16 September 1963. The nucleus of the Squadron was formed by the transfer from the British Army of 75 Malayan Field Squadron, an essentially all Malay unit forming part of the Engineer Base Group in Singapore. To those who have never tried it the process of transferring a unit from one Army to another is in itself quite fascinating, particularly with the easily dispensable assistance of both nations' financiers who—in the best traditions of their calling—solemnly refuse to pay for anything. The establishment of 75 Squadron was 5 officers and 204 soldiers, compared with 12 officers and 327 soldiers for the Federation Squadrons. The actual transfer strength was eventually 6 officers and, due to very rigid medical standards imposed by the Federation Army, only 180 men.

The Pulau Tioman project had been offered to the Chief Engineer of the Federation Army several months before the raising of 3 Squadron. He had decided that this was an ideal task for shaking down a new squadron, only just over half of which had worked together previously and then in a different Army, the balance being made up with young recruits fresh from combat engineer training. The project was put to me, as Squadron Commander, in June 1963 and was planned for the period February to November 1964. This allowed the Squadron over four months, in its new Federation Army station in Taiping, to receive its new recruits, reorganize, carry out both individual and collective training, and prepare itself for the Pulau Tioman project.

Pulau Tioman

Pulau Tioman lies some fifty miles due east of Rompin, a town situated in the south-east corner of the State of Pahang. The island, which forms part of the state of Pahang, is 12 miles long and 8 miles across at its widest point.

The journey to the island is usually made from Mersing, a small port lying WSW of the island. On approaching the island from the south one is immediately struck by its general resemblance to that of a dragon. The grotesque rock formation in the extreme south has the ferocious appearance of a horned head behind which a long and straight steep-sided spine stretches out to a tail at the northern tip. Although mountainous (highest point 3,400 ft) the island has several long stretches of beautiful, but narrow, sandy beaches. Apart from isolated coastal fringes of coconut plantations, and a few "cleared

areas" inland forming the first stages of an agricultural development programme, the island is covered in dense primary jungle.

Mother-in-law did an excellent job on the unfortunate dragon. The island is basically formed from a very hard, good quality granite with a number of out-crops of pure volcanic rock. In places there are deposits of soil, much of which is clay. However, due to the abundance of rock, and the whole island floor being strewn with closely packed boulders (many apparent as such and estimated in some cases to weigh as much as 1,000 tons), it is extremely difficult to excavate and transport soil to where it is required, and rock clearance constitutes the major effort required in the development of both communications and agriculture.

The coastal waters are deep and clear with extensive coral beds close to the shore. The waters support an abundance of marine life and they constitute one of the finest skin diving areas around the shores of Malaysia. This feature, combined with the (popularly imagined but rarely found) tropical blending of long narrow sandy beaches backed by the typical picturesque Malay houses interspersed among the coconut palms, makes the island a great tourist attraction. Undoubtedly it is a place well worth visiting. However, living on it, even for a short time, is peculiarly depressing and one's alcoholic intake appears to become proportional to the square of the unbroken time spent on the island.

The inhabitants of the island, who are almost entirely Malay and are largely of Indonesian origin, number just over 1,400, although this may by now have increased. The main centres of habitation, with approximately equal numbers of about 300 each, are the three coastal villages of Tekek, the island's administrative centre, in the west, Juara in the east and Mukut in the south. The remainder of the population is scattered around the coastline in either small villages or in single isolated houses. Tekek has an excellent newly-built and well-equipped school, a police station with good wireless communications back to the mainland, and a modern government-sponsored clinic with a qualified hospital assistant and a midwife. Before the current development the only form of transport between the mainland and the island, and on the island between the villages, was by boat, a slow and (in the monsoon) sometimes impossible journey.

Originally the local population derived its living mainly from fishing and copra. Recently, however, a few have been employed on the construction of the airfield and road and, as the road trace developed and the jungle clearance progressed, an increasing number were able to turn to agricultural development, a field which offers numerous possibilities including rubber planting and timber extraction. To date very little effort has been made to increase the local production of vegetables and other food and, in consequence, the bulk of indigenous foodstuffs has still to be imported from the mainland, together with all consumer goods. Apart from the agricultural possibilities, and the desirability of developing existing local industries, the island has a great potential (already adequately established in principle) as a tourist centre and holiday resort.

Development Background

Any development of the island's amenities and potentialities depended primarily on the expansion of both external and internal communications. As

part of the Malaysian national rural development programme it was decided to undertake this work in phases:

First Phase. The construction of an airstrip at Tekek, and the construction of a mountain road from Tekek to Juara.

Second Phase. The construction of a coastal road from Tekek to Mukut, and the extension and reinforcement of the existing light duty steel piled reinforced concrete jetty at Tekek.

Later (if fully justified). The construction of a coastal road from Mukut to Juara, and (at best only a pious hope) the completion of a coastal road around the north end of the island from Tekek to Juara.

The Public Works Department (PWD) Pahang (known in Malaysia as JKR—Jabatan Kerja Raya), whose headquarters are in Kuantan, was instructed to implement the first phase of this programme. They were, however, unable to provide from their own resources the staff and equipment required for these tasks, and the funds required to finance a project of this size if every aspect of the effort had to be costed in the usual way. An approach was made to the Ministry of Defence requesting that, as in many previous instances, military engineers should undertake the work. The Ministry agreed to this request provided that the PWD gave certain assistance. Broadly speaking the Squadron would provide the staff required for the planning, organization and control of the work, together with a high percentage of the earth-moving plant, vehicles, supporting equipment and labour: we would also arrange and execute the move to the island, the eventual evacuation and the intermediate moves of everybody and everything connected with the project, regardless of their origin. The PWD on the other hand would provide such plant and equipment, and skilled and semi-skilled labour, which was essential to the project and which could not be provided by the Federation Engineers. The tables at the end of this article give a quantitative interpretation of the finally-agreed division of effort, based on this general principle.

Reconnaissance and Planning

Apart from some outline correspondence with PWD, Pahang, which included the receipt of some maps, general notes and sketchy reconnaissance impressions from differing agencies, much of which subsequently proved to be classifiable as F6, no action was taken by the Squadron until October 1963, by which time the first hurdles of transfer and resettlement in Taiping had been satisfactorily crossed. Then, a small military reconnaissance party was constituted and despatched with orders to get itself to the island, find out what it was all about and not to return until it had found an airfield site, a road alignment and had made an approximate overall assessment of the task. Captain R. W. McK. Sanderson, RE was in charge of the party: he had with him an enthusiastic young Chinese officer, James Tuan (known to the Malays as Tuan Tuan!). This turned out to be quite an assignment and, due to rough seas, the party had great difficulty in even getting to the island.

It is not easy to find a road alignment in dense jungle where the contours on existing maps are hopelessly inaccurate and ground level visibility is virtually non-existent. No helicopters or sophisticated aids were available, and one can only enlist local knowledge and hopefully walk in different directions until reaching an impassable precipice. However, after an arduous and eventful three weeks a suitable airstrip site had been found (one way

only) and a possible road trace had been examined, although the road construction was ominously forecast as "an extensive and extremely difficult task".

After a thorough debriefing of the reconnaissance party initial thoughts began to crystalize on the general method of tackling the task, and the quantities of men and equipment required to complete the task within the agreed time scale. However, it is always as well before going into print, when time is available, to murmur abroad these outline ideas and listen to the advice and thoughts (and even non-negotiable orders) of others. Informal discussions were held with PWD, Pahang, and these were followed at the end of the month by a high-powered "confirmatory look at the ground" by a party consisting of the State Engineer, Pahang, Mr R. S. Kendrick, OBE, and his rural development officer (at that time Mr P. Kirwan), on the PWD side, and the Chief Engineer, Federation Armed Forces, Lieut-Colonel E. M. Mackay, MBE, RE, myself and Sanderson on the military side. The Royal Malaysian Air Force was persuaded to release one of their new Alouette III helicopters for an overseas journey and, complete with an overhead Twin Pioneer escort, we set off for the island. This turned out to be quite an exhausting day at the end of which all my outline plans were approved in principle. The project was deemed to be eminently feasible and suitable for military engineers and with a "carry on chaps and good luck, let us know if you want anything" the hierarchy departed and the less exalted ranks were left to start thinking seriously about the problem.

Over the next few months discussions, liaison and planning proceeded in an orderly and uneventful fashion. I decided that the task did not justify the presence of the entire Squadron on the island nor, from a number of considerations (both unit, project and Federation Engineers), was this desirable. The ideal military force, to match the available plant and the promised PWD contribution, seemed to be the Plant Park Troop (less certain base elements), Two Field Troops and elements of Headquarters and MT Troops (a total military force which fluctuated between 160 and 180 men). This left a field troop in Taiping to cope with other mainland tasks allotted to the Federation Engineers, together with a sound administrative base which was best suited to handle all aspects of Squadron business, including an annual administrative inspection, all the annual specialist inspections and the preparation for the Squadron's move to Sarawak later in the year. It also gave me an excellent set up for continuously swanning around the countryside. Details of the major items of plant, transport and ancillary equipment employed on the project, and the numbers and organization of military and civilian personnel are given in the Tables at the end of this article. I do not intend to enlarge on these.

It was decided to base the task force at Tekek. The only real objection to this was that the mountain section of the road would have to be tackled upwards from the more difficult steeper side, rather than downwards from the top of the ridge. However, the advantages of Tekek over Juara were in all other respects so overwhelming that there was no sensible alternative. The PWD agreed to let a contract for the construction of a temporary camp for the task force and they also agreed to loan us an experienced American Peace Corps plant operator to help us with the cutting of the pilot trace to the top of the ridge.


3 ENGINEER SQUADRON MALAYSIAN ENGINEERS
PULAU TIOMAN PROJECT
ROAD TRACE - TEKEK TO JUARA
DISTANCE 6 1/4 MILES

The method of movement of the force to the island had already been decided as by Landing Craft Tank (LCT), to be hired from the British Army in Singapore. Four journeys would be required. Other possibilities had been considered but none compared with the LCT either on grounds of general feasibility, practicability or cost. In January 1964 a joint reconnaissance was made with 46 (*Div*) LCT Squadron, RASC to confirm the general suitability (and restrictions) of the Tekek beaches. This showed that, despite the presence of underwater rocks, there was always a sufficient depth of water on a reasonable tide to ensure the ship's safe passage for the two hours before high water. The ship had to be off by high water as, if worked on a falling tide, there was always the possibility of her being left high and dry on an unlevel and rocky shore and this, of course, was quite unacceptable. Furthermore working at this state of the tide would allow unloading to take place over the steeper part of the beach, thus minimizing the negotiable water gap.

The possible mainland loading points for the LCTs were Singapore, Mersing, Kuala Rompin and Kuantan. Early reconnaissance of these locations quickly ruled out Kuala Rompin and Mersing; neither location was accessible by a first class unrestricted main road, neither location could provide a firm and sheltered loading area with a steep enough bank to ensure a dry ramp on the LCT, and neither location had any special advantages which outweighed these disadvantages. Singapore and Kuantan on the other hand had none of these disadvantages. Singapore had the special advantages of being the home port of the LCTs, of possessing a special-to-ship concrete loading ramp for LCTs operated and backed by the full facilities of 10 Port Squadron RE, of being served by a railhead and of being a large centre of both civil and military civilization with all the tangible and intangible benefits that this implies. Kuantan on the other hand, whilst possessing none of the special advantages of Singapore, was perfectly adequate for normal LCT operations (for which it had already been approved), working from the sheltered banks of the Kuantan River. It also had special advantages of its own. In the first place much of the plant earmarked for the project was already in the area, the military plant having just completed work on a nearby major civil road construction project. Furthermore it had been decided that all plant for the project must be the newest and the best available and must be thoroughly inspected and tested (and if necessary, overhauled) before being shipped to the island: any other policy would indeed be shortsighted. Kuantan housed the Headquarters of PWD, Pahang, our sponsors, and with it one of PWD's largest State Mechanical Workshops: this factor alone really outweighed all others as all our plant could be marshalled in, and checked out by, the workshops of the parent developing state (who were to pay our major spares bills and provide any base repair facilities required during the project), and we should be able to call on PWD's resources for assistance of any kind in Kuantan. So Kuantan was, therefore, agreed upon as our take off point from the mainland.

Outline specifications were agreed verbally with the PWD for both the road and the airstrip and the Royal Malaysian Air Force (as the probable major users of the airstrip) were consulted on the latter. The airstrip was to be built to Twin Pioneer standards which, including overrun and underrun, effectively requires a pavement 500 yds long by 30 yds wide (cleared to 50 yds) plus an off strip parking area 200 by 100 ft. The road was to have a formation width of 30 ft between ditches, a 6 in thick waterbound macadam

surface to a width of 20 ft, and a ruling gradient of 1 in 15 with a maximum gradient of 1 in 10. This was a demanding specification for the mountain section of the road.

By the end of January all seemed to be under control. Planning was well advanced and even the implementation of the plans seemed feasible. The associated supporting agencies were all booked and ready to phase in accordance with the agreed schedule. I had already secured an unbreakable grip on the promised American Peace Corps representative (Charlie Judd) and had resolved, or agreed as irresolvable, most of my differences with the PWD. In fact relationships with the PWD staff were excellent: they were a splendid bunch—it was not their individual faults that they were collectively victims of such a constipated system. The key officers were the Senior Executive Engineer (Rural Development)—Fred Hazlewood, the State Mechanical Engineer—Thamalingham and the State's Plant Superintendent—Charlie Clingan: their names will be mentioned later but undoubtedly, without their collective help and personal efforts, much less would have been achieved.

The Move to the Island

Every large town in Malaya possesses an official government sponsored Tourist Information Centre. One day in late February Sanderson and I visited the Kuantan Centre and were glancing through a newly produced tourist brochure. We were struck by the statement ". . . boating to the island of Tioman is an interesting affair . . .". Little did we then realize just how masterly an understatement this was and, in fact, just how interesting this boating could be!

We had in fact gone in to the Centre to talk to the Harbourmaster. The north-east Monsoon, due to peter out at the end of January, was still in full spate, our first LCT was already 24 hours overdue on its journey from Singapore (at £300 per day!) and the movement of all small boats over the sand bar, across the mouth of the Kuantan river, was suspended. The Harbourmaster felt that it was quite impracticable even to consider the chances of discharging any cargoes on the Tioman beaches under these conditions, and viewed us both as in need of mental care and attention. Later that afternoon, whilst talking on the wireless to the officer in charge of the advance party on the island, Captain Chang, this view was confirmed: Chang's opinion was that conditions were quite unfavourable and the operation must be delayed. This was a good start!

The advance party, some twenty-five strong, had been scheduled to arrive on the island approximately ten days before the first LCT arrived. However, because of the appalling weather, they were unable to persuade anybody to take them across despite the very determined efforts of this resourceful Chinese officer who usually managed to "exert pressure" on the locals (a strictly Oriental practice on which no questions are asked). Eventually Chang had persuaded one of the larger boats to divert to Tioman on its routine run down the East Coast, and he and his party finally arrived less than three days before the first LCT was due, after a very eventful journey on which they almost lost most of their stores whilst transferring to a smaller boat in Tekek Bay. Their tasks were to lay an improvised ramped exit on to which the LCT could line up as it beached (thus facilitating the discharging of the cargo and its evacuation from the beach), the supervision of the final stages of the camp

construction by the PWD's contractor and the general organization required for the reception of the first men and equipment. They had their problems. Every time they built an exit the succeeding tide (heightened by the heavy swell coming straight off the sea) washed it away. The contractor's boat lay moored in the harbour, where it had been for several weeks, unable because of the swell to get in alongside the jetty: the contractor had nevertheless tried to get some of his stores ashore and the coastline was strewn with various lengths of 4 × 2 in timber. Clearance of the camp site had not even been started. Unperturbed, Chang took over the fisheries huts, the school and various other buildings and got himself as well organized as was possible in the circumstances.

The LCT arrived in Kuantan later that evening and having berthed in the Kuantan river, opposite the loading ramp, a hurried conference was held on board with the military engineers, the PWD and the skipper, who, of all names, had to be called Flood! This was no day for superstitions or faint hearts. I persuaded everybody (against their better judgement, and my own) to continue with the operation, and loading was scheduled to begin on the rising tide at 2 pm the following afternoon, a Sunday. All went very well. So it should have done. It was gratifying to reap the fruits of hours of detailed planning and rehearsal during which the ship's cargo deck space of 114 ft by 24 ft, together with its entrances, had been laid out and "loaded" in the PWD yard: many pieces of graph paper had been flung into wastepaper baskets in repeated attempts to achieve the most economical loading and every available gap was crammed full with drums of diesel oil of which we had to move 12,000 gallons. It all fitted beautifully. By 6 pm LCT *Agedabia* was sailing up the comparatively peaceful waters of the river towards the open sea. On deck the men were going through the lifeboat drill with the first mate, after which they were given anti sea sickness pills: they then had to set about finding available shelter for the night. In the wardroom Sanderson and I, together with Fred Hazelwood and Charlie Clingan, checked and rechecked on our proposed unloading and recovery drills. Our confidence rose with our beer intake until, with a pyramid of beer cans wedged from the table to the ceiling, we retired to bed.

Agedabia reached Tioman early the following morning. Unloading could not begin until 5 pm and so we anchored in Tekek Bay. Chang came out to meet us and several of us went ashore to discuss unloading problems. Certainly there was a heavy swell and the ramped exit constructed on the beach had been severely damaged. Once the equipment could be got on to the dry sand its exit from the beaches on to some firm ground beyond the high water level presented little difficulty. Getting it across the wet gap without every item getting drowned, or stalling and becoming the subject of a major recovery operation, was obviously going to be the problem. At the start of unloading, two hours before high water, whilst the LCT was bow-heavy and before the rising water carried her in a little to the steeper, and more favourable, slope on the beach (all reducing the wet gap), the nominal water depth was going to be about 4 ft. With the swell this was going to vary every few seconds between 2 and 6 ft. The 6 ft depth was unacceptable and had to be reduced. Some form of improvised sunken manoeuvrable platform was therefore required to raise the equipment at least 2 ft above the sea bed in this critical stretch near the ship. A sunken but moving coconut trunk, cut by the advance party as part of one of their destroyed ramps, provided an idea: it

stayed under water and, although ashore of formidable and normally unmanageable weight, thanks to Mr Archimedes it could be maneouvred under water with ease. Coconut palms were in abundance and we had chain saws, wire and labour. We set to stock-piling logs on the beach. As soon as the water receded to just below the half tide mark we started to construct our platforms, on the water's edge: there were four of them, and they were virtually 15 ft square sections of lashed coconut corduroy track, giving a total lift of just over 2 ft.

By 4 pm all was ready and the LCT made its approach run. As soon as it grounded we moved our platforms, now just movable at one hour after half water on the rising tide, into line. This was not easy, particularly with the platform nearest to the boat where the water was coming up to 6 ft. But it was worth every bit of the effort. Down came the ship's ramp on to the end of this 60 ft of submerged roadway. The step at the end of the roadway was masked with sandbags. Off came the first vehicle, a D7 with Hyster winch, straight up the beach to its recovery station. Once it was there we all felt much happier: we now held a trump card. The rest of the unloading proceeded fairly smoothly, but after an hour our roadway became a liability as it was now preventing the LCT driving forward up the beach as her bows got lighter and the water got deeper, and it could no longer be manoeuvred in the deeper water—also the sandbags on the end step had moved and vehicles were getting an unpleasant bump. However, it was a simple matter to back the LCT off and run her in again alongside the coconut tree roadway as by now we were working on the steeper part of the beach. By 5.45 pm we were through. We retracted and set sail for Kuantan, ready to deal with the next load.

Reloading the LCT in Kuantan for our second trip was uneventful, although it took a little longer due to the inclusion of three extremely awkward and, almost unmanoeuvrable, iron-wheeled stone crushers. Weather conditions had if anything worsened but, after giving all concerned a well deserved rest, we again set sail for Tioman.

In retrospect we all felt that the unloading of this second LCT was the most exciting episode of all our water transport exploits. Due to the time of the high tide it could not begin until just before dusk: the bulk of the unloading therefore took place by floodlighting which, together with two generators, we had brought over on the first trip. In the event we had a 30 knot gale blowing straight off the sea and torrential rain accompanied the whole operation. The swell and surf had increased in proportion and conditions were probably as bad as they ever could have been. On the credit side we were beginning to know the ropes, we had done the operation before, we had a shore organization with resources of its own, and our trusty D7 with its Hyster winch was already reassuringly in position. The unloading was accomplished without serious incident but watched from the bridge of the LCT it was an impressive sight.

An amusing incident with one of the PWD smooth steel wheeled road rollers occurred during the early stages of the unloading. Driven by an Indian Malaysian it went down the ramp in fine style. On encountering the uphill sand at the change of slope at the bottom of the ramp it lost tractive effort and stuck. At this point, in the deepest water of its journey, a swell upsurge started to fill the driver's cabin and the poor chap fidgetted and gesticulated and looked most unhappy. The swell receded and he somewhat apprehensively regained control whilst the winch cable was being paid out. However

the next swell upsurge was a monster. It filled his cabin and, the fan having sent up a large and spectacular water spout, the engine gave up the ghost to the accompaniment of a disastrous hissing sound and other expensive and ominous noises. A loud shout of "Oh my God I am drowning", reminiscent of the best Sellar's records, rang out and the driver abandoned his roller! As he jumped off, the swell receded, and he was instantaneously standing in less than 2 ft of water. He obviously felt a little sheepish and remounted to steer his roller out under the power of the winch.

The next two LCT disembarkations, later in March, were comparatively uneventful. The weather was fine and the sea was calm. We were not able to have four consecutive LCT loads as the ships were required to meet urgent operational requirements in Borneo. This turned out to our advantage as we were experiencing delay in the clearance of all our plant through the PWD workshops. On the island Chang, with finer weather and with plant, men and equipment at his disposal, had worked wonders. He had organized the camp building contractor and, on consideration of a small donation to the project funds, had levelled the site for him and boosted his labour force. He had constructed an excellent unloading ramp and had built a good road from the jetty, past the unloading point, into the camp. The third LCT, containing only small stores on Service Corps wheels (a total of 15 × 3 Tonners plus 2 × Land Rovers and trailers), was unloaded in twelve minutes: the LCT stood by while these vehicles were unloaded in the camp and within an hour and a half all the empty vehicles were back on board and we had set sail back to Kuantan. The fourth run presented no problems and the LCT returned to Singapore on 20 March, three weeks after the previous session had ended. Sanderson had remained with the third load. Lieutenant Chidambaram, "our man in Kuantan", who had executed all the loadings had evacuated Kuantan with the fourth load, and he too remained on the island.

By the end of March the camp was completed, occupied and fully functional. The task force was now ready to start work.

The First Three Months

During March the advance party had already carried out some work on the airstrip site. Charlie Judd, who had arrived with the first LCT, had also progressed a few hundred feet up the mountain section with his initial pilot trace for the road. Now with the complete facilities of the force available to him, and working from a sound and efficient base under Chidambaram's control, Sanderson was able to bring the full potential of the force to bear on the two tasks. Whilst it was desirable to make the airstrip functional as soon as possible the overriding plant priority was to get the pilot trace through to the ridge at Red Hill. Provided that the pilot trace from Tekek to the top of the ridge remained passable to logistic traffic (Land Rovers with trailers, or even D4 with trailer) then the continuation of the pilot trace through to Juara, and the recutting (backwards) of the mountain section, could proceed concurrently. It was obviously going to be some time before the mountain quarry could be opened. I had estimated that to produce the minimum quantity of 3,000 tons of crusher run rock required for surfacing the road it was likely that our crushing capacity would have to keep at it for at least six months. It was obviously vital to open up an interim quarry at once, even if this meant stockpiling crushed stone in the wrong place!

The weather was not kind to us during April and May: during these two months a total of forty working days (out of the sixty available) was lost due to rain. However, Charlie Judd never got discouraged and he was a tremendous inspiration to us all. He had his problems. Whilst conditions were very wet it was not possible to drive anything up the pilot trace except an occasional trip with the D4: the two D7s at the head of the trace were only brought down in exceptional circumstances. Therefore getting his fuel up and, for much of the time, the daily ascent of himself and his operators required a major effort. Nevertheless, on morale grounds, I was convinced (and all agreed) that it was far better to return every night to the comforts of the base rather than camp in misery on the hill. By the end of April he had made it—he was "up the hill": a tortuous journey it was too, with a slope of 1 in 1¾ at one particular hairpin twist. By early May he was streaming across the Padi Jepun to Juara, which the pilot trace reached in early June.

Chang, controlling the field troop labour, had the primary task of setting up a temporary quarry and producing the required stockpile of stone. His only readily accessible supply of rock was on the beach near the start of the mountain section; it was never entirely satisfactory as it was not a solid source but a collection of massive boulders. He set up his stone crushers a hundred yards away on the sea shore and along-side the road, in as efficient a position as he could find. By the end of June we had reached a stockpile of over 1,500 tons of crusher run. It was not an efficient system, but at least we had some stone.

Meanwhile the airstrip progressed well. The north end of the site was extremely low lying and boggy: this required extensive drainage and considerable fill, but, although we had to divert a river, we won in the end. Much of the soil in this area was of course silty sand. Some good clay was located near the south end of the strip and this was won with towed scrapers and front-end loaders working to tippers, and was used for the main fill and for mixing in with the existing silty sand. This gave a good final surface although, due to lack of proper compaction throughout the depth of fill, we had to excavate and relay in two small areas. One area was the old river bed, which was subsequently found to have been back filled with the inclusion of old palm trees. The NCO responsible for that was quickly sacked. The other area was at the north end of the strip and was solely due to bad compaction.

The airstrip received its first aircraft, a Single Pioneer of the Royal Malaysian Air Force, on 7 May. The Air Force were unhappy about the length of this one way strip (one way due to the hill at the south end: nothing simple could be done to make it two way) and during May the strip was gradually extended until it had a usable surface of 720 yds by 40 yds, compared with the originally agreed requirement of 500 yds by 30 yds. The airstrip was proved by a Twin Pioneer in late May but, because it was one way, it could only be cleared for operational use and not for regular unrestricted use. Two major problems had become obvious during the construction, those of surface erosion in the wet weather and the dust menace when it was dry, both of which would be best solved by an effective surface seal. The PWD suggested trying a bitumen prime and seal process which they had used successfully on previous similar surfaces. The bitumen required (some 300 drums), together with items of plant and equipment which had not been ready by the middle of March and more diesel oil, was imported in mid-May by a fifth LCT run which was quite uneventful. During June the prime and

seal process was carried out and by the end of June we had an excellent looking bitumen surfaced airstrip, 450 yds by 30 yds, with 100 yds overrun, 170 yds underrun (both fully usable as airstrip), wide shoulders and a parking area. And that was it! I resolved to extend it no more! I could see and appreciate some of the Air Force's difficulties and I knew there were unpleasant air currents in the Tekek bowl: but one can go on for ever in an attempt to please, and I felt we had gone quite far enough.

During May, as it became free from the airstrip, plant was redeployed on to the road. By the end of June road construction on the Juara side of Red Hill was well in hand from Red Hill to chainage 250 + 00. On the Tekek side the Tekek section was complete and work was progressing slowly on realigning the Mountain Section from Red Hill down to the stone crushers' site. In the last two days of June one of the Field Troops was relieved by the Troop from Taiping and certain HQ and MT Troops personnel were also changed and, where possible, Plant Park Troop personnel. This change over was effected by train between Taiping and Kluang and by Twin Pioneer between Kluang and the island.

The Second Three Months

Early in July I was told that the Squadron's move to Sarawak had had to be advanced by a month and we were now required to be fully operational in the Borneo States by the end of November. Allowing for evacuation of the island, clearing up the loose ends on the mainland, consolidating in Taiping and carrying out pre-Sarawak administration and taking accumulated annual leave and embarkation leave, it would be necessary to stop work at the end of September and evacuate the island during early October. Even this was cutting it a bit fine. Obviously it would not be possible to complete the road to the original specification and it was agreed with the PWD that we should omit the laying of the water-bound macadam surface. We would open up the mountain quarry, move in the crushers and stockpile more crushed stone there. Whilst I was disappointed with this restriction it was a tidy compromise.

The weather was much kinder to us during these three months and we lost, due to rain, only seventeen working days out of the ninety, and progress was good. By the middle of August the road was complete from Red Hill to Juara and almost the entire effort was now employed on the mountain section. With the exception of the surface (omitted due to the agreed reduction in the scope of the project, following the reduced time scale) and one short stretch of road on which the gradient was one in seven, the road was completed on time to the specification. The PWD even got a bonus! As some of the heavier plant completed the main earthworks on the mountain section so it was redeployed on to a Phase II task, the cutting of the road to Mukut. Approximately 1½ miles of the pilot trace for this 10–12 miles of road was cut and, but for the breakdown of two of the D8s, we would have gone much further.

We had stockpiled the required 3,000 tons of stone, albeit at the bottom of the hill, and the only effective crusher was obviously very sick. There was little enthusiasm for setting up the mountain quarry! However when we left the island we had laid it out, finished the earthworks, blasted to the start of a promising rock face, stockpiled a large quantity of block stone and moved the crushers on to the site.

Stone had in fact been our *bête noire* throughout the project. There was.

always too much where we did not want it, and we had to remove it: there was never enough where we did want it, and we had to generate it. We had had to carry out considerable rock blasting even to get the pilot trace through. To achieve our final formation we had had to blast, to a greater or lesser degree, over the entire length of the road, except on the short flat Tekek section. On the Juara section, although the incidence of stone had been high, it had broken up more easily and some of it could be removed by dozing without blasting; this type of rocky soil was ideally suited to compaction with our Hyster Grid roller. Charlie Judd was always complaining that there was a lack of "good dirt" on "this goddam island" and he was right. Fortunately Red Hill provided an excellent reservoir of "good red dirt". Soil from Red Hill in fact provided much of the formation (on top of the rock) both on the mountain section and across the Padi Jepun: in all some 30,000 cu yds must have come from there.

In the quarry all our secondary breaking had to be done by explosives. Boreholes were not satisfactory as, although more economical in explosives, they were time-consuming, detracted our limited compressor capacity from primary blasting boreholes in both the quarry and on the road formation, and they tended to break the rock up too small and distribute the fragments too far. Instead we resorted to plaster-blasting (pop-shooting), unless the pieces were so large that they required over $\frac{3}{4}$ lb of explosive to break them up ($\frac{3}{4}$ lb being approximately commensurate with the point at which plaster blasting becomes ineffective), in which case boreholes had to be used. Together, on the road and in the quarry, we were using 1,000 lb of explosive and 5,000 ft of cordtex a week: the consumptions of blasting caps (detonators) and safety fuze were, by comparison, negligible.

A second field troop change over took place at the end of August. On this occasion, due to operational commitments, it was not possible to obtain the use of the Twin Pioneers: the journey, therefore, from the railhead at Kluang to the island had to be effected by road and sea. Whilst this went quite satisfactorily it certainly emphasized the tremendous advantage of air trooping. With the departure of this troop of oldest inhabitants the project also lost Chidambaram (and his Malaysian war hound) who had handled the entire administration of the force from the beginning. This had been no mean task. Daily supplies were assembled in Kluang under the control of a small Squadron detachment commanded by an extremely capable Sergeant. The detachment moved these supplies forward by road to Mersing where they married up with the launches which we used for the sea crossing. The control and productivity of this lifeline were a constant headache to Chidambaram, and many wireless hours, telephone calls and great patience were spent on its maintenance. However, despite its ricketyness, it always produced the vital rations and mechanical spares which was a great credit to all concerned with its operation. An adequate supply of reserve compo rations was held on the island and air supply channels were always available in an emergency. Compo rations were used extensively during the first few weeks of the project when the weather was particularly bad. Air supply was also used at that time to bring in fresh rations to relieve the monotony of compo. However the air supply chaps were very heavily committed and we only requested their services when essential.

In addition to the fundamental logistic question of supply, the administrators had their other problems both on the A and Q sides. Pulau Tioman was a

highly malarial area and in the first few weeks of the project malaria caused an almost complete turnover of the PWD staff: it was not long before all the civilians were paraded on pill mornings. Routines for the regular supply of films, purchase of canteen items, collection of cash for fortnightly pay parades, compassionate leave and course attendances all took time to work out and settle down. Towards the end of the project we even had marriages on our hands! Wireless communications have already been mentioned: whilst we achieved the highest possible standard with the equipment available these communications were never entirely satisfactory. Our "Pronto", an electronics genius, tried everything possible to improve these communications, particularly with sophisticated aerial systems. Signals personnel were most impressed by his efforts and readily conceded that there was little else that could be done.

A special word is justified on the supply of mechanical spares, for plant, ordinary transport and a range of static and specialized equipment. This to a limited extent also covers project stores, explosives, fuel and other key items affecting the technical engineering progress on the task, although none of these items was ever as continuously critical as the supply of mechanical spares. In the majority of cases it was vital that such spares were supplied promptly. Without them machines would be out of action and our output would be below our potential, and this was unacceptable. The Malaysian Ordnance Corps had, as yet, been unable to match the rapid and recent expansion of the Engineers' plant holdings and most of our plant spares had to come direct from the main civil agents. Although the situation with spares for some of the normal transport was easier (notably Land Rovers), it was still the practice for Ordnance to buy direct from the trade against individual indents in probably well over 50 per cent of the cases. It was always quicker, if one had access to a cash account, to go to the agents. With our extended and complicated military lines of communication, and our complete dependence on the immediate delivery of spares to a task which had to be finished in a set time, it was obviously imperative to deal directly with them. I effectively had the cash in as much as PWD had agreed to supply certain spares consumed on the project: I in fact got them to agree to our procuring the spares and sending them the bill, a highly illegal practice but overtly moral and perfectly justified in this case. I was also quite ruthless about the interpretation of what we procured on this system—everything! None of us ever admitted this and we kept the potential interfering elements happy by duplicating certain demands through the official channels. As few of the parts, thus demanded, ever materialized this duplication presented no problem. Our own staff branch in the Ministry of Defence were covert connivers to this system and were a tremendous help to us as our on-the-spot progress chasers, most of the agents being in Kuala Lumpur. Undoubtedly our spares would have proved to be very expensive if the costs had been analysed. However I had a job to do in a certain time and I was not going to be hamstrung for a lack of spare parts caused by the inflexibility of a ponderous system!

In an essentially informal narrative, such as this, it is difficult to know what to omit. Let it suffice to say that we got the job done. The evacuation was uneventful. How lightly can one dismiss all of that poor officer's carefully planned and excellently executed operation? His last load was entirely towed crocks! However with Charlie Clingan's assistance it all arrived back in Kuantan safely even if the 19 RB face shovel did slope arms as it left the LCT.

We had learnt a lot and were able to leave the island with a feeling of achievement and we were far better equipped to tackle our next assignment. And so it was back to the mainland and the dispersal of our well-worn equipment, much of the military content of which was now due for its annual CIV Inspection. Back to reorganization, leave and Sarawak. Life was never dull.

Lessons Learned

I have listed below, in no particular order, the points which, on reflection some months later, strike me as worthy of special mention. Some of these points have not been mentioned previously, as I have not had the space to discuss every aspect of the project in detail.

a. Nearly all accidents can be avoided. Between us I think we prevented a number of possible accidents by stopping or modifying, as we saw them, practices which were potentially dangerous. We were extremely lucky in as much as whilst working under these difficult conditions we only suffered three personal injuries, one moderate and two minor, and five vehicle accidents only one of which had to be classified as "Beyond Economic Repair", and then only because the same vehicle sustained two accidents. We kept on using it to the end of the project, and even evacuated it back to the mainland. However none of these particular accidents should have occurred. In every case it was established that either normal safety precautions had been neglected, or that direct orders had been disobeyed. In these circumstances immediate and severe disciplinary action must be taken.

b. It is possible (indeed it is a pleasure) to work with the PWD. Our basic aims in life are the same but our systems are different. However this is the fault of neither party and on a combined operation, such as this, mutual tolerance must be exercised and the two systems must be welded together as harmoniously as possible. Complaints, bones of contention, moans, and any source—or possible source—of discord must be brought out into the open and worried literally to death. Acceptance of each other's limitations, together with complete honesty and frankness, is essential.

c. Under the circumstances surrounding this project and, I suspect, this is true on any plant task under almost any circumstances—it was certainly true in Sarawak—the largest single problem of all is the rapid supply of the required mechanical spares. It is almost impossible to devote too much thought and effort to the continuous solution of this problem, a solution which must be based on a flexible and generous approach, a solution which must if necessary be selfish, quite ruthless and completely single-purposed. If a job is worth doing at all it is worth doing well and quickly: this demands efficiency and awareness of productivity. Plant must be kept working, almost at any cost!

d. There is no short cut to proper compaction. The right roller must be used to match each set of circumstances. Compaction is a science and must be approached as such. In practice it must be adequately supervised.

e. As a first priority let the sun get at the whole of the working site. When rainfalls are high and frequent, rapid drying out is vital.

f. Tippers which are the product of superimposing a tipping body on a standard 3/5 ton conventional load carrying vehicle chassis are, without doubt, quite the most useless compromise ever made.

g. The corrosive effects of salt water are grossly underrated, and every step must be taken to neutralize, or reduce, these effects where salt water working cannot be avoided.

h. Rock must be one of the most "cussed" commodities with which civil engineers have to deal. Its handling, particularly in quarries, needs careful planning, close control, constant supervision, and—where possible—as much experience and expertise as are available.

j. There is no need to be frightened of an LCT or a seaborne operation. The success of such operations does depend on careful and meticulous planing, rehearsals and reliable information: however, previous experience is not required and the entire process is a matter of common sense. If you are directly in charge of such an operation then personally measure every single piece of cargo—many vehicles of ostensibly the same group are different sizes!

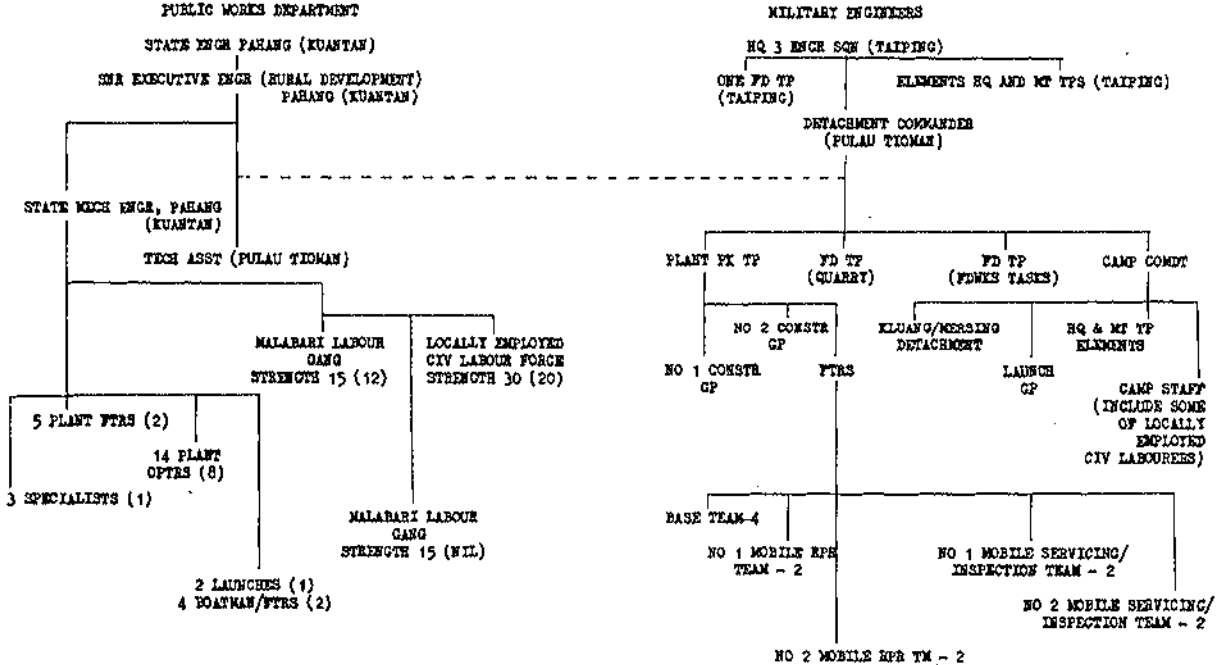
k. Time and tide indeed wait for no man!

PULAU TIOMAN PROJECT

Plant/Transport/Ancillary Equipment

Plant	Military	PWD	Total
1. Tractors			
A. Size I Tracked Caterpillar D8H tilt dozer (Powershift)	2	—	2
Tracked, Caterpillar D8H, angle dozer	2	—	2
B. Size II Tracked, Caterpillar D7, angle dozer (one with winch, one with CCU)	—	2	2
Wheeled, Michigan 180, bulldozer with CCU	1	—	1
C. Size III Wheeled, Michigan 75A, with front end loader	3	—	3
D. Size IV Tracked, Caterpillar D4, angle dozer	—	1	1
(ii) Wheeled, Fordson Super Major, fitted with front shovel and backhoe	2	—	2
2. Excavators, tracked, 19RB (one long boom, one face shovel)	2	—	2
3. Graders, 12 ft mouldboard, Austin Aveling	3	—	3
4. Scrapers, towed, 8 cu yds, Onions	2	—	2
5. Rollers			
Self propelled, smooth wheeled, Aveling Barford 6/10 tons	1	1	2
Self propelled, pneumatic tyred, Pacific 33TC	1	—	1
Towed, vibrating, Pacific ACE 30 cwt	—	1	1
Towed, Hyster, grid (three drum)	—	1	1
Transport			
6. Trucks, ¾ ton, 4 × 4, Landrover, LWB	5	—	5
¾ ton, 4 × 4, Landrover, SWB (project vehicles)	2	—	2
7. Trucks, 3–5 ton, 4 × 4, tipping Bedford	6	—	6
3–5 ton, 4 × 4, Leyland	—	2	2
8. Trailers, 15 cwt, two wheeled, Scotthorn	4	—	4
Ancillary Equipment			
9. Stone crushers (2 × Parker, 1 × Pegeson)	—	3	3
10. Compressors, 600 cfm (Broomwade)	1	—	1
315 cfm (Holman)	—	1	1
275 cfm (Atlas Copco)	—	1	1
11. Generators (1 × 15 KVA, 1 × 10 KVA)	—	2	2
12. Workshops Trailer	—	1	1
13. Concrete mixers	—	2	2
14. TOTALS	37	18	55

PULAU TIOMAN PROJECT OUTLINE ORGANIZATION



NOTES:- UNBRACKETED FIGURES SHOW PLANNED NUMBERS. FIGURES IN BRACKETS SHOW AVERAGE ACTUAL NUMBERS THAT MATERIALISED FROM THE PWD.

APPROXIMATE TOTAL STRENGTHS:- MILITARY 160 - 180
CIVIL PWD - 56 (25)
LOCAL - 30 (20)
TOTAL - 86 (45)

TOTAL FORCE: 240 - 240

Rough Going. A typical length of the pilot track near Tekek

Lover's Leap. Part of the mountain section of the road

Red Hill

Twin Pioneer landing from the south end of the airstrip

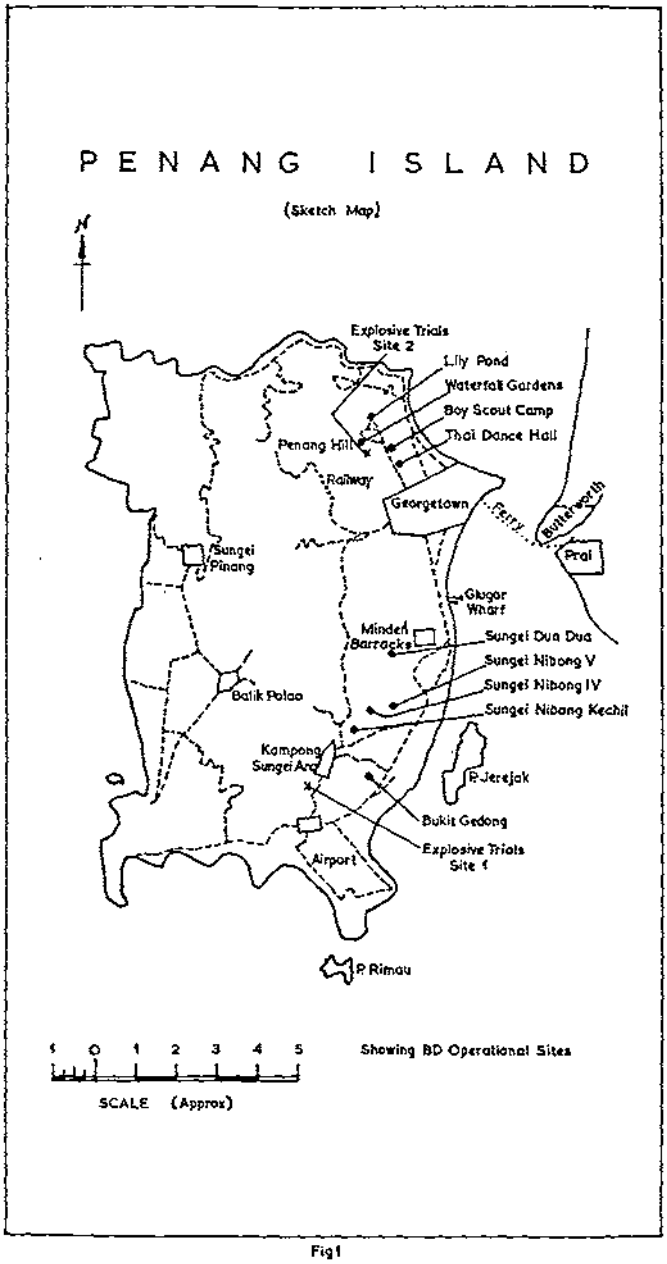

PENANG ISLAND
(Sketch Map)
N
Explosive Trials Site 2
Lily Pond
Waterfall Gardens
Boy Scout Camp
Thai Dance Hall
Penang Hill
Railway
Georgetown
Ferry
Butterworth
Prai
Sungei Pinang
Glugor Wharf
Minden Barracks
Sungei Dua Dua
Sungei Nibong V
Sungei Nibong IV
Sungei Nibong Kechil
Balik Pulau
Kampong Sungei Ara
P. Jerejak
Bukit Gedong
Explosive Trials Site 1
Airport
P. Rimau
5 4 3 2 1 0 1 2 3 4 5
SCALE (Approx)
Showing BD Operational Sites

Fig 1

Bomb Disposal in Betio and Penang

By "MANX"

Two interesting overseas tasks were completed in March 1966 by an officer and an NCO of the BD Unit (UK) RE. The first was the clearance of Betio, a small islet in the Gilbert and Ellice group, and the second subsidiary task was a full technical reconnaissance of the Japanese bomb and mine dumps in Penang Island. Major H. P. Qualtrough, MBE, RE was the officer supported by Sergeant "Joe" Cooke, BEM, RE. They were allowed the minimum of stores, and this article outlines not only the bomb disposal problems, but also the difficulties of doing a job 17,000 miles from home.

In 1963 Mr Val Anderson, the High Commissioner for the Gilbert and Ellice Islands, requested that tiny Betio be cleared of the tons of bombs and shells that littered the island. It had been the scene of a fierce battle between American Marines and Japanese defenders during which 3,000 tons of bombs and naval shells were poured on to the newly-completed airstrip and surrounding bunkers. The Americans lost over 1,000 men in this action, killing 5,000 Japanese and Koreans. A meeting was arranged with the BD Unit, and it was clear that very little was known of the amount of work to be done or of the types of ammunition likely to be found. The result was that an offer was made by the War Office to clear the islet, and the Commissioner left with the vital parts of a 4c mine detector (which did not include the handle) in his luggage, promising to search parts of the islet and tell us what he found.

It was then decided that a further reconnaissance should be made of the nine remaining groups of tunnels, still containing Japanese bombs and mines, on the eastern side of Penang Island. One group had been cleared by 11 Field Squadron in 1950, and the general locations of the remainder were known. However, the biennial question of how and when the remainder were to be cleared had arisen, and the BD Unit had been asked for its advice. All available reports were studied and analysed and, even discounting the blood-curdling comments and suggestions which formed the majority of them, it was clear that far too little was known to make sound decisions.

Now began a long process of request, discussion, and frustration. The BD Unit wanted to reconnoitre Betio to decide on a sound working party, and the right tools and equipment, but the Colonial Office could not pay. The minimum party of five BD engineers (sappers) was reduced to nil; the officer and sergeant were to go out once and do what was required in one visit; their stores were to be air-portable by civil airliner and limited to 500 lb weight. BD Unit retired to consider the impossible and finally agreed on one Officer, and one NCO who clearly had to be capable of taking over in an emergency. Suddenly, with hardly time to arrange bank accounts for the pair, they were ordered to leave in October 1965.

The choice of equipment is interesting. The job in Penang required a full "locator" survey of the tunnels and pits, followed by excavation at suitable points to remove weapons to split them open for explosive analysis. Although Japanese bombs had simple fuzes, which could be immunized by elementary processes, they had used Picric Acid, Tri Nitro Anisole (TNA) and Hexanitrodiphenylamine (HND) as fillings and boosts. These basic explosives, although not likely to deteriorate during a normal storage life, can become

Sec	Name	Pits	Covered Trenches	Tunnels	Remarks	Estimated Contents			
						60 Kg	250 Kg	500 Kg	Mines
1	LILY POND			3	All collapsed				
2	WATERFALL GARDEN	1		2	In shape of a U				
3	BOY SCOUT CAMP		35		Probably accommodation sites, small arms storage sites				
4	THAI DANCE HALL		4		Only 3 blast walls remain and huts are built over tunnel sites	(Borehole location required)			
5	SUNGEI DUA DUA			2	In shape of a V, one tunnel mainly collapsed	400 +		40 +	
6	SUNGEI NIBONG 5		27		All had collapsed				
7	SUNGEI NIBONG 4	1	5		Trenches partly tunnelled, four collapsed, fifth site of large explosion				30 MAX
8	SUNGEI NIBONG KECHIL	1	2		End 20 feet fully tunnelled, pit was 60 ft by 8 ft wide by 4 feet deep				
9	BUKIT GEDONG		5		One tunnel site of previous explosion? Length 60 ft width 8 ft - all collapsed	1600?	40		

Fig 2

most unstable after years of tropical decay, and this is particularly true of Picric Acid which can form dangerous picrates. There is also the danger of detonator decay and the formation of ultra sensitive azides.

It was decided to take two Forster 4013 surface locators and a box of special charge containers. (These are illustrated on pages 235 and 239 of the September *Journal*). In addition a fuze-immunizing set was made up for Japanese and American bomb fuzes, and 20 lb of books and notes assembled as a reference library. Carrying cases were discarded and all stores wrapped in polythene bags, soft packing and cardboard boxes. This packing proved quite adequate and, providing stores are accompanied and not left to await arrival, well worth employing on future tasks of this kind. RARDE prepared a paper on the chemical analysis of the main types of explosives, and the symptoms and recognizable features of deterioration at the critical stage. Detectors and explosives required for the clearance of Betio, were to be sent from FARELF by sea. The party left on 22 October for Singapore via Bahrain and Gan, to miss the India-Pakistan troubles.

The Penang Reconnaissance

Fig 1 shows the sites of the nine remaining groups of tunnels and trenches which had to be examined. Locator search would define tunnel centre lines, and indicate whether bombs were present and their depth. Plans and cross-sections were to be drawn, and survey and draughting help was required. Sergeant Cooke left with Sapper Shum of HQ EBG by rail to arrive in Penang on 27 October. In the meantime a conference was held under the chairmanship of Major J. Rickards, RPC, OC PCLU Penang, to discuss the provision of civilian labour, transport and plant, the right to work on civilian property, and the choice of suitable demolition sites. Insurance and claims for damage, workmen's compensation in the event of their being "redesigned", and the priorities for Sungei Dua Dua, and Bukit Gedong, the clearance of which had already been promised, were also discussed.

On 28 October Major Qualtrough with Inspector Mossinac of the local police, and Lieutenant Owens of the Hong Kong BD Tp visited all the sites. Many of the trenches and tunnels could be recognized by blast walls at their mouths, but the numbers found did not agree with previous records and plans, nor with local knowledge. Twenty years growth of mangosteen, durian, coconut and tropical vegetation had quite changed the landscape.

A start on the task was made on 30 October without any authority to work on the sites, or agreement as to insurance or claims. Scrub clearance was followed by mine detector clearance of the surface scrap, and then the locator survey. After analysis of the readings, centre lines were plotted and marked out, depths estimated and sites for excavation chosen. It was about this time that the UK party became aware of the real significance of the term "Acclimitization". Work began at first light each day, and although it ceased at 1400 hrs there was much local administration to be seen to. In addition explosive work in the quarries could only be done after 1700 hrs when they closed, in order to avoid hire costs. Major Hugh MacSwiney had been detailed as liaison officer at HQ FARELF, and this was a tremendous asset as not only did he help with Penang problems, but also the complicated administration of the move to Betio.

Fig 2 summarizes the sites from north to south and the findings in each. Some of the sites of the Boy Scout Camp group (Serial 3) were probably

accommodation but most of them were considered to be storage areas. At the Thai Dance Hall group the actual tunnels were not confirmed, and further reconnaissance is necessary. As Lieutenant Owens progressed with his reconnaissance party so he was followed by the excavation gang who had been taught to use a mine detector in two days. The Forster 4013 located timber-dogs at 8 ft, railway lines at 18 ft and bombs down to 12 ft, the maximum depth at which they were found. The diggers proved the ground at each 2 ft level before digging out the next two feet, the final clearance being left to the professionals.

2 November brought word of the arrival of the explosives by sea. Then there followed three days of true slapstick comedy although at the time it did not seem funny. Each time a party went to offload the stores either the lighter had been moved to another wharf or the dock labourers refused to handle such dangerous items. Relations had reached a nadir, resolved only by having the lighter delivered to the most remote wharf, and Major Qualtrough and his driver offloading the stores while watching the moorings in case the crew took them to sea again.

Excavations went well and in hard latterite 3 ft diameter shafts were sunk to 20 ft. In soft soils however tunnels had to be opened up along their length, and the risk of latteral falls accepted. Photos 1, 2 and 3 show a typical 250 Kg find, the stepped excavation work at Sungei Dua Dua North tunnel, and a 500 Kg HE bomb excavated clear, with part of the bomb case of the next one in line, under the overhang.

Work progressed but it was impossible to find a demolition site suitable for anything larger than 60 Kg bombs. Nevertheless, after a very bumpy ride in a land-rover several bombs were opened up, and subsequent analysis showed TNA, HND and picric fillings, but none in a critical state of instability. The number of bombs in each tunnel was estimated by multiplying the "packing" at the excavation sites, by the length of each tunnel estimated by the locator survey. During final excavation it may be found that other types of bombs are stored in a tunnel or the locator readings were due to the railway lines in each tunnel.

Photo 4 shows a typical destruction of a 60 Kg bomb by a modern demolition technique using the charge containers mentioned earlier; the nose and tail with part of the filling are intact, and one of the felt wads inserted between these sections is on the stick. Photo 6 shows the party removing explosive from a Type 96 "Grapefruit" mine found at Sungei Nibong IV. The RNB & MD officer's help was much appreciated, and the filling was identified from the original packing label inside the base plate.

Work continued until 22 November when Sergeant Cooke and Sapper Shum left for Singapore with all the kit by RAF aircraft. In the four remaining days before leaving for Beito in the Gilbert and Ellice Islands, Sergeant Cooke managed the equipment and stores side, while Major Qualtrough wrestled with a report that demanded the full effort of Engineer Branch typists and draughtsmen, in Singapore.

Betio in Tarawa

The 4,200 mile journey to Sydney was spent jammed into hip-fitting seats of the economy class Quantas Boeing 707, at the mercy of the passengers in front, who could suddenly throw back their seats crushing our not insignificant bomb disposal engineers. Leaving at dawn on 27 November, the party

arrived ten and a half hours later at 0900 hrs, for a sleep, a rapid tour (had to see the bridge), a huge lunch, and a visit to the RAN Diving School at present commanded by Lieut-Commander David Lambert, RN. (There is a very close link between RN and RE in the BD world). At 1830 hrs they left for Nadi (pronounced Nandi) 3,000 miles away in Fiji, where the first transit troubles arose with the equipment. The problem was that instead of placing the equipment in bond for onward transmission as requested, the Customs wanted everything declared and cleared by them. This situation was resolved, however, when Major Qualtrough promised to introduce legislation when he became Secretary for the Colonies, and a typical sized Fijian porter dumped the luggage outside Fiji Airways. The final journey of 1,300 miles was in a Heron, and 200 lb of stores had to be left behind for the next bi-weekly flight.

The journey was broken at Funa Futi in the Ellice Islands where a further 30 lb of equipment had to be left behind. The Micronesians here are charming and cheerful and very similar to the Fijians. Their diet is mainly fish, coconut and rice, but the trade based on the coconut cannot provide a balanced economy. (Breakfast here was the only meal without a fish content!). The party finally arrived at Tarawa atoll at noon next day, and moved by launch to Betio where their work was to be for the next three months.

Betio is the south-western islet in the atoll which lies just north of the equator, and 175 deg East of Greenwich. Figure 3 shows the islet as it is today, with the main built up areas. However, in addition, huts and dwellings cover most of the rest of the land.

The bunkers numbered 1 to 42 were Japanese gun sites, stores and command posts, some of which still contained bombs, and ammunition for the 8 in, 6 in, 5 in, 4 in, and 3 in guns. The Americans had made a great effort to clear the islet at the end of the war, and having re-evacuated the population they blew what they could find on the causeway and bulldozed in the bunkers. However, collapsed bunkers still contained masses of unexploded rounds, and the causeway was liberally scattered with miscellaneous mines, bombs and ammunition.

The party was greatly helped by Paddy Williams, the Chief Police Officer, and Bill Kirby-Jones, the manager of the Wholesale Society, who broke most of the rules to provide loan and hire facilities for fridges, fans, and bedding, as well as a craft for fishing expeditions.

The task, quite a formidable one for a party of two, was as follows: To excavate all bunkers by hand, remove HE for sea dumping, and re-inter human remains; to mine-detect the whole island when the detectors arrived; to collect all surface unexploded missiles and move to selected sites for sea dumping; to destroy certain rounds in situ for examination and analysis; and to sea dump everything collected over the reef into deep water. In the event, although some items should have been destroyed in situ for safety reasons, they were moved to Takaronga Point to prevent damage to property and possible fragment danger to the population. The stores required were picks and shovels for hand work, plant for major excavation, oxy-acetylene for cutting RC bars, tapes for mine detecting and transport. Four picks, eighteen shovels and two wheelbarrows were eventually collected together after a struggle. The one size IV tractor was broken down on a northern islet without spares, and the several Massey-Ferguson light excavators had been imported without hydraulics! There was no oxygen available, heavy gauge fishing line

did for tapes, one tractor and trailer were provided for transport, and one 19RB from the harbour area was to be available when not required on shipping work. Officer transport consisted of two bicycles.

After a preliminary reconnaissance on 30 November work began on 3 December with a party of up to fifteen prisoners, augmented by locally-employed labourers. All the bunkers, except No 2, had been cleared by 19 January, a rather slower rate than had been hoped. Unusually wet weather had ruled out nineteen days and, as most of the labourers enjoyed spending their pay at the Bino-Bino bar on Friday nights, Saturdays were obligatory day of rest and the acceptance of Christianity by the locals made Sunday a rest day too.

The average rainfall for Tarawa is 76.91 in, but some years it is as little as 15 in. In December 9.31 in fell and in January and February 29.5 and 29.8 in respectively. Small problems, though large at the time, arose over non-attendance for work, unreliable supervision, lack of transport (sea and land), and stores late in arriving, but the hard work reduced the ample figures of the BD team to economy class Quantas 707 dimensions, and this was regarded as an asset!

Bunker 29 had been a double arched ammunition storage dump for a gun complex, and had probably been destroyed by a direct hit. The ammunition ranged from 6 in to 27 mm A/Tk, much of which had been severely distorted and the explosive fillings varied from liquid, to easily definable picrates. Removal of these finds caused considerable concern because the civil labour remained patently uninterested in safety precautions, and the local population would nightly carry out private enterprise work to get free explosive for fishing. "Attractive" items, which could not be sea dumped before nightfall, had to be taken to the police station for guarding; an added hazard.

Bunker 2 shown in Photo 7, was the most difficult task as it had been hit several times. Excavation began on 29 December but on 3 February, after almost 20 tons of HE had been removed, work was abandoned as it was decided that burrowing (it wasn't tunnelling) under collapsed sections was even more dangerous than the explosives being handled.

Most of the larger bunkers produced human remains. In bunker 15 four loaded rifles complete with bayonets were recovered together with not enough bones to fill a mess tin. It may be some consolation to the Japanese to know that all these remains have now been interred at one site.

Fortunately Australia uses standard British type explosives, and they arrived on 3 January by ss *Santa Rosa*, just too late to augment the Christmas and New Year's Festivities, and much too late to enable the party to blow many *in-situ* items that required it. However, at Takaronga Point charges were used on American 8 in shells with excellent results, except that explosive fillings, not identified at the time, heavily impregnated the air in the bunker and put Major Qualtrough out of action for two days with appalling headache, coughing and chest pains. One hundred lb GP bombs, and 20 lb and 12 lb fuzed fragmentation bombs, were similarly dealt with as were 8 in Japanese shells. (Photo 8.)

Most of the finds however were dumped at sea from a ship's lifeboat (Photo 9) and an outrigger canoe. (Photo 10.) Although the islanders are meant to be natural seamen their efforts with the oars on the lifeboat can only be described as a passable imitation of a ruptured centipede. However they worked hard, and sea dumping was completed on 3 March.

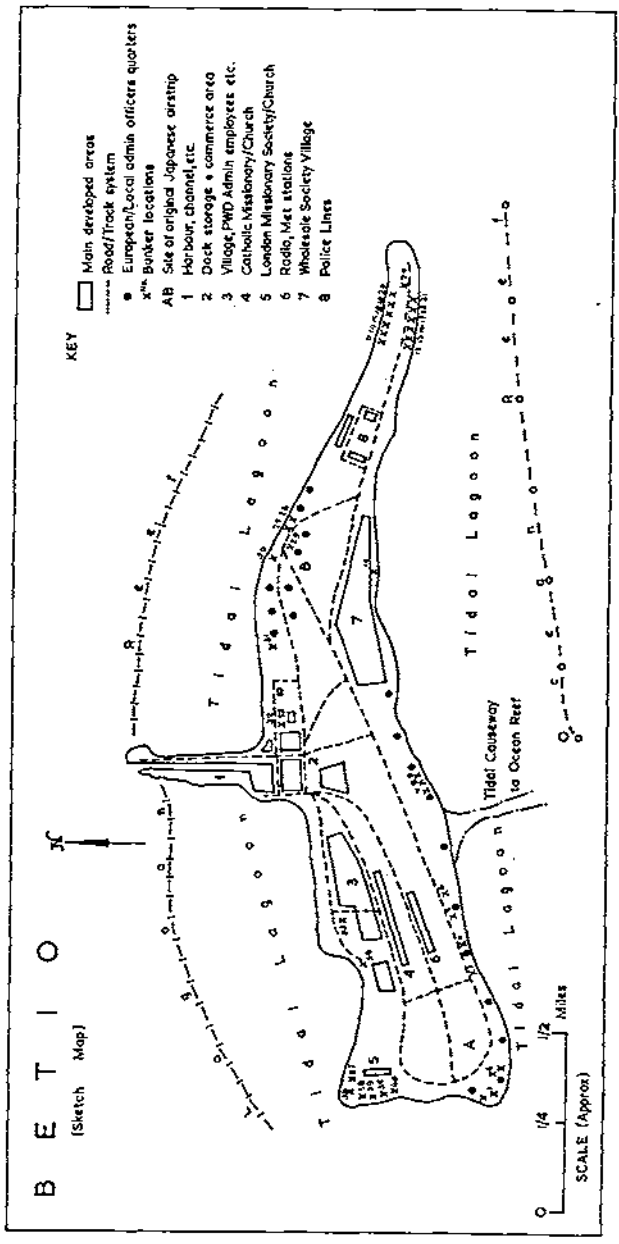

BETIO
(Sketch Map)
KEY
Main developed areas
Road/Track system
European/Local admin officers quarters
Bunker locations
AB Site of original Japanese airstrip
1 Harbour, channel, etc.
2 Dock storage + commerce area
3 Village, PWD Admin employees etc.
4 Catholic Missionary/Church
5 London Missionary Society/Church
6 Radio, Met stations
7 Wholesale Society Village
8 Police Lines
Tidal Lagoon
Tidal Causeway to Ocean Reef
SCALE (Approx)
1/4
1/2
Miles

Fig. 3

Little need be said about the detector search of the island which was incomplete when the party left. In spite of the small number of finds (10 tons) compared with the 90 tons cleared from bunkers, the appreciation of the locals was nevertheless quite touching. The party also left behind a set of No 4A detectors, which FARELF were prepared to lose, and which, with special adaptors made in the United Kingdom by the BD Unit, could be used with standard wireless set batteries. These will be used by the Police to search the remaining built-up areas, which are not expected to yield much.

Little has been said about relaxation on the island. There are two open-air cinemas (it usually stops raining in time), a few high powered wirelesses, a dance hall and Bingo! There is also the Betio Club (rather an euphemism), the Bino Bino Bar already mentioned, several fish and rice shops, and the latest, a Gilbert and Ellice type Chinese Restaurant. Bathing is ideal when the tide is in; the fishing is excellent, particulary off the ocean reef where it is not unusual to catch 100 lb of good size fish in a couple of hours, and walking the reef at low tide, especially at night with lamps, produces an amazing variety of shells. The basic industry is Copra, the dried meat of coconuts, but when the phosphates of Odean Island run out in seventeen years time the islands will have to depend on financial aid from the United Kingdom. Even now the economy and development can only exist with British aid. The habits, manners and general system of life have been well covered in Sir Arthur Grimble's books, and it is a pleasure to record that the inroads of civilization to date have only inflicted minor damage on this outpost of the Old Empire and its charming people.

Conclusions

The tasks which had begun with two years of desultory letter writing and "take it or leave it" decisions had at last been completed. The bomb dumps in Penang have now come of age having survived twenty-one years of corrosion and deterioration, and yet the discussion continues. Such delays, where deteriorating explosive is such a vital factor, are completely unrealistic from BD point of view. Unfortunately the complexity of staff channels and shoestring finance, ignore what should be the overriding factors, the safety of the community, and the well-being of the men who have to do the job.

Whether we were right to accept these tasks with a two-man team, is now merely a matter of conjecture, but the Malayan driver who moved bombs to a quarry for analysis certainly had his doubts. What is certain is that had there been increased numbers of BD trained men available, the technical reconnaissance results would have been much more detailed and the safety of the two tasks better under control.

Is it too much to hope that trained BD Engineers in Field Squadrons will be available in future to help do such jobs anywhere in the world?

Editor's Note

A party of twelve Sappers under Sergeant J. R. Slacke, RE, of the BD Unit (UK) RE is being trained in the UK and will begin the final clearance of these dumps under Major A. J. Loch in February 1967. The task is expected to take about a year.

Photo. 1. 250 lb bomb in shaft, located at 9 ft depth.

Photo. 2. Excavation in soft earth.

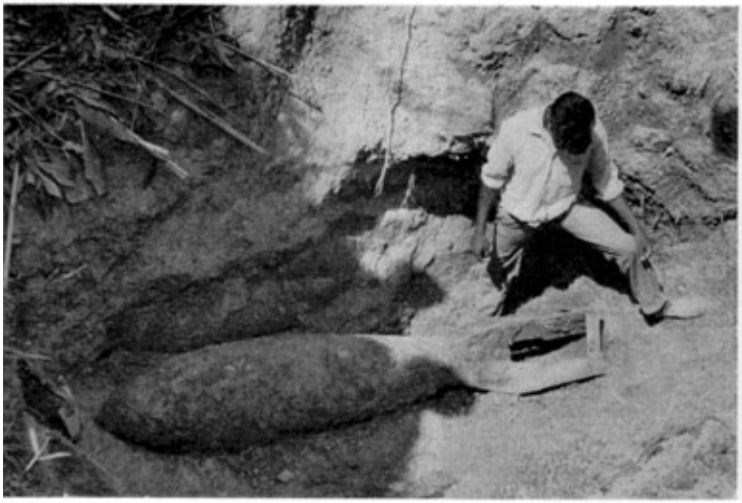


Photo. 3. 500 kg bomb at Sungei Dua Dua.

Bomb Disposal in Betio and Penang 1,2,3

Photo. 4. 60 kg opened for explosive analysis.

Photo. 5. Excavating at Sungei Nibong IV.

Photo. 6. Japanese "Grapefruit" Mine. (Sgt Cooke at rear in "Acclimatization Kit".)

Bomb Disposal in Betio and Penang 4,5,6

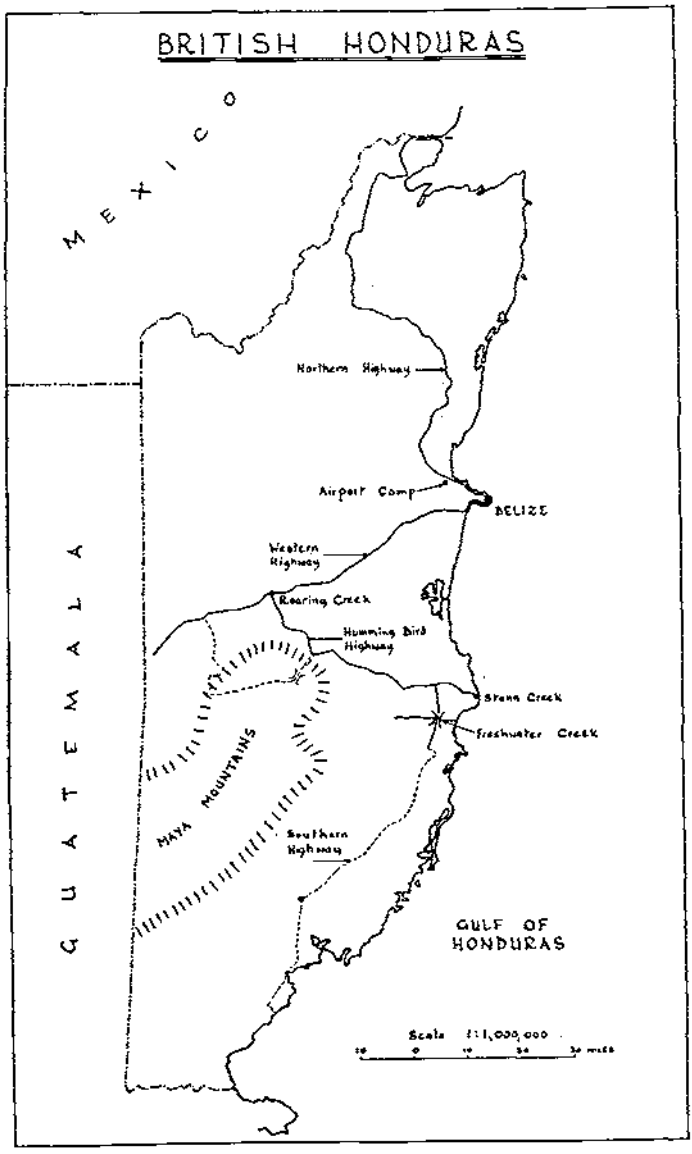
Photo. 7. Bunker 2 with some of the safe excavated shells.

Photo. 9. 2 tons of 5 in shells was the maximum load.

Photo. 8. A Japanese 8 in shell opened explosively.

Photo. 10. The canoe carried nearly ¼ ton a time.

Bomb Disposal in Betio and Penang 7,8,9,10


BRITISH HONDURAS
MEXICO
GUATEMALA
Northern Highway
Airport Camp
BELIZE
Western Highway
Roaring Creek
Humming Bird Highway
Stann Creek
Freshwater Creek
MAYA MOUNTAINS
Southern Highway
GULF OF HONDURAS
Scale 1:1,000,000

Belize Revisited or What the Sappers did in British Honduras

By Major H. E. H. Newman, RE

Introduction

Royal Engineer units of the Strategic Reserve Support Echelon have to be able to fly on light scales at short notice anywhere in the world, and be prepared, on arrival, to carry out a variety of Sapper tasks which may, or may not, have been preplanned. To practise this role it is necessary to carry out exercises in selected areas overseas. One such area was British Honduras.

In November and December 1965 a detachment of 36 Engineer Regiment, together with small detachments from 42 Field Survey Regiment and 131 Parachute Engineer Regiment (TA), took part in Exercise Pole Vault. In January 1965 a reconnaissance party from 38 Engineer Regiment had visited British Honduras and found that there were several worthwhile Sapper tasks to be done. In August 1965, a second reconnaissance party, this time from 36 Engineer Regiment, selected suitable ones and obtained information on which they could be planned. Tasks were agreed by 12 Engineer Group, detailed plans were made and stores lists were sent to British Honduras Garrison Headquarters.

Before describing what we did some description of the country is necessary to set the scene.

The Country

The People. British Honduras is one of the smaller countries of Central America. It is about the size of Wales with a population of about 105,000. The people are a mixture of Mexican, Maya Indian, European and Negro. To the outsider it appears to be a complete multi-racial society. The immediate and overriding impression of the people is their friendliness. The second characteristic, and it became very quickly apparent, was their lack of regard for time. To them our sense of urgency was considered as a form of lunacy to be pitied.

The Topography. Like Gaul the country is divided geographically into three parts: the coastal plain, including Belize, the Northern Lowlands and the mountains.

The coastal plain, which is between five and twenty miles wide, is largely swamp much of which is mangrove. While this can be used as an infantry training area it is no use to engineers. Roads built over it are likely to sink and do so during the rainy season which lasts from August to November or December.

The capital, Belize, is a township of about 40,000 people and is by far the biggest centre of the population. It is a port in the sense that ships call, but they have to stand off and unload into lighters. It was badly damaged by hurricanes in 1931 and 1961. While it offers a certain amount of entertainment to the soldier, it cannot be considered as a high class tourist centre and is not one of the best laid out cities in the world. It looks as though, like Topsy, it just growed.

To the north and west are the Northern Lowlands an area of savannah which rises gently to about 600 ft and is inhabited by Mexicans and Maya Indians.

Westwards the coastal plain rises towards the Mountain Pine Ridge area. As it does so the ground becomes drier until in the hills themselves the terrain is like a steeper and more highly tree-covered version of Salisbury Plain. The air is fresh and healthy, altogether a delightful area for living and training. To the south and west the hills descending to the plains are very steep and covered with thick jungle made much thicker by the devastation of Hurricane Hattie and the subsequent growth of secondary jungle.

The Communications

There are four trunk roads: the Northern, Western, Southern and Hummingbird Highways. All except the Hummingbird Highway are built on what is basically swampland, and are consequently continuously liable to settlement, flooding and erosion. The Hummingbird Highway, being largely a semi-mountain road, is narrow and twisty. Most of the surface is mountain pine clay—a form of gravel with varying amount of clay content. It binds quite well but is very apt to pothole after rain. Although there is a big programme of asphalting the surface, particularly on the Western Highway, vehicles take a terrific pounding when travelling about on these roads, particularly during the rainy season when it is impossible or uneconomic to repair them.

The Tasks

The tasks allotted by 12 Engineer Group were:—

1. An airstrip with a 2,000 ft runway, to take light aircraft at Roaring Creek, the proposed site of the new capital of the country. The airstrip is designed to enable visitors to the new capital to be ferried to and from Belize International Airport. This task was estimated to take eighteen dry working days.

2. A high level timber piled bridge across the Freshwater Creek, some ten miles south-west of Stann Creek. The bridge was to consist of eight 15-ft spans, each pier to contain five piles. The bridge was to replace a low level one and thus to make the Southern Highway an all-weather road for a further 10 miles. This job was estimated to take twelve working days using two pile drivers.

3. Survey and continuation of construction of a mountain trail, passable to 3 ton trucks, from the Mountain Pine Ridge towards the Hummingbird Highway—a distance of about nine miles over some of the steepest and thickest terrain in the country.

4. Survey for fire towers in the Mountain Pine Ridge area.

The first two tasks were to be done on behalf of the PWD and the last two for the Forestry Commission. It should be emphasised that at all stages, both in planning and execution, we worked very closely indeed with the appropriate authority. This paid enormous dividends.

The Time Available

When the exercise was first projected, it was intended that a field squadron should fly out from UK in early November and return from Belize in mid-December. Subsequently these dates were altered with bewildering rapidity until we finally left Lyncham on 21 November and had to start our return on 14 December. So instead of having the best part of five weeks in the country we had three. When one considers the time taken to deploy to work sites up

to 120 miles away and the time required to strike camp, return to base and hand over stores to the rear party, the effective working time was reduced from four to two weeks.

The Advance Party

The advance party of two officers and eight soldiers left London Airport on 3 November. Their main tasks were to ensure that all plant and stores were on site ready for use by the main body on its arrival, to erect camps near the work sites and at the Force HQ at Airport Camp and to arrange for the reception and rapid transit of the main body.

The advance party was given tremendous help by D Company 1 Staffords who very kindly offered us the services of 14 Platoon who lent us transport, cleared camp sites and erected tentage, thus leaving the advance party reasonably free to get on with drawing stores and consulting with the PWD and Forestry Commission.

Unfortunately, not all the plant and stores were on site by the time the main body arrived. This was our first disappointment and our first experience of the most carefully made arrangements going wrong due to the local malaise of mañana. It must be emphasised that this is no way a criticism of the outlook or attitude of the local authorities who went far beyond the call of duty in their efforts to help us. It is simply that the local labour had no idea of time, appeared to regard rain as an automatic signal to cease work and also regarded expenditure of energy as something to be avoided like the plague.

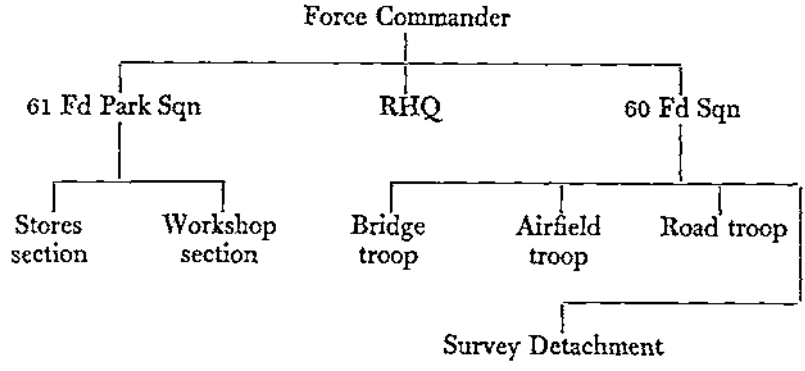
The Flight Out

We left England on Sunday, 21 November in the sort of weather which one is glad to leave behind: persistent, cold, wet rain. It rained all the way to the MCCP at Devizes and worse still the Force Commander's car had a puncture. Picture two very damp majors changing a tyre on the middle of Salisbury Plain!

At Gander we had our third breakfast—at least some of us did—the rest had their second lunch. We arrived at Nassau on the Sunday evening and spent one (in some cases two) nights before continuing our journey in Hastings aircraft to Belize. At Nassau it was warm (75 degrees) and sunny. At Belize it was hot (85 degrees) and just as sunny. The main body passed through to their various camps very smoothly after a short stop for a hot meal.

The Force

The Force was organized as follows:—



The detachment from 42 Field Survey Regiment was split between the Survey Detachment and the Road Troop. The detachment from 131 Parachute Regiment (TA) was employed as one section in the Road Troop. Both detachments did a terrific job of work and were worth their weight in gold.

The Airstrip

Prior to the arrival of the main body, the advance party had collected together some plant and had managed to clear some of the vegetation from the runway and cleared areas. This was quite a formidable task since what they were clearing was a fairly dense jungle of mixed palms and small trees interspersed with softer vegetation. Work went steadily ahead, reasonably to schedule for the first week after the main body arrived. However the first snag struck was a boggy area two-thirds of the way down the runway which had to be removed. Work on this had just started when the rains came. There was 4½ in of rain on the first day and 2¾ on the second. Thereafter for ten days it rained heavily every day. In the early part of this chhotta monsoon some work was possible, but soon the whole area became a quagmire quite impassable to any form of plant and work came to a standstill. Even before this, we met the big tipper problem. It became a daily practice for the field park squadron commander to be promised three or sometimes four tippers for the following day. In the event none, one or occasionally two would turn up. By the time the main body had to return to Airport Camp for the move back to UK, there remained some ten days of work, given adequate plant, tippers and fine days. Although a strong rear party was left behind to complete the airstrip continuous rain prevented more than sporadic work. The airstrip was, therefore, handed over to the PWD with an estimated three days' work remaining.

The Bridge over the Freshwater Creek

It had been arranged that all necessary plant and stores should be on site by 24 November, but when the troop detailed to build the bridge arrived on the evening of 24 November they found little timber or plant there. This was a presage of things to come. The piles were still in a timber yard near San Diego, a distance of some eighty miles from the site, and the shorter ones (20 ft) were transported by unit drop sided three-tonners. Some of the longer ones had been put on a PWD low loader. The low loader broke down 5 miles south of Roaring Creek and the driver had to go to Belize for spares. This took a day. It broke down again 15 miles later with two punctures which took a further day to repair. By this time the PWD pile driver had arrived but not the one hired from Lindo Bros. This arrived on 27 November without its pile driver rig which turned up on 28 November. The Lindo Bros pile driver was an RB 19 with a 50 cwt hammer. Consequently it could not be used because it was top heavy when the hammer was raised.

When the larger piles were inspected, it was found that these were too wide for the leaders of the PWD pile driver and needed reshaping. They had to be sent away for this.

Before work started the PWD representative made an alteration to the design. It was now required that the bank seats should be supported from slipping into the gap by pile bankseats. These were driven and bankseats placed. Work progressed steadily until pier 6 was being driven from the south bank. Prior to this it had been found that because of deep pockets in the

river, and because there were no extensions to the pile driver leaders, instead of the 30 ft piles, which were on site, 35 ft piles were needed. These had to be ordered. They were cut from the forest north of Mullins Creek 20 miles away but by the time they were cut the rains had started, and not only was it extremely difficult to get them out of the forest, but it became impossible to get them to site because a PWD bridge collapsed and there was no way round it. PWD authority was, therefore, given for two piles in each pier to be pine rather than sapodilla. This enabled piles to be cut nearer the site and removal to the site, although still difficult, was possible. The last pine pile appeared on site on 7 December. In the meantime the pile driver situation had deteriorated. The PWD pile driver had a 30 cwt hammer which was too light for the huge sapodilla piles. The Lindo Bros pile driver was not suitable for reasons already given. Consequently the A frame and leaders of the Lindo Bros machine were modified to fit the PWD driver and the 50 cwt hammer was used. The resultant contraption was very feeble and had to be rewelded frequently, so driving continued with a very sick machine. All this while the area of the bridge became boggier. The insects were always extremely hostile, and the origin of the phrase "hard bitten" became fully understood. Nevertheless morale remained extremely high and the bridge was finally completed by 11 December 1965. This represented the equivalent of fourteen days' work, which under the circumstances was a very creditable performance.

The Road

The task was to build a drift across a creek about 20 ft wide, to extend the trail up to the top of the plateau beyond and to find an alignment from the top of the plateau to the Hummingbird Highway—a distance of about seven miles through extremely dense jungle. The party arrived on 25 November and set up camp. The first task was to dam the stream so that the footing for the drift could be dug out. However as early as 27 November the creek became flooded. Nevertheless plant work went on beyond the creek up to the top of the plateau along an alignment which had already been cut by the Forestry Commission. On 30 November work was held up on the drift due to lack of cement, but this was produced next day. On 2 December, in common with the other sites, work had to be stopped because of very heavy rains and flooding. It was only possible to restart work three days later and even then further rain made progress slow. An additional difficulty was that the site was virtually cut off from 2 December because three tonners could not get down or up the steep, winding slippery track. The party was pulled out on 5 December in order to emplane for Nassau. The drift was 30 per cent complete. One and a half miles of trail had been cut and graded, and the alignment had been selected along a distance of a further mile. Beyond this no alignment could be found that would give even reasonable gradients. However a good road had been cut to a part of the jungle which the Forestry Commission wanted to reach.

The Survey

The task was allotted to two NCOs and four Sappers of 42 Field Survey Regiment. Because of rain and low cloud for a very large part of the exercise, it was not possible to complete the task by the time the team had to be called back. However the vast majority of the job had been finished and useful work was done.

Other Tasks

In addition to the major jobs mentioned, the force undertook a large number of smaller tasks which are listed below:—

1. Construction of a playground for handicapped children at the Stella Maris School. This entailed the construction of a chicken wire fence with a 6 ft gate, removing all vegetation, draining and filling with 2–3 in of sandy gravel an area of 90 × 55 ft.

2. Construction of a mooring for a 3½ ton boat.

3. The following workshop jobs:—
Manufacture of nine signboards for the garrison and D Coy 1 Staffords.
Repainting of eight signboards for the garrison and D Coy 1 Staffords.
A chute for the swimming pool.
Repairs to outboard motors.
Desk name boards for all officers of the garrison.
Manufacture of a letter rack for the Garrison WO and Sergeants' Mess.
Manufacture of three flag poles.

4. A route reconnaissance along the Southern Highway from Freshwater Creek to a point near Hell Gate some sixty miles to the south.

5. Assorted wood machining for MPBW. In addition the wood machinist overhauled the universal woodworking machine and gave instructions on its use to the local carpenters.

Plant

Plant was obtained from a variety of sources. Some was hired, but most was borrowed from the PWD as and when it could be made available. This might appear to be a somewhat haphazard arrangement and, indeed, it was by no means ideal. It was too often the case that badly-needed tippers did not turn up. The lack of low loaders too made the transfer of plant from one site to another particularly frustrating. The two pieces of equipment that came out of the ordeal best were the Drott Traxcavator and the Michigan Light Wheeled Tractor. Hired plant was in poor condition and needed endless maintenance. PWD relied almost entirely on Caterpillar Dozers and Leyland tippers, both of which proved very reliable.

Vehicles

We operated on only fifteen vehicles altogether, of which nine were land-rovers. With these we had to carry out all command and administration functions and some engineering jobs. Although we sometimes appeared to be short of transport, this proved to us that Strategic Reserve units are generally far too liberally equipped with transport. A considerable reduction would ease the administrative load on a unit and incidentally reduce the enormous Army transport bill. Mileages driven were collosal; each vehicle averaged about 2,000 miles a week. Naturally this led to driver fatigue and emphasised the need for relief drivers to be trained. It is my belief that *every* soldier should be able to drive ¼ ton and 3 ton vehicles safely on the road.

Signals

We used SRC 13 almost exclusively and it worked very well. Ground stations were set up at Airport Camp, Roaring Creek and Freshwater Creek

using dipole aerials with 50 ft masts. Ranges of up to 30 miles to mobile stations were achieved regularly.

At night it was normally necessary to use morse because the heavyside layer made voice impractible. This emphasised the importance of giving elementary morse training to all regimental signallers. Because we gave this training we had a signals net open day and night throughout the exercise.

We had been advised to take C42 sets but had to leave them behind because of weight restrictions, and in the event we did not need them.

On the very rough roads it became more important than ever to check frequently netting and tightness of bolts. If this was neglected it would only be a matter of two or three miles before the radio was off net and practically out of the back of the landrover.

The Return

When we left England, we thought we would be leaving Belize between 16 and 21 December. However, the Rhodesian crisis broke at the beginning of the month and all plans for our return were cancelled. It is probably just as well we didn't know the various plans put forward for bringing us back. Eventually we were told that we would start ferrying men and stores to Nassau on 11 December. This ferrying was to continue for six days. Our return dates from Nassau were to be notified later. We had visions of Christmas in Nassau.

The first party arrived on the airfield on 11 December and waited for the first aircraft—and waited—and waited. Some time later we were told that the plan had been changed again and that we should be ready to emplane at eight hours' notice. By the 14th we were beginning to wonder, when we were told by the airport that an RAF Hastings was on its way. True enough, it was ours. We were off! The flight to Nassau was done in four days in three Hastings a day and went very smoothly without the benefit of a trained emplaning officer. We all had a day or two in Nassau and arrived home in the early hours of Sunday, 19 December.

The Rear Party

We had originally planned that the rear party of one officer and ten soldiers would remain in British Honduras until 9 January to return stores and strike the base camp. When it became clear that the airstrip would not be completed by 10 December, it was agreed that the rear party should be increased to about thirty and would have the additional task of completing the airstrip. This enlarged rear party was commanded by Major Gilliat. Stores were handed back with remarkably few deficiencies. The airstrip continued to present the twin problem of torrential rain and lack of tippers, and finally, as stated earlier, had to be left for PWD to finish.

Administration

Administratively the exercise went very smoothly. All "Q" matters were controlled from the Force Headquarters. "A" matters were kept as simple as possible. There was virtually no sickness. Discipline was very good. Pay was straight forward. Morale was very high. We were extremely fortunate to have the whole-hearted backing of British Honduras Garrison who supplied our every need.

Conclusions

Beyond all doubt this was a most valuable exercise for all who went on it. While it might be said that a longer period at a more temperate time of year would have been better, it can be argued that it was better training to have to work under adverse conditions against a very restricted time limit. There must come a time in the life of any unit when it comes face to face with reality and in this exercise we did.

At all levels a number of lessons were learnt, from organizational matters at RHQ level to the vital necessity for keeping cutting edges sharp, especially when dealing with woods as hard as sapodilla.

Finally, everybody was tremendously impressed with the friendliness and hospitality of the people of British Honduras. It was most gratifying especially for 60 Field Sqn, just back from Aden, to be greeted with beaming smiles instead of the scowls and grenades to which they had become accustomed.

Sappers of the Seventies

By Captain M. J. Payne, RE

Introduction

In recent years several articles and correspondence have been published in this *Journal* on the subject of "Whither the Corps?", written by fairly senior officers representing broad surveys of the Sappers based on a number of years experience and service. This article however, being something of a worms-eye-view, is written by an extremely junior officer, but I hope it is representative of the views of those who have been Sappers long enough to have an inkling of what it is all about and who are wondering what sort of a career is in prospect.

The recent Defence Review has given a number of pointers to the future, not the least of which is a very real possibility of redundancy. The Sappers, relative to the rest of the Army, have become less technical and many people are unsure of what we are trying to achieve.

Much of this uncertainty stems from not knowing what part Britain should play in the world; the oft-quoted Clausewitz dictum that war is the extension of diplomacy assumes a definite foreign policy. Therefore this policy must first be determined before considering how the Army and its constituents are to be organized and trained.

This article is an attempt to see what our foreign policy should be and to deduce how the Army, and particularly the Sappers, should be organized to carry it out. It is a fact of human nature that a man is most content when he can see the purpose of his job and knows that he is doing it well. Therefore, parallel with the main theme runs an examination of how the "Sappers" can continue to be the highly attractive career that they have been in the past.

World Trends

Three Presidents, De Gaulle, Nasser and Soekarno have by their various actions ensured that the British Army ten years from now will be a very different affair from the present day. Each one has acted as a catalyst on the foreign and economic policies which have changed Britain from a rich Colonial Power into one, not so rich, and unsure of its role in the world.

In Europe BAOR is becoming daily less credible as an operational theatre and the soldier serving there has to perform mental gymnastics if he is to justify his existence to himself. In the past NATO has probably been the major force for peace in the world, and it still provides some of the "options" that are needed in the current theory of the graduated response. But the material progress made by Russia renders an attack by her on the West less probable; like us she is beginning to have too much to lose. General de Gaulle, far from being the anti-social bore that he is made out to be in most of the other NATO countries, is a supreme realist and alone has had the courage to match his deeds to his words. The dissensions he has caused in the Alliance have shown the Warsaw Pact countries that they are not faced by such a solid phallanx after all, and they have taken the chance to speak up for a rapprochement that must surely eventually come about. When it does, nearly half the Army's field force will cease to have an operationally valid task. Complete withdrawal, however, is unlikely for a number of reasons. Both the Socialist

and Conservative Parties are deeply committed to a European Britain and, so far, NATO is our only successful joint venture. Attempts to withdraw from ELDO and mutterings about the Concord project have shaken our neighbours' confidence; the removal of troops in large numbers might well ruin for ever the chance of achieving one of the main policies of both parties. In addition, the cost of providing barracks and training areas in Britain for the returning BAOR units would be prohibitive, so British soldiers will probably continue to serve in Germany even though the vestiges of operational necessity will have been removed—a situation that makes difficult the maintenance of morale.

In the Middle East President Nasser's leadership of the Arab World has successfully alienated Britain from the area and now all that remain are isolated remnants of a once considerable influence, symbolized by a string of bases already vacated or that will shortly be abandoned. The precise nature of our policies there is not clear, but it seems to centre round "protecting our oil interests" and "policing our late Colonies against Communist-inspired insurgency". Since oil is now a buyers' market and Transport Command's new C130's and VCIO's will put the UK-based Strategic Reserve about twelve hours away, even taking into account overflying problems, these policies, should they continue at all, will not be backed by the physical presence of troops in the area.

In South and South-East Asia there is a contrast of influences with declining Colonial responsibility and an increasing commitment to SEATO countries and possibly to other nations situated near Communist China. The eclipse of President Soekarno has removed Confrontation as the major task in South-East Asia and most of the British forces there will return home. Malaysia is anxious to have a reduction in British forces so that she can pursue the so-called "Asian Common Market"—the by-product of the recent talks with Indonesia. The "permanent" Malaya Garrison is, therefore, unlikely to last very long. Traditional commitments may be reduced to policing Hong Kong, Fiji and Mauritius. The brand-new requirement for British military power is to try to bolster the numerous poor countries on the periphery of China and at the moment especially Thailand. It seems unlikely that Singapore, as a tiny overseas independent nation, will want to lose the boost to her economy and the political bargaining power against both the Western Allies and her neighbours that is provided by the British base there. Without this, she could hardly maintain her secession from Malaysia. From this reasonably secure base Britain can support limited war operations and more particularly maintain a large supply of heavy engineer equipment.

These changes deeply affect the Army in a number of ways. In the first place it is bound to get smaller, by perhaps 30 per cent, judging by newspaper reports. Secondly the number of permanent overseas stations will be reduced substantially. For an Army that since Henry V has been encouraging its men to see the world—even if it was only Harfleur—this will be a serious disincentive to recruiting.

UK Foreign Policy

The World Bank recently published a set of statistics which showed a remarkable correlation between a country's average annual income *per capita* and the likelihood of significant conflict. The nations of the world were divided into four income groups "rich", "middle income", "poor". and "very

poor" and the percentage in each group that had had conflict since 1958 computed. There was only one incidence in the rich countries, half the middle income group were affected and of the "poor" and "very poor", 69 per cent and 87 per cent, respectively, had suffered insurgency. The conclusion must be that to raise this average income will be to reduce the chances of conflict—which is the very purpose of the European based "police force". The arrival of foreign troops may well quell the disturbance but it will not remove the cause. Although the Marxian theory of economic causes to all political movement has been discredited, there is still a large element of truth in it, as is shown by the World Bank figures.

British foreign policy should be directed towards increasing aid to countries at the bottom end of the scale. Investment for industrialization and direct grants of money, although necessary, are insufficient as they often tend to increase the difference between the rich and poor in the country concerned, thus aggravating the causes of discontent. Furthermore, in the present economic climate Britain is unable to give money on a large enough scale for it to be effective. It is often difficult to persuade the local government to undertake rural development and the best approach is often to try direct action such as the supply of birth control clinics, agricultural experts and construction teams for the development of communications. Thus a village, deep in the country, can raise its standard of living by selling the surplus food it has accumulated through better cultivation and controlled population to the nearest town with which it has recently been linked by a good road. The money obtained can be used to buy goods produced by the new industries that are being developed in the towns. Wealth cannot be increased without the movement of raw materials and goods so that a primary need in the poorest countries is for road, rail, sea and air communications.

The primary aim of our foreign policy must, therefore, be to play our part in maintaining world peace by the effective use of aid. It has now been realized that aid is almost useless unless it is controlled by the donating country, and the best way to do this is by making the aid practical, in terms of construction and technical training, rather than in the form of cash grants.

Intervention with force must come second, since it is a sign of failure.

The Role for the Corps

It is in this need for direct aid that the Sappers can find their salvation. In most of the "poor" and "very poor" countries there is a desperate shortage of contractors capable of performing the tasks required, so that skill and equipment must be imported.

The organized, readily-transportable units of the Corps are the ideal solution to the problem. If we can swing our main effort to engineering then we shall have the double reward of doing the job for which we have been trained and of leaving behind not only vitally needed facilities, but also pools of good will, skill and even equipment. If new plant is employed on each job, it will increase efficiency, reduce shipping and maintenance cost, give useful orders to British industry and finally leave quantities of plant behind for the assisted country.

It may be argued that squadrons employed on such tasks will not be working for the Army. However some are already working for the RAF, so there is no reason why others should not work for the Foreign Office. Never

the less, it is evident that, before we can persue such a policy, there must be a searching reappraisal for though, in theory, this would be a highly satisfactory deployment for the Corps recent experience, particularly at Crown, has shown that we are not yet able to operate economically in this role. The present lack of practical engineering experience has resulted from a considerable combat engineer commitment in support of the rest of the Army. However, the degree of combat support, necessary from the Corps for a "police action", is far less than that for a full scale nuclear conflict or a limited war. A force involved in a "Revolutionary War" needs roads and water, bridges and electricity, not anti-tank mine fields or demolitions. If the government is to be persuaded that it has the ideal instrument for its policy at hand we must first show ourselves thoroughly capable engineers. This can only come about by re-thinking the degree and type of support that the Army is going to need ten years from now, and trying to put the results into practice early enough to be effective.

The Royal Engineers Today

To the young officer who joins the Corps now, there is an unmistakable air of things not being what they used to be, of being a member of a venerable organization respected for what it has achieved in the past rather than for what it is today. One hears misty-eyed stories of lieutenants who bridged great rivers, majors who developed whole provinces and generals who commanded armies in battle. In 1966, a lieutenant can still span great rivers, but he must put the bridging equipment back the next morning! Distinguished Sappers of old, like Lord Napier, spent many years engaged on civil engineering projects but were quite capable of command in campaigns afterwards. As engineers, they usually had to work alone, design whatever they were building themselves, obtain materials, recruit and organize local labour and then personally supervise the work. Unlike their contemporaries in the Cavalry or Infantry, or indeed the Gunners, young Engineer officers who had had this experience had been forced to take far reaching decisions at an early age. Although they may not have spent years in the mill learning the specifics of staff duties, they found that they had learnt to plan and to take decisions in a different way, but one which no less fitted them for command.

Over the years, such opportunities have become less and less until today the laying of a few square yards of concrete is the occasion for an article for the *Journal*. The removal of the responsibility for Works Services has taken away the chance for every Sapper officer to gain at least something of this experience.

Former Engineer officers were famous for an incredible fertility of mind and any new concept automatically became a Sapper responsibility in order to try it out before other Arms were let loose upon it. Often Sapper officers spotted its military application long before the rest of the Army. Submarine mining, mechanical transport, military flying, military signalling and the tank all began with strong associations with the Corps. Nowadays, however, we are content to follow drills and books and little of consequence is ever produced by serving RE officers. The automatic reaction to any novel suggestion is: "give it to MEXE!"

If ideas are scarce and projects few, training for such work has gone ahead by leaps and bounds. Today roughly half of all regular RE officers take an engineering degree compared with only one-third ten years ago; there is an

abundance of courses from the various Staff Colleges down to "Essays for recalcitrant Subalterns" all designed to further officers' education.

A similar proportion of soldiers possess trade qualifications, but the increasing emphasis on combat engineering has meant that many Sappers of all ranks are employed entirely differently from the purpose for which they had been recruited and trained. This emphasis has nowadays made experience of combat engineering practically a *sine qua non* for promotion. The position to which this occupation has been elevated is difficult to understand because the Infantry, with far lower recruiting standards, produce most competant Assault Pioneer Platoons by means of intensive training, so it would seem sensible to judge a man much more by his trade since this is a truer measure of his ability.

Clearly in a small Army flexibility must be maintained, but in the Corps it has become such a fetish that no-one gains sufficient experience in any one job to become really professional, and the idea of specialist (and therefore highly competent) squadrons is looked upon with horror. Whatever the, doubtless excellent, reasons for such a policy, it has a very real adverse effect on the younger members of the Corps. Soldiers recruited into the Sappers as tradesmen are all too often disenchanted by their lack of employment in their trade and junior officers, hoping for the best promotion chances, are forced to compete for the Staff College with the disadvantage of having lost up to four years regimental service.

Obviously, the Corps must continue to give combat support to the Army, but the level down to which this is provided must be re-examined, to see whether we may not make other Arms more self sufficient and so release RE manpower for more useful work.

The Necessary Changes

The concept of the all-purpose squadron should be abandoned and instead, two main types, the Combat Support Squadron and the Construction Squadron formed. Flexibility will still be maintained by alternating postings, but with the advantage of trying to do two things consecutively as opposed to concurrently, as at present. At first the construction squadrons will come from units under Corps, or equivalent, control leaving the Divisional Squadrons affiliated to their brigades.

These Construction squadrons will spend nine months in the year engaged on projects and the remaining three on combat engineer and infantry training. The rise in morale which will result from being employed on worthwhile jobs and the increased efficiency of the unit at tackling a task through being fully stretched in construction will make this three month period ample. Squadrons will once again be imbued with the sense of urgency that is almost always lacking in the peace-time Army today.

Parallel with this must go an effort to make the Royal Armoured Corps and the Infantry take over more direct support engineer work, in order to fill the gap left by the new Construction squadrons. Armoured Engineers, although a stroke of genius in 1943, are now routine and should be handed back to the Royal Armoured Corps. Similarly, the infantry's Assault Pioneer Platoons must be expanded to take over simple tasks such as mines, smaller demolitions and small improvised bridges. These skills should be disseminated throughout the Infantry, as they are in both the Russian and Chinese Armies, thereby leaving the presently named Divisional Engineers to carry

out the major engineering tasks in the area. It is no more inconsistent to have unit Sappers than it is to have Unit MT. This could be assisted by the attachment of a RE sergeant to every regiment or battalion.

The principle must be re-established that once an idea has been fully developed and can be used through a set system of simple drills, it should cease to be the responsibility of the Corps and the potential, thus released, used to its full elsewhere.

Having shifted the emphasis in this way, it now becomes essential to maintain the professional competance, particularly of officers. The proportion who today have received university training is as high as any civil engineering firm and could be cut from the present 50 per cent down to 30 per cent. Not everyone gains from a theoretical education and those whose bent lies more towards the practical should be attached to the design office of a firm of Consultant Engineers for say a year, followed by two years on the site of a major project. Here they will be dealing with men similar to those in the Royal Engineers and they will also see first hand the problems of organization and control that are involved.

In order to maintain the freshness of approach at the higher levels in the Corps, commissions should be offered to qualified engineers from civilian life in much the same way as is practised now by the RAMC. Regular officers must be given the chance to broaden their scope by serving outside the Corps as engineers with civil firms (as at present, but in larger members) and as soldiers in the more unusual type of regimental posting, such as the Trucial Oman Scouts. Nowadays careers tend to become too stereotyped. Sappers have never been accused of being this before.

The Other Rank trade-structure must be overhauled and brought up to date. There is an excessive proportion of old fashioned building trades (plumbers, painters, bricklayers, etc) and of precision machine operators (fitter machinists, wood machinists, wood turners, etc), for which there is little scope today. The proposed Construction Squadrons will rather require concretors, steel fixers, operators for modern construction machinery, so that the emphasis in trade training should be altered in this direction. Civil Engineering practice employs GCEOs or General Civil Engineering Operators, who are capable of carrying out all tasks on a site except carpentry and fitting. Such a trade could be introduced as an alternative basic skill to Combat Engineering, whose BIII Syllabus is about 40 per cent irrelevant to revolutionary war.

It goes without saying that the confusion over the use and deployment of plant should be cleared up.

Lastly, research and development must become the concern of every officer in the Corps. Design study should be part of the Sapper promotion examination and each unit should be allotted money for an experimental fund set apart for the production of new ideas. Theoretical treatises would also be accepted. One frequently hears complaints that equipment designed for the army is not what is required and that it takes far too long to come into service. If every officer took an active part in development this would not be so. It is distressing to see that the Corps has no hovercraft, only now a helicopter flight, no computers in use, no lasers—the list is endless—and what new ideas we do have come from MEXE.

This will incidentally have a useful side effect: one of the worst features of the modern Army is the over supervision of subordinates with resulting;

dissatisfaction and lack of initiative. If every Sapper officer had a research or design problem, he would not have time to oversupervise!

Conclusion

This article contains many criticisms, but it is hoped that they will be taken constructively, for that is the intention. It also contains a few suggestions which are no doubt being implemented at this very moment along with many more, but the younger members of the Corps must be forgiven if sometimes they are confused and cannot see what lies ahead.

Defence trends make the Army an uncertain occupation and to remain attractive the Sappers must undergo some extensive changes. Everyone wants a job that is stimulating and useful; if we can anticipate these trends and at the same time improve our professional ability, we will be able to give better support to the Army in the traditional way and to embark on a whole new field of development in areas that most urgently need it. Then the Royal Engineers will be a truely worthwhile career.

Computers for the Corps

By Captain C. G. B. Brodley, MBE, RE, BSc

Introductory Note

This article was prepared in March 1965 after a study period in BAOR referred to in the text. There were indications at that time that the Corps was coming to a decision about the use of computers and the article was put aside. In the intervening period, however, there have been few indications that any further progress has been made. Although the Corps is still as enamoured of Critical Path as it was in 1959, this is only a convenient stepping stone to the use of computers.

BAOR has been used as a background and example but the principles and arguments involved could be equally applied to other areas. A similar programme would be a useful adjunct to any feasibility study for a British Army in say Australia and its deployment from there.

I must acknowledge my debt to Lieut-Colonel J. A. Burton, RAOC who not only gave the original presentation but also subsequently gave me much advice and encouragement.

Introduction

The first doubling of man's knowledge occurred in about 1750, the second in about 1900, the third in 1950 and the fourth in 1960. To maintain this rate of progression is, of course, impossible; by now we should have eight

times the total knowledge of 1950. Nevertheless the advance in technology continues to move at a bewildering rate. A direct result of, and today a major factor in aiding, this advance is the electronic computer. Calculations, and especially permutations which previously took months to work out, can now be solved in a matter of seconds.

Industry has been quick to grasp the commercial benefits of these applications and, where the foreseen expenditure warrants the cost, computer programmes are written to simulate a great number of economic variables. To cite one instance, a programme was run for a large oil company to discover the most cost-effective deployment of a proposed new oil refinery. A programme was written to simulate the arrival and departure of its fleet of oil tankers, its road and rail transport and its various commercial depots and outlets inland. Exhaustive permutations of these factors, linked with alternative sites for the new refinery, on a scale that would have been quite impossible without the aid of a computer and planning team, secured the most economic siting.

Industry and Government research have stimulated demand in other activities. With the advent of smaller computers and more sophisticated techniques it has become possible to use computers in the air, on the sea, and in the field. Target indentification and direction finding was an obvious use for all types of gunnery, more especially surface to air. Using prepared programmes related to the constant factors of design in the equipment, it is possible continuously to evaluate and up-date information coming in from the target. This information is then simultaneously relayed to the gun-laying equipment and a display console. This is, admittedly, vast simplification but it is sufficient to the argument that it can be done. The important factors are firstly that the aim of detection and destruction on any approach is capable of rigid definition, secondly that the equipment to achieve this is in existence and thirdly that the information required to evaluate the problem is capable of being written into a computer programme.

Computer programming can be thought of as very basic logic. To a question put to it a computer can only answer "Yes" or "No". "There is a current" or, "There is not a current"; "Blip" or "No blip". To obtain a response from a computer it is necessary that each step in the argument is capable of being answered by "Yes" or "No", and it must also take into consideration all the eventualities that may occur. A simple programme may be written for lighting a match:—

Take box from pocket	Yes	
+		
Open box (right way up)	Yes	
+		
Does it contain any matches?	Yes	No (Get another box)
+		
Take out match.		
+		
Is it live?	Yes	No (Throw away match)
+		
Strike match against side		
+		
Is it alight?	Yes (and so on)	

If the computer is not given instructions to deal with an empty box then it will grind to a halt on the first empty box that it encounters. Similarly it must be told what to do with a dead match. There is no need nor the space further to amplify programming, but it is evident that, so long as equipment exists capable of interpreting the facts of a problem, and these facts, no matter how many or how complex, can be programmed then there exists a reasonable case for development.

The question to us is, can such techniques benefit the Royal Engineers? There are already illustrations of the use of computers in other arms of the service. The RAOC have computer systems to handle all indents, receipts and issues, and these are in operation. The RAPC have a computer system that handles pay documentation and accounting, and the RA have field computers. In the discussion that followed a recent BAOR study period the prevailing thought was that this was all very well, but the Sapper problems, were different. The sea and the air are homogenous media, unlike the ground over which we must operate, and the computers used by the RAOC and the RAPC dealt with repetitive procedures albeit on a vast scale. It was one thing to perfect a system of naval gunnery operative in mid-Atlantic because it would be just as operative in the China seas. It was, however, another thing to try and evaluate all the uncertainties of a Sapper land operation. Who can programme for enemy interference or for the variations in road or river width? A floating bridge, to take just one example, can be adequate on one site; two miles away, however, on the same river, or at the same site two months later, it might be a few bays short. The reaction was readily understandable, but it should not prevail.

We are indeed faced with problems that are often indeterminate and complex. If, however, anything can be pre-planned now, if anything can be done to make us more effective and efficient and reduce our losses or cut down operating procedure and construction times, then we must make ourselves responsible for doing it. The whole purpose of this paper is to suggest ways in which computers might be used to lighten the load in any future situation.

Deployment of Equipments

In training at sub-unit level great emphasis is placed upon rapid construction drills. From the harbour area to the river line, year in year out, troops are practised and rehearsed so that valuable minutes can be saved. Yet this is only the sharp end of a problem that begins a long way back. Efficiency and constant practice may reduce construction times by thirty minutes or even an hour, but how does this compare with the time taken to locate, brief, load and deploy the equipment in the first instance? The task can be as much prejudiced by poor deployment as it can by bad construction, yet the staff problems are such that they can be largely solved by a computer.

To illustrate let us consider a river crossing operation involving heavy equipments. Some of the suitable equipment may already be deployed, some may have been committed to reserve and some written off. More than one equipment may be suitable to the task. The problem is: what to use and on what sites, where is it to come from and can it be brought up on time? It is a problem that will engage Engineer officers in Headquarters with Loading and Movement Tables and Reconnaissance Officers in Troops with their "Recce Boats". It is this effort that a computer can best help.

The first essential is that every single item of river crossing equipment

possessed by the Corps, from an assault boat to a heavy floating bridge, must have had its own individual characteristics programmed. The laden capability, length, weight, transport requirement, road speed, loading times, construction and recovery times and every other pertinent fact must be written in. The computer then has a "River Crossing Equipment Memory" that can be plugged in at will—a memory vastly superior in its scope and far less fallible than that provided by any Engineer staff. This memory corresponds to the RAOC Stores catalogue, it is a library of all the constant factors. In a comprehensive programme there is no reason why every known crossing site together with its accompanying harbour area should not be included. There can be few stretches of the major rivers in BAOR for example, that have not at one time or another been subjected to a reconnaissance. There is no difficulty in programming this information—it can be done—it is only a matter of storing and collating the original reports.

Armed with a vast memory tape, there is need for two smaller programmes. The first of these requires constant revising and is a locating tape. Like map pins on a mapboard, this tape would need to show the location of every item of equipment under command. Together with the memory tape every fact concerning each item of equipment would be readily at hand. The second of these two smaller programmes would consist of those special requirements pertaining to the task in hand, and this is the only task that has to be done from the moment orders are issued. Even this can, to a certain extent, be pre-planned. Many factors will always occur in an operation of this sort and a skeleton programme, akin to an empty proforma from *Staff Duties in the Field,* made up. The crossing sector would throw out the sites available within it together with equipments applicable to each site. The deployment tape would instantly show what equipments are available, where they are located, and what combinations of these equipments will fulfil the task. All the salient timings can be obtained: when should recovery and loading of a committed equipment start, or deployment to harbour areas? How long will construction take? and how long can the equipment remain in use?

It would be wrong to pretend that it is simply a matter of plugging in the computer and awaiting results. A computer will only handle the facts at its disposal on the programme it has been fed, and it takes a long time to feed a computer. What it will do is allow vast quantities of preparatory work to be stored for those times of emergency when the answers are needed in a hurry. It will sift all the facts, evaluate the pros and cons and present a number of solutions. It will do this within minutes and without anybody leaving Formation HQ.

Initial Deployment of Troops and Resources

Prior to the ideological schism between East and West wars were usually caused by the ambitions of individual nations. Before the unification of the German States, France had tried to dominate a Europe composed of a series of small and changing alliances. After the Franco-Prussian War of 1870, it was Germany who twice brought Europe and the world into conflict, Rumania and Italy changing sides in the intervening period. The only constant factor throughout was the determination of Great Britain to protect herself and the Low Countries and to maintain a balance of power within Europe. In times of peace there existed a state of diplomatic flux wherein the

end result gradually became discernible. Though the incident that would bring war could not be foretold—Serajevo in 1914 and Poland in 1939—there were long periods beforehand when the writing was on the wall—from the time of Germany's rejection of the Anglo-German Naval Agreement in 1910, and the German occupation of the Rhineland in 1936. Even so we were in no way satisfactorily prepared for war when it came.

Today this period of diplomatic flux has vanished. In the interests of collective security the nations of East and West have remained armed for conflict. The alliances are stated and their forces largely deployed. In 1937 the stationing of troops in Europe would have appalled America; today it is accepted, and their withdrawal now would appal the Western European countries except perhaps France. There can be no prolonged period of grace. If BAOR is to have a real military, as opposed to political, significance then it must be capable of very rapid deployment. There is, therefore, an unprecendented need for rapid deployment and execution of initial tasks which are prodigious. The tasks are known, but priorities and deployments, have to be decided and an assessment made whether they can all be done with the resources available. Certainly there is no way of attempting this assessment in practice, even in dummy form, for security reasons if none other. It is not suggested that no thought has been given to these problems—an enormous amount of work has been done—but the solutions that have been evolved could be more rigorously tested by a computer.

A suitable programme would include the targets by serial number, together with their type; the time and labour required for their preparation, the stores and transport required, and the location of each target. The complementary programme would include all the resources available for tackling the task. Having programmed the entire commitment several things can be ascertained. Firstly can all the tasks, as envisaged, be done at all? Secondly, if it is not practicable, what targets can be eliminated with the minimum effect, and what is the most cost-effective solution with the resources available? Thirdly, assuming that complete units are wiped out, what is the best way of plugging the gap without prejudice to the entire task? Fourthly, have the areas of responsibility been defined in the most effective manner having regard to the targets within the area and the men and materials available? Engineer staff officers are trained to study these tasks, but once they have arrived at an appreciation there is no certain way of testing it. Their knowledge is indispensable to a computer for they must "feed" it, but a computer will sift and evaluate the facts and test them against the requirement in a more certain and searching manner than has previously been possible.

Much has been written about the Critical Path Method of works planning, to date largely limited to the physical construction tasks facing the Corps. Critical Path Planning is admirably suited to computer programming, and the use of computers to solve the larger and more complex problems is the next logical step. This is not an exhaustive paper by any means. More fertile and experienced minds will no doubt see other possible applications; the storing of route reconnaissance information is another obvious promising field. All I have attempted to show is that the possibility of improving our techniques does exist. It would ill become us to surrender the opportunity without investigation. The task may seem enormous, it does not become less enormous in time of emergency, and for the present we have the opportunity to prepare.

Correspondence

Ernest J. Martin,
72 Lock Chase,
Blackheath,
London, SE3.

The Editor,
RE Journal

27 August 1966

Dear Sir,

MY DOGS WEAR MY COLLARS

As a collector of medals (awarded to other people!) I read Colonel Oram's article in the June *Journal* with interest and pleasure.

It is possible, of course, that there are two versions of the story from which he derives the title of his article, but the one I have heard is that Queen Elizabeth said: "I will not have my Sheep marked with a strange brand, nor suffer them to follow the Pipe of a strange Shepherd." I quote from De Wicquefort, *The Embassador and his Functions* published in 1716—true, not a contemporary source, but much nearer to the date of the happening than to today.

Yours sincerely,
ERNEST J. MARTIN.

Lieut-Colonel E. E. Peel, RE, BSc, MICE
Civil Engineering School,
Royal School of Military Engineering,
Chatham, Kent.

The Editor
RE Journal

10 August 1966

Dear Sir,

WHICH HUT?

Lieut-Colonel J. D. Townsend-Rose, in his article "Which Hut?", printed in the June *Journal*, has over simplified a complicated problem and in doing so has drawn conclusions which can, at the very least, be misleading. The overall effect of the article is to damn the Twynham.

In his requirements for military hutting he has listed some fourteen to sixteen characteristics which he states have been considered. Of the conclusions drawn from these considerations some are fact, some comparable assumptions, some are opinion and at least one, the cost of erection, has been omitted altogether.

Table 2 is an unfair comparison unless an estimate of the number of possible dismantlings and re-erections are considered, a very pertinent military characteristic.

Table 3 compares cost per square foot of floor area. This is misleading unless the useful floor area is the basis of the comparison, the Tent GS Mk II and the Nissen have, by their very shape, severe limitations on the proportion of actual floor area that is useful.

I would suggest that if the military characteristics are more realistically weighted and, in particular, due cognizance were taken of cost and speed of erection and ease of dismantling and re-erection, an entirely different conclusion would be drawn.

Of the Twynham huts erected in Aden some were new, many had been erected

once before and some twice before. In this School one Twynham has been erected and dismantled nearly 100 times and several are in their "twenties". Accepting this fact, and it is fact and not opinion, the objection to the use of Twynham huts for short term use, due to high cost, is completely unwarranted.

Lieut-Colonel Townsend-Rose, in all fairness, does make the point that "the relative assessments can only be a personal observation"; this is however lost in the text and Table 4 which sums up the relative merits of the huts does not reflect this. I know of no justification for the low ratings given to Twynham hutting and indeed can find nothing in the article to substantiate such low classification.

Yours faithfully,

E. E. PEEL,
Lieut-Colonel, RE

Major T. W. Tinsley RE
522 Specialist Team,
Royal Engineers (Constr)
HQ Commander British Land Forces Borneo
British Forces Post Office 660

The Editor
RE Journal

31 August 1966

Dear Sir,

Lieut-Colonel J. D. Townsend-Rose produced a very sensible approach to selecting "Which Hut". The decision must be based on the questions: "How long must the hut last?" "What types of hut are there in store that we could bring in?" and "What materials are readily available locally?" The answers of these three questions must be decided: the selection of the type of hut should then be fairly easy.

There are a few small points I should like to make:

(*a*) If plastic domes or hessian arches make better huts than the ones we know, we should be prepared to train in their techniques. It is the factor of suitability rather than difficulty that should be decisive.

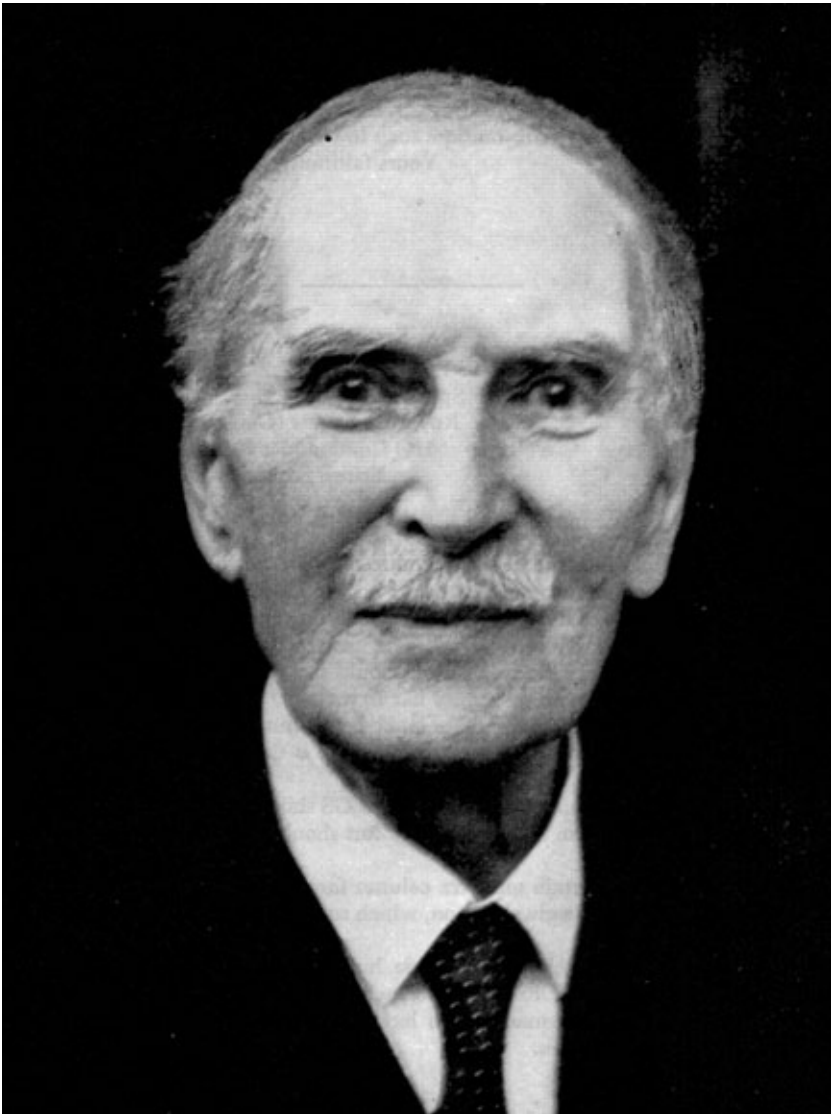
(*b*) In Table 2 the volume of floor for a tent GS should be 10.8 cu yd; the span of life of a concrete floor to an Australian type hut should be ten years (five years if in wood).

(*c*) Table 3 should contain an extra column for air freight for the last lift to site. This would be £100 per deadweight ton, which somewhat dwarfs all other aspects in the table.

We have not used much factory-made hutting in Borneo for accommodation because local timber is plentiful. However, where wide spans have been needed, for workshops, etc, the factory made sheds have been used. This could be because it saved designing bigger trusses.

Yours faithfully,

T. W. TINSLEY, Major RE.



Brigadier General Sir Osborne Mance,
KBE, CB, CMG, DSO

Memoirs

BRIGADIER GENERAL SIR OSBORNE MANCE, KBE, CB, CMG, DSO

PAST PRESIDENT, INSTITUTE OF TRANSPORT

HARRY OSBORNE MANCE, a famous Transportation Sapper, and a Foundation Member and one-time President of the Institute of Transport, died at his home in London on 30 August last, aged 90 years.

He was the eldest son of Sir Henry Christopher Mance, Kt, CIE, LLD. He was educated at Bedford School and the Royal Military Academy, Woolwich, where he was awarded the Pollock Medal, and he was commissioned into the Royal Engineers on 15 March 1895, the top of his batch.

During his young officer training he was awarded the Fowke Medal and on leaving Chatham he specialized in railways and was posted, in April 1897, to the 10th Railway Company, then stationed at Woolwich. He was sent on a year's attachment to the Traffic Department of the Great Western Railway, and rejoined his unit in time to accompany it to South Africa. Throughout the Boer War the Sappers became responsible for the operation, repair and construction of an ever-lengthening rail system on which the maintenance of the Expeditionary Force depended. Indeed it was its sole life line. On the prosaic railway line, rather than in the battle line, therefore, lay the main task of the Royal Engineers in that campaign. To it all else was subsidiary, and on it the whole prosecution of the war depended. Sir Percy Girouard, the Director of Railways for the South African Field Force, formerly one of Kitchener's "Band of Boys" and Director of Railways in the River War, was not slow to spot Lieutenant Mance's outstanding ability and he made him a Deputy Assistant Director of Railways and Armoured Trains, a post he held throughout the campaign at the close of which he was awarded the DSO.

He rejoined the 10th Railway Company in 1903 and returned with the unit to Woolwich the following year. In December of that year Mance, then a substantive captain, was given command of the Company which in September 1905 moved with the 8th Railway Company to Longmoor Camp to connect the camp by rail with Bordon Station on the London and South Western Line. He was thus one of the founders of what was to become the Transportation Centre, responsible for the training of so many Royal Engineers regular and auxiliary force Movement Control and Railway Units.

In 1908, with two other RE officers and a small party of NCOs and Sappers, he went out to Nigeria to supervise the construction of the Baro–Kano Railway. In control of a large local labour force, without any mechanical plant, his party achieved a remarkable construction rate, at one time laying six miles of track a day. Whilst on leave from Nigeria he married, on 2 November 1911, Elsie, youngest daughter of Major-General W. Stenhouse of the Indian Army. They had three children, two sons and a daughter. The second son has continued the contact with Nigeria where he is now serving with the Church Missionary Society in charge of a Church in Ibadan.

Early the following year he was posted to Longmoor as Commanding Officer 53rd Railway Company but, that unit being disbanded in July 1912, he was given command of the 10th Railway Company which, with the 8th Railway Company, formed the only regular Railway units in the British Army. The following December he was sent to the War Office as a Staff Captain in the QMG Department. He remained there throughout the 1914/18 War holding successively the appointments of Deputy Assistant Director of Movements, Assistant Director of Railway Transport and, with the rank of Brigadier-General, Director of Railways, Light Railways and Roads. For his services he was made CMG in 1917 and created CB in 1918.

From 1919 to 1921 he served on the Supreme Economic Council and was transportation adviser to the British Delegation in Paris. Returning to Regimental duty in October 1921 he became the CRE Thames and Medway Area, Chatham. His last appointment was CRE London District which he held from January 1923 until his retirement on 16 May 1924.

Retirement from the Service, however, did not bring to an end Mance's active life. In 1924 he became Technical Adviser to the Ottoman Bank, a post he held until 1962. He also became a Director of the Bankers' Investment Trust Limited and of the Army and Navy Investment Trust Company Limited and the Port of Tangier Company. He was the British Director on the Board of the German Railway Company from 1925 to 1930. He prepared a Financial Report on the Austrian Railways in 1933 and in 1936 he reported on the co-ordination of transport in East Africa. He was created a KBE in 1929.

During the 1939–45 War Sir Osborne Mance accepted an invitation from the Ministry of War Transport to become Director of Canals an appointment he held, without pay, through the war. He served as the British Member on the United Nations Transport and Communications Commission from 1946 to 1954 and as the British Delegate on the Central Rhine Commission from 1946 to 1957.

As stated earlier in this memoir, Mance was a Foundation Member of the Institute of Transport, before which he read important papers and was awarded their Triennial Gold Medal in 1926; he was elected to the Council in 1943 and served as a Vice-President from 1945 to 1948 and as President 1949–50. His range of interest covered all forms of transport and communications, including their international relationships and importance to international commerce. His publications included: *The Road and Rail Transport Problem* (1940), *International Telecommunications* (1943), *International Air Transport* (the same year), *International River and Canal Transport* (1944), *International Sea Transport* (1945) and *International Road Transport and Miscellaneous and Frontiers, Peace Treaties and International Organization of Transport*, both published in 1946.

Writing in *The Times* Lord Hurcomb paid a moving tribute to Sir Osborne Mance's immense contribution to international transport. In his private friendships, he wrote, "Mance was a delightful companion. Loyalty to old associations, military, transport and personal, was fundamental in his character."

A truly great man, whose life had almost spanned a century, died on 30 August 1966. The funeral was held privately for the family only.

COLONEL H. CARINGTON SMITH, OBE, BA

HERBERT CARINGTON SMITH, who died at the Cumberland Infirmary, Carlisle, on 11 July, was born in 1906 at Toronto, Canada. His grandfather had emigrated from London about 1850, while his mother's forebears were United Empire Loyalists who had moved north from the American Colonies after the War of Independence. In joining "the Imperials", Herbie (as he was widely and affectionately known) followed family tradition. After schooling at Upper Canada College, Toronto, he graduated in 1927 from the four years' course at the Royal Military College, Kingston, with the rank of Under-Officer, having gained all round distinction.

Three years training at Chatham and Cambridge University with Ewbank's (18 YO) Batch was followed in 1930 by two with 5 Field Company at Aldershot, and then a posting to the newly-formed 18 Field Survey Company at Fort Southwick, thence to the Ordnance Survey at Southampton and Edinburgh. During 1933 he took part, as a Surveyor, in an Oxford and Cambridge University Expedition to Spitzbergen.

First foreign service came in 1935 with the British Guiana–Brazil Boundary Commission, a tour of two and a half years. After another eighteen months with 19 Field Survey Company, in the rank of Captain, he was made Acting Major on the outbreak of war and took the Company to France with the BEF. He returned about the year-end, having been selected to attend the first Short War Course at the Staff College, Camberley and was later awarded *psc*. After short periods with AD Survey, London, 22 Training Centre RE, Scarborough and the Railway Training Centre RE at Derby he was posted to the SME, then at Ripon, in succession as Instructor in Field Works and Bridging and Brigade Major. During his time at Ripon he again visited Spitzbergen for special duties with Force III, composed largely of Canadian Sappers, sent to evacuate the inhabitants, destroy fuel stocks and render all facilities useless to the enemy. This was achieved successfully without interference. Here he received a mention in despatches for saving a Sunderland flying boat from being driven ashore in a storm. He collected some French-Canadian soldiers, none of whom had ever handled an oar, took out a small rowing boat, got a line to the Sunderland and towed it to safety.

Next came a two-year appointment as GSOI (Technical) on the Liaison Mission to Australia, where according to reports "the Australians thought the world of him". This duty took him amongst other places to Papua, the scene of jungle warfare against the Japanese invaders in extremely difficult and trying conditions which posed exceptional engineering problems.

His next foreign tour took him back to the Far East, as CRE to the British and Indian Divisional Engineers, BCOF Japan and thence in May 1948 to command of the Engineer Training Centre, FARELF at Kluang, Malaya, until November 1952. He was awarded the OBE in January 1948 and received a mention in despatches in December 1949.

Returning again to the UK, he was in May 1953, on promotion to substantive Colonel, appointed Assistant Director DRE (Equipment), Ministry of Supply. His final tour began in 1957 in command of 23rd Engineer Group (TA) at Hereford where he retired in February 1960.

Colonel Carington Smith's varied career well reflected his ever-inquiring mind, his objective and practical approach to situations or problems and his

rich vein of invention and originality in any field, however unfamiliar. His unfailing good humour and quiet enthusiasm were immensely infectious, while his modesty, good-natured tolerance and strength, tempered with gentleness, earned him universal respect and made him many friends.

Herbie had a passionate love of sailing and the sea, and his happiest hours were spent afloat. He became a qualified skipper in the REYC and took part in many races. It was characteristic that he sailed in *Ilex* in the 1931 Trans-Atlantic Race achieving, among other feats, the daily production of fresh bread from a biscuit tin oven. As skipper of *Right Royal* in the 1956 Channel race he saved the yacht when dismasted in a gale. He refused all offers to be taken off by other boats, which would have meant abandoning ship, and brought *Right Royal* and crew, battered but safe, into Dunkirk.

He married in 1950 Alison Gatey, and leaves a son and a daughter. On retirement they lived for a time at Hereford, moving in 1965 to Keswick. Early in 1966 he contracted a severe jaundice, with complications. Despite two major operations and slowly ebbing strength, his characteristic courage and determination never wavered, until he quietly slipped away.

The sympathy of a host of friends, both within and outside the Corps, will be extended to Herbie's widow and family in their untimely loss, and he will long be remembered with admiration and affection.

B.M.A.

Book Reviews

THE ARMIES OF QUEEN ANNE

By MAJOR R. S. SCOULLER, *psc*

(Published by the Clarendon Press: Oxford University Press. Price 70*s* net)

The author of this most comprehensive study of the British Army in the time of Queen Anne was, until recently, a serving regular Royal Signals officer. Being a Staff College graduate he no doubt during his service learned in broad outline how the Army of today is controlled by Parliament, recruited, paid, disciplined, accommodated, trained, equipped and otherwise organized and administered. It is, however, doubtful if he, or any other present day *psc* officer, has amassed an intimate detailed knowledge of the machinery that operates the Army of Queen Elizabeth II comparable to that necessary to write this detailed treatise on the way the Armies of Queen Anne functioned over 250 years ago. The extensive bibliography at the end of the book gives a small indication of the immense research that must have gone into its production. In erudition it compares with the two volumes of the *History of the Royal Arsenal* and *The English Artillery 1326–1716* by Brigadier O. F. G. Hogg. The book is excellently written, easily read, full of dry humour and well indexed.

The Army of Queen Anne, under Marlborough, was amongst the most outstandingly and brilliantly successful British Armies in history. It was in fact unique in that it did not begin its career with a series of defeats. In the main it won every battle in which it was engaged and acquired that self-assured, unaffected disdain for other troops that has ever since carried British soldiers through many a dark day. Other Armies of Queen Anne captured Gibraltar, waged war in Spain and Portugal, campaigned in Canada and the West Indies and fought at sea with equal brilliance, tenacity and success. And all this in spite of a fantastically cumbersome organization

and diversity of control, so well described in the book, and in many places ineptitude, jealousies, place seeking and downright corruption.

The book is divided into six chapters dealing with the overall control of the Army and the duties of the Secretary at War, the Paymaster General, the Board of Ordnance and the Board of General Officers; the internal organization of the Army, the Captain-General or Commander-in-Chief, Staff Officers and the Military Secretary's Branch; Establishments, Regimental Organizations, Recruiting and Reinforcements; Pay, Clothing and Quartering; the Train, Artillery, Engineers, Ordnance Services, Transport, Supplies, Medical Services and Remounts; Deserters, Prisoners of War, Resettlement and Dependents.

Each chapter is most enlightening. The wonder is that the complex machine was accepted and that it worked despite its many faults. That it did so was almost entirely due to two men—John Churchill, Duke of Marlborough, and Sidney, Earl Godolphin, Lord Treasurer of the Council for eight years of Queen Anne's reign, who "managed" polititians and bent regulations in order to raise men, money and arms to enable Marlborough to prosecute the war.

Perhaps to the Sapper reader the references to the Board of Ordnance and their military gentlement of the Artillery and the Egineers will be of the greatest interest. A splendid folding plate sets out the "Outline of the Office of Ordnance with the Salaries of Officers". Few today would be tempted to return to that organization, which was abolished by Palmerston in such a peremptory manner at the close of the Crimean War, except that the engineer officers then drew over twice as much pay as their gunner colleagues.

Wellington in his Peninsular Campaign bitterly resented the independent control that the Board of Ordnance exercised over the gunners and sappers. To circumvent this he raised his own "private Army" of field engineers known as the Royal Staff Corps. Marlborough, his predecessor, was able to do things in a grander manner. Not only did he make himself Captain-General of the Army, but he also held the post, *in absentia* whilst away on his campaigns, of Master General of the Ordnance, thereby becoming the boss of both concerns. Indeed during his nine campaigns in NW Europe from 1702 to 1711 he left unfilled the appointment of Chief Engineer of England on the establishment of the Office of Ordnance and retained with his continental expeditionary force the most able and the most senior of the Board of Ordnance's Engineer Officers, using their talents, both as engineers and artillerists, where best it served his purpose.

SALUTE THE SOLDIER

By Captain Eric Bush, Royal Navy

(Published by George Allen & Unwin Ltd. Price 52*s* 6*d* net)

This splendid anthology by Captain Eric Bush, DSO, DSC, follows his *Bless our Ship*, a story of his life in the Royal Navy, and *The Flowers of the Sea*, hailed by Taffrail as a maritime treasury of verse and prose.

Salute the Soldier was written as a companion to *The Flowers of the Sea*. The hundreds of passages in the anthology tell of our country's great military achievements and glorious failures and enable the reader to study the thoughts of the poets and the writers of the time and to catch, if only fleetingly, the passion of the hour and to remember that an Army is composed of individuals, each dominated by his own human considerations whether he be a great Captain or a simple Soldier.

To the Sapper reader the many references to Kitchener and Gordon will be of particular interest, as will the splendid accounts of Durnford's action at Isandhlwana, Chard's defence of Rorke's Drift and Digby Jones at Wagon Hill. Many, however, will be surprised to see that the extracts from The Official History of the War, Vol. II *The Mediterranean and Middle East*, included in the anthology, quote the author as being Major-General I. S. O. Playfair, late Hampshire Regiment.

THE MILITARY INTELLECTUALS IN BRITAIN: 1918–1939

By ROBIN HIGHAM

(Published by Rutgers University Press, New Jersey $7.50)

Dr Higham is a Professor of Modern British History and of Technology and War at Kansas State University. By birth a Londoner, he was evacuated to the USA as a boy in 1940. Before he was 18 he joined the RAF in Canada and served as a pilot in Transport Command. After the war he secured his PhD from Harvard University. His previous works include:—

Britain's Imperial Air Routes 1918–1939 (1960), *The British Rigid Airship 1908–1931* and *A Study in Weapon's Policy* both published in 1961, *Armed Forces in Peacetime: Britain 1918–1939* (1963) and, in conjunction with David H. Zook, *A Short History of Warfare*, published earlier this year.

His present book developed from work done on a National Security Policy Research Fellowship. It is broadly divided into sections dealing with the climate of political opinion in the interwar years, and the lives, ideas and works of the so-called official and unofficial intellectuals of Sea, Land and Airpower, their often conflicting views on matters of defence and how war could be avoided or, once joined, how victory could be obtained and what kind of victory it should be.

Admiral Sir Herbert Richmond and Captain Bernard Acworth dominate the Naval scene as the outstanding "pundits of Seapower". Sir Frederick Sykes and Marshal of Royal Air Force Lord Trenchard appear as the philosophers of the new Air-arm and the concept of the strategic bombing to break the enemy's will to resist. In matters primarily, but not exclusively, affecting the Army Major-General J. F. C. Fuller and Captain B. H. Liddell Hart stand out as the great advocate of Landpower and more particularly Mechanized Landpower. Indeed these two names, and extracts from their works, are the most quoted in the whole book. Both fell into temporary disrepute through their supposedly sinister political connexion with respectively Sir Oswald Moseley and Mr Hore Belisha. With time, however, the tarnish wore off and in 1963 they were each jointly awarded the coveted Royal United Service Chesney Medal, an award instituted in 1899 as part of a memorial to that distinguished Sapper officer, General Sir George Chesney, and given from time to time to Authors of specially eminent works calculated to advance military science and knowledge.

DUBLIN CASTLE AND THE 1916 RISING

By LEON O'BROIN

(Published by Helicon Ltd, 22 Upper Fitzgerald Street, Dublin. Price 6s)

This paperback gives a concise account of the events which led up to the 1916 Rising, largely from the point of view of those responsible for the administration of the country. The author has made considerable use of source material not previously available, and the book is refreshingly unbiased and genuinely historical.

It gives convincing reasons why Government failed to prevent the rising in spite of the fact that it had previously been forewarned. It illustrates the difficulty which confronts anyone called on "to give a people the idea that they are being fairly governed and the way prepared for the transfer of Government to them" whilst at the same time acknowledging that "the enforcement of law and the preservation of order should always be independent of political expediency".

Its interest to members of the Corps will be mainly in the generous tributes the author pays to Sir Matthew Nathan who as Under-Secretary for Ireland was responsible under the Chief Secretary, Augustine Birrell, for its administration. Nathan was commissioned in the Corps in 1880 and subsequently had a very distinguished career in Colonial appointments as successively Governor of Sierra Leone, the Gold Coast, Hong Kong and Natal and later as Secretary to the Post Office and Chairman of the Board of Inland Revenue.

The Royal Commission which reported on the Rising found that the main cause was "an unchecked growth of lawlessness and the fact that Ireland for several years had been administered on the principle that it was safer and more expedient to leave the law in abeyance if collision with any faction could thereby be avoided". Birrell as administrative head and Nathan as Under-Secretary were held responsible for the situation that had arisen and for the outbreak that occurred. Both of them resigned and Nathan returned to regimental duty as a Lieut-Colonel.

The whole of one chapter is devoted to the opinions of persons of varying backgrounds who held other, and more generous, views about his conduct. The author himself praises him warmly. "He was an uncommonly good man, accessible, hospitable and the possessor of a marked gift for friendship". "He had unlimited initiative and drive and an unequalled capacity for working hard over long stretches". "Nathan took away with him the good wishes of many people, for no one could question the transparent honesty of the man and the genuine efforts he made to keep the peace in Ireland otherwise than by coersion."

Three years later Nathan became Governor of Queensland and Chancellor of its University. Later he served on a special commission on the Constitution of Ceylon and as Chairman of a Colonial Secretary's Committee. In retirement he published a massive and interesting work on the annals of West Coker where he spent the last years of his life.

"To the end" sums up the author "he was the conscientious servant of the public and deserves to be remembered as such". This book helps to do so in any interesting way. H.W.

THE HISTORY OF THE ROYAL CANADIAN ENGINEERS

VOL I. 1749 TO 1939. 410 PP, PLUS MAP AND ILLUSTRATIONS
VOL II 1936 TO 1946. 735 PP, PLUS MAPS AND ILLUSTRATIONS

(Published by the Military Engineers Association of Canada, PO Box 591, Ottawa, Ont, Canada. Vol. I—$5.00, Vol II—$10.00, both ordered together $13.00)

According to the preface, detailed work started on this History in 1950. Volume I appeared in the autumn of 1962 and Volume II in the summer of 1966. The authors and the publishers give thanks for unstinted help from many sources.

Volume I covers the period from the early days of Canada, under both French and British regimes, up to the period immediately before the Second World War. The date 1749 is chosen because it was in that year that the first definite engineer unit was formed, a territorial artificer company at Halifax in Nova Scotia. In general in those early days Canadians as a whole were experienced as individuals in the simple types of field engineering required in their country. The volume traces the development from the *Levée-en-masse* organization through the gradually increasing urban development to the provision of more and more specialized engineer units—and it is always a question of making bricks without straw. The story is largely one of territorial units—the regular Canadian Engineer Corps was only born in 1903—and the Canadian Engineers of the First World War were almost an *ab hoc ab initio* organization. This war is dealt with in detail, giving the development of the organization at home and abroad, including Signals, Railway and Forestry Corps, the many tasks undertaken by all four branches and the lessons learnt from experience. The volume ends with the post-war reorganization, the years of the doldrums and the gradual awakening to the new dangers.

Volume II overlaps the end of Volume I slightly to give a complete view of the final pre-1939 re-organization and then goes on to give a detailed account of the part played by the Royal Canadian Engineers in the Second World War at home and overseas and ends with the immediate post-war re-organization of 1946. Once again it has been possible to go into greater detail of units, individuals, operations and activities than might have been expected when dealing with a Corps of this size and also

once again the lessons learned by sometimes bitter experience have been clearly drawn. It also possesses an extremely comprehensive index.

The object of the exercise, as given in the authors' preface, is to produce a record of the work of a great many, mostly unnamed, individuals, whose main aim was to do as good a job as they could for their country and "to apply engineering science to the emergencies of modern warfare in order to protect and assist the troops, to ameliorate the conditions under which men serve and to facilitate locomotion and communications." (*Major-General W. B. Linsdey, Chief Engineer, Canadian Corps, 1918*). Of the result a former Director of the Canadian Army Historical Section says—"The result is not a Madison Avenue product but a solid pair of books, based on painstaking research, which is a contribution to Canadian history and will be a source of pride and a great practial asset to the Royal Canadian Engineers in years to come." But it should be added that it is also eminently readable. A.J.K.

HISTORY OF THE SECOND WORLD WAR

Civil Affairs and Military Government Central Organization and Planning

By F. S. V. Donnison, CBE, *edited by* Sir James Butler

(Published by Her Majesty's Stationary Office. Price 55*s* net)

The earlier volumes of this series of the Official History of World War II cover the British Military Administration in the Far East, the Allied Military Administration of Italy, Civil Affairs and Military Government in North West Europe and the British Military Administration in Africa. This volume describes the central direction of these activities. It also contains some illuminating examples of early impositions of military government ranging from the time when Cromwell, in 1654, placed England under the control of ten military governments, each with a major-general at its head, examples of how Marlborough and Wellington tackled the problem in their respective days and what was done in this connexion in the American Civil War, the South African War and the First World War. Problems encountered in those by-gone days however pale into insignificance when compared to those that presented themselves in the Second World War with the almost complete collapse of civil government and administration of overrun enemy territories coupled with mass destruction and havoc, famine, disease and a countless herd of hapless displaced persons.

Problems were not made easier by the conflicting policies and directives issued by the governments of Great Britain and the United States of America, the jealousies of the Allies, the actual birth pangs of the in many respects highly technical Civil Affairs organization and the reluctant acceptance by the military machine of a corps of civilian specialists even though it contained many outstanding officers who for reasons of age, or other considerations, were not employed in a military role. Major-General S. W. Kirby, who had been Deputy Chief of Staff at GHQ India, was appointed the first Director of Civil Affairs (Military Government) under the Permanent Under-Secretary of State, the War Office in June 1943; he was succeeded by Major-General A. V. Anderson the following year who remained in charge of the directorate until it was dissolved. A very heavy responsibility rested upon those two Sapper officers and upon all those working under them in the Civil Affairs organization. This history recounts how well they carried out their task even though the methods they had to adopt varied between theatres of operation.

THE RENAISSANCE ENGINEERS

By Bertrand Gibb

(Published by Lund Humphries. Price 56*s*)

Although this book bears the title the Renaissance Engineers, and indeed a greater part of it is devoted to the great engineering genius of Leonardo da Vinci and his contemporaries, it describes also the works and "inventions" of Archimedes, Hero of Alexandria and Roman, Byzantian, early Moslem and Mediaeval engineers.

The Sapper reader will readily see from this book how these early creative men of genius, or "engineers", who were initially employed almost exclusively on the design and construction of engines of war, seige apparatus, defence works and fortifications, developed into those who designed and constructed works of public utility and became the forerunners of the architect, the civil engineer, the mechanical engineer, the hydraulic engineer, the mining engineer, the municipal engineer and even the aeronautical engineer of today.

The book is profusely and excellently illustrated and there is hardly a page not adorned with a drawing of one kind or another depicting an invention of one of the host of early engineers whose lives, capabilities and works the author has so well described in this volume.

THE SILVER BADGE

By ARTHUR G. KINGSMILL

(Published by A. H. Stockwell Ltd. Price 10*s* 6*d* net)

This book was written by a man who wears the Silver Badge of the First World War: "For King and Empire and Services Rendered".

The author was a Corporal in the 2nd Battalion Queen's Own Royal West Kent Regiment, stationed in India at the outbreak of war, and sent to Mesopotamia. The battalion formed part of General Townsend's force besieged in Kut-el-Amara. The first part of the book gives a graphic soldiers' description of the initial advance and the long siege of Kut, the privations and desperate situation of the garrison, the two failures to raise the siege and the ultimate tragic surrender. Out of a garrison of 15,000, 1,800 were killed or died of wounds or diseases, 1,900 were wounded. Of the 12,000 British and Indian soldiers taken into captivitity over one-quarter died.

Corporal Kingsmill was repatriated with other badly-wounded cases after the surrender, and the rest of the book describes his hospital treatment and his determined efforts to get work after his discharge from the Army throughout the hungry thirties, although almost totally disabled, in order to support an ever-increasing family.

To commemorate those of their Regiment who died in the Mesopotamian campaign Kingsmill and seven other old comrades raised money to present to the City of Maidstone an eight foot public seat inscribed with the words: "50th Anniversary Siege of Kut 1915–1916, presented by comrades of Kut, Queen's Own Royal West Kent Regiment". The Mayor of Maidstone formally accepted the seat on behalf of the City at a ceremony held in Brenchley Gardens on 30 April this year. Kingsmill and his friends also collected enough money to allow seven comrades and a widow of a comrade to attend the ceremony who, without this financial assistance, would not have been able to be present.

Kingsmill certainly lived up to his Regiment's proud motto: "Invicta. Quo Fas et Gloria Ducunt."

A HISTORY OF THE ROYAL SCHOOL FOR DAUGHTERS OF OFFICERS OF THE ARMY 1864–1965

By HONOR OSBORNE AND PEGGY MANISTY

(Published by Hodder & Stoughton Ltd. Price 30*s*)

This is a book which will appeal primarily to those who have some connexion with the Royal School, but it will delight a much wider circle in the Army and in the world of Education.

It is surprising to realize that the Navy had a school for the education of the daughters of its officers twenty-five years before the Army opened its counterpart in Bath in 1865. Nevertheless, both schools were well in the forefront of boarding schools for girls.

The authors are to be congratulated on making so readable the tale of initial vicissitudes, in which clashes of personalities and financial difficulties played a prominent part. Personalities of Governors and Mistresses remain important throughout the whole of the first hundred years of the school's life and financial difficulties were never absent, yet neither are allowed to obscure the girls themselves—their transition from rigid Victorian conventions to present-day freedom; from red flannel petticoats and pinafores to near mini skirts.

The progressive improvements in educational methods and standards are fully detailed, but the tale is told with such vivacious humour and wealth of anecdote that though it is factual, it is never dull. From the pages emerges an image of a first-class modern school, imbued with traditions of loyalty and service, of which the Army can be justifiably proud. Links with the Corps have always been close, not only in the succession of daughters of RE officers who have been educated at the Royal School, but also in the Board of Governors in which Sapper officers have played a distinguished part throughout its history. A.D.C.

SERVANTS OF THE DRAGON THRONE

By CHARLES DRAGE

(Published by Peter Dawnay Ltd. Price 42*s* net)

Charles Drage writes with a swing; when you start to read one of his books it is difficult to put it down and time flies. His biography of Edward Bowra and his son Cecil is no exception to his other works.

Edward Bowra, whilst still a teenager, left his job in the London Customs House to join Garibaldi's Red Shirts and followed that colourful revolutionary figure in his extraordinary campaign in Italy. Later he became employed in the Chinese Maritime Customs towards the end of the Taiping Rebellion where, once again, he deserted his desk for more active service and joined Gordon's Ever Victorious Army to be present at the storming of Soochow. Garabaldi is depicted as an ungovernable, riotous Castro-like insurgent, but one who won young Edward's admiration. Gordon, on the other hand, Bowra described, rather surprisingly, as "a very fair representative of the curled and oiled darlings who parade the Park or Row during the Season in faultless coats and angelically unwrinkled gloves. . . ." Not a generally accepted picture of the great Victorian hero, but he hastened to add that "he united the skill and foresight of the practised soldier". Rising speedily in the Chinese Maritime Customs, Edward Bowra was selected to bear-lead the Pin Ch'un Mission to Western Europe in 1866 as an emissary of the Dragon Throne of China which at that time was unrepresented diplomatically overseas. A most remarkable itinerary was mapped out for the Mission which visited Paris, London, Oxford, Birmingham and Manchester, the Hague, Hamburg, Copenhagen, Stockholm, Helsingfors, St Petersburg, Berlin and Essen and, returning by way of Paris, re-embarked for China at Marseilles. During his short visit to England Edward married Thirza Smallwood and she returned to China with him and the rest of the Mission. Fruitful years and rapid promotion in the Chinese Maritime Customs followed and in 1873 Edward Bowra was placed in charge of the Chinese section of the Vienna Universal Exhibition where he and his young wife entertained Royalty and other important personages visiting the Chinese section. The following year, whilst on furlough in England, he died two days before his thirty-third birthday on the threshold of a great career and with a reputation, well beyond the narrow confines of the Customs Service, firmly established.

Young orphaned Cecil Bowra due to the influence of Sir Robert Hart, his father's previous chief and now probably the most powerful European in China, was accepted for the Chinese Maritime Customs service at the age of 17. His promotion in the service was not meteoric like his father's and indeed after his marriage to Ethel Lovibond whilst on long leave in England he seriously considered leaving the service

and practising law, either at home or in Shanghai. His outstanding work, however, during the Boxer Rebellion gained him accelerated promotion to Commissioner and a promise that he would, after home leave, be understudy to the Chief Commissioner of Customs for the whole of Korea. This post did not materialize, but after a period in Mukden where he was host to the visiting Lord Kitchener who made a deep impression on the Chinese due to his facial likeness to their traditional God of War, he was appointed Chief Secretary in Pekin, a key position to which he had always aspired after twenty-three years service in the Treaty Ports. The rule of the Dragon Throne came to an end when Dr Sun Yat-sen was elected President and the Emperor abdicated on 12 January 1912 and for the next thirty-seven years China was to be delivered over to turmoil, civil war and Japanese invasion until in 1949 the iron grip of Communism imposed order and tyranny once more. Throughout his service as Chief Secretary Cecil Bowra was, if not in name, Inspector-General of the Customs Service, one of the main sources of income to whatever Chinese Government was temporarily in power or whatever War Lord held sway, and it was with these desperate characters that he had to deal from a position of no strength at all except his own indomitable and unyielding courage. On his retirement in 1923 he left China in triumph and showered with leaving presents from a host of well-wishers and also from a number of Chinese officials whom he had often opposed.

Father and son, the Bowra family served China faithfully for over half a century. Their story is a most fascinating one.

RECLAIMING DERELICT LAND

By J. R. Oxenham

(Faber and Faber Ltd. Price 42s net)

The author of this book held a Royal Engineer (Territorial Army) Commission before and during the Second World War; he was employed on roads and airfield construction in the Middle East, and later in charge of timber production in the Calabrian forests during the Italian campaign. For the last twenty years he has been involved in the reclamation of some twelve thousand acres in this country. He has served on the Councils of the Institution of Municipal Engineers and the Town Planning Institute. He writes, therefore, from great experience; he also writes with great clarity.

His excellently illustrated chapter on mechanical equipment should be read by all Royal Engineer officers. His views on the employment of Regular and Reserve Army Sapper units on clearance and rehabilitation projects, requiring considerable earth-moving by mechanical equipment and demolition, are most welcome.

THE MECHANICAL AND PHYSICAL PROPERTIES OF THE BRITISH STANDARD EN STEELS

By J. Woolman, MSc, and R. A. Mottram, AIM

Volume 2, En 21–En 39

(Published by Pergamon Press Ltd, Headington Hill Hall, Oxford. Price £7 7s)

This is the second of the three volumes to be published by the Steel User Section of the British Iron and Steel Research Association making available in one source of reference data on the most commonly used range of steels in the UK—BS 970. En Steels. The project is being jointly financed by the BISRA and the Dept of Scientific and Industrial Research.

Volume 1, reviewed in the *RE Journal* of March 1963, presented the most important properties of En 1 to En 20, this volume covers En 21 to En 39 inclusive.

For easy reference the compilation has been divided into sections, each devoted to one En number, and within the sections the various items of information are arranged in the following order:—

Specification—Chemical composition and mechanical properties; Related US and other national specifications where comparable; Applications; Welding; Machinability; Hot working and heat treatment temperatures; Physical properties; Isothermal and Continuous cooling diagrams; Hardenability; Mechanical properties at room, low and high temperatures—including creep properties; Torsion and fatigue characteristics.

Apart from the tables of data, curves have been reproduced where information warrants in order to show graphically the effects of tempering temperature and of ruling section as heat treated, and also to indicate the range of properties which might be expected from steels conforming to a particular En number.

Nine pages of notes on the use of the tables are also included.

The volume, comprising 488 pages, is excellently produced and well bound. It would be a boon to designers and production engineers. F.T.S.

Technical Notes

CIVIL ENGINEERING

Notes from *Civil Engineering and Public Works Review*, July/August 1966

THE FORMAL EDUCATION OF THE CIVIL ENGINEER. In this article in the July issue, the author, J. D. Pateman, Esq, BSc, AMICE makes a survey of the training of the civil engineer through the stages of sixth form to university and then post graduate training. He examines the logic of this training in the light of the present-day prerequisites of a civil engineer. It is proposed that the undergraduate course should have a broad base and be devoid of specialist subjects which, in a degree syllabus, cannot be dealt with to a high enough standard to create specialists. He advocates postgraduate courses as the most satisfactory method of training the civil engineer in specialist topics and recommends that there needs to be much more stress given to this form of training by graduate engineers and their employers. It is an article of interest to those in Corps who are responsible for formulating the policy for training young RE officers as the problems are similar.

ANNUAL CONVERSAZIONE HELD AT THE INSTITUTION OF CIVIL ENGINEERS IN JUNE 1966. The July issue gives details of the engineering models and apparatus exhibited at this conversazione. They covered a wide range of civil engineering activities and were typical of contemporary developments in research, design and construction. Of particular interest was the Ministry of Public Buildings and Works design for a hanger to meet the Ministry of Defence requirements for servicing Belfast and VC 10 aircraft at Brize Norton. The hanger is of the cantilever type, of 1,043 ft overall length and 214 ft wide with a clear height of 50 ft. The frame was, in the main, fabricated in high yield steel. The hanger is one of the largest in the world and covers an area of nearly 5 acres. One senior officer in the Corps has been closely connected with this project and two regular RE Squadrons have recently carried out other construction tasks at Brize Norton.

The London Transport Board exhibited models of the New Victoria Underground line which is to run between Victoria and Walthamstow. The new double tunnel is due to open in 1969 and will provide a link between King's Cross, Euston and Victoria. In some parts of the construction the tunnel linings are of precast concrete segments, in others, use is made of articulated jointed cast iron segments.

The Port of London Authority exhibited a model showing their scheme for modernizing and extending Tilbury Docks. One officer is attached to the main contractor on part of this project to gain site experience on a current Long Civil Engineering Course.

EDGE BEAM PARAMETERS IN THE DESIGN OF CYLINDRICAL SHELLS. In this article, in the July issue, Dr D. M. Brohn, PhD, DCT, AMIStructE, gives the results and conclusions of his investigation into the experimental behaviour of four thin cylindrical shells, following the compilation of a simplified design procedure. In general, shell structures are analysed on the basis of elastic behaviour of the material of construction. A large proportion of shells are constructed in reinforced concrete whose behaviour is not strictly elastic. The results of Dr Brohn's experiments are likely to be of use to design engineers specializing in this subject.

WESTERN AVENUE EXTENSION. It is announced in the August issue, that the 13,500 ft Western Avenue Extension is to be constructed by John Laing Construction Ltd. This project is for the construction of an elevated motorway between Westway at the White City Stadium and Paddington Green, London. It will be Europe's longest and technically most advanced elevated motorway. The new elevated motorway has been designed in prestressed concrete with "black top" riding surface by Messrs G. Maunsell and Partners, Consulting Engineers, in association with P. F. Stott, Esq, MA, MICE, Director of Highways and Transportation for the Greater London Council. Mr Stott, when previously a partner of Messrs G. Maunsell and Partners, was responsible for the design of the Hammersmith Flyover.

RENOVATING MEDIEVAL BOHEMIAN CASTLES IN CZECHOSLOVAKIA. The master builders of ancient monuments in Bohemia normally used soft rock, chiefly sandstone, because it was easily worked for their constructions. As a result, the structures have become eroded over the years, by atmospheric conditions, and suffer from deterioration in the mortar joints as well as in the masonry itself. Professor Ing Dr Jiri Streit and two colleagues describe how modern methods of intrusion grouting, using aerated mortars, were used to renovate four medieval Bohemian Castles. The equipment used was the British "Aerocem" process.

OPTIMUM SHAPE FOR A SINGLE ARCH WITH SOLID FILL ABOVE. In this article, in the August issue, Dr E. Lightfoot concludes that single symmetrical arch road bridges are conveniently and economically designed with circular profiles, providing the rise to span is chosen to correspond to the equivalent cover to span ratio. In this way the relevent coshine curve for an arch without any bending is closely approximated, so that the forces due to bending in the selected circular arc are minimized. A design chart from which the design engineer can read off the rise to span ratio for various conditions of loading and cover to span ratio is included in the article.

DESIGN AND CONSTRUCTION OF THE SEVERN BRIDGE. The main article of interest in the August issue is a description of the design and construction of the Severn Bridge. This new suspension bridge, the sixth longest in the world, was opened by HM The Queen on 8 September 1966. The bridge, which looks very similar to the Forth Road Bridge, is constructed principally in steel. The road deck is of interest as it is made up of eighty-eight aerodynamic metal boxes which were floated under the bridge, lifted into place and welded together. The designers claim that this method of constructing the road deck is lighter and cheaper than the more orthodox lattice girder deck construction while still retaining the required stiffness. The method of "spinning" the main cables was very similar to that employed on the Forth Road Bridge. The Consulting Engineers were Messrs Mott, Hay and Anderson and Messrs Freeman

Fox and Partners. The contractors were John Howard and Company, Ltd for the main bridge substructures. The superstructure of the main bridge was constructed by Associated Bridge Builders Ltd, a company formed by Sir William Arrol and Co, Ltd, The Cleveland Bridge Co, Ltd, and Dorman Long (Bridge and Engineering) Ltd. The total cost of the bridge itself was £8 million. The article also includes details of the Wye Bridge and viaduct which connect up with the Severn Bridge. Some thirty-nine miles of roadworks are being constructed in connection with the river crossing formed by the Severn Bridge and Wye viaduct. R.C.G.

THE MILITARY ENGINEER

JULY–AUGUST 1966

WEATHER SATELLITE SYSTEM by Dr Robert M. White, Administrator, Environmental Science Services Administration. Two Environmental Satellites, Essa 1 and 2 were launched in February 1966 and compose the system known as the Tiros Operational Satellite (TOS) system which is to provide regular and reliable cloud picture coverage of the entire sunlit portion of the earth once every twenty-four hours. This article is a description of the organization by means of which the pictures are made available to users round the world in less than two hours after receipt, in respect of Essa 1 and almost immediately in respect of Essa 2. The value of such pictures to the meteorologist is immense and the article contains several cloud pictures and explains how they can be read. There is a full description of the way in which the system is operated and of the future developments which are planned.

TAMING THE SANDS OF CAM RANH by Lieut-Colonel James M. Mueller, Corps of Engineers. An article in the January–February 1966 number of the *Military Engineer* described the engineer tasks encountered at Cam Ranh, a sheltered harbour in Vietnam which was to become a base port. The dune sand of Cam Ranh peninsula is fine smooth grained sand of uniform size which is difficult going for six-wheeled vehicles. Various methods of stabilization were tested. They are described in this article and the results are given.

ALUMINIUM MATTING RUNWAYS IN VIETNAM by E. T. Lyons. This describes the construction of airfields in Vietnam using aluminium plank matting known as AM2. AM2 consists of extruded aluminium mats or planks that can be interconnected to form an airfield of any size or shape. A full mat is 12 ft long, 2 feet wide, and 1¼ inches thick. Half mats 6 by 2 ft are also used. The difficulties experienced over the preparation and maintenance of the sub-base are described in some detail with other technical details of construction.

THE COMPUTER STORY by 2nd Lieut James Clyde Thomas, Corps of Engineers. An interesting short history of the development of calculating machines from the Antikythera believed to be 2,000 years old and now in the Archaeological Museum at Athens to the most modern Computer. There are good illustrations.

A NEW MAP FOR VIETMAN. THE PICTOMAP by Major General T. J. Jayes, US Army. The map demands of the Vietnam war have led to the development of the Pictomap as a partial solution. The pictomap is composed of a photo-image base on which the cultural, planimetric, and topographic information has been surprinted. The photographic base is enhanced by adding colour tones to accentuate vegetation, open land, and the shadows caused by relief. The article describes the technical processes involved and there is a 1/25,000 pictomap, in colour, included. Although the new process does not meet all requirements the enthusiasm expressed by a wide variety of users in the field shows that it is a significant step towards fulfilling their needs.

SEABEE CONSTRUCTION AT CHU LAI by Cmdr T. C. Williams, Civil Engineer, US Navy. An account of the construction of an airfield in support of operations in Vietnam and

of many auxilliary services carried out in conjunction with it. The airfield was constructed principally of aluminium matting described in an article in this number. There is much interesting technical detail.

Corrosion Protection of Underground Heat Lines by Lieut-Colonel Lindsay M. Applegate, US Army, retd. A very detailed well illustrated article dealing with the problems of protecting insulated pipe lines to carry steam and condensate or hot water under pressure. There are two main categories dealt with. One in which the pipe lines are enclosed in steel casing and the other where the pipes are in concrete ducts or thermally insulated concrete. A new system referred to is the use of cellular glass insulation.

Thermal Insulation in Buildings by Frank J. Powell. The author is assistant chief of the Environmental Engineering Section, Building Research Division of the National Bureau of Standards. The article deals with the principles governing the production of thermal designs for buildings with the object of controlling temperature and humidity and providing a comfortable and easily controlled indoor environment. No details of construction methods or of materials are given but the article provides a comprehensive account of the factors involved. The lines of further research that is necessary are indicated. An important consideration is the best way in which correct specifications can be given of insulating materials.

Military Engineer Field Notes

High Line Helicopter Recovery. A short account, with photographs, of the recovery of a helicopter which was forced to land on a 7,500 ft peak in California. The chief interest of the action was the improvization of an air rope way using trees.

Maintaining Large Culverts in the Arctic by Major Samuel L. Britten, Corps of Engineers. Of interest as showing how varied the problems of living in the Arctic are. Culverts become choked with ice which does not melt quickly enough when thaw conditions begin. The best solution found was the use of a minerally insulated heating cable energized by a 5 k-w generator.

King of the Bridges by Captain John L. Gaebel, Corps of Engineers. A reminder of the usefulness of the simple king post truss for reinforcing bridges in underdeveloped countries which are of too light construction to carry military loads, and for the solution of other bridging problems. Various uses are described with outline calculations. The author regrets that no design tables are given in The Army Field Manual on bridging.

J.S.W.S.