THE ROYAL ENGINEERS JOURNAL

APRIL 1994 VOL 108 NO 1

Guidelines for Authors

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

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

Length. Normally approximately 4500 words (ten A4 pages **double line** space) + illustrations). Good blockbusters can be serialized.

Clearance. The author must clear his/her article with his/her CO where applicable.

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

Computers. Articles saved as Wordperfect 5.2, Microsoft 5, or ASCII files, on a 3.5in DOS floppy disc, are welcomed.

Photographs should be black and white if possible. Coloured photographs rarely reproduce well only if they are of good quality with sharp definition.

Line Drawings, should be drawn in proportion with the page size (145mm x 205mm).

Rewards can be generous. The Publications Committee has about £250 in prize money to allot for each issue plus valuable annual prizes. All authors receive £10 to help cover costs.

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

Contributions should reach the Editor by:

15 June for the August 1994 issue
Early October for the December 1994 issue
Early February for the April 1995 issue

Submissions before the deadline will be particularly welcome.

THE INSTITUTION OF ROYAL ENGINEERS

(Established 1875, Incorporated by Royal Charter, 1923)

Patron – HER MAJESTY THE QUEEN

Chief Royal Engineer
General Sir John Stibbon *KCB OBE BSc(Eng) CEng FICE*

COUNCIL

President
Major General G W Field *CB OBE* ... 1993

Vice Presidents
Colonel A F George *TD MA LLM BSc* ... 1990
Major General F G Sugden *CB CBE* ... 1993

Members

Elected

Colonel R S Eyre *TD ADC BSc(Eng) DMS FICE MIHT* 1991
Lieut Colonel W J H Clark *BSc(Eng) AMICE* 1991
Major A D Macklin *MA(H)*.....1991
Colonel W M Davidson *BSc(Eng) CEng MICE* 1992
Colonel J W F Sweeting *LLB*.....1992
Lieut Colonel R A Leonard *MISM*.....1992
Lieut Colonel N A Sutherland *OBE BSc(Eng)*.....1992

Ex Officio

DG Mil Svy.....Major General M P B G Wilson *ARICS FIMgt*
D Engr Sp.....Brigadier R A Bradbury *BSc(Eng) CEng FICE*
Comd Engr UKLF.....Brigadier I D T McGill *Bsc(Eng) CEng FIMgt MICE*
Comdt RSME .....Brigadier P J Russell-Jones *OBE BSc(Eng)*
Regt Col.....Colonel C P R Bates *BSc(Eng)(H)*
Col PB7..... Colonel P S Adams *MBE BSc(Eng) MSc FCIS*

Coopted (non-voting)
Corps RSM...WOI (RSM) P L Brown
Director National Army Museum (or senior museum professional)

Secretary: Colonel R I Reive OBE ... 1992
Treasurer: Lieut Colonel A J Hicks ... 1989

Corresponding Members

Colonel T R Bradwell *OBE BSc(Eng)*, BLO Fort Leonard Wood, USA
Lieut Colonel P W Clarke, BLO Pionierschule, Munich
Major R C F Braybrook, BLO Engineer School, Angers
Major E J Ward *BSc(Eng)*, Exchange Appointment, Australian SME
Captain P J Langford, Exchange Appointment, Canadian SME

PUBLICATIONS COMMITTEE

Ex Officio		
D Engr Sp	Brigadier R A Bradbury *BSc(Eng) CEng FICE*	*Chairman*
Regt Col	Colonel C P R Bates *BSc(Eng)(H)*	*Vice-Chairman*
Col Engr Svcs	Colonel N Munro *MA CEng MICE*	
RO1 Author RSME	Colonel M R Cooper *BA*	
Surveyor	Major A Keeley *BSc*	
Editor *RE Journal*	Colonel R I Reive *OBE*	
Elected		
Senior serving officer	Colonel I S Mercer *CBE*	1988
Senior retired officer	Colonel M J Payne *MA MPhil*	1993
TA officer	To be announced	
Coopted		
Museum Director	Colonel J E Nowers *BSc(Econ) FIMgt*	

Secretary: Mrs J D Scanlan

All correspondence in connection with editorial matters should be addressed to the Secretary, Institution of Royal Engineers, Ravelin Building, Brompton Barracks, Chatham, Kent, ME4 4UG

The Institution of Royal Engineers is Registered as a Charity Number 249882

BUDGET, INVESTMENTS, MEMBERSHIP, SCHOLARSHIP AND MEMORIALS COMMITTEE

Chairman:	Colonel A F George *TD MA LLM BSc*	1988
Vice Chairman:	Colonel R Pridham *OBE BSc*	1993
Members:	Colonel A T Brett *BSc(Eng)*	1993
	Colonel C P R Bates *BSc(Eng)(H)*	1992
	Colonel P S Adams *MBE BSc(Eng)(H) MSc FCIS*	1993
	Colonel N Munro *MA CEng MICE*	1993
	Colonel J W F Sweeting *LLB*	1992
Secretary:	Colonel R I Reive *OBE*	
Treasurer:	Lieut Colonel A J Hicks	

ROYAL ENGINEERS MUSEUM AND LIBRARY

Trustees: The Council

MUSEUM EXECUTIVE AND LIBRARY COMMITTEE

Chairman:	Major General F G Sugden *CB CBE*
Vice-Chairman:	Colonel C P R Bates *BSc(Eng)(H)*
Members:	Brigadier P J Russell-Jones *OBE BSc(Eng)*
	Colonel J E Kitching *BA FIMgt*
	Colonel R I Reive *OBE*
	Lieut Colonel A J Hicks
	Dr J N Rhodes *TD MA PhD AMA*
	Lieut Colonel R A Leonard *MISM*
Coopted:	J H Fitzmaurice Esq
Secretary:	Colonel J E Nowers *BSc(Econ) FIMgt*

TRUSTEES RE MUSEUM FOUNDATION

Chief Royal Engineer:	General Sir John Stibbon *KCB OBE BSc(Eng) CEng FICE*
Chairman:	J H Fitzmaurice Esq
Members:	Major General G W Field *CB OBE*
	Major General W N J Withall *CB*
	Colonel Sir Idris Pearce *CBE TD DL*
	Colonel P E Williams *TD DL*
	Colonel W T Dennison *CBE*
	Colonel C P R Bates *BSc(Eng)(H)*
	A F Budge Esq *OBE DL*
Secretary:	Colonel J E Nowers *BSc(Econ) FIMgt*

RE MUSEUM STAFF

Director:	Colonel J E Nowers *BSc(Econ) FIMgt*
Curator:	Dr J N Rhodes *TD MA PhD AMA*
Registrar:	J Rattue Esq
Assistant Curators:	Mrs B J Williams
	A Gladwell Esq
Administrative Officer:	Mrs J Ellender
Telephone:	Chatham Mil 2312
	or Civil: Medway (0634) 406397 or 822312

RE CORPS LIBRARY

Librarian:	Capt R T Arnold
Assistant Librarian:	Mrs M Magnuson
Telephone:	Chatham Mil 2416
	or Civil: Medway (0634) 822416

ISSN 0035-8878

THE ROYAL ENGINEERS JOURNAL

© Published in April, August and December by the Institution of Royal Engineers, Chatham, Kent, ME4 4UG

Printed by Staples Printers Rochester Limited, Neptune Close, Medway City Estate, Frindsbury, Rochester, Kent, ME2 4LT

Volume 108 April 1994 No1

Contents

Editorial

WE HOPE our readers will forgive us for allowing a preponderance of articles in our "50 Years On" series to be included in this edition, but what we have tried to do is give a flavour of the Sapper involvement in the momentous actions which took place during 1944. The emphasis in these articles is on the Normandy invasion, but we have not forgotten the Corps' involvement elsewhere, with *4th Indian Division at Cassino*, and *Brief Encounter – North Burma*.

As regards Normandy, I am pleased to be able to include an article by our German Liaison Officer – *The German Defence Plan in France May/June 1944 (A German Perspective)*, which helps to set the scene. I am most grateful to the many senior authors who have contributed to this edition, depicting the various stages of the invasion, commencing with the recce of the beaches from X-craft – *COPP to Normandy 1943/44 – a Personal Account of Part of the Story*, followed by the parachute and glider landings – *3 Parachute Squadron RE* and *HQRE 6 Airborne Division*, the assault landings through the eyes of an OC – *26 Assault Squadron RE*, the construction of landing strips primarily for use by Spitfires and Hurricanes – *The Construction of B3 ALG Airfield*, the use of noise in deception – *Sound in Warfare and a Brief Account of the Activities of the Light Scout Car Companies in World War Two*, and, of course, last but not least an account of *The Mulberry Harbours*. I hope that with these articles you will be able to get a good feel for the complexity of the overall operation and for the concerns and activities of the individuals concerned.

Many of you will have read of the sad death on 7 February 1994 of General Sir Charles Richardson, who was such a key member of Montgomery's staff in the desert and throughout the NW Europe Campaign. It is perhaps fitting that this particular edition of the *Journal* should carry a review, written by him just before his death, of the new book "Wavell in the Middle East 1939-41". General Richardson's memoir is planned for the August *Journal*.

As the Corps finally withdraws from Gibraltar this year, it is interesting to note our continuing involvement with tunnelling. We have, over the years, been associated with various attempts to construct a Channel tunnel. With the official opening of the tunnel (in which many Sappers have been involved) on 6 May 1994, I am delighted to be able to include Brigadier John Constant's article – *The Tunnel – a Feasibility Study, 1967-71*, which recounts his involvement in the detailed work carried out in the early stages.

The Corps continues to be heavily committed to Bosnia and the article *A Nation at War: a People Without Hope* gives an interesting insight into the war's effect on the populace. *Operation Grapple 1, Some Lessons Learned*, written by Captain Weber, a Canadian exchange officer, on the other hand, gives a good account of the lessons learnt by one of the squadrons included in the initial deployment.

The two articles by warrant officers in the last edition were well received, and I am delighted to be able to include another, this time on the way the Euro NATO Training Engineer Centre at Munich is adjusting its training to meet the changed requirements. It is good to see our warrant officers contributing to the engineer debate so positively.

In conclusion may I remind you of the Joint Professional Meeting, advertised in the *Supplement*, which is to take place at Chatham on 16 May 1994 and is linked to the opening of the special D-Day exhibition in the Museum running until 5 November 1994.

The German Defence Plan in France May/June 1944 (a German Perspective)

LIEUT COLONEL ROLAND VON REDEN

I was delighted to be asked by the Corps Secretary to write an article on the German perspective of the "Landing in Normandy" on 6 June 1944.

As I am writing this article for *The Royal Engineers Journal* I think I should concentrate mainly on the barrier plan and obstacle system the Germans had at the Atlantic and the Channel coast in order to prevent an Allied landing.

The Strategic Situation, Germany – 1944

In 1944 Hitler's main Allies – Italy, Hungary, Rumania, Spain and Japan – could, or would, not help him, either because they were experiencing serious political difficulties, or because parts of their country were occupied, for instance like East Rumania by Russian troops. In those days all his hopes were focussed on "...the failure of the Alliance between the western countries and the Soviet Union. Hitler thought that as a consequence Great Britain would have collapsed because of its 'moral exhaustion'. Finally, Hitler also planned to use his 'Wunderwaffen' in order to defeat Great Britain..."[(6)p19]

"The German Army staff and the staff of the *Wehrmacht* sometimes did not work closely together."[(6)p25] Hitler did nothing to improve this situation because he always feared that the *Wehrmacht* staff or the Army staff would become too powerful. Those army generals who opposed him, or did not accept his orders, he discharged or placed in uninfluencial positions. As a result of this constant lack of cooperation, command and control was sometimes in chaos and severe mistakes were made during operations, mainly from 1942 onwards, and in France after the landing of the Allies.

The German Air Force never really recovered from the losses suffered during the Battle of Britain.

"The U-boat war of the German Navy became more and more ineffective, as did the whole German Navy which suffered heavy losses."[(6)p25]

What was the German military situation like at this time? Africa was lost, and at the Italian front the Allies were pushing the Germans to the north. At the Eastern Front the Germans were forced to withdraw and Hitler ignored one of Clausewitz' rules which stated "...not to concentrate on how to hold or to keep an area, but on how to defeat the enemy..."[(6)p29] (viz the battle for Stalingrad.)

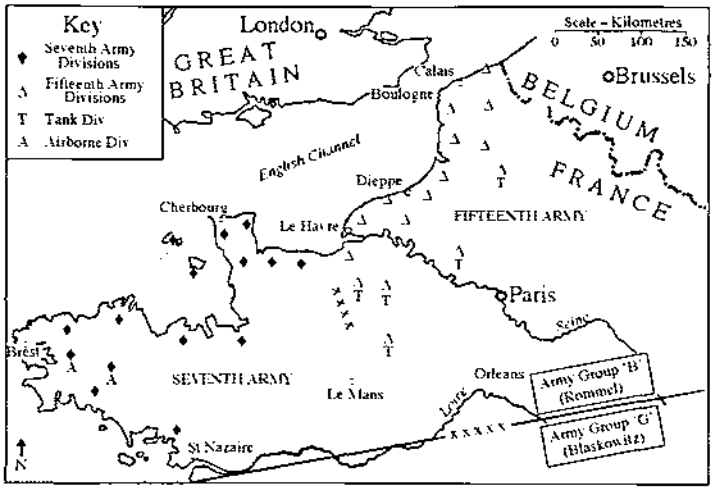
At the Western Front German forces, insufficient in strength, composition and organization, were expecting an Allied landing. There were also different perceptions, by the German Naval Command and the Commander in Chief of the Army Group B in France, General Rommel, of the possible Allied landing sites. For instance, the Navy thought "the Calvados coast (Cote de Nacre) unsuitable for landings because of its rocky cliffs"[(6)p39] and therefore gave less importance to the German fortifications at this part of the French coast.

German Operational Plan for Defence Against an Allied Landing

The Germans normally obtained enough intelligence to identify likely Allied landing sites and actual landing dates. However, at this time they either did not take them seriously or their forces' staffs in France interpreted the information incorrectly. Hitler did not allow the three German Services to have a joint command in France, therefore combined operations could not be planned properly.

"Once Rommel became Commander in Chief of Army Group B (15 January 1944) nearly every day he expected the Allied landing. Following a detailed appreciation he expected the main Allied landing to take place in the area around the 15th German Army, but also considered possible landing sites at the rivers Somme, Bresle, Arques and the Seine mouth, the Calvados coast or the Cotentin peninsula."[(6)p39]

In opposition to Hitler, the *Oberkommando der Wehrmacht (OKW)* and the *Oberbefehlshaber West (ObWest)*, Rommel suggested he should ...conduct the defence more offensively..."[(6)p39]. Therefore he thought to harass the assembly of the Allied invasion forces by attacking British harbours with U-boats, using modern sea mines, by air attacks and even using the V1. But these proposals were not accepted by the *OKW*.



Map of area covered by article.

Rommel also demanded "...to concentrate and to command and control the whole III German anti-aircraft corps in the area of Normandy..."((6)p39) once the Germans found out that the Allies were going to land there but Göring did not accept this.

The Germans, in preparation for the defence, used their propaganda machine to the full, speaking about the invincible "Atlantic Wall" and using deception measures.

"Hitler ordered that the defence against an Allied landing should be mainly to reposition on the 'Atlantic Wall' to prevent the enemy from building a bridgehead. Infantry divisions were to be the main forces for this defence, however Hitler finally agreed Rommel's proposals to use the armoured divisions' reserves as close as possible to the landing sites because of the likelihood of the air threat by the enemy."((3)p676,(6)p70) This was against the advice of the *ObWest*, General von Rundstedt. On D-Day these reserve divisions had "to hide in harbour areas during daylight and could only move in small packets"((1)p558) to support the main effort being unable to move as a whole during daylight because of the enormous Allied air superiority.

On 6 June 1944, to defend the whole of France, the Germans had available:

"The Army: 61 divisions (38 infantry divisions, nine armoured divisions and nine units with a similar strength to a division)."((3)p674, (5)p171)

From April 1944 onwards, Rommel commanded and controlled two armies, consisting of eight general commandos, 24 infantry divisions and five air force field divisions. The infantry divisions were not the most effective and were ill-equipped. The only modern and effective troops were the armoured divisions.

"The Air Force: (3 Air Fleet, General Sperrle) only had 631 aircraft (165 of which were fighters/nightfighters). On 6 June 1944 they were able to deploy only 319 aircraft and lost 90 fighters on the first day of the landing – the Allies had about 12,000 aircraft, a proportion of 1:20."((3)p674)

"The Navy: (Navy Group West, Admiral Krancke) had minor units (five destroyers, eight torpedo-boats, 34 motor torpedo-boats, 309 minesweepers, 116 watchkeeper boats, 42 boats with up to ten 5mm guns on them and 49 smaller U-boats able to operate in the area of the possible landing sites) which could not support the defence decisively."((3)p674)

Deployment of Engineer Units and Building Organizations to Construct the "Atlantic Wall" and Other Obstacles

Besides the division and the corps engineers, which mainly had to lay minefields and to prepare obstacles other than minefields, the Germans deployed "engineer fortification battalions, engineer fortification building battalions, construction engineers((7)p164, 178, 201), navy fortification engineers and air force engineers"((6)p19, 25) to build the "Atlantic Wall" and other fortifications and buildings relating to the "Wall".

Also available was the "Organization Todt", founded at the very beginning of the "Third Reich", which utilized the huge numbers of unemployed civilians to construct motorways, buildings etc.

The "Atlantic Wall"

The "Atlantic Wall" was a linear fortification and barrier system close to the French Atlantic and Channel coasts. The build-up at the areas of the main French harbours, thought by the *OKW* to be the most likely Allied landing sites, was well advanced but not at the Calvados coast. Because of Hitler's wish to build invincible fortifications!,((6)p19, 25) along the Channel coast and the islands of Jersey, Guernsey and Sark, the Germans built offensive battery groups at Cap Griz Nez. On the British islands, 11 batteries

consisting of 38 gun turrets were built, whereas along the 1609km long frontier between Dieppe and St Nazaire, only 37 had been built by June 1944. The various German fortification building engineers built the following bunkers: command posts, turrets[(6)p29] with six loopholes, turrets for artillery cannons and for mortars eg: Ring "Tobruk", ringstand for 8cm mortar[(6)p39], ringstand for a turret of a main battle[(6)p39] tank, stands for 15cm cannons and other bunkers.

The whole fortification building programme suffered because of the lack of an overall concept, lack of building materials and the confusion of the command and control chains, and the divergent views of commanders.

Double gun casemate with two floors.

When General Rommel first became responsible for the inspection of the "Atlantic Wall" and later became Commander in Chief of Army Group B, he was well aware of all these problems and did everything he could to solve them. He thought out a barrier concept using the few existing fortifications and bunkers in his defensive area as a backbone. He asked the Navy to "...lay sea mines which they did but first in the mouth of the river Gironde,..."[(6)p63] (near Bordeaux) and only one minefield in front of the Normandy coast which the Allies succeeded in breaching. The German Navy also used outpost-boats as part of the coastal defences.

To make an Allied landing more difficult, Rommel ordered the building or laying of barriers mainly in the area of the 15th Army above and below the low water mark and in the rear areas. Therefore the Germans built, in front of such seashore obstacles as were there, "...mineposts, concrete shore mines[(6)p39],

Ringstand for 8cm mortar during its building process.

Turrets with six loopholes for machineguns and a small "bell" for infantry as an observation post.

so called Tchech-Hedgehogs, Tetraeders, so called Belgium roll-bucks and gratings, hamper-curves [6p19] and minefloats."[3p674] At the high water line they built a strong point system combined with minefields or other obstacles such as loophole stands in combination with wire obstacles.

The artillery fire power, "...was restricted because the Germans had only one battery which could fire effectively at a distance of about 20km because of the lack of fire control equipment."[6p62]

To counter the Allied air threat, the Germans dispersed and covered their units. They also built obstacles in a so-called "Landfront", a belt of about 3 to 5km in depth, which was the rear area of the shore defensive position and which was in support of the defence against possible Allied air landings. Rommel himself designed one special type of obstacle which became known as "Rommel-asparagus."[1p552] Other obstacles positioned in the rear area to be used against armoured forces were beam barriers[3p676, 6p70], antitank ditches[1p558], concrete block obstacles[3p674] and concrete hump obstacles.

"Concrete" shore mines.

On the eve of the "landing" Rommel was on his way to see his wife. Afterwards he wanted to see Hitler in order to brief him personally about his anxieties concerning the situation at the Western front. Other German generals and general staff officers were either on leave[2p373, 3p679] or doing a map exercise in Rennes, because the Germans did not expect an Allied landing during bad weather. The German electronic reconnaissance discovered that the Allied landing was about to start, but this message was not passed on in full through the chain of command and was therefore not taken seriously enough. The Germans also thought that the landing at Normandy was an Allied deception and still expected the main landing force in the area of the 15th German Army; they therefore hesitated to use their reserve divisions immediately in order to attack the Allied landing forces at the Normandy coast.

On the morning of 6 June 1944, German defenders saw "...the large Allied landing fleet."[1p556] Although "...not everything went according to their time schedule for the attack, ..."[4p677] the Allies succeeded in building their bridgeheads – this was the beginning of the end of the "Third Reich".

Lessons Learned

WHAT were the key points of the Allied Forces success?

- The Allies had air and sea superiority in the Atlantic, the Channel and in France.
- The Allied Intelligence Service and deception measures were far better and more effective than the German ones. For instance, the Germans believed, until 25 July 1944, that the main Allied Landing would still take place in the area of the 15th German Army.
- The Allies could rely on more and better resources and equipment than the Germans.
- The superiority of the Allied air force, their ships' artillery during the landing phase, and their artillery, was the backbone and key to the successful operation not only during the first phase of the landing but also during subsequent operations in France and later on.
- Another advantage was their joint command. In comparison to General Eisenhower, the *ObWest*, General von Rundstedt, was not allowed to be as powerful as the US General. Hitler, the *OKW* and the *Oberkommando des Heeres* also often interfered in General von Rundstedt's and General Rommel's final decisions.

German defence plan in France p8

So, what did the Germans learn from this?

For the defence from the Baltic Approaches against a possible attack of the former Warsaw Pact, NATO had to avoid making the same mistakes as the Germans did in France in their defence against the Allied landing.

First of all NATO had and still has joint commands. Secondly they did not build a "Baltic Sea Wall" but created a General Defence Plan, in which the whole area of Denmark and Schleswig-Holstein would have been used for the defensive operations, which was less linear than the one at the "Atlantic Wall".

NATO was going to use small ship units: eg fast patrol crafts and small U-boats, also navy and air force aircraft in order to destroy the enemy's landing fleet. If the enemy were to succeed in landing, Commander Baltic Approaches' intention would be to destroy him by a flexible defence using his armoured forces and using all sorts of obstacles eg: demolition obstacles, constructed obstacles and minefields. The engineers should have prepared terrain and situation orientated obstacles, and the artillery should have used target orientated obstacles. The engineers and the artillery would also be using mainly scatterable mines.

Other important lessons the Germans learned were: firstly to have sufficient antiaircraft defence units to cover its reserves, its artillery and logistic support, and secondly, whenever possible always have air superiority.

Beam barrier.

BIBLIOGRAPHY

(1) Autorenkollektiv; "Der 2 Weltkrieg; Bilder, Daten, Dokumente"; Bertelsmann Verlag; Gütersloh 1968
(2) von Below, Nicolaus; "Als Hitlers Adjutant 1937 – 45"; v Hase & Köhler Verlag; Mainz 1980
(3) Dahms, HG; "Geschichte des 2 Weltkrieges"; Rainer Wunderlich Verlag; Tübingen 1965
(4) Liddell Hart; "History of the Second World War"; Cassell & Company Ltd; London 1970 translated into German by Duden,W & Foerster,R-H; Econ Verlag; Düsseldorf/Wien 1972
(5) Natkiel, Richard; "Atlas of World War II"; Bison Books Ltd; London 1985
(6) Speidel, Hans; "Invasion 1944 – Ein Beitrag zu Rommel's und des Reiches Schicksal"; Rainer Wunderlich Verlag; Tübingen 1949
(7) Zentralarchiv der Pioniere; "Deutsche Pioniere 1939-1945"; Kurt Vowinckel Verlag; Neckargemünd 1976

Hamper curves.

COPP to Normandy 1943/44 – a Personal Account of Part of the Story

MAJOR GENERAL L. SCOTT-BOWDEN CBE DSO MC*

The author was commissioned into the Corps in 1939. In 1940 he served in Norway with Special Forces in 2nd Independent Company; in 1941 was Adjutant 53rd (Welsh) Divisional Engineers; in 1942 in Canada and the USA returning in 1943 to Special Forces as a commando in Combined Operations Beach Reconnaissance and Assault Pilotage Parties. After D-Day he took over 17th Field Company in 3rd Division.

In 1946/47 he was Brigade Major 98th Indian Infantry Brigade in Burma, followed by service in Palestine, Libya, Greece, Korea commanding 12 Field Squadron, Arabia, and Germany as CRE 1st Division.

In 1966 he commanded the Training Brigade RE, in 1969 attended the National Defence College in India and in 1970 raised and commanded the Ulster Defence Regiment. He returned to India as Head of the Defence Liaison Staff and Defence Adviser to the High Commissioner, retiring in 1974. He was a Colonel Commandant RE from 1975 to 1980.

He and his wife live on a small farm. They have three sons and three daughters. All sons went into the Army. He says that without the help of the eldest, who instructs at the Staff College, his first attempt in 55 years to write an article for the Journal would have been abandoned!

As midget submarine X-craft 20 approached the Normandy coast shortly after dawn, cruising at 2½kn on a southeasterly bearing, Commander Nigel Willmott DSO DSC RN, raised the periscope and said "There is a fleet of fishing boats just ahead!" Having successfully crossed the German minefield, passed the Pointe du Hoc confirming our course and rounded the Pointe de la Percée, this was an expected hazard. Our complement was Willmott, the head and founder of the Combined Operations Beach Reconnaissance and Assault Pilotage Parties, known as COPP, myself a major and Senior Military Officer of COPP, Lieutenant Ken Hudspeth DSC RANVR (Royal Australian Naval Volunteer Reserve), the Captain from South Australia, Lieutenant Bruce Enzer RNVR (Royal Naval Volunteer Reserve), the Engineer Officer from Northern Ireland, and Sergeant Bruce Ogden-Smith DCM MM, formerly of the Special Boat Section, The East Surreys, and The Honourable Artillery Company.

We had left *HMS Dolphin* at Gosport on the morning of Monday 17 January 1944 and had unexpectedly been ordered to cross the Solent to call at the Royal Yacht Squadron, Cowes, where Willmott and I went ashore and received a short final updating on the operational situation and some words of advice and encouragement from Rear Admiral Sir Philip Vian VC, recently appointed to command of the British Invasion Fleet. We were then taken on tow by an armed trawler *HMS Darthema* and parted company with her well out into the Channel clear of our own minefields. We travelled on the surface using our diesel engine which was identical with those installed in London double-decker buses. In an X-craft they are very smelly. We had submerged off the French coast at dawn. The fishing boats ahead of us were all pointing southwest into wind with their nets out. Hudspeth, who had been in the attack which put the German Battleship *Tirpitz* out of action in Norway and knew the form on avoiding nets, recommended that we went under the bow of the nearest boat to avoid entanglement. Willmott agreed; then he saw there were armed soldiers on most boats presumably to prevent the French fisherman escaping in the night to England. I was on duty at the helm adjacent to the periscope and took a quick look hoping for a possible unit identification. The German soldier in the boat ahead was leaning back in the bow with a rifle slung over his shoulder and his greatcoat collar

Maj Gen L Scott Bowden CBE DSO
COPP to Normandy 1943 44 p10

X-craft 23. Lieutenant George Honour DSC RNVR the captain amidships, and Sub-Lieutenant Jim Booth of COPP at the bows. The craft is rigged for marking Sword beach off Ouistreham on D-Day. The identical sistership X-craft 20 did the Omaha beach reconnaissance in January 1944, and also acted as marker on the British sector for D-Day.

up: he was contentedly smoking a large curved cherry-wood pipe so I guessed he might come from Bavaria; there were no other clues. We passed under the little fleet and took a general view of the beach which we knew was to be for the Americans. It was nearly high tide when we beached at periscope depth in about 7 or 8ft of water on the left-hand sector of what was to be named "Omaha" beach. Willmott took two bearings to fix our exact position and handed the periscope to me. We had developed close inshore reconnaissance techniques off Kintyre in Scotland. It required much care to prevent exposure of bow or stern in the tidal waves. The trim needed frequent delicate adjustment by pumping water fore and aft. No-one moved without the skipper's permission. The periscope was amazingly good although only about the thickness of a walking stick. Close inshore it could only be raised briefly about a foot to avoid detection, so it was important to come up on the correct bearing. First I took a quick general view and was astonished to see hundreds of soldiers at work, and how hard they were working. We knew Field Marshal Rommel had recently taken command; he had certainly stirred things up. From our low-level view and pointing slightly up due to the slope of the beach, it was often possible to see under the camouflage netting and so verify the types of emplacement being constructed. From detailed briefings by most skilled air-photographic interpreters at Headquarters 21st Army Group in St Paul's School, London, I knew those emplacements whose suspected identification needed confirmation. Oblique photographs taken by reconnaissance aircraft flying along the beach as low as 50ft could not always indicate whether an emplacement might be for an anti-tank or machine gun or where the embrasure pointed. Generally they enfiladed along the beaches and many were totally defiladed from fire from the front. The shoulders of the four main narrow valleys leading up to the high ridge running along the back of the beach contributed to one of the strongest imaginable defensive layouts. Later from another fixed position we

would take cross-bearings on our previous observations to pinpoint them exactly. Quite often when I was too absorbed in what was going on Willmott snapped "Down periscope!" He and I changed over regularly and took notes for each other. He also did thorough round-checks in case patrol craft were about. The early nightfall in winter stopped our fascinating viewing.

We withdrew offshore and then that first moment after surfacing when a hatch could safely be opened brought intense relief from the build-up of air pressure and shortage of oxygen. We moved out, still on the electric motor, far enough offshore to start the diesel where it could not be heard, for charging the batteries which took about 3 to 4hrs. During this time, we had to listen to the BBC news; if it contained a certain phrase, that was an order to return to base immediately. The batteries occupied almost the whole of the forward compartment leaving only about 2ft 6in maximum height for stowage of our COPP gear and in which to contort into our bulky swimsuits. Either Willmott or Hudspeth was up top on watch precariously and uncomfortably strapped to the raised air induction tube, now called a snorkel. Ogden-Smith and I prepared for the night reconnaissance while Enzer looked after everything else.

The lack of space in an X-craft whose maximum internal diameter is only 5ft 11in is worth emphasis. Amidships under the main hatch is the tiny wet-and-dry compartment, so-called as it can be flooded to enable one swimmer at a time to leave or enter the X-craft under water. It also contains the heads which cannot be emptied in dangerous waters because of risk of detection! When using the wet-and-dry compartment under water the swimmer has to operate the valves and pump as the water fills the compartment completely. The swimmer being partly buoyant is forced to the top. In the pitch dark you do not know whether you are on your head or your heels except by feel. It is the most unpleasant part of an X-craft crewman's training, but essential for their offensive role and in case of emergencies. Fortunately, on our operations we did not have to use this process as we could get out in reasonable weather conditions when the craft was surfaced. However, there is always a danger of taking in water even in a moderate sea.

Our personal COPP gear consisted of identity disc, body-belt with escape aids, including photographs for identification papers which would be provided by the Resistance in case our recovery failed and if we made our rendezvous with them 12 miles inland, long johns, sweater, swimsuit with hood and fitted boots, webbing belt, Colt 45 automatic, spare magazines, commando knife, wire cutters, wrist compass, wristwatch, emergency ration, waterproofed directional torch to signal for recovery and an 18in earth auger for testing beach bearing-capacity. There were many variations to these depending on the operation and climate. Bearing in mind that those special Royal Marine Commandos who had been captured after their brilliant raid at Bordeaux under Colonel "Blondie" Haslar in December 1942 were all executed on Hitler's orders, I insisted that our badges of rank were sewn onto our swimsuits and sweaters so that if caught it could be seen we were not disguising the fact that we were soldiers. The Intelligence Staff had warned us that if captured we would probably be taken straight to Paris for very subtle interrogation initially by the armed forces.

The batteries were charged and Ogden-Smith and I were ready for the night reconnaissance ashore on the left-hand sector which was to become the United States 1st Division beach. There was a moderate sea, some cloud and so conditions were good. We were able to move in close on the electric motor to shorten the swim; there was about 300yds of exposed beach above the rising tide. Nevertheless, remembering how many soldiers had been about earlier, we were cautious. We had selected a stretch of beach away from buildings and possibly sentries. Fortunately, we were not required to bring back any samples from the beach itself, as we were by now, as a result of an earlier reconnaissance, trusted by the scientific experts to be able to check accurately the beach bearing-capacity wherever we went. In any case this beach was less suspect than the widely eroded areas of the Plateau de Calvados to the east. We covered quite a large area of beach and fortunately when we were examining the shingle bank below the wire and the road where there was some cover, we heard what we thought was probably an inattentive two-man patrol talking and moving east. So far there were no obstacles or mines below the high-water mark. They would not have withstood the winter storms, although some of the more substantial types of obstacles were already being tried out on the Pas de Calais beaches. The German priority for construction of beach obstacles was from east to west.

We swam out beyond the breakers; our recovery went smoothly, and we moved well out to sea to

charge batteries. While that was happening we had to take everything off, check and store all our kit, clean our Colt 45 automatics which we stripped on top of the echo sounder. Then there was a very welcome sort of brew-up produced by Enzer. Little of the night remained. We dived at dawn and moved in for a repeat performance on the right hand sector towards Vierville which was to become the United States 29th Infantry Division beach. Daylight reconnaissance went well revealing much detail of the work in progress and we prepared for another night's sortie. Although it was mid-January, the sea had become very calm, a condition we did not like at all as even when the moon is down anything moving on the surface can be seen from a long way off. We slid off the casing several hundred yards out and swam quietly into shallow water crawling forward slowly about 400yds east of the Vierville re-entrant observing and listening when suddenly a powerful torch was beamed straight at us. We did not move, kept our faces down and took care to keep aligned with the beam as the gently rising tide could swing us broadside showing our shapes. The sentry did not approach, but he kept his torch trained firmly on us. In time as the tide came in we eased gently back. He then swung his beam about and eventually switched if off. I have often wondered what he thought he had seen and whether he reported it? We then swam well to the east and tried again. This time there was no trouble. We examined the beach with our augers over a wide area as planned, and the shingle bank at the back of the beach made mainly of rounded stones about 6in in diameter. We had been particularly asked to check this bank as it might be difficult for the passage of tanks. It appeared to have been man-made and was above normal high water. There was masses of wire immediately behind and a probable minefield. We each took one stone. I lost mine swimming out but Ogden-Smith's was well received. It is odd to think that such a mundane object was of significance to the greatest invasion of all time!

Whilst we were ashore a Bomber Command raid had been laid on in the River Orne area to divert sentries' attention. Surprisingly the flashes from successive bomb explosions many miles away lit up the X-craft well out to sea. It was very visible to us onshore and that was disturbing. We crawled back knowing our tracks would be erased by the tide, swam in the calm sea about half a mile out before signalling for recovery. We completed the night's routine, keeping very alert to crash dive while surfaced for battery charging. Next morning we closed in on the Vierville sector again, hoping to find out more about these very tough defences. After raising the periscope briefly a few times strange external rather unpleasant clanging noises started. Willmott soon saw small shells exploding close to the periscope. Had we been detected? We thought not. We were moving very slowly at about half a knot, with the small stick-like periscope exposed, at intervals, about a foot only. As it was not disturbing the water, perhaps it was thought to be a stray mine and was being used as a good aiming mark for target practice. The shooting had gone on intermittently for about 20 minutes without damaging the periscope. We would have been blinded if it had been hit. Although prepared to do a third night's reconnaissance, we had already acquired a mass of information, so there was little point in staying around taking an unnecessary risk as, if our presence had been suspected, a search by patrol craft or even aircraft, which might see us in the shallow water, were possibilities. We headed for home. Next day *Darthema* spotted us and escorted us towards Portsmouth harbour with two Motor Gun Boats (MGBs). We made alongside the jetty in the inner harbour of *HMS Dolphin* where to our surprise Rear Admiral Dark commanding the submarine base and a few others were waiting to receive us. When the rear hatch was opened setting up a through draft, there was a slight onshore breeze. It was amusing to see the reception committee recoil from the X-craft's four days of accumulated odours.

Next morning while plotting our observations, I was summoned to the telephone by Rear Admiral Creasy at Supreme Headquarters. He said "Are you coming to London this weekend?". I said guardedly "No Sir! I am rather busy with paper work." He said "Oh! I think it would be a good thing if you did and call in at my office at 2pm tomorrow, Sunday." I rather "hit the town" that evening! Having smartened up in my Service Dress uniform and well-polished Sam Browne belt for the Admiral, I reported just in time to his office in Norfolk House, St. James' Square, for what I presumed would be a short debrief by him.

Admiral Creasy took me straight to a long blacked-out former dining room. The walls were covered with curtains concealing maps. There was an arc of chairs facing one end. We were followed by five American and British admirals and five generals! There were no aides or any other staff. When they had seated themselves Admiral Creasy

said who I was, drew back the curtains revealing a small scale map showing an area from the Cherbourg Peninsula to the east of Le Havre, and said "Now Scott-Bowden, describe your recent operation." I was totally unforewarned. Having examined the map, I said "Sir, it is going to be very difficult on this scale." He walked me to the other end of the long room and exposed a very adequate map of what was at that time the only American beach. He turned to the distinguished company and said "Come on chaps, bring your chairs down here." It was a bad start, but gave me a minute to think. I had deduced that the admirals had lunched well together at the "Senior" which was some relief. The generals were more subdued. They were United States Lieutenant General Omar Bradley, Major Generals Bedell-Smith and Bull, and the British Major Generals Brownjohn and Inglis from Supreme Headquarters, both Sappers from my own Corps who would expect a reasonable performance. I described our activities in about 20 minutes, then they started firing questions, the admirals first. I managed to answer some about inshore currents and the like but they were more concerned with the further offshore conditions, which bowled me out. Then the generals had a go which was easier. After they dispersed, General Bradley came up to the map and talked and questioned me alone for a while longer. One of his principal concerns was how tanks would move from the beach to the top of the ridge. It was anticipated that the four main re-entrants would be completely blocked for some hours by German demolitions and mines until the United States assault engineers could open them up. There was a diagonal track to the left up which I had seen a pair of Percheron carthorses in tandem pulling a two-wheeled farmcart heavily loaded with rock from an emplacement under construction. He pressed me hard for an opinion on whether tanks could go up this track. I thought that the gradient was suitable but from our periscope view it was impossible to judge the width. Although good for a farmcart, I thought it might be too narrow for a Sherman but light tanks would make it. That was the sort of thing he discussed. Eventually I risked saying "Sir, I hope you do not mind my saying it, but this beach is a very formidable proposition indeed." He placed his hand on my shoulder, looked me straight in the eye and said "I know, my boy, I know." At that time, it was his only beach. I had not been helpful. I then mentioned that our other job was assisting in pilotage and that I hoped we would be allowed to help with this on D-Day. He said he would see what could be arranged. It was fixed. The last thing he said to me was "Be sure to give my personal thanks to Sergeant Ogden-Smith." Although deeply worried, he was very kind and considerate. What we in COPP had no reason to know then was that General Montgomery, who had earlier been appointed Commander-in-Chief of the Land Forces, was already insisting on an extension of the whole beachhead and the use of Airborne Forces. In a small way COPP may have assisted in General Bradley's full endorsement of that vital proposal.

I have described our reconnaissance of Omaha beach first as it was done exactly in the way and under the conditions for which we had developed and adapted our techniques, and we were thoroughly prepared and confident. However, for our earlier reconnaissance of a British beach we were not so fully rehearsed. In COPP, which I had joined in May 1943, we were anticipating doing operations for the invasion. I was new to it all and underwent intense training, including doing a month's recruits' course at the Commando Depot at Achnacarry. Other courses included navigation at *HMS Dryad*, air photography with the Royal Air Force and various Combined Operations indoctrinations. Willmott was first to be briefed in August 1943 about the choice of landing areas. The standard COPP method of operating was to observe from a submarine by day and using a pair of two-men canvas canoes specially designed to be passed through the torpedo loading hatch, to do beach reconnaissance by night. The canoes closed into the shore and one man from each canoe swam ashore to operate as a pair. This worked well in the numerous reconnaissances done in the Mediterranean with its small tidal range. Canoes were not so easy to use where tides were affected by the great oceans, although, given reasonable weather, it was quite possible. The difficult problem for Normandy was that normal submarines could not go through the enemy minefields and the Germans had by now acquired sufficient radar skill to detect a surfaced submarine's conning tower, so other means were sought; X-craft provided a possible solution. They would probably pass over the minefields safely and having a negligible profile even with the snorkel raised were virtually undetectable by German radar. However, they had no room for passengers, so certain COPPists were sent to *HMS Varbel* in Loch Scriven for two months' training as X-craft crew members and to evolve, with the X-craft specialists, reconnaissance techniques. Willmott also ensured

that we remained superbly fit, swimming naked at dawn every morning even when there was a skim of ice on the little bay near the head of the loch fed with fresh water from a freezing burn. We also climbed mountains, canoed and swam miles in our swimsuits in the loch amongst the seals. Having been accepted as competent crewmen, we returned before Christmas to our depot at Hayling Island Sailing Club on Sandy Point at the top of the west side of the channel into Chichester harbour. It was an ideal place for a highly secret organization being then in a heavily restricted area into which very few civilians had access. In the meantime, the X-craft were being prepared in Scotland for COPP operations and were due to be sailed south to be ready for the next dark period from 17 to 22 January 1944.

Willmott and I were suddenly summoned to Combined Operations Headquarters and told that the scientists had anxieties about the beach bearing-capacity of the Plateau de Calvados beaches for the passage of heavy-wheeled vehicles and guns particularly in the British and Canadian sectors where in Roman times the coastline and a port had been more than a kilometre further out. Erosion by the sea had covered with sand ancient peat marshes included in an overall review in Latin of the Roman Empire's fuel reserves. I saw this review on Professor J D Bernal's desk. He was Chief Scientific Officer to the Chief of Combined Operations. Where there is peat there is usually clay which if insufficiently covered by sand is dangerous. Similar geological conditions existed on the Brancaster beaches in Norfolk. A RAF bomber had dropped bombs in a selected suspect area on the Plateau de Calvados. The bomber had done this skilfully diving and making smoke to make it appear that it was damaged and the bombs had had to be jettisoned to avoid arousing any suspicion. A similar pattern of bombs was dropped off Brancaster. Over a period the Plateau de Calvados craters were monitored by air photography and checked against those at Brancaster. The results were not sufficiently conclusive for the scientists.

Reconnaissance for the invasion was a British responsibility as we had been fighting an increasingly sophisticated air and sea cross-Channel war for four years and knew the form. Mr Churchill, in his capacity as Minister of Defence, had ruled that no-one was to go to France, who knew of the invasion plans, without his permission.

The Combined Chiefs of Staff in Washington had been demanding from COSSAC, (Chief of Staff to the Supreme Allied Commander), who had formulated the plans, a firm estimate of the amount of beach trackway required for the invasion, but, because of the scientists' uncertainties, no reply had been forthcoming. An ultimatum came stating that as vital production priorities in the United States had to be changed to meet the worst case optimum estimate, an immediate decision was vital if such requirements were to be met in time for the invasion.

COPP-1 was to prepare for an operation at short notice but as a preliminary test, in 48 hours' time, we, after some instruction in collecting samples, were to do a night trial at Brancaster sailing out in a tank landing craft from Kings Lynn. If this was successful, we might be permitted to do an operation to Normandy on New Year's Eve 1943/1944.

Military scientists did not believe that we could take the samples they required, record accurately from where they had been taken and not get caught doing it. Professor Bernal came on this trial and was posted as a sentry! He had the ear of Professor Lindemann, "the Prof", Mr Churchill's scientific advisor. We sailed out from Kings Lynn, Ogden-Smith and I being equipped with the additional burden of a large bandolier with a dozen 10in tubes with phosphorescent numbers on their caps and an 18in auger which was efficient; pushed fully into the sand and given one half turn, when pulled up it produced a 10in core sample from the lower end. It was the dark period and we were in luck as there was some mist; having swum ashore, we crawled in an inverted "W" course to achieve wide coverage, took samples, recording their positions on our underwater writing tablets and incidentally located all the sentries without being detected. Having gone back to the sea, we then stood up, walked to the shore, shouting to the frozen sentries who converged on our 15cwt truck at the back of the beach where we displayed our wares in the heavily dimmed headlights.

Two days later, we were told that a reconnaissance had been approved. We were to examine a suspect area of beach west of Ver-sur-Mer on New Year's Eve when the Germans might be less vigilant. We were to go from Gosport in two MGBs whose experienced crews were regularly engaged in Channel operations. They would tow two very small shallow-drafted craft called Landing Craft Personnel (Navigational) (LCP(N)) specially designed for hydrographic survey.

The MGBs would stop short of the minefields and transfer COPPists to the little craft which would then cross some two miles over the minefields,

close-in to the beach and drop Ogden-Smith and myself well short of the breakers as these small craft could easily broach-to in the surf. They would then go offshore, anchor and await our signal for recovery much later. In the meantime, the MGBs would continue on what was planned to appear to be a normal patrol.

The weather was bad; the wind had already backed to the northwest and was Force 5. Willmott held "a council of war" in our MGB; we decided to go ahead. The next totally unexpected hazard was that the Ver-sur-Mer lighthouse was turned on; whether to celebrate the New Year or assist their patrol craft to navigate back to their bases through the minefields, we did not know.

We transferred to the little craft, crossed the minefields and Ogden-Smith and I went over the side opposite the areas to be examined. At least we were certain of our position thanks to the lighthouse, but it was a longer swim than planned as the breakers started well out. We found ourselves being taken rapidly east as the storm was creating a much stronger current or "set" along the beach on the rising tide than anticipated. It would stop for a while at about high tide, then reverse. We reached the shore opposite the village, La Riviere, where fortunately the beach was screened by buildings and trees from the lighthouse beam. We rapidly made it to the back of the beach, taking cover in some groins below high-water mark. We then heard singing and some shouting back in the village. It was unlikely to be the French and sounded like soldiers celebrating as they do the world over. So we made our way west, coming across a useful concrete ramp blocked at the top by heavy steel obstacles, known as "hedgehogs", with extensive standard German wire entanglements on either side. We risked walking as there was three-quarters of a mile to go before reaching the suspect area but soon we were into an area traversed by the beam and had to flatten ourselves every minute or so. We then noticed that our craft, though well out, were being exposed by the beam as it swept by. However, the weather was worsening and heavy slanting rain was beginning to diminish visibility. Feeling more secure from sentries further away from the village, we reached our area and started the examination, taking samples according to the pattern required, leaving out one leg of our "W" as we were already at the back of the beach. The one who took the sample loaded it into a tube in the other's bandolier. We took ten each. Then we found a quite large exposed patch of peat standing a foot or so above the sand which had stood out clearly on the air photographs. We examined the sand all round it which was of substantial depth. It was time to go. We went out into the surf festooned as we were with our personal gear, plus the loaded bandoliers, and started swimming; we were smartly flung back. The wind was still strengthening. We quickly tried again rather harder with the same result. The prospects did not look too good. Nothing could be abandoned without compromising secrecy. We sat as far out in the surf as possible to work out the wave pattern, hoping to be able to time the best moment to go: the lighthouse beam helped in this. At the third attempt, timing it right we made it through the surf and swam hard to make sure of not being swept back again. I swam harder than Ogden-Smith and for a moment thought I had lost him. Then I saw him raise an arm and could just hear him yelling, so I swam back somewhat alarmed, thinking he had either got cramp or his suit had sprung a leak which would cause loss of buoyancy and make things very difficult. When I got close, he shouted "Happy New Year"! He was right; it was well past midnight but I had been alarmed and shouted "Swim you b.....! or we will be back on the beach." Then I recovered, relented and wished him a Happy New Year too. We still had quite a way to go before signalling for recovery with our standard service torches which were fitted with a directional cone. We were personally responsible for waterproofing our own torch using several of those articles designed for keeping down the population. However, in this case, they were vital for saving life! Signalling and waiting for recovery is always rather tedious even on training which we had done so often off the coast of Scotland with X-craft and elsewhere with canoes. We were used to it but had not operated with LCP(N) before. Keeping the torch pointing in the right direction was essential and not easy to do in a rough sea in the dark when one needed to be on the top of a wave to be seen. Eventually Willmott's craft came up and we were assisted inboard. We had no idea what a difficult time this craft and the back-up craft had experienced. Some of the crew were exhausted. They were to have anchored but that proved impossible and one anchor was very nearly lost; so they had to keep moving to maintain an approximate position and in the storm had great difficulty in keeping in contact with each other. By the time we were aboard the craft were short of fuel; after getting separated again, eventually they

both made the two miles or so out to the rendezvous with the MGBs. This was achieved using our COPP special infrared gadgets and the new to us device called QH (a secret radio aid to navigation). The senior officer of the MGBs then received orders from Commander-in-Chief, Portsmouth not to attempt to return to Gosport but to run before the wind to Newhaven. This we did with the LCP(N)s and their crews on tow. Luckily, despite the weather, Willmott, Ogden-Smith and I had been able to transship to the comparative luxury of the MGB. Lieutenant Geoffrey Galwey RNVR, a COPPist, was less fortunate as the crew of his back-up craft were seasick and exhausted. He stayed at the helm being exposed to the winter weather without food or drink for over 12 hours. Quite a feat of endurance for an officer who had been invalided out of the Royal Navy as a midshipman in 1932! On our return our results were reported to Combined Operations Headquarters and the samples taken immediately to the scientists whose anxieties were allayed; presumably, the Combined Chiefs of Staff in Washington then received an answer to their ultimatum.

During the 1943/44 period we had trained four more COPP teams bringing the total to ten and provided some replacements for casualties to the Middle and Far East theatres. There were 11 in a team, three naval officers and five ratings, and an RE officer, a senior NCO and a draughtsman all operationally trained. They did outstanding work, for all the major assault landings, for some which were contemplated but never implemented and for various smaller and clandestine operations particularly on Mediterranean islands, across the Adriatic and in the Far East, down the Arakan and Tenasserim coasts. However COPP reports on the Morib beaches for the invasion of Malaya were insufficiently heeded. It was indeed fortunate that atom bombs were dropped ending the war, just before the invasion took place, which it then did unopposed but with great difficulty in getting vehicles ashore.

Unfortunately there were a number of COPP casualties, some in the Middle but more in the Far East. Among them Captain J E F Johns and Sergeant F Cammidge were killed on Phuket Island; Major Ian Mackenzie was taken prisoner, survived, later became a colonel, retired home early to New Zealand but died aged 47. Recovery of four others in their canoes failed off Malaya however they made it inland to the Cameron Highlands and joined with the resistance forces there. The stories of COPP are numerous but alas most will never be told. Security restraints on covert operations applied for a long time, and too many participants were either casualties or sadly have departed saying little.

For Normandy, nearer "D" Day, as orders and briefings went down successive levels of command we were called in as required. I attended a briefing by Brigadier Basil Davy, Chief Engineer 30 Corps, and was able to suggest to Major Tim Thompstone, commanding 81st Assault Squadron, that he blast his way off the beach at La Riviere by using the ramp which I had inspected five months earlier. This he did with great effect, capturing much of Ver-sur-Mer with his assault tanks, AVREs, and winning the DSO.

Ogden-Smith and I were mainly with US V Corps for briefings for Omaha beach. We answered various questions, and the fact that we had been and seen the beach seemed to give some encouragement. For D-Day we were assigned to Naval Force "O", commanded by Rear Admiral Hall, to assist with pilotage and had attended the major rehearsal exercises. We sailed in the Admiral's flagship from Weymouth and stopped briefly before dawn. The very small pilot craft were launched and we went down the scrambling nets to board. I had opted for the right hand US 29th Division beach pilot boat and Ogden-Smith went with the US 1st Division on the left. The pilot boat which I was in, was commanded by a very experienced US naval lieutenant doing his fourth assault landing. He had a crew of two; a coxswain, and a gunner of Mexican extraction manning a four-barrelled "pom-pom" for anti-aircraft fire but which could be directed horizontally. The little craft also carried six small rockets, three on each side. We sped rapidly to the head of the fleet, taking station in front of the eight Landing Craft Tank (LCT) in column carrying the 32 amphibious Sherman tanks which would be the first to land; the LCTs deployed in line abreast. We took position on their left; as we approached the 1500yd position, the decision then had to be made as to whether to stop and launch the tanks so that they could swim ashore under their own propulsion or go straight on in to put them on the beach. It was rough. The US navy lieutenant was responsible for this decision. The major commanding the tanks was in the turret of his tank in the left hand LCT and he by signs made very clear he wished to be taken on in. I think out of courtesy, the lieutenant asked me my opinion. I said "It is far too rough; we should go right in."

Just previously we had seen 250 Liberator bombers off-load their bombs. Having been briefed that the defences would be pulverized, we were more than disappointed to see all the bombs fall beyond the top of the ridge. I said "That's a fat lot of use. All it's done is wake 'em up." We looked east to see what was happening on the left. Their eight LCTs were stopped and were discharging their tanks into the sea. We later learned that out of their 32 tanks, 26 were drowned with their crews. Then everything happened fast. I discharged three of the rockets, our gunner opened up and I gave him some targets mainly embrasures. He was enjoying it. The LCTs grounded on time and exactly in the right place just short of the beach obstacles full of mines, downed their ramps and the amphibious tanks emerged still with their canvas flotation gear up which they then had to blow free. Some had difficulty as they were being hit by intense machine gun fire. Soon they were being knocked out by antitank gunfire. Not many tanks survived. From among the obstacles we heaved inboard some tank crew survivors. The smaller Landing Craft Assault (LCA) were now beaching closer in to off-load infantry and engineers. We transferred our survivors to one of them returning to its parent ship. The assault troops were being mown down by the score as they moved in the shallow water. Some made it to the back of the beach. Fire was pouring into the defences but not having much effect. Enemy fire was coming back undiminished. Those who found very slight cover at the back of the beach were killed instantly if they attempted to move. To the left of where we were keeping station avoiding incoming craft, the assault was going better and moving up the ridge; on the right from the place where that sentry had beamed his torch at me five months ago the assault was halted. Destroyers closed in and naval gunfire support started being effective. Even the *US Battleship Texas* had closed and was visible broadside-on firing its main armament. Our task was to observe progress and report verbally what we had seen to Admiral Hall. Gradually with immense courage the infantry and engineers, some using man-pack flame-throwers worked along the ridge destroying the rabbit warren of bunkers as the naval gunfire moved along just in front of them. It was a magnificent display of navy and army cooperation. We went back to report; on board they already knew that the battle was being won.

In some history books it has been suggested that the Americans should have accepted the British offer of assault engineer tanks, AVREs. If they had, the Churchill AVREs would have suffered terrible casualties. At least the same high level as the leading US tanks before they even reached the back of the beach. Furthermore, the very highly trained and rehearsed US combat engineers although they suffered heavy casualties did what was required very successfully. They were much assisted in their planning and training by a skilled and diplomatic Territorial Army Sapper, Lieutenant Colonel Richard Fairbairn MC, who was with them on the day.

Our two X-craft, X20 and X23 (Lieutenant George Honour DSC RNVR) marked the British beaches. They had a difficult time having to remain submerged for eighteen hours after the 24 hour postponement. Other COPPists on various craft also assisted with pilotage.

After the US and British link up at Port-en-Bessin, I was standing at the then small cross-roads at the head of the harbour when Brigadier Basil Davy arrived, saw me, and demanded to know what I was doing. I was looking somewhat disreputable having had to discard my battledress which was saturated in the oil from knocked out tanks on D-Day, and could only acquire a pair of US waterproof trousers and a sort of golf jacket. I said "Absolutely nothing, Sir. My job is finished." I did not add that I was supposed to go back to the UK after D-Day. Then Major John Cave-Brown commanding 233 Field Company in 50th Division arrived. The Brigadier said "Stay around with John. I will soon find you a job. We have had a lot of Sapper officer casualties." Later the next day in the dark in front of 185 Infantry Brigade forward positions, I took over 17th Field Company busy laying 5000 mines across the expected axis of attack by 21st Panzer Division.

So ended my service with COPP, apart from a threatened Court Martial, for failing to return to the UK, from the new Chief of Combined Operations, Major General Robert Laycock, via Commander-in-Chief 21st Army Group to CRE 3rd Infantry Division Lieutenant Colonel R W "Tiger" Urquhart. Fortuitously Tiger knew General Bob very well and thus I escaped indictment to soldier on happily ever after.

3 Parachute Squadron RE

Normandy – 5/6 June 1944

J C A ROSEVEARE DSO BSc CEng FICE FIWES

Born 1914. Educated at Hurstpierpoint College and London University. 1934/39 river engineering and waterworks. 1939/46 commissioned service in Royal Engineers in France and UK. Instructor 141 Officer Cadet Training Unit RE 1941/42. Joined Airborne Forces 1943. Officer Commanding 3 Parachute Squadron RE in Normandy, the Ardennes and the Rhine crossing. Demobilized in 1946. Joined Binnie and Partners. Worked on major civil engineering works including Tai Lam Chung Dam in Hong Kong. 1957 joined Freeman Fox and Partners. Project engineer for Ffestiniog 360 MW pump storage hydroelectric power station. James Watt Gold Medal Institution of Civil Engineers. Made partner 1970. Major projects worldwide including Cross-Harbour Tunnel, Hong Kong and foundations for Bosphorus Bridge and Kotri Bridge, Pakistan. Member Panel 1 Reservoirs (Safety Provisions) Act 1930. Retired 1982. Lives near Bath.

The long awaited invasion of Normandy began on the night of 5/6 June 1944.

Three airborne divisions: two American on the right flank and one British on the left, were dropped during the night about six hours before the seaborne divisions started to disembark. The vital task of safeguarding the left flank of the invasion was entrusted to Major General Richard Gale's 6th Airborne Division. To do this it had to deny access to the high ground between the Caen Canal and River Orne, and the River Dives, some 8km to the east.

To achieve the objective the main tasks of the Division were:

- To capture intact the bridges over the Orne and the canal, vital for the survival of the Division.
- To capture and destroy the Merville Battery whose guns enfiladed the beaches.
- To destroy the five bridges over the River Dives between Varaville and Troarn, to cut the main routes from Caen towards Le Havre.

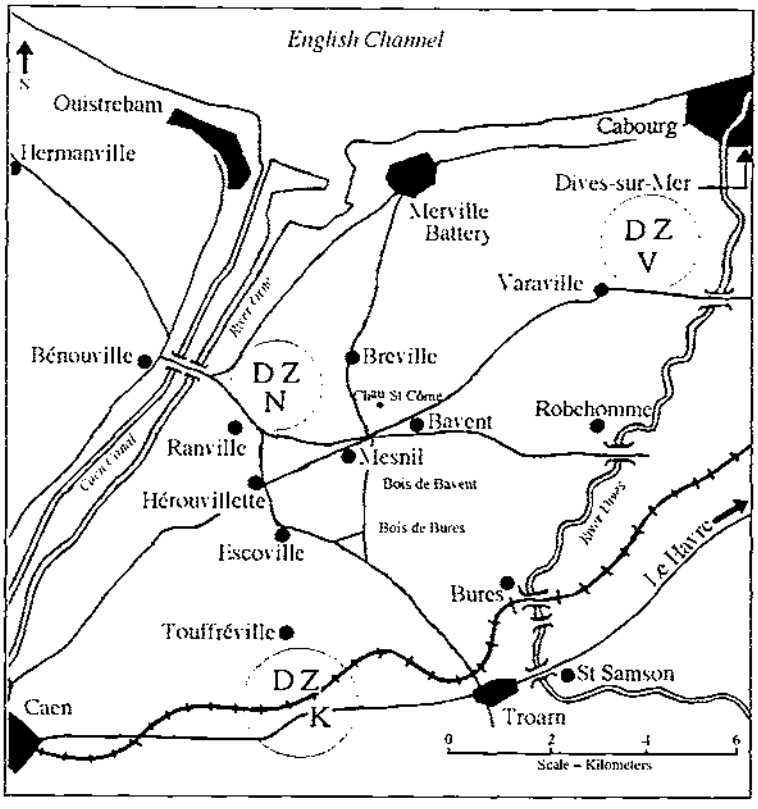
There were insufficient aircraft available to lift more than two brigades in the initial phase of the operation. The 6th Airlanding Brigade with supporting arms would not arrive until the evening.

For the operation, 3 Parachute Squadron RE was under command 3 Parachute Brigade and 591 Squadron under 5 Parachute Brigade. The drop zones (DZ) were "N" north of Ranville for 5 Parachute Brigade, "V" north of Varaville for 9 Parachute Battalion and 1st Canadian Parachute Battalion and "K" near Touffréville for 8 Parachute Battalion.

Because of the diversity of Sapper tasks both parachute squadrons were divided on two drop zones: 591 Squadron less 2 Troop on DZ "N" had to clear the landing zone of Rommel's "Asparagus". 2 Troop dropped on DZ "V" with 9 Parachute Battalion and also provided six Sappers to go with the three Horsa gliders allocated to the Merville Battery. 3 Troop of 3 Parachute Squadron was also on DZ "V" to destroy the bridges near Varaville and Robehomme. 8 Parachute Battalion with 3 Parachute Squadron less 3 Troop were on DZ "K" to attack the two bridges at Bures and the main road bridge beyond Troarn at St Samson.

The best plans of men... What a shambles! Only the 5 Brigade drop was respectable and it was able to move quickly to re-enforce the *coup de main* glider party of the 2nd Oxford and Buckinghamshires who had captured the bridges

J C A Roseveare DSO
3 Para Sqn RE (p19)



Map of area, including dropping zone sites.

on the Orne River and Canal earlier. No demolition charges had been laid by the Germans and this was probably a disappointment to the Sappers in the party. The glider landing strips were successfully cleared by members of 591 Squadron who found that some of the poles were not as firmly embedded as the Germans might have hoped. No doubt this was a deliberate action on the part of French forced labour. However the gliders arrived from all directions and some managed to put down in quite unexpected places.

The troops on DZ "V" were scattered far and wide. It seems likely that the navigators mistook the River Dives for the Orne in the low-lying mist. Many were dropped in the flooded river marshes and, weighed down by heavy kitbags, some were drowned. The Sapper demolition party never arrived at the Merville Battery. 3 Squadron Troop was luckier and the Troop Commander was able to collect sufficient men and stores to carry out the demolition of the Varaville bridge. Sergeant Poole, in civilian life a southern railway engine driver, found himself almost alone near Robehomme with a few Canadian paratroopers. He collected all the explosives from their Gammon grenades and, single-handed, cut the single span lattice girders of the bridge, dropping the span into the River Dives. Later on, more Canadian paratroopers and sappers arrived in the Robehomme area and the bridge abutments were attacked, increasing the destruction. These troops were then attacked by lorry-borne German infantry from the Dives-sur-Mer area and beat a fighting retreat on D+1 to the Le Mesnil area about 7km away, where 3rd Parachute Brigade was dug in.

On DZ "K", following the two pathfinder aircraft, 3 Parachute Squadron was to drop first followed by 8 Parachute Battalion. After take off I was rather surprised to see that all the planes had their navigation lights on. No doubt the dangers due to collision were greater than the possibility of attack by enemy night fighters. The flight was uneventful until we reached the French coast where flak was quite heavy; evasive action by the pilot nearly tipped me out – I was standing in the doorway ready to drop as number one of the leading plane.

Very soon the red light came on. I thought it was too soon and shouted to the troops that we might be on the wrong DZ. Then came the green and I snapped the container release switches and jumped. As soon as the chute opened I set about getting rid of the 60lb kitbag packed with demolition equipment, tools, etc. To my fury the release mechanism did not work and I landed with the bag still attached to my ankle instead of hanging on a 15ft rope. I expected a broken ankle but luck was with me.

In 3 Squadron we always prided ourselves on being very quick out of the plane and, sure enough, my Squadron Sergeant Major Bob Barr,

who had been the last out of my plane, soon arrived and gave me a smart salute which did my morale a lot of good as I had just managed to cut myself with my fighting knife trying to disentangle parachute and kitbag.

By a splendid piece of navigation Squadron Leader Miller had put me down 50yds from the Rebecca Eureka homing beacon laid by the pathfinders half an hour earlier. Unfortunately, it was the right beacon but on the wrong DZ. It did not take long to establish that we were on DZ "N" with the bulk of 5 Parachute Brigade. There was even a signpost at a crossroads at the edge of the DZ to confirm it. It was obvious from the noise that a battle was developing in Ranville but there was not a great deal of firing in our direction, and it was none of our business.

Our task was to collect the troops and find the containers. These had been fitted with a delayed-action device which ensured that they landed in about the middle of the "stick". They were also fitted with lights on a triangulated arrangement which opened up on landing to hold a light above standing crops.

Troops from every formation in the division were milling around trying to locate their rendezvous. Gliders were a hazard as they came in with a swish and a thump. A Sterling bomber ablaze went over in an easterly direction. It transpired that this was one of 591's missing planes. Miraculously, some survived the crash and were taken prisoner.

The loading of the folding trolleys went well. We were particularly concerned to get the General Wade shaped charges which were needed for the masonry arch bridge at Troarn. As more sappers and 8 Battalion soldiers arrived at our makeshift rendezvous, we now had about five officers, thirty Sappers and about twenty 8 Battalion soldiers. I judged that we had sufficient explosives and other equipment to carry out an attack on the three bridges, if we could reach them. There was no sign of the two gliders which had been laden with further charges for the five spans of Troarn bridge. We heard later that they had arrived on the correct DZ, about 6km away.

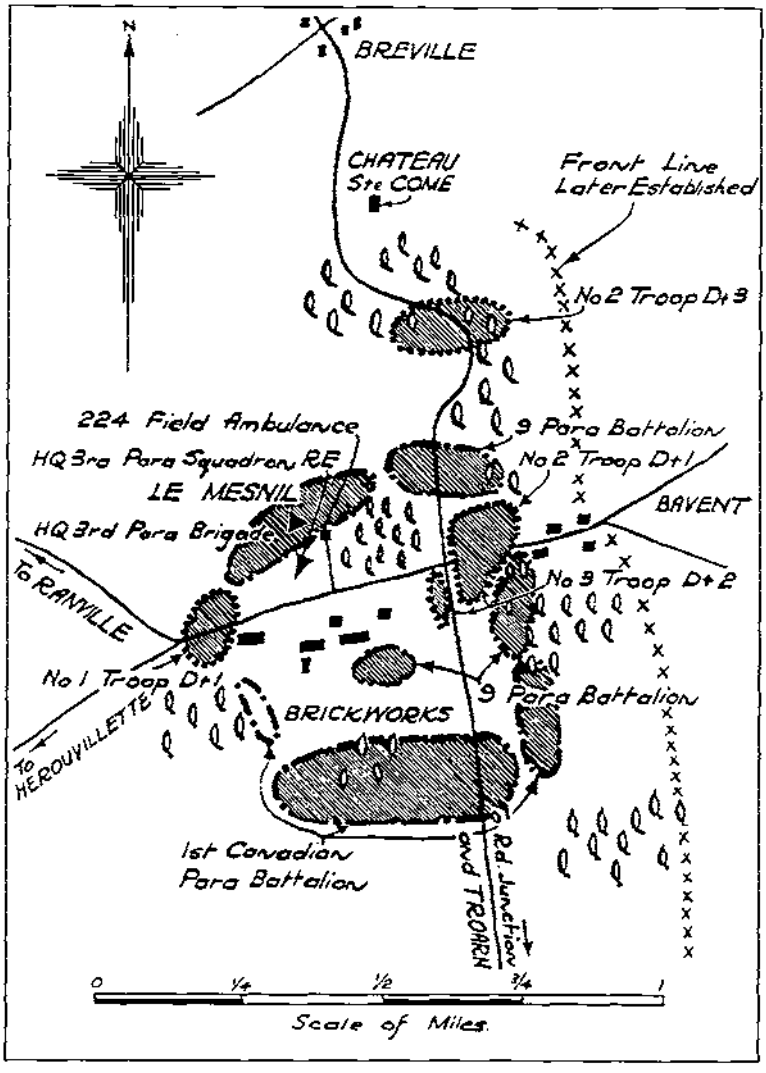
Heavily laden we set off on the long march to our objectives. As we went a jeep and trailer appeared out of the murk; it belonged to 224 Parachute Field Ambulance. I had no compunction in commandeering it – the lack of a jeep and trailer might make all the difference between success and failure. We passed through Hérouvillette and Escoville without incident. If there were Germans there they must have pulled the bed clothes a little higher – we had no wish to disturb them.

The long pull up to the Bois de Bavent was punishing. Some of the troops had injuries from the drop, which did not help matters. At a crossroads at the edge of the woods I called a halt and we reorganized. All the medical stores were unloaded and replaced by the General Wade charges. I ordered the 8 Battalion and medical contingents to dig in and await events. I sent Tim Juckes with the bulk of the Sappers, through the Bois to destroy the two bridges at Bures. Their march was unopposed and they reached the bridges in about an hour. There was no sign of the enemy but there was a Horsa glider with a jeep and six-pounder antitank gun half submerged in the river. The glider pilot was conscious but had broken legs. Without some heavy lifting gear it was impossible to recover the jeep and the gun. Both bridges were prepared and successfully blown by about 0900hrs.

There remained the Troarn bridge. Without the 8 Battalion to fight us through the town it was evident that only a *coup de main* operation was likely to succeed. It was thought that the recce regiment of the 21 Panzer Division was in occupation.

I took the wheel and we set off. On board were Lieutenant David Breeze and No 1 Section of 1 Troop with eight NCOs and Sappers and a half ton of explosives. It was still rather dark and gloomy on the edge of the Bois and before I could stop I ran into a barbed-wire roadblock. By the Grace of God, Lance Sergeant Irving had "borrowed" a pair of wire cutters from 8 Battalion to deal with telephone wires during our march. Without them we should have got no further. Disentangling and cutting the wire seemed to take an age and we were very apprehensive. However, there was no sign of the enemy and we were able to continue our journey.

We were now entering the town and stopped just short of the crossroads. Dave Breeze and Sergeant Irving went forward to have a look. They were peering round the corner to the left when I spotted a German with a rifle, riding towards us from the right on a bicycle. I had to shout "Look the other way" – if he had let go his rifle and stopped shouting that German might be alive today. Now it was a matter of jumping aboard and making the best speed possible through the town as it was obvious that surprise was lost.



Le Mesnil crossroad – 6 to 9 June 1994.

I doubt if we were making more than 30mph due to the limited power of the jeep and the heavy load. As we came round quite a sharp bend – there were the Germans and the gun fight started. One German tried to set up an MG 34 but we were too quick for him and he dashed back into a building and out again as we passed: then a stream of tracer bullets passed over our heads as we got the benefit of the steep gradient down the hill.

As there was no further opposition we were soon at the bridge unloading the General Wade charges. Unfortunately Sapper Peachey and our only Bren gun were missing, which made us feel very vulnerable.

Demolition was the simplest thing possible; the charges were laid contiguously across the crown of the arch from parapet to parapet connected to cordtex detonating cable and an igniter. The whole job took less than five minutes.

To return through Troarn would have been suicidal and as we had no means of carrying out further damage to the bridge and only Sten guns for our protection, we set out along a track beside the river; ditched the jeep and swam several water courses before taking to the woods of the Bois de Bures. We came across an elderly Frenchman milking a cow. When I informed him that he was being liberated he was not impressed. Perhaps he did not understand my accent. We arrived at 3 Brigade Headquarters about mid-day, a very bedraggled and exhausted party, having been shot at by the Germans, bombed by the RAF, shelled by the Navy and unappreciated by the French.

The arrival from Touffréville DZ of troops from both 8 Battalion and 3 Squadron, with a jeep and trailer loaded with General Wade charges, gave the opportunity to make another attack on the Troarn bridge. 8 Battalion fought their way into the lower part of the town and covered the Sappers in their jeep and trailer down the main road to the bridge. Another span and one of the bridge piers were destroyed by Lieutenant Tony Wade and his Sappers from No 1 Troop by 1400hrs. They then withdrew to 8 Battalion which was established at its crossroads rendezvous in the Bois de Bures.

In the weeks that followed 8 Battalion, with Sapper assistance, completely dominated the area with aggressive fighting patrols and no threat to the bridgehead materialized from this quarter.

In the Le Mesnil area a fierce defensive battle to hold our lines now began. 9 Parachute Battalion

hardly existed as a battalion and the Canadians had also suffered heavy casualties. 3 Squadron played a vital role in holding back determined attacks which the enemy mounted with tanks and self propelled guns in the Le Mesnil/Chateau St Côme area during the next six days. We were very relieved when it became known that elements of 51 Highland Division were expected in our bridgehead. Unfortunately, their attack on 11 June in the St Côme area was repulsed with very heavy casualties. The critical situation was not relieved until a very gallant assault by 12 Devonshire, 12 Parachute Battalion and 12/18 Hussars on Breville finally established a solid defensive position in the area. The Sappers fought with great gallantry: three officers were awarded the Military Cross and two NCOs received the Military Medal.

When they could be spared from the front line, there were plenty of the usual Sapper tasks of minelaying and clearance, road cratering and laying boobytraps. More domestic matters were water supply and the building of bunkers for headquarters and field ambulance. The poles from the DZ were excellent for providing overhead cover against the continual mortar attacks.

The operational strength of each parachute squadron was 18 officers and 127 other ranks. A total of 94 casualties were suffered by the two parachute squadrons:

Killed	3 officers and 19 soldiers
Wounded	5 officers and 45 soldiers
Missing	5 officers and 17 soldiers

The defensive battle continued until mid-August when, on the 17th, the great advance began. 6 Airborne Division led on the left flank and the mobile warfare made a pleasant change from the trench warfare of the past weeks. The rivers Dives, Touques and Risle provided plenty of Sapper tasks. We reached the Seine at the end of August and then withdrew. After enjoying the wonderful hospitality of the Normans, we returned to England on 5 September to refit and retrain for the battles ahead – the Ardennes and the Rhine crossing.

VE day found us in Wismar on the Baltic – we were among the first British troops to meet the Russians.

HQRE 6 Airborne Division – 5/6 June 1944

J S SHINNER BSc FICE

The author enlisted in late 1940 and, after passing through 142 OCTU, was posted to 257 Field Company RE. He joined Airborne Forces in 1943, going first to 3 Parachute Squadron RE, then to HQRE as Intelligence Officer on the formation of 6 Airborne Division.

A Prisoner of War from 6 June 1944 until April 1945, he returned to Germany after repatriation, until demobilization in early 1946. He was Mentioned in Despatches.

Since the war, his career has been in the water supply industry in the United Kingdom, and in the mid-fifties he joined the East Surrey Water Company, becoming successively chief engineer, general manager and a director. He became a non-executive director in 1985 and was appointed Deputy Chairman from 1989 until his retirement in 1991.

HQRE was a small unit consisting of the CRE, Adjutant and Intelligence Officer and ten NCOs, sappers and drivers. For the assault into Normandy the CRE and IO, each with one sapper, travelled in separate aircraft carrying troops of 591 Parachute Squadron RE in the first parachute drop, landing from 0050hrs onwards. The remainder of HQRE followed in two gliders in the first glider wave.

This account consists essentially of extracts copied verbatim (omitting only names) from my diary, written shortly after the events described. To fill in the picture I have added some descriptive and explanatory material, much of which is the result of research over the last few years.

The hamlet of Grangues lies in a valley about 5km south of the coastal town of Houlgate. About 1km further south the D27 road from Varaville towards Pont l'Evêque runs along a ridge at about 120-140m above sea level. Significantly, the location of Grangues relative to the River Dives is very similar to that of Ranville relative to the River Orne, some 10km further west. The terrain, however, is very different, with steep-sided valleys, small fields and orchards and woods, as opposed to the open undulating countryside around Ranville.

Among the habitations scattered along the D27 ridge is a farm, close to the road on the north side at Lieu St Laurent; a little further east, on the south-facing slope and surrounded by its own parkland is the Château de Grangues.

In June 1944 a unit of the German 711th Division occupied the Château and grounds. The owner and his family, including his son and his five year old daughter, had been allowed to stay on, living in very restricted and uncomfortable circumstances in the basement. Their household included a very old Irish woman, who had been nanny to two generations of the family, and the young daughter of the farmer at Lieu St Laurent, who was a Red Cross helper.

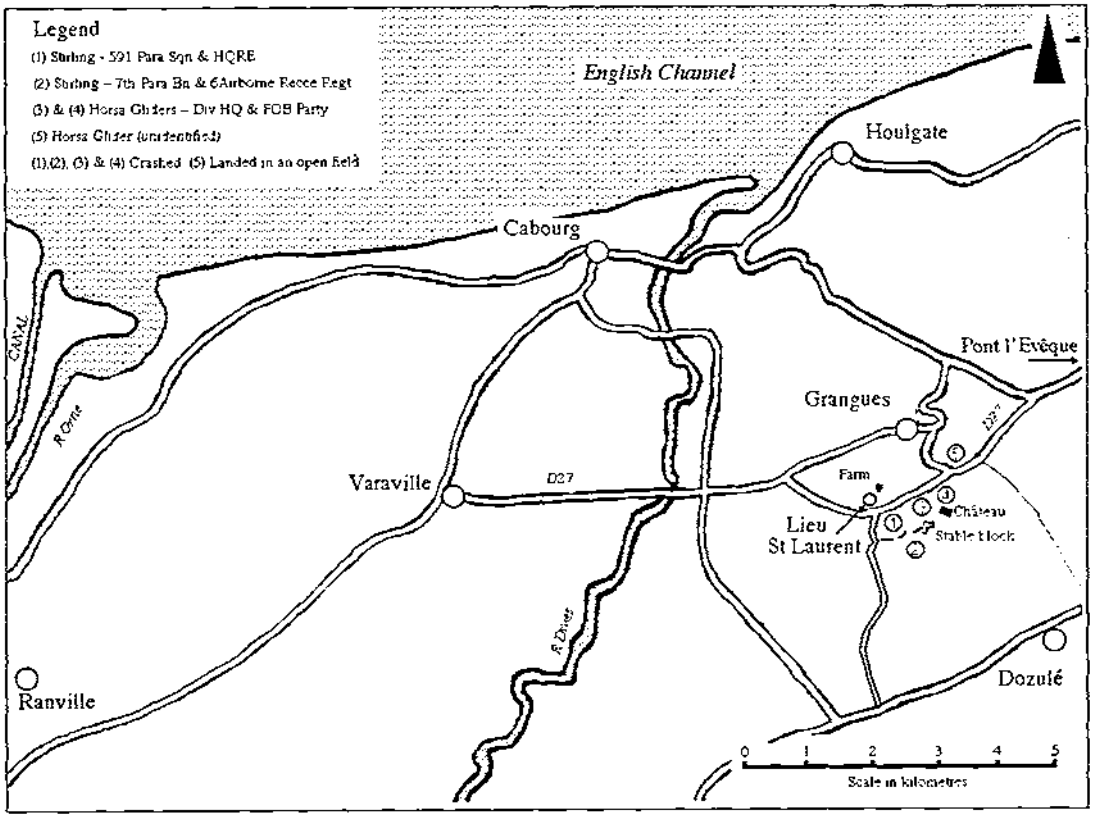
So, on the evening of 5 June 1944, these people and the other French folk in the neighbourhood settled down for just another night under German occupation.

On the other side of the Channel on 5 June, preparations for the assault were reaching their climax. The troops were in their transit camps, isolated from the outside world, and final arrangements and briefings were taking place.

My diary records:

"D-1, 5th June 1944 dawned fine but windy at our transit camp at Harwell. We looked out of our tents as we woke up and saw that all the aircraft and

J S Shinner
HQRE 6 Airborne Div p24



Map of area covered in article.

gliders had overnight become zebra-like in black and white identification stripes. I made quite certain that my kit was all correct and stowed away my camp bed and stuff to be left behind, and put it in charge of a driver who was to follow by sea.

Towards the end of the morning, the CRE and I got our small team together and, with the latest and largest photos of the DZ (dropping zone), we went through final details of our plan; in the afternoon I slept for an hour, sunbathed a little, and ate a large meal at 1900hrs.

At 1930hrs we left for Fairford, our take-off airfield. We had a pleasant 30 mile or so drive through the English countryside. I think we all wondered a little how long it would be before we saw it again – I know I did.

We were to fly in a Stirling of 620 Squadron. Most of our people had been up a couple of days previously for a flight to familiarize themselves with the aircraft and crew – I had missed this because I was away with the CRE at Tarrant Rushton.

Once on the airfield I felt no nervousness, just a slight feeling of expectation and excitement. The wind was still strong but was forecast to drop at about 2200hrs; sure enough, it did.

Take-off was timed for 2337hrs. At 2245hrs we got into our kit.

This is what I wore and carried:-

Underwear, string vest, shirt, battledress, camouflage scarf, airborne smock, beret, 1lb of gelignite, two No 36 grenades, .45 Colt automatic and ammunition, shell dressing and morphia tubes, code list, escape kit (magnetic "compass" fly buttons and silk maps sewn into linings of clothes) emergency rations, fighting knife, compass, map, jumping jacket, helmet, mae west, parachute and a leg kit bag containing two small packs, a map board and a Sten gun.

Others carried more than this and we popped through the door of the aircraft like corks in a bottle."

The Sappers of 591 Squadron were carrying an assortment of weapons, tools and equipment, including such items as a folding bicycle. Their primary task on landing was to demolish and

remove the poles which had been erected to obstruct the glider LZ (landing zone). For this purpose each man carried a 5lb charge of plastic explosive in a bicycle inner tube wrapped around his body – these were to contribute substantially to our subsequent troubles.

It is easy to be wise after the event, but I am convinced that we underestimated the difficulties experienced by heavily laden men in an aircraft lurching under fire, and that we tried to carry too much.

"In the aircraft we settled down comfortably. I was in the navigator's compartment for take-off, and we were off the ground within one second of the correct time. We climbed for five or ten minutes and then I went back to my travelling position behind the main spar.

The trip across could not have been more uneventful. Until 20 minutes before jumping time we had the lights on. Then one of the aircrew went back to the rear of the aircraft, the lights went off and for a moment or two all one could see was the big luminous 'D' above the dinghy toggle."

The crewman who went aft was the wireless operator. As well as his job of acting as dispatcher, he had to investigate an intercom failure between the rear gunner and the cockpit. This resulted, among other things, in the navigator receiving no estimates of drift.

"When one's eyes adjusted to the moonlight coming through the portholes, one could see ripples on the sea below.

We were to jump at 0100hrs, and our last two minutes' flight would be overland. Three minutes to go, and leaning over to a porthole I could see surf and a strip of sand.

Red light on!

Then, someone on the beach picked up a handful of pebbles and threw them against the fuselage. Then another and another – only they were not pebbles, they were flak. One bit nicked my right arm – it didn't hurt, but felt a bit numb.

The sky seemed to be full of vivid flashes and orange streaks. Suddenly there was a flash and a burst of flame inside the aircraft, astern of where I stood. In a matter of seconds the whole of the inside of the aircraft was blazing.

Each of the sappers had been carrying 5lb sausages of plastic explosive and one poor chap had his hit, and it burned fiercely. Five or six of us at the forward end of the fire were forced forward towards the main spar by the flames. I felt the flames singeing my face and yelled to someone to get the escape hatch off to let out the suffocating smoke. I told one of the sappers to go forward to the radio cabin to find out what the situation was. He contacted one of the crew, but obviously things were badly wrong up there, because they passed the order to jump and then immediately cancelled it. In any case we could not have got past the blaze between us and the exit hole."

Four parachutists aft of the fire did, in fact, jump and all survived – three becoming prisoners of war and one evading the Germans and making his way back to the beachhead. The officer who jumped at No 1 recollected, before he jumped, seeing one of the port engines on fire, and had a vivid image of the contrast between the orange red of the flames and the greenish flames and dense smoke inside the aircraft. He had a short glimpse, after he jumped, of the aircraft "well alight" disappearing over a hill, and assumed that there could be no other survivors.

"Almost immediately after this the nose dipped, there was a horrendous rending and crashing and I had the sensation that we were being rolled over and over. It seemed to go on for an awfully long time. When all the movement stopped I became aware of something (fuel?) swilling over my face and that there was a fierce fire burning in the forward part of the aircraft a few feet away. I also realized that I couldn't move of my own accord because I was hanging upside down, by one leg, on my static line, which had become entangled with the roof of the aircraft.

If I didn't do something I was going to cook in the immediate future. Again my luck was in, and the urgent action required was taken by another survivor who came staggering my way. I shouted to him to cut me loose and in two seconds his fighting knife had done the job and we were both on our feet. We only had a few feet to walk because, just behind where I had been hung up, the fuselage was broken off and there was a pile of wreckage and dead and injured men. We couldn't see any sign of the tail!

The two of us set about getting some of the injured out. As far as I could tell – I was pretty dazed and shaken – there were four of us on our feet, three or four men alive but badly injured and the others dead. The front part of the aircraft was a raging furnace and there was obviously nothing to be done for the aircrew there. We pulled out two of the sappers but couldn't shift a third man

The crashed Stirling; photograph taken in April 1946 by Mlle Anne, the farmer's daughter mentioned in the article.

who was very firmly trapped in the wreckage. There was a good deal of tracer flying about – I don't know where it came from or who it was aimed at – and a fair amount of banging.

Another fire was burning not far away and I thought it must be another unlucky one.

We thought we had crashed a little way south of the DZ and that we might be able to make friendly contact, so I left two men at the site and went with a corporal to a lane at the side of the field to see if we could locate ourselves. I got out my compass and we started off – with difficulty, because we were both injured – northward towards where we thought the DZ was. We couldn't make anything of the country – it was not nearly as open as we had expected – and after a while we started back the way we had come. We had not gone far before we spotted two German helmets bobbing up and down in the field on the left of the lane. At the same time they saw us and started to climb through the hedge. I let off at them with my Colt, but because my arm was nearly useless it went high above their heads. At the same moment another half a dozen appeared in the lane behind us and it was a case of "put your hands up" or be bayoneted.

We put our hands up.

The patrol which had captured us was led by an Unteroffizier. *We were marched maybe a quarter of a mile and down a drive through some trees to a fair sized house, evidently a Company HQ. Here we had our equipment removed and one of our chaps was allowed to put a shell dressing on my arm, after which I was tied up with a piece of rope. There was a good deal of banging and crashing going on and the Germans were in a state of some agitation."*

We had in fact crashed in a small meadow amongst orchards on the ridge along which the D27 road runs, about 6km from the coast, less than 250m from the farmhouse and 500m from Grangues Château.

An air photograph taken on 20 June 1944 shows that we approached from the northeast – not due north as might have been expected – lost the tail on impact and then ploughed on for a further 100m through the corner of an orchard and across the meadow, leaving wreckage on the way so that only the wing centre section and a relatively short length of the fuselage were left by the time we came to rest.

The inference must be that after being hit and losing one or both port engines the aircraft veered left (eastward) and went into a gentle descent and was then brought round on to a southwest course in an effort to correct for the deviation.

So much for the several lurid stories I have heard, including one that we were seen flying no more than ten feet above the roof of the Château, minus the tail!

J S Shinner
HQRE 6 Airborne Div p27

The aircraft carried six crew and seventeen parachutists, four of whom managed to jump as the fire took hold. Of those who remained on board, four aircrew and four parachutists were killed in the crash. Two of the aircrew, the rear gunner and the wireless operator, had miraculous escapes when the tail broke off. The remaining nine parachutists survived, some of them injured; seven of these survivors were shot by the Germans later that night.

A second aircraft crashed less than 400m from ours; it is probable that this happened shortly before we came down and accounts for the flames that I saw nearby. It is known that this aircraft carried a complement of twenty five; the parachutists were from the 7th Battalion, the Parachute Regiment and 6th Airborne Reconnaissance Regiment. There were no survivors.

Between the two crash sites the air photograph shows a line of four very large bomb craters, evidently dropped by a bomber off course, and possibly mistaking our fires for his target.

The building to which we had been taken was a stable block in the grounds of Grangues Château.

"After what I judge to be about half an hour an officer arrived in a car. He immediately ordered me to be untied and I was separated from the others, put into the back of a car with him and we drove away. We travelled about four miles, twice running through roadblocks and once narrowly avoiding a dead German lying in the road. Our destination was a fairly large (probably brigade) headquarters. I was taken into a small room where a senior staff officer in mess kit (red stripes on trousers etc) was sitting with a 'phone in each hand. He was furious at the intrusion – I was filthy and dripping blood on his carpet – and I was hastily removed and taken to an office where there was an intelligence officer. He was totally reasonable and correct. He first produced a British paratroop medical orderly, who dressed my arm as best he could. The IO gave me a superficial search after which he asked me my number, rank and name. He also asked for further details with the offer that, if I helped, news of my capture would be sent to England quickly. I refused, and he didn't press the point, going so far as to say, 'You are quite right'. I was then taken to a stable and locked in with about eight other prisoners."

I believe that the headquarters to which I was removed was la Briboudière just to the west of Dozulé. It is interesting that, although the Germans were very much awake and about in large numbers quite early on in the proceedings they did not – at least in my case – exploit their advantage. My search was so superficial that the code list for the day which I was carrying was not found and I was able to dispose of it next day. Nor did this, and subsequent searches, reveal my wrist watch which I wore under bandages and ultimately brought back to England. My interrogation was almost nonexistent.

The crashes of the two aircraft were only the start of a night of terrible and sinister events around the Château, the full details of which are unlikely ever to be unravelled.

After my removal there was probably little action until about 0320hrs when the first gliders came in. Two gliders crashed in the Château grounds; another landed a short distance away. Of those close to the Château one crashed into a dense copse and there were no survivors. Little is known of the others, but undoubtedly there were both casualties and prisoners taken.

At some time during the night, after the arrival of the gliders, eight British soldiers were shot by the Germans, including others from my aircraft. The Germans claimed that there had been an attempted breakout, but all the evidence points to their having been shot out of hand.

There is a bizarre and touching conclusion to the story. Apparently the old Irish woman living with the family, deeply religious, was outraged at the way the bodies were being treated. Being a neutral subject she was in no fear of the Germans; she harnessed up a donkey and cart, commandeered a working party, and ensured that they all had decent burials. Now they lie in Ranville cemetery.

Today all is quiet and peaceful at Grangues. The small girl from the Château married and she and her husband, as well as her brother and his family, divide their time between their Paris homes and their country retreat at the Château. The farmer's daughter married after the war and lives with her husband in Houlgate.

The only signs of war in the area are the four large bomb craters and, in "our field", astonishingly after so many years, a stunted growth of the grass in the area scorched and devastated by the crash.

A memorial to the fifty two men who died at Grangues has been planned. It will be erected in the village and unveiled in June 1994.

26 Assault Squadron RE – 6 June 1944

MAJOR GENERAL A E YOUNGER DSO OBE

Major General Younger was commissioned in January 1939 and saw service at Dunkirk in 1940 and then in Normandy, Holland and north Germany, including the Rhine crossing. After a Staff College course, he spent two years in Burma and then raised the Engineer Training Centre at Kluang, Malaya, in 1948. In 1950-51 he commanded 55 Squadron in Korea and later served in Germany and Kenya. He instructed at the US Army Staff College and served in the Ministry of Defence and as Chief of Staff, Allied Forces in Northern Europe. His final appointment was as instructor at the Royal College of Defence Studies from 1972-75.

In a raid on Dieppe in early 1943 unacceptably high casualties were suffered by the attacking units largely because the tanks which were landed there could not find an exit from the beach, and therefore could not support the infantry as they moved into the town.

Planning was already starting for a major landing in Europe, as this would be much the quickest way of ending Hitler's war, as long as it went well. However, the Dieppe experience showed how disastrous a poorly planned landing could be, and a major lesson was that engineers must land first to prepare exits, so that tanks could support the attacking infantry.

In the summer of 1943 the decision was taken to form 1st Assault Brigade Royal Engineers, for this task, in 79th Armoured Division, commanded by Major General Percy Hobart. Hobo, as he was always called, started his army career in World War One as a sapper officer. He later transferred to the Royal Tanks where he became a leading exponent of aggressive armoured warfare. He was a strong character, particularly regarding the selection of subordinate commanders, when the slightest sign of a possible weakness would result in an order to leave his division immediately.

Three engineer regiments were collected together, numbered 5, 6 and 42, each of four assault squadrons, each of four troops. A new tank was to be developed for these units, called the AVRE (Assault Vehicle Royal Engineers), and the units would operate a total of 312 of these. Air photographs of the extensive defences being built by the Germans along the coast of western Europe started to come in. The Brigade Commander, Brigadier "Ginger" Watkinson, a particularly clear-headed and imaginative officer, analysed the information and directed training to develop ways of overcoming the many and varied problems.

I cannot attempt to describe all that each of the twelve squadrons did in preparing for and carrying out the assault landings. To do so would require a fat book. I must therefore make this a personal story. I was posted to command 26 Assault Squadron in 5 Regiment in November 1943. We had an excellent Commanding Officer, Denis Cocks, who worked tirelessly in the months before the landings to sort out the personnel, administrative and training problems of each squadron, but who, sadly, was to be killed on D-Day.

I think it was sometime in April that I was summoned to HQ 3 Canadian Division for my first briefing about Operation *Overlord*. It was explained to me that 7 Canadian Infantry Brigade would be landed on each side of the River Seulles in Normandy and that we would be landed ahead of them to create two exits from the beach to the

Maj Gen A E Younger DSO OBE
26 Assualt Sqn (p29)

west of the river, leading to Graye sur Mer, and two more to the east, leading to Courseulles sur Mer. Of course all this was top-secret, not to be discussed with anyone, and there was still no indication of the landing date. I was given low-level air photographs of where we would land, which also showed the mass of heavy metal obstacles that the Germans were setting up on the beaches. For planning purposes within the squadron, I was issued with some good maps of the actual area, in which all French names had been removed and American and British names substituted. The effectiveness of this became apparent later on, when one of the officers in 26 organized a sweepstake in which each of them made a guess as to where the area was. Looking at the choices, I saw that not one had selected Normandy.

I worked with the Canadians to develop their plans and, finally, probably two or three weeks before D-Day, received the final copy, with orders to brief my officers, but still using the phoney maps. One sobering fact in these plans was the attached movement order, showing landing dates and times for all units. This was some thirty pages long and contained hundreds of entries, but Serial 1 on Page 1 was "H Hour – 26 Assault Squadron, Royal Engineers."

We received new tanks about a month before D-Day, and moved down to a piece of common land in Gosport, where, with 80 Squadron, we started the laborious business of waterproofing them for an assault landing. 80 Squadron was our sister unit which would land in front of the other Canadian brigade on our left. We were sealed off from the outside world during this period, and most of the civilian population of Gosport had been evacuated. Across the road from us was 1st Hussars of Canada, the armoured unit that would land with us in their DD (Duplex Drive) tanks, designed with a propeller which could be engaged to drive them through water. The idea was that they would be able to stay hull down, and therefore in comparative safety, in about six feet of water and bring heavy fire to bear on the massive German pill-boxes.

We exchanged visits with 1st Hussars on several occasions. They were always ready to discuss our mutual problems and were a friendly and hospitable bunch, although I remember that, towards the end of our time there, their CO invited me to have a drink and then called for one of his officers to pay for it. He then explained that he and his officers amused themselves in the evenings playing poker and that this officer had won so consistently that he now owned all the cash of all the other officers! Luckily he turned out to be as generous as he was skilled at poker.

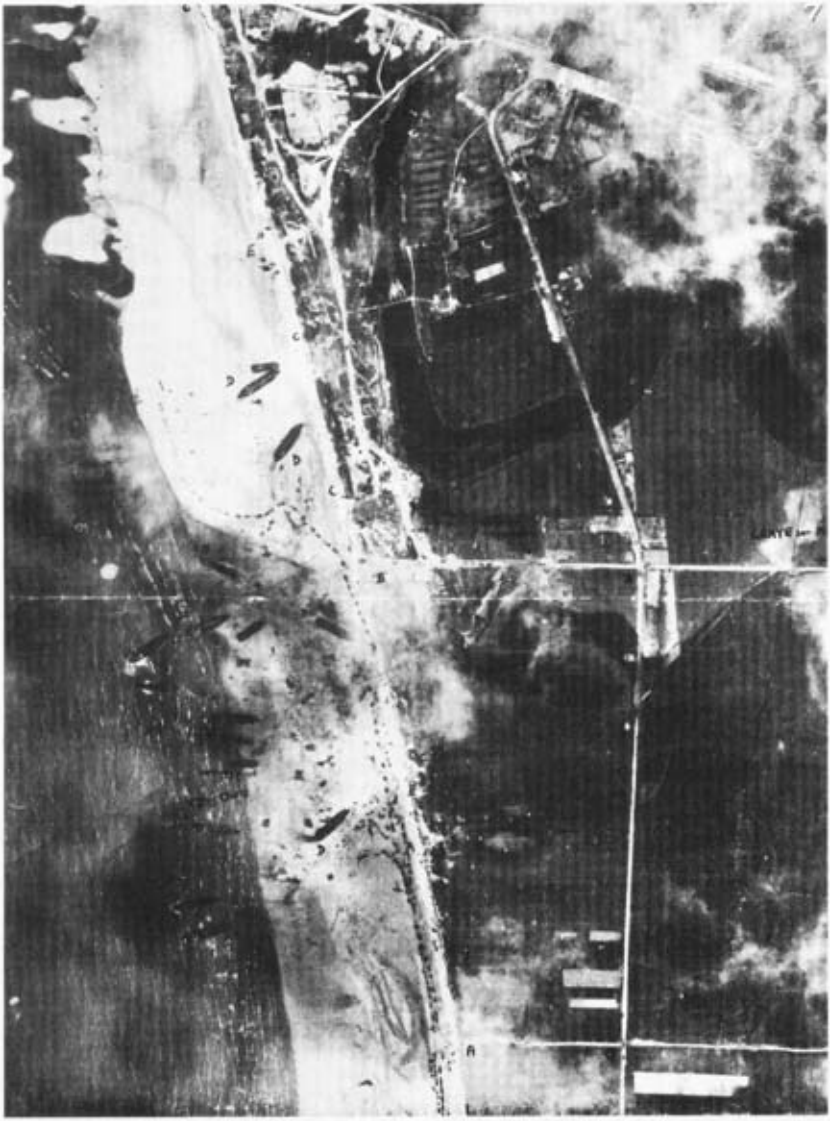
I think it was 3rd June that we were ordered to embark. A very hectic day followed and I remember that one of my sergeants asked me if I had had a chance to talk to the Prime Minister. I did not know what he was talking about but questioning revealed that Winston Churchill had mixed with some of our lads as they waited to embark. I had been very busy and had not heard about this. I have always regretted this missed opportunity for talking, however briefly, to that wonderful man.

Finally our loading was completed and we moved out into Southampton Water and anchored. Wireless silence was absolute, but we could still communicate by semaphore, which I had insisted that all officers and senior NCOs must master. We, of course, knew nothing of the great decisions being taken by Eisenhower, first to postpone the attack because of a gale warning, and then to order it to go ahead, in spite of a continuing gale.

We received a codeword very early in the morning of 5th June that meant the operation was on. Our flotilla set sail and within each landing craft permission was given to issue each tank with the real maps of where we were going. This was the first that the rest of the squadron knew about our real destination. I had a young second lieutenant on board with me, David Pratt, and I unsealed the big roll of maps and told him to sort them out and give each tank its share. We had two flail tanks and three AVREs on board.

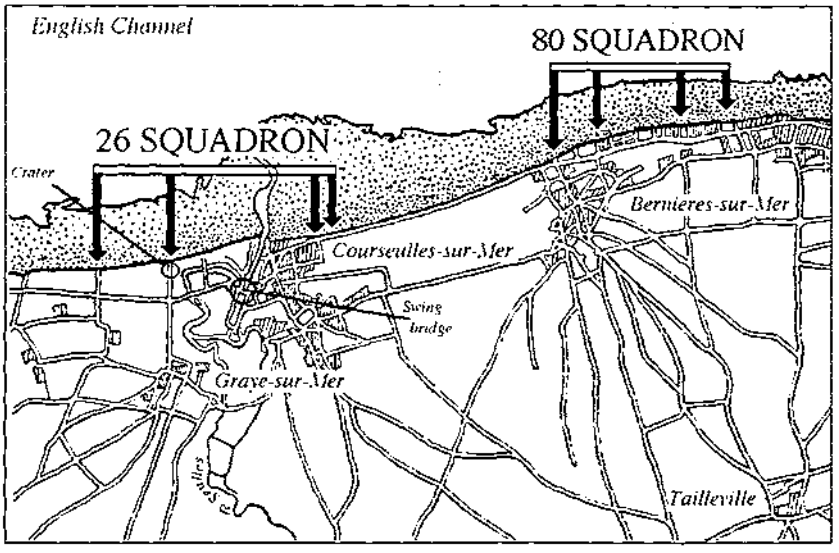
I went up to the bridge to be with the Flotilla Commander, a naval reservist who I had got to know well during previous exercises. As the Isle of Wight sank from view, the only craft in front of us was one businesslike RN frigate, but behind, as far as the horizon, was a double line of landing craft. Level with us to our left was another double line of landing craft, probably with 80 Squadron in the lead.

The sea became rougher and rougher. I remember calculating from the assault bridge that was loaded on one of the AVRE on our craft, that we were tipping to 45 degrees each side of the vertical as we rolled our way over. I have since been told that that amount of roll is impossible, as we would have sunk, but that is what it appeared to be.



The landing beach at Graye sur Mer on the afternoon of D-Day.

26 Assualt Sqn (p31)



Normandy beaches used by 3 Canadian Division for initial landings.

After some hours, I decided to try to grab a bit of sleep. I went down to the cabin, where I found young David Pratt sprawled over one bunk, completely oblivious, with maps all over the floor. He had obviously been very seasick. I left him and retired to the heads, where I followed his example.

I felt better after that and sorted out the maps. I then tried to get some sleep in the other bunk but I had to hold on to the side so much that real sleep was not possible. However, I did get some rest until the noise of firing made me get up. I had a quick shave and went back up to the bridge. The French coast was in view and there were all shapes and sizes of naval craft round us, all firing inland. The flotilla commander explained that we had had some engine trouble during the short night and that he had had to order most of our following craft to overtake us. They were not far ahead, but I was worried that this would change our order of landing, not that I could do anything about it. We passed under a large cruiser and were deafened by the salvoes from its main armament and I watched a landing craft loaded with dozens of rockets sail parallel to the coast as it fired them off. To our left another landing craft lowered its front hatch and the first DD tank moved slowly down the ramp. To my horror, when it dropped into the water, a wave splashed over it and it sank. Nobody appeared to swim out of it. Sensibly, the landing craft commander lifted his ramp and made for the shore on a course parallel to us, so that the rest of his load could wade ashore in shallow water.

The tank deck carried about two feet of water and it was obvious that most, if not all, of our men had been very seasick. In spite of all the firing that was going on, some of our men were still distressed by the rough crossing and could not bring themselves to climb into their tanks. Together with a sergeant, I went round heaving them up to their turrets. Then two sailors started firing the Bofors guns, which were our ship's armament, and the din of this, as the rounds passed inches over our heads, woke everyone up.

The tide was far higher than we had been told to expect, presumably due to the gale force wind, and there were obstacles in their hundreds sticking out of the shallow water. Most had an antitank mine wired to the top. Our skilled navigator managed to avoid all these and we ground to a halt in about four feet of water. The ramp went down and the first flail drove out onto the beach.

From my turret I could see AVREs that had landed ahead of us. Something was wrong, as there were far too many tanks at the 2 Troop exit and none at the 1 Troop one, some 300yds farther west.

The flail tanks pulled away from our Landing Craft and then the other two AVREs and finally my tank took to the water. Standing in the turret and looking out, all seemed to be going well, but suddenly I found myself sitting on the floor of the tank. Inside the turret, my wireless operator was seated, looking down at me, and I said to him, "What have you done?" His reply was "Sir, we've been hit."

I had heard nothing and felt nothing, but the moment he spoke I realized I was very deaf. Inspection showed that a deep slot had been gouged out of the turret. Luckily this was at the thickest part, where the armour was about eight inches of solid steel and the hit had not penetrated this. I suppose I had been knocked out for

a brief time, but I certainly felt no pain. The important effect of this hit, however, was that our radio aerials were removed, so I ceased to be able to command the Squadron from my tank.

We drove on through the shallows, avoiding obstacles with mines wired to them, and onto the sandy beach, where DD tanks of 1st Hussars were shooting again and again at the embrasures of huge concrete pillboxes. Inside one of these embrasures I could see the muzzle of an unpleasantly large high-velocity gun but, luckily for us, the Canadians appeared to have silenced it.

Infantry were starting to land and were taking casualties on the beach as we reached some sand dunes and I jumped out of my tank, determined to sort out the muddle. As I had suspected, 1 Troop had landed at the wrong place and was attempting to create a gap where 2 Troop should have been, whilst 2 Troop, possibly delayed by the storm, was behind them. Peering over the top of a sand dune, I saw that One Charlie, 1 Troop's leading tank was nosing into a huge, water-filled crater just inland from the line of the sand dunes. I first went to find the commander of 1 Troop and told him to pull out his AVRE and take them along the beach to where they should have landed. In the meantime, One Charlie, not knowing how deep the crater was, edged farther into it, until its commander, Sergeant Barton, realized that it was far too deep for him to be able to cross. His tank started to fill with water and he ordered his crew to abandon it and run for safety back to the sand dunes. Regretfully, only two of the crew of six survived this, and they were both badly wounded.

I next sought out the squadron commander of 1st Hussars and asked him, as a matter of urgency, to position some tanks on the crest of the dunes to bring fire to bear on the enemy defences that were dominating the flat area behind. He agreed to do this, and a welcome rattle of fire steadily increased from our side.

Of the flail tanks of 22nd Dragoons that had been placed under my command for the operation, two had gallantly tried to flail a route through the extensive minefield that lay to the west of the big crater. The boom of one became completely tangled in masses of barbed wire and the other lost a track from an exploding mine. However, there was one good result from this in that we then had two tanks south of the line of dunes and capable of directing fire at enemy positions in front of them, which they did to great effect.

To cut a long story short, we pushed One Charlie right into the crater with another AVRE, and released the fascine it was carrying into the water ahead of it. Then we dropped an assault bridge so that the far end landed on the turret of One Charlie, which was just above water level.

We then dropped another fascine at the far end and the AVRE that did this managed to cross over. I positioned him on the far side, ready to help any driver that got into difficulties in attempting to cross. At long last we called forward the first Canadian tank and, very slowly, it succeeded in crossing this makeshift bridge. By then there was a large number of troops and vehicles on the beach and it was good to see at least some of them moving away to carry the battle farther inland. There were a couple of near disasters, as tank drivers misjudged the route over, but our AVRE on the far side managed to haul these out of trouble. Steadily we improved the crossing with rubble and timber from damaged buildings and the numbers passing over gradually increased.

To complete the story of One Charlie, a few days later, when things had calmed down a bit, the Beach Group Sappers, 85 Company, dragged our assault bridge off the turret and built a much more respectable Bailey bridge across the gap. This was named Pont AVRE and it happened that King George VI, General Eisenhower, Field Marshal Montgomery and General de Gaulle, all crossed over it when they first landed in Normandy. An enormous Cross of Lorraine has been built nearby to commemorate the last named. In due course, a civilian bridge replaced the Bailey, but One Charlie remained undisturbed until 1976 when 26 Armoured Engineer Squadron, the direct descendants of the original builders, decided to extricate it as an exercise. After a lot of hard work, this was successfully accomplished and it was a moving sight when this muddy old monster was dragged out of what had been its resting place for 32 years. Now it stands, amongst the dunes at Graye sur Mer as a memorial to all those who fell on that beach, men of 7th Canadian Brigade, of the Beach Group, of the Royal Navy and of the Royal Engineers themselves.

1 Troop had still not completed their route off the beach, partly due to enemy fire but also because all the flail tanks had been immobilized. The only course left for them was the slow one of hand clearance of mines for some hundreds of

One Charlie in 1977.

yards. However, this was proceeding steadily, so I decided to check on 3 and 4 Troops on the other side of the the River Seulles. I walked into Courseulles but found that there was no way over the river. A swing bridge existed, which was swung into the open position, but looked intact. As I looked closer to see if it had been prepared for demolition and found that it had, a shot rang out and hit the bridge close to me. I jumped into the doorway of a house and was joined there by a Frenchman and a Canadian soldier. The Frenchman knew exactly where the shot had come from. He directed the Canadian as the latter fired about five shots from his rifle into a window down the street. I went out and cut the electric leads to the charges on the bridge and, with help from the Frenchman, turned a large wheel and slowly swung the bridge round until it spanned the river. Finally I crawled under the roadway and pulled off the explosive charges and flung them into the river.

I then crossed the bridge and made my way through the deserted town towards the shore. I saw someone dart behind a ruined house, only to find that it was Dickie Boase, bound on the same errand as myself, to make contact. His report was excellent, all had gone well. Both he, with 3 Troop, and Ray Mare with 4 Troop, had laid their assault bridges successfully against the esplanade wall and tanks, vehicles and men were now streaming inland across them.

Before returning to Graye sur Mer I made a slight detour to inspect what appeared from my map to be an area of farmland on the southern outskirts of Courseulles. If this was not mined, which it wasn't, it would make a reasonable place for us all to rendezvous for the night, and I explained this to Dickie. I then went back to 2 Troop and was delighted to see how much they, and the Sappers from 85 Company, had improved the crossing. Traffic of all sorts was passing steadily over.

One of my ears had become annoyingly painful by then, so I went down to the medical dressing station that had been set up on the beach. I felt embarrassed doing this, as there were many men far worse wounded than me lying there, to say nothing of two rows of dead, one German and one Allied. However, a most professional young naval doctor had a look at me and told me that I should be evacuated. I said I was not feeling too bad and that I had too much to do, so he filled my painful ear with sulphanilamide powder; a piece of first aid that undoubtedly saved me from the possibility of the most unpleasant effects of infection.

Before dark the whole squadron, less the casualties we had suffered, collected together in the field I had selected. We formed a defensive perimeter, in case of counterattack, posted sentries and each cooked a much needed meal before settling down for the night. I had to do one final task, to report to Brigadier Forster, the Brigade Commander, to obtain release from his command. A motorcycle had been loaded on our Armoured Recovery Vehicle specially for this and I finally located him, in very good heart, farther inland, I believe, than any of the other brigades that had landed.

Looking back after fifty years, I ask myself what lessons I learned on this eventful day. Certainly nothing direct was learned, that we should train more at this or less at that. I had known that things might go wrong, if only because a large number of men in grey uniforms were determined that our plans should go wrong, and I had duplicated most of our pieces of equipment for this eventuality. However, I had never foreseen that we might use an AVRE as the central pier of a bridge.

Perhaps the only real lesson was that the unexpected must always be expected in war. Use all your imagination to evolve original and demanding types of training before you go to war, but, when you do go, be prepared to meet unforeseen situations without hesitation.

26 Assualt Sqn (p34)

Construction of B3 ALG Airfield, Normandy, June 1944

THOMAS (TOM) MITCHELL, MBE BSc FRIBA MIStructE

The author was commissioned into the Corps on 22 January 1940. Posted as captain to No 3 RE Construction Company Centre, he was responsible, throughout successive bombings while the unit was at Plymouth, for repairs to maintain City services and for destroying buildings shells left standing after the raid which destroyed the whole City centre. Promoted major to command 694 Artisan Works Company in April 1941, projects included construction of the antitank gunnery ranges at Lydd and a combined operations HQ under Dover Castle. Promoted lieut colonel after completion of B3 in June 1944, he commanded No 16 Airfield Construction Group RE, constructing advanced landing grounds or repairing captured German airfields up to the ceasefire on Luneburg Heath. After this he laid concrete runways on Flensburg and Hamburg airfields, and pierced steel planking runways on German grass airfields selected by the RAF for occupation during the following winter. He was demobilized in November 1945.

The 1944–45 Allied campaign in northwest Europe, the long awaited "Second Front" codenamed *Overlord*, with a sub-codename *Neptune*, for the assault and landing on the beaches, relied on the Allies having air superiority over the battlefield. For the initial landing in Normandy, and until the autumn of 1944 when Tempest aircraft joined 83 Group RAF in the Netherlands, the British forces under General Montgomery had to rely on Spitfire and Hurricane aircraft for protection from enemy aircraft, on rocket-firing Typhoon aircraft for offensive action against enemy tanks and transport in the immediate battle area, and on Mosquito and Mustang aircraft for reconnaissance relevant to the operation of the former.

The Spitfire and the Hurricane had been designed for the defence of the British Isles against marauding aircraft, a role they fulfiled magnificently, particularly in 1940. They had been designed to fly up from airfields near the coasts to destroy intruders, and for their fire power and manoeuvrability in the air rather than for long range flying. In operational role the RAF reckoned they should be operated not more than a hundred miles from the battlefield they had to protect. The distance from our airfields near the south coast of England to the landing beaches in Normandy stretched them to the limit, for the distance between these beaches and the nearest point on the English coast was approximately a hundred miles. Pilots told me that they could only spend a few minutes over the beachhead battle before having to head back to England for fear of running out of fuel. It was therefore vital that airfields should be constructed in France very rapidly after the initial assault and that means should be provided for the rapid construction of others, at intervals of about a hundred miles along the lines of advance, and for the rapid repair of captured enemy airfields.

The Army created and trained special units for this purpose by converting existing Royal Engineer and Pioneer Corps formations. No 12 Army Group RE (12 AGRE) was formed with, under its command, three airfield construction groups, Nos 13, 16 and 24, and a unit formed from civil engineers in Air Ministry offices which was named 5357 Wing. Each of the RE groups had a group HQ and two road construction companies, each of the latter having attached and under operational command one pioneer company. The name "road construction company" was adopted presumably to prevent the enemy guessing their real purpose. As a major, I

Thomas Mitchell MBE
Construction of B3 ALG Airfield (p35)

was OC 693 Artisan Works Company (693 Coy) when it was converted and placed under the command of CRE 24 Airfield Construction Group. Henceforth, and until the company moved into its marshalling area prior to embarkation for France, all ranks were trained intensively in the use of the new equipment the company received and in all relevant matters, eg tree felling, aircraft recognition, soil mechanics, etc. I had to find ways of training operators in the use of angledozers, tractors and scrapers, motor graders, excavators, trenching machines, etc under realistic conditions and with tasks similar to what we would have to do in the campaign, but without disturbing agricultural land – not easy when land was being cultivated so intensively during the war in order to feed the nation and foil the enemy's attempt to starve us into submission.

The RAF also had to create a new force, which was designated Second Tactical Air Force (2nd TAF), to be mobile and work closely with the Army. It was composed of the following formations:

- No 2 Group – bombers.
- No 83 Group – fighter aircraft.
- No 84 Group – fighter aircraft.
- No 38 Airborne Wing, a formation of Army Cooperation Command.
- No 140 Photographic Reconnaissance Squadron, a unit of No 35 Wing RAF, which continued to administer it.

The air force officers in these formations were initially much less than enthusiastic about operating from airfields moving forward with the advance. 2nd TAF and 12 AGRE met together for the first time at a two-day seminar for senior officers, which I attended. It was held in a room at the south end of Park Lane, London, conveniently near the side entrance of the RAF Club. After that the newly-formed army and air force units went on to hold various joint exercises outdoors, including choosing and reconnoitring a site in SE England for an airfield of the size and specification of those we hoped to construct on the other side of the English Channel, and going through all the motions of constructing and occupying it, but without disturbing the soil.

Finally, after all ranks had been given embarkation leave, my company had orders to move to a stretch of road near Hampton Court Palace, from where our long convoy of trucks, and mechanical equipment on tank transporters, was escorted through London by police at a fast nonstop pace, to a preliminary marshalling camp in Southend. From there we commenced a process which continued in our final marshalling camp at Ipswich, viz, exchanging our vehicles for new ones which had to be collected from ordnance depots in various parts of England, as well as collecting some equipment which we had not needed while in England, where we were able to have repairs done at static workshops etc. From Southend we moved into Marshalling Standing Camp R6 at Ipswich where we spent a busy period collecting our full compliment of equipment, documents and manuals for operations in Europe. All vehicles had to be "waterproofed" so as to be able to operate for ten minutes while immersed in deep sea water. Our new vehicles mostly arrived already so modified, but we had to modify some ourselves.

While there we received through RE channels aerial photographs of the site which the *Overlord* planners had chosen for the first airfield my company had to construct after landing. These had been taken by the RAF, and were provided with interpretations; they also showed the beach on which we were to land. The airfield site seemed to be on farmland behind a bluff rising from a coastal road. In approaching our beach from the sea the bluff would be seen on our left. There was no indication of the location. The beach and bluff might have been anywhere, and facing in any direction.

My officers and I pored over those photographs, trying to visualize the terrain, scenery and buildings. I decided on the route to be taken by everyone in 693 Coy in walking or driving from the beach to the airfield site. All ranks were briefed, and it was decided that the company would rendezvous in what appeared to be a farmyard on the route. It would be my duty on coming off the beach to report to my CRE, and he gave me a rendezvous – an enemy gun emplacement near the farmyard.

The RAF seemed now to be making daily recce sorties when weather conditions allowed, photographing our site from different angles and at different times of the day to help interpretation by studying shadows cast by the sun, and also to keep watch on enemy activity, either in the construction of new defences or in troop movements. One day, shortly before we moved to the embarkation hards at Felixstowe, we had a fright. The latest photographs showed that a new German covered gun emplacement had been constructed near the end of our proposed runway. The RAF said "Don't worry. We'll fix it for you. We'll mount a bomber

attack and demolish it." I was horrified. That would have put paid to any idea of constructing an airfield rapidly on that site, a view confirmed when I saw later what RAF bombing raids had done to German airfields. It seemed to me that the Germans could not possibly have constructed in a day a gun emplacement of the kind shown. The RAF was asked to take more photographs and to interpret them very carefully. To our relief we got word that they had done so and that they now said that this new gun emplacement was a dummy.

Part of 693 Coy's initial task after landing was to reconnoitre and mark a crash landing runway on land next to the beach to allow pilots of disabled aircraft to avoid being taken prisoner by landing behind enemy lines or to avoid having to ditch in the sea. To do this, 693 Coy recce officer Captain J Mottram, together with a RAF liaison officer, Squadron Leader Hamilton, left Ipswich for a marshalling area near Southampton. They crossed with the first assault on 6 June, landed safely, and accomplished their mission. Happily this emergency runway was never used.

Thereon this memoir can be continued most vividly from 693 Coy's War Diary. The original is in the Public Record Office at Kew, London, on sheets of Army Form C2118. It is in my handwriting, each entry signed by me. Excepting the events of 7 and 8 June 1944, when the diary for these days was obviously written just before dusk on the 8th, it was written daily, and sometimes oftener. I now possess photographic copies of the diary, made by the Record Office and released to me by the War Office. It is quoted verbatim in the following narrative but changes in layout are made to accommodate the information on the narrow columns of the *Journal*. The text in brackets thus ( ) is amplification from memories which have remained clear and vivid.

WAR DIARY

Army Form C2118
Unit 693 Rd. Constr. Coy. R.E.
24 Airfield Constr. Gp.

June 1944
Commanding Officer: Major T. Mitchell, R.E.

Ipswich, 1 June, 0410hrs
Commenced move from marshalling standing, Camp R6 to embark hards at E4. Remained in box at embarkation point till

1830hrs
Loading of L.S.T. II 3507 commenced. Considerable difficulty appeared to be experienced in stowing 'B' vehicles on top deck as stowage plan too tight for number of vehicles. Loading ceased on account of tide at 2330hrs. when all top deck and half bottom deck stowed.

1600hrs
Electric welding trailer which had arrived at Camp R6 at 1600hrs 31st May was loaded on to tank tptr. already loaded with blade grader by the kind cooperation of O.C. of. ...Bn. U.S. Army. Weather fine but showery.

Felixstowe, 2 June, 0900hrs
Loading of L.S.T. 3507 recommenced (ship had stood offshore overnight).

1130hrs
Loading completed. Two 3 ton lorries belonging to another unit and 693 Coy. machinery lorry could not be loaded on account of space. As this vehicle was to have been the last to go on the whole ship no exchange could be made to enable a less valuable truck to be left.

(The machinery lorry was my Company's mobile workshop for the maintenance and repair of our plant and equipment in the field. Failure to load it was serious.)

Off Felixstowe, 2 June, 1215hrs
L.S.T. 3507 anchored to a buoy in a line of other L.S.T.s. Sent back signal from ship to embarkation point asking number of ship in which machinery lorry would be loaded.
Remained at anchor off Felixstowe all day.
Weather fine and sunny.

3 June, 0900hrs
Still at anchorage. Rigged up improvised shower on deck with aid of ship's Engineer Officer.

1800hrs
Met C.E. 30 Corps. who was now on L.S.T. lying alongside 3507.
C.E. sent signal to D.C.S.O. 7 Armd Div., saying essential 693 Coy. machinery lorry be loaded.

2100hrs
Signal received back saying machinery lorry would be loaded on spare L.S.T.

2130hrs
Signal received to commence briefing and news circulated that ship would sail 0730 following morning. Received maps from O.C. ship. Arranged programme for briefing troops following day. Distributed maps to officers.

(These maps showed the codenamed landing beaches and the hinterland but no real place names.)

4 June, 0900hrs

Ship did not sail as expected. Received instructions from O.C. ship troops not to be briefed till ship at sea.

5 June, 0830hrs

Ship sailed 1445. Briefed troops somewhere in Thames Estuary.

(I didn't know the ship's course. I guessed that we sailed into and out of the Thames Estuary because we passed close to guns on platforms sticking up out of the sea. I had seen them on news films described as "forts at the mouth of the Thames". I had received the sealed orders from which I briefed the troops while in the marshalling camp at Ipswich. As far as I remember the envelope mainly held messages from Churchill, Eisenhower and Montgomery to be read to the troops. There was no clue as to where the landing beaches were on the French coast. It was a beautiful sunny day and we were all enjoying the sail as I read out the messages on the open upper deck of the LST, and announced that our company was due to land on the beach codenamed *King*. From previous study of anonymous aerial photographs of that area every officer and man of my company knew how to get from the beach to the site of the airfield we were to construct. By late afternoon we sailed westward past Dover, the white mass of chalk which had been tipped down the face of the Castle cliff from the excavation of the tunnels for the Combined Operations HQ looking as though floodlit by the sun. 693 Coy had earlier fitted out that HQ which was now helping to control our movement. I couldn't help remembering how accurately the Germans shelled Dover every evening when I was stationed there. I was glad when we were well past that white cascade. We sailed on into the night. After checking all I had to check and inspecting all I had to inspect I went to sleep to wake up just before dawn to be told by the ship's captain that we were off the Isle of Wight, about to assemble to cross to France. At some time on board we had all been given a sea sickness pill – the first time I knew that such a thing existed – and now I suddenly realized how sea sickness might have affected the assault. The pill worked perfectly for me. Previously I had always been very sick on cross channel ferries.)

On Sea, 6 June, 0900hrs.

Ship approaching Isle of Wight.

(The view on the crossing was stupendous, a sight such as never seen before and which will probably never be seen again anywhere. There were ships as far as the eye could see in all directions. They were equally spaced in equally spaced parallel lines all heading to or from the French coast. The ships sailing back to England told their own story. Their sides were lined from bow to stern with ships' boats on protruding davits. These were ships which had carried the first assault wave of infantry. Many of their boats were hanging from one davit only. They were hurrying back to embark more troops. Attaching a ship's boat to two davits in a heavy sea is difficult and takes time. In the shelter of an English harbour there would be time to do this as troops embarked.)

1800hrs

Anchored off KING beach: continued there all evening, no rhino ferry apparently being available to start unloading.

(It was afternoon when we sighted the French coast which was sitting beneath an immense cloud of black smoke. All houses along the seafront behind the beach were blackened and seemed in ruins. Big naval ships, in deep water, well offshore, were continuously shelling targets inland. We also anchored a long way from the beach, no doubt as near as the draught of the ship would allow. No one seemed to know where we were. I had, however, once spent a few days in 1927 on the beach at Lion-sur-Mer which is just a few miles west of the mouth of the Caen Canal. I recognized the landscape and so knew where we were. Checking on a map afterwards I found that our beach was at Ver-sur-Mer, just 15 miles west of Lion-sur-Mer. The sea was very stormy.

To get my earth-moving etc equipment and men ashore, shallow-draught rectangular floating platforms with a freeboard of about two feet, and with an outboard motor at each corner, had been constructed in Britain and towed across to the beaches. They were codenamed *Rhino*. The plan had been to manoeuvre them under their own power into position at the bow of the LST whose bow ramp was then to be lowered onto the floating platform. Equipment and men would then go down the ramp onto the platform which would take us to the beach, using its outboard motors.

However, a very major hiccup then occurred. The platforms could not cope with the heavy seas. We couldn't get ashore that evening.)

Off French Coast, 7 June

Personnel and vehicles on L.S.T. 3507 stood by ready to move all night awaiting unloading. As no unloading took place this was unfortunate as it deprived everyone of a proper night's rest, which would have been desirable in view of the task ahead.

(It was a noisy night. The big naval ships kept up a continuous bombardment. The Germans bombed us from the air. Ack-ack fire from ships and shore against the bombers was continuous. The din was terrific. At dawn we saw that the sea storm had worsened.)

1045hrs

A L.C.T. came alongside and it was decided to try to offload the plant. The sea was rough. A great many attempts were made to tie up the L.C.T. When finally achieved the heaving of the ramp to the L.S.T. due to the sea was too great to allow the heavy plant to cross. Three U.S. Army 15 cwt. cars managed to off-load: I decided to leave the unit and go with them in order to see the airfield site as early as possible and make a plan for work.

(The LCT seemed very small compared to our LST. It was brought alongside, tied up after many attempts, and kept on station by a display of seamanship I shall never forget. The bow ramp of our LST was lowered. The heaving of the sea seemed to get worse. I stood peering down from the top of the ramp. The sight was awe-inspiring. At one moment the landing craft would be far below the bottom of our lowered ramp. Next moment the two ships' relative vertical positions were reversed, and the LST's ramp thumped down on to the deck of the LCT with such noise and force as to make it seem inevitable that the smaller vessel would be sunk. I watched, fascinated, becoming more and more aware of the great skill of the young naval officer handling the LCT. I got an angledozer poised at the top of the LST ramp, but had to decide that it could not have got down safely. Stowed behind 693 Coy plant was a detachment of US Army self-propelled guns the CO of which was anxious to get ashore. He offered me a lift in one of the three 15cwt cars, which were like large Jeeps. He drove it. He got it poised at the top of the ramp and watched several cycles of the up and down movement before letting in the clutch. Down we went, safely, into the LCT. It was a brief thrill. The young naval officer asked where we wanted to go. We named the beach, sailed past evidence of the assault the previous day, and, because of the high ground clearance of the US vehicle, we got ashore without even getting our feet wet. The beach master checked us in, and directed us to the exit. I thanked the American, and started walking.)

King Beach, 1245hrs

O.C. landed on beach.

1410hrs

O.C. reached on foot pre-arranged rendezvous with C.R.E. at German gun emplacements south of Ver-sur-Mer. C.R.E. was not there and no notice could be found saying where he had gone. To get about more quickly I dumped my pack with a R.E. Stores Officer who was establishing his billet and

Ver-sur-Mer, 1530hrs

eventually found the C.R.E. established in a bivouac at Ver-sur-Mer.

1535hrs

Set out to find Capt. Mottram, 693 Coy. Recce Officer and Sq. Ldr. Hamilton, who were carrying out recce of site. Found that ¾ of length of proposed strip was still under fire from enemy. Viewed the ground. Capt. M. and Sq. Ldr. H. had been to H.Q. of Bn. on ground and had learned that OC Bn. estimated 3 Coys. required to clear enemy. Returned to C.R.E.'s H.Q. with Capt. M. and Sq. Ldr. H. to report to C.R.E. and arrange to clear enemy. Local Bn. could not undertake as they were moving forward.

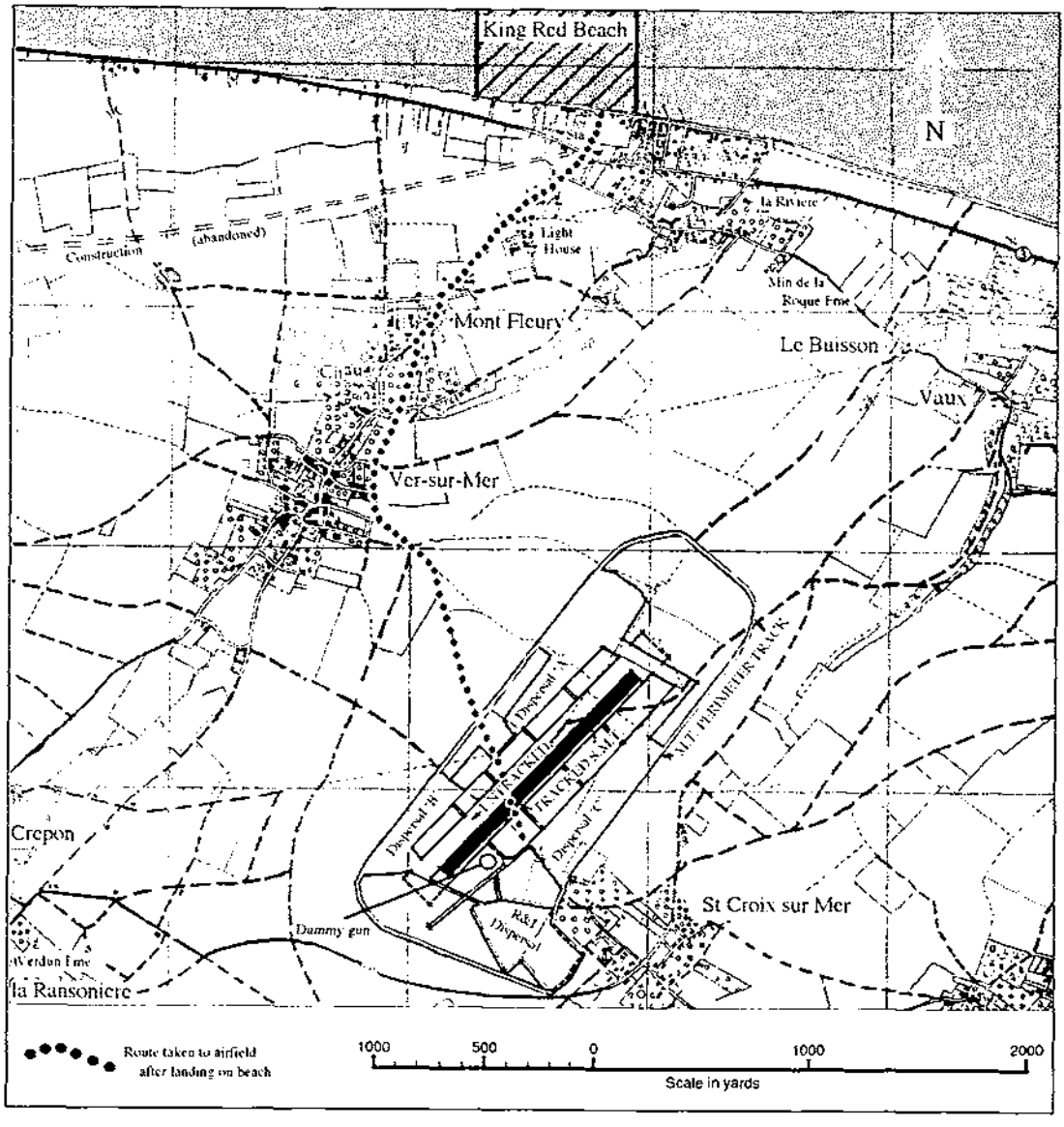
1700hrs

Sent an officer from Gp. H.Q. to look for any mechanical equipment that might be landing and to hurry up to site. 92 Coy. P.C. arrived.

Ver-sur-Mer, 1730hrs

C.R.E. went off to conference at Corps H.Q.: he gave orders that work would not commence that night.

(In England I had decided from studying the anonymous aerial photographs taken by the RAF exactly how to get to our airfield site. Every man in my company had been briefed to take the same route. I was now curious to see the actuality. The main street of Ver-sur-Mer ran uphill in a SSW direction. As I walked past the blackened windowless houses I wondered if there were German snipers still lurking there. There were, because later we learned that the adjutant of No 16 Airfield Construction Group had been shot and wounded and shipped straight back to England while walking up that street. After about ¼km my chosen route diverged to the east from the main street and suddenly I was alone – no one



Part of map dated May 1944, showing area from beach to airfield.

else to be seen. I came to a feature I had not detected on the aerial photographs. A small stream crossed the road. There was a ford for vehicles and a narrow wooden bridge for pedestrians. I was being constantly on the lookout for mines. I decided to walk through the ford rather than risk the bridge which might have been booby trapped. I remember thinking what a pity it was to have got wet feet after having got ashore with them dry. I continued up towards my rendezvous. It was eerie. Not a soul to be seen. I knew I was on the correct route when I came to the group of farm buildings which was the rendezvous for my company and its equipment. I came to the German gun emplacement. I listened before going inside. There was no one there – no enemy, no CRE. I did quite a bit of walking that afternoon, finding the CRE and his HQ, then up to the site of our airfield at St Croix. From the gun emplacement the road continued uphill through open fields to our site adjoining the village of St Croix, approximately 1¼km inland but approximately

2½km from the beach on which I had landed. After the position of the south end of the landing strip had been agreed between my recce officer Capt. Mottram, Squadron Leader Hamilton, and me, we waited impatiently for the arrival of men and equipment.)

2000hrs

Some mechanical equipment arrived – two 693 Coy. Cl. II angledozers, which ought to have arrived one tide *later* than main body, and Lts. Miller and Malloy of 75 Coy. with two Cl. II angledozers and two motor graders.

St. Croix-sur-Mer

Decided to start work on end of strip furthest from enemy. C.R.E. still at Corps. Led mechanical equipment to site and commenced clearing dummy German gun emplacements. Found them booby trapped.

2030hrs.

2 i/c arrived with one Cl. I. tractor and scraper.

2130hrs

Remainder of 693 mechanical equipment from ship 3506 arrived less one motor grader, viz. 3 carrimore trailers with rollers. Rollers put to work at once beating down crops. Sent 2 i/c to recce bivouac. Work continued till dark.

(The CRE's order not to commence work that night was no doubt prudent. The enemy occupying three quarters of our site between the south end of the runway and the sea, was a pocket of resistance left behind by our advancing infantry, for mopping up by others. These enemy might have tried to break out in my direction rather than surrender, and in doing so might have caused casualties among men and equipment and delayed construction of my airfield. On the other hand the fact that elements of 75 Coy had been sent up to St Croix indicated that their airfield site must still be occupied by the enemy. So I decided to disobey orders. I had already looked at the dummy German gun emplacement; it was made of camouflage netting on a metal framework. I was glad I hadn't gone inside it because there was a flash and an explosion the moment the bulldozer touched it. It had been booby trapped no doubt to deter the locals from interfering with it.

During the evening I had a visit from an officer of *Phantom*, a small mobile recce unit set up by and under direct command of General Montgomery to give him and his HQ information quickly about the progress of events before reports through the usual channels could reach them. During the night my bivouac area received small arms fire from a NE direction and my men returned fire. Next day we discovered that it was Montgomery's advance HQ which had been shooting at us.)

8 June

Work commenced 0500 hrs. Remainder of plant had still not off loaded from ship. In view of this it was decided to do a minimum of grading, retaining cropped surfaces where possible, merely beating down crops. The length of the crops, however, made it impossible to judge the ground until they had been flattened. Grading of about ¼ of strip was accepted. No more could be undertaken as only one scraper out of a total of six had arrived.

1100hrs

Capt. Wilson 693 Coy. arrived with two Cl. II tractors and scrapers and one motor grader. All tpt. available was now being used to beat down crops. In addition 2 i/c had been detailed earlier to go and obtain local farm implement resources for crop cutting. He produced one ancient Fordson tractor with a mower which the Coy. fitters modified for tractor towing, and one horse drawn mower complete with horse and French driver.

1700hrs

Lt. Ollerton 693 Coy. arrived with B vehicle convoy from L.S.T. 3507 and reported one 20 ton Albion tank tptr. drowned. Decided during afternoon that ground much rougher than had been anticipated before beating down crops, and that approximately ¾ of strip must be graded.

(8 June was an eventful day. The picture of my 2 i/c Capt Lasdun, arriving over the brow of the ground just south of our work leading his farm equipment, has remained in my memory ever since. In spite of having beaten down some crops on the runway (Sqn Ldr Hamilton had agreed that the RAF aircraft would be able to land and take off on the areas we had so treated, provided the ground beneath was not too rough), there was a much greater area of standing crops which were harvested. Towards the north end of the runway there was an area of potatoes which caused much anxiety because of the quantity of top soil to be removed to reach firm subsoil, and until 1100 we had only one scraper to handle it. It was a beautiful hot sunny day. Sometime very early, while the coy was working at the south part of the site which had been cleared of enemy

the previous day, I started to walk the rest of the runway area. I suppose it must have been when I got word that the whole site was now clear of enemy – probably when an officer from Montgomery's advance HQ came over to tell me so, and we discovered that we had been shooting at one another during the night. Some half way along I came on an air raid shelter entrance sticking above ground. It had no doubt been made to shelter farm workers caught in the fields during RAF raids. As I approached it a German soldier emerged. He surrendered meekly.

Water was another anxiety. To form a firm runway surface able to carry loads, the subsoil had to be compacted at what is known as "optimum moisture content" using sheep's foot and wobble wheel rollers. If too wet it would have had to be drained. On 8 June it was very very dry and needed to have water added. We had special watering trucks for this purpose, but none arrived before 1700hrs. Before then, just in case they had been lost on the beach or at sea, I sent a plea to the CRE. He acted quickly. Next day several of the watering trucks, which most municipalities used to have for keeping down dust on roads, arrived up on the site bearing names like "Brighton" and "Eastbourne". The airfield was to operate initially as an RRS (refuelling and rearming strip), aircraft flying in at dawn and operating from St Croix all day, returning to their airfields in England at dusk, their operations being controlled from England, as they would be until the Tactical Air Force HQ could be established on French soil. For that limited role only one taxi track on one side of the runway, one dispersal area and a MT track parallel to the taxi track were all that were required. We recced, surveyed and marked these out: but to ensure continuity of work we also surveyed the complete taxi track system and two other dispersal areas and recced a route for a permanent motor road to encircle the whole airfield outside the taxi tracks and, at the ends, clear of the runway over run areas and the take off and landing angles. Sometime about 1300hrs, while my 2 i/c Capt Lasdun and I were reconnoitring a route for the motor road round the south end of the runway we suddenly saw a German fighter aircraft coming towards us and very low, and firing all its guns. We threw ourselves into a ditch and miraculously were not hit although we were right in the path of the hail of bullets that momentarily turned the soil into a heaving sea, as though liquid. The German was being chased by a Spitfire which shot him down within our sight. Although we had the impression that the German was deliberately shooting at us, it is equally likely that he was getting rid of his load of ammunition to be able to fly faster.)

9June

R.R.S. could not be completed by 1st light. This was unavoidable. There have been 36 hrs. delay in the arrival of any plant at all on site and thereafter there had on the average been only about ⅓ of total shipped.

1200hrs

R.R.S. was completed, including one taxi track and one dispersal area. The A.O.C. was expected to land at 1500 hrs., and work was restricted for this purpose. The A.O.C. did not arrive.

1400hrs

Two Cl. II angledozers sent to assist in clearing coast defences at Port-en-Bassin for four days. (We worked on till last light).

10 June, 0630hrs

First aircraft landed on St. Croix-B3-RRS. A.O.C. landed later during the morning. The first aircraft to land was a Typhoon. Its engine had been hit by flak and was giving trouble. That was followed by a formation of Hurricanes from No. 46 Group R.A.F.

(At dawn on the 10th I was eating my breakfast of tinned sausage and bacon in my slit trench in our bivouac area when I heard the noise of a Spitfire changing pitch and landing. I was out of my trench like a shot, thinking I must have got a wrong message about the AOC's arrival time. By the time I got to it the aircraft was in the dispersal area, the engine cowling was off, and the RAF mechanics were clambering all over it. I asked the RAF engineer officer what had happened to it. He said the pilot had said he had engine trouble but his mechanics couldn't find anything wrong. I realized quickly that this pilot was wanting to be the first to land on French soil from the air after D-Day. I said to the young man – he had a strong Glaswegian accent, "Do you realize that the AOC is due to land here soon and that he won't be amused by your landing before him?" That aircraft was in the air in no time. There is a sequel. After the ceasefire in 1945, 83 Group established its HQ at Schleswig and one day whilst visiting there from my HQ at Flensburg a pilot came up to me and asked if I would sign a piece of paper he was holding. On it he had printed, "This is to certify that ... was the first airman to land by air on French soil

after D-Day, 1944" – or words to that effect. I can remember neither the young man's name or rank. I signed it, and that piece of paper is no doubt framed and standing on some mantelpiece, possibly in Glasgow.)

Second taxi track completed during the day. O.C. 75 Rd. Constr. Coy. – the second Rd. Constr. Coy. in 24 Gp. – arrived during the morning.

2130hrs

O.C. Plant Sec. 75 Rd. Constr. Coy. arrived at B3 with the remainder of 24 Gp. mechanical equipment.

(We had carried all the fuel, for making the airfield, in our scrapers and had had enough spare capacity in these to house a portable hot shower installation; by the evening of 9 June we had assembled it and hot showers were now available. This was a luxury only made possible because the allocation of shipping space for us was by volume, and we were able to house the complete installation of enclosure, boiler, head tank etc in our six scrapers. We had made the installation in Marshalling Camp R6 at Ipswich and as 693 had originally been an Artisan Works Coy we had all the necessary trade skills to make a thoroughly efficient piece of equipment.)

11 June

Only sufficient mechanical equipment employed to complete third and last dispersal area of B3 A.L.G. Remainder of men and machines rested.

(Every man had a hot shower that gloriously sunny day. It was thrilling to see the RAF operating from our runway. Now, instead of being able to spend only a few minutes over the battlefield before having to return to England for fear of running out of fuel, the aircraft were over the battlefield in minutes. They took off three abreast, the lines of three following each other so closely that there were always nine aircraft roaring down the runway together, their wheels folding up the moment they were airborne. The aircraft were still under operational control from England and returned to their airfield there each evening. The first sorties on 10 June revealed an unforeseen problem. Dust. Because of the fine dry weather and the nature of the soil the aircraft enveloped themselves in dense clouds of pinky brown dust. It affected the aircraft engines. Special filters were designed and manufactured in England in a day, I was told, as a temporary measure. The only real solution was to operate from surfaced runways. Two such rapidly laid surfacings had been developed in Britain and RE road construction coys had been trained in laying them with special equipment. One, PBS (prepared bitumen sheeting), was a very thick and strong roofing felt type of material laid in long continuous rolls stuck to each other, as they were being rolled out, with a fluid contained in machines nicknamed "stamp lickers". Several bridgehead airfields surfaced with this material had been planned and should have been nearing completion by 11 June but could not even be started as their preselected sites were still under enemy fire. The RAF therefore decided to have B3 made into a complete ALG airfield instead of an RRS.)

12 June

B3 A.L.G. completed and new motor road completely encircling the airfield commenced.

0900hrs

O.C. 75 Coy. with one Cl. I angledozer and one excavator moved to commence new airfield (B8) at Magny near Sommerview.

13 June, 0015hrs

Airfield bombed. Only damage was to 693 Coy. One A.E.C. tractor mid 4 x 4 rendered U/S and one Mack heavy tractor 6 x 6 destroyed completely. One man killed and one injured. One man of the mechanical equipment guard provided by 92 Coy. P.C. also injured. The man killed and the men injured were the *only* men sleeping above ground.

(The Germans had presumably hoped to hit the runway. All my personnel had orders to sleep in individual slit trenches or in a dry ditch bordering our bivouac.)

0900hrs

Two further scrapers and dozers sent to Magny.

2200hrs

Perimeter road at B3 completed.

(A minor crisis occurred on the perimeter road. At about 1800hrs we struck what is known technically as a soft spot on the east leg of the road, just north of the public road to St Croix from Ver-sur-Mer. In its extreme form a soft spot becomes a quicksand. This one was probably caused by an underground water course. It

meant getting an excavator into position, excavating down to reach the source of the trouble and firm ground, disposing of the excavated soil, replacing it with dry soil – which meant setting up another excavator elsewhere – and draining the trouble spot to prevent a recurrence. The work had to be done thoroughly for the road had to be able to carry loaded 20-ton vehicles. This happened while the RAF was moving in, in a big way – by evening the airfield was occupied by three wings each with four squadrons at full strength of 18 aircraft per squadron – some 217 aircraft plus supporting services – signals unit – engineers, air control etc and airfield commander's HQ caravan. We had to dig down about six feet. We couldn't bypass the spot quickly as it adjoined a wooded area on one side and the taxi track on the other.)

14 June, 0500hrs

A second runway parallel to and adjoining first commenced at St. Croix.

0830hrs

2 i/c and Capt. Mottram sent to recce. bivouac area at new airfield at Magny.

(The second runway was to be dustless and able to last throughout the summer. As all the then available PBS was already allotted to other airfields the staffs had devised an alternative and, in the few days since it had been decided to make B3 into an ALG, they had obtained the necessary materials and had them shipped over. We graded the new runway. On top of the graded surface we laid, stretched, and secured hessian which we soaked with heavy fuel oil obtained from the Navy and over which we stretched Sommerfeld track. The latter was like the steel mesh reinforcement used in concrete roads.

The Magny airfield was to need the resources of the two RC coys of 24 Gp. Its runway unavoidably ran through a dense wood of tall mature trees.)

15 June, 0830hrs

Brig. Pannet D.C.E. Airfields 21 Army Gp. visited airfield B3.

0935hrs

Gen. Eisenhower landed on B3 in a Fortress.

(That the big Flying Fortress did no damage to our airfield was a testimony to the soundness of its construction. My wife and various friends saw Gen Eisenhower's arrival on a newsreel in a local cinema at home and spotted me in the group meeting him.)

1000hrs

Movement of mechanical equipment to airfield B8 at Magny commenced – owing to lack of tpt. this is a shuttle move.

(We had lost vehicles in the bombing on 13 June and a tank transporter drowned in coming off an LST.)

1430hrs

693 Coy. H.Q. moved from Ver-sur-Mer to airfield B8 at Magny near Sommerview.

(I don't know why I write Ver-sur-Mer in that entry. My coy HQ had been on the airfield at St Croix throughout. We had not been able to see the seashore from the high ground on which we had constructed B3. Now, as I descended towards the beaches after seeing the last 693 Coy vehicle off, I saw for the first time the extraordinary bustling scene of activity between ships and shore that had been going on ever since I had landed. The Mulberry concrete harbour had been constructed and ships were being unloaded at it and vehicles pouring off it, while all sorts of craft were ferrying men and materials to the beaches from ships for which there was no room alongside Mulberry – LCTs of various sizes and many DUKWs. The latter were amphibious boats rather than amphibious vehicles. The Rhinos on which it had been planned to bring our equipment ashore on 6 June but which could not be used then because of the rough seas, were now also busy bringing equipment ashore. Word had come to me up at B3 that the docks coy of which my youngest brother was 2 i/c was working unloading ships in deep water and onto the shore road that ran under the cliff beyond the north end of B3. The route I was taking joined that road. I stopped beside an officer. He was a lieutenant in the docks coy. He said that his coy had come over with the first assault. Did he know where Capt Mitchell was? Yes, he had seen him just a minute or so ago. Pointing, he said that it was just along there. I went along there. A NCO said that Capt Mitchell had just gone out to one of the ships. I couldn't wait. I drove on to my next job at B8.

Following now is the diary of my CO CRE 24 Airfield Construction Group, which is with

mine in the Public Record Office at Kew. It is in admirably concise language which tells the army and air force commanders all they wanted and needed to know.)

Ver-sur-Mer, 7 June

B3 St. Croix-sur-Mer air strip laid out and preliminary work started under command of O.C. 693 Rd. Constr. Coy. R.E.

9 June

R.R.S. at B3 St. Croix-sur-Mer completed by noon. A.L.G. completed by dusk. This was the first A.L.G. to be completed in France.

10 June

Aircraft commenced operating from B3 St. Croix-sur-Mer A.L.G. Work on this site continued to improve the facilities.

(Following are extracts from "A short historical account of No. 83 Group R.A.F. during the period 1 April 1943 to the end of the War in Europe" by Squadron Leader D R Morgan BA:

"On the morning of the 9th June the main headquarters was established in an orchard at Creully. Apart from looking after itself, however, it had as yet very little to do. At 1500hrs B3 airfield at St. Croix became ready as an R and R strip. This was a very creditable performance, since it was barely three days from the day of the initial landing of the construction group. No time was wasted and the following day, that is, D plus 4, the airfield was in use. The first aircraft to land on the bridgehead were Hurricanes from No. 46 Group..."

Following is an extract from the Memoirs of General Karl Koller, Chief of German Air Staff:

"There are many reasons why Germany lost the War; political, economic, and military reasons which were our own fault. None of these reasons were decisive in themselves, nor were they together decisive ... Quite apart from them, what was decisive in itself was the loss of air supremacy."

B3 helped to secure air supremacy over the beachhead for our forces and so prevented them being subjected to the dive bombing they experienced at Dunkirk.)

POSTSCRIPT

ONLY the minimum amount of my company's equipment deemed necessary for the construction of a fuelling and rearming strip was shipped to arrive at the Normandy beaches on 6 June 1944. This was divided between two ships, each containing sufficient to enable the RRS to be constructed even if one of these ships was to be sunk, although it would then have taken longer to complete our task. These ships were LST 3506 and LST 3507. They were similar in principal to modern roll-on, roll-off car ferries, with upper and lower decks and bow ramps. My second in command sailed in LST 3506 and I was in LST 3507. The remainder of the company's men and equipment sailed in ships due to arrive one tide later than 3506 and 3507.

As recorded above, when I left 3507, my company's equipment could not be offloaded on to a Rhino floating platform, as had been planned, because the Rhinos could not be manoeuvred in the stormy sea. The storm continued throughout the 7 and 8 June. I suppose that as men and equipment arrived at the airfield site in dribs and drabs I may have asked the men how they got ashore. If I did, I had forgotten when I started to write this memoir: so I rang Sir Denys Lasdun who, as plain Captain Lasdun, was my 2 i/c. He told me that they had to leave ship into deep water. In England this possibility had been foreseen, and all our vehicles had been waterproofed to withstand ten minutes immersion in water with their engines running.

The captains of LSTs 3506 and 3507 must have waited for a low tide, sailed straight at the beach until their ships grounded, then held their ships in that position while they lowered the bow ramps and the vehicles and men inside disembarked into the deep water. Lightened by the offloading, the LSTs would float off the beach on the next high tide. This explains why some equipment which was in ships intended to arrive one tide later than 3506 and 3507 actually reached the airfield site interspersed with arrivals from 3506 and 3507. It would be interesting to hear the captain of one of the ships concerned give his account of the grounding manoeuvre, to hear him tell how he deliberately did that which every captain normally tries to avoid.

Sound in Warfare and a Brief Account of the Activities of the Light Scout Car Companies in World War Two

LIEUT COLONEL A D E CURTIS MC MA

The author was educated at the Imperial Service College, the RMA Woolwich and St Catharine's College, Cambridge University. He was commissioned in 1937 and on mobilization was posted to 7 Field Company, 4 Division, serving with that unit in the British Expeditionary Force until May 1940.

After completing the Staff College course he joined the staff of Headquarters Supreme Allied Commander South East Asia in Ceylon. Since the end of the war he served in Singapore, Gibraltar, Cyprus and Germany.

Retiring in 1963, he worked in the construction industry and in the Construction Department of the British Standards Institution. He also served for many years as a councillor for the Borough of Surrey Heath and is now living in Camberley.

THE "Light Scout Car" organization (1942-1945) was an all-Arms affair and the extent of Sapper involvement in it was comparatively small but was nevertheless significant. The story provides yet another example of the extraordinary variety of situations in which Sappers may become involved in wartime.

The activities of the organization were carried out under great secrecy during the war and continued to be under reporting restrictions for many years after 1945. It seems that for security reasons operational reports and other records were deliberately removed from war diaries etc. Staff at the Public Record Office have been most helpful but the records on the files, that I have seen there, have been of only minimal assistance. In consequence I have had to base this article almost entirely on my personal recollections supplemented by some accounts given to me first hand by colleagues. It should be regarded as a "personal note" rather than a definitive history.

Sound has played a part in warfare since earliest times. It has been used to cheer, to intimidate and to confuse. Sound has also been a betrayer. Loud sounds have occasionally been used to mask lesser, but more significant, operational sounds. However it was only in World War Two that it was thought worthwhile to form and equip specialized units to reproduce sounds for tactical deceptive purposes. This development stems from the appearance on the battlefield of noisy machines and operational activities involving distinctive sound patterns. And since such machines can at times be battlefield dominant and since the sounds they make can be detected and analysed by the enemy the opportunity occurs for carefully planned and executed tactical deception.

The story begins in the Western Desert in January 1941. To deceive the Italian garrison of Bardia as to the point of attack on the perimeter of the town, an armoured car was equipped with a gramophone and loud speaker system. Sounds of tank movement were broadcast near the enemy outposts and the defence was confused. This exploit was described in the battle report sent to London and was read with interest at the War Office.

At a high level it was considered that this concept of "sonic deception" could offer the possibility of important results at a future critical juncture of the war, if it could be developed using more

Lieut Col A D E Curtis
Sound in warfare (p46)

sophisticated equipment and specially trained units. Accordingly a directive was issued defining the following principles:

- No further development or use of electronic sonic deception would be permitted without express permission from the War Office.
- A training centre would be set up in the UK to study the concept further and to raise, equip and train a number of small units for future operations.

The first principle did not please the Middle East Command, who considered that they had an idea which could be of considerable importance in the Desert Campaigns and that they were being unnecessarily prevented from making use of it. They protested strongly but were overruled. As things worked out in the end one has some sympathy for the view of Middle East Command; deceptive tank noises in the desert (where tank formations were comparatively scarce and where noises carried well) would have had maximum effect. By the time UK units had been trained and equipped for operations, armoured units had become more generally part of the battlefield scene and in consequence tank noises in the night were less dramatically received.

By 1942 a small training centre was established near Ballantrae, Ayrshire, under the command of Colonel Disney Barlow (ex King's Shropshire Light Infantry). It was decided that the sound reproduction equipment should be that developed for the cinema industry and that only the most up-to-date versions of this should be used. This stipulation arose from the need to reproduce sound of the most convincing reality possible. It was feared that any lesser quality of reproduction could become readily detectable by enemy listeners or listening devices and that the deception could be too easily exposed. A deceptive operation blown is an operational plan prejudiced. This decision required use of sound reproduction equipment from the USA where for some years there had been fierce competition in the trade to develop "hi-fidelity" sound reproduction for the cinema business.

It was also decided that for use in the European theatre the sonic equipment should be mounted on lightly armoured vehicles and the American "White" scout car was designated.

The development of sonic deception for land operations therefore became dependent on US sources with attendant risks of transport across the Atlantic.

As far as personnel were concerned it was decided that units should be recruited on an "all-Arms" basis including of course the necessary technical personnel, with an appropriate leavening of experts from the cinema industry. A strong Sapper element was thought to be necessary, no doubt largely on the well-known principle that no new technical development in the British Army can prosper without direct input from the Corps.

In the autumn of 1942, I was serving with 9 Armoured Division in Northamptonshire and was called to London for interview. Under admonition of great secrecy I was posted to Ballantrae and shortly afterwards was joined there by Mike Heath, Gerry Chambers and John Hepburn, from the Corps, together with a wide selection of all ranks from many regiments and other corps as well as some naval personnel. These latter were needed to investigate the possibility of using sonic deception in conjunction with naval inshore operations; then, as their ideas developed in this direction and equipment needed to be adapted for naval use, they were moved to other locations.

Pending the arrival of proper equipment for field training, there was much discussion on tactical possibilities and future organization. It was evident that the primary use of sonic deception would be in the broadcast of recorded noises of movement of armoured tracked vehicles. Accordingly recordings were made of the sound pattern of different types of tank then in use and studies were made of their acoustic characteristics and other properties. Other important operational activities were also recorded and studied – for example bridging operations.

The location of the Training Centre at Laggan House (now demolished) was conveniently close to open moorland and there the broadcast sounds were listened to at varying distances and in different conditions to establish optimum ranges etc. Eventually when enough equipment became available, alternative patterns of deployment and movement were worked out. Although the moorland beyond Barrhill is sparsely inhabited there were some scattered farms in the area and it must have seemed strange to the local inhabitants to hear these unexpected noises coming over the moor.

This preliminary study phase lasted considerably longer than had at first been expected. There was, of course, the constant struggle for priority in the issue of equipment, competing against many more obvious and pressing needs but the situation (as far as we were concerned) was aggravated by the loss at sea of our first expected shipment of sound reproduction equipment.

Eventually the organization of a standard field unit for most theatres developed into a company of

two troops, each troop including four White Scout Cars for sound broadcasting. A scout car crew comprised a driver and an operator. The cinema projector (less the picture head) was located immediately behind the driving compartment and the speakers stored in the rear of the vehicle. These speakers could, when required, be raised above the height of the driving cab and could be rotated in any direction desired. A selection of alternative sound programmes was stacked conveniently for the operator's use.

As had been expected, the "sonic scenario" most in demand involved portrayal of movement of armoured and other vehicles. The main question of selection being to ensure that the chosen programme suited the terrain over which the supposed movement was to take place and the types of vehicle supposedly involved. The other scenario which was thought likely to be needed portrayed the sound of bridging operations. It had been interesting to learn that in 1917 the Turks had been deceived at the Shumran Bend on the River Tigris by a well-managed dummy bridging operation including, it is understood, some deliberate noise-making at the diversion site.

A further possibility for the use of sound-making equipment was examined. It had been reported that in the campaign in Malaya (1941/42) the Japanese had made effective use of loudspeakers in the jungle to disseminate threatening and bloodcurdling announcements to unsettle allied troops. It was thought that this concept might be taken up in appropriate circumstances by broadcasting frightening or eerie sounds to disturb enemy detachments. For example, the persistent and monotonous repetition of tolling bells or, perhaps, eldritch screeches. This concept came to be known as "terror" tactics. Some experiments were tried on the open moorland which must have surprised the local crofters even more. However it was decided that such a scenario would be unlikely to be effective in North West Europe and I do not know if "terror" tactics of this sort were ever used in the Far East.

Owing to the delays encountered in the availability of the sound reproduction equipment and the scout cars, the first units for military service did not become operational until the end of 1943. I think that naval units had been ready earlier. I have been unable to verify whether this was the case but certainly naval craft were employed inshore along the French coast as part of the deception operations organized in support of the Operation *Overlord* landings in June 1944.

During 1943 the number of men and vehicles had become too great to be accommodated at Laggan House and an overflow site was acquired at Bardrochat House, Colmonell, farther up the friendly valley of the River Stinchar. This was slightly nearer to the training area and provided a useful base from which the later stages of training could be completed.

Early in 1944 two companies were dispatched to Italy, one of these being commanded by Mike Heath. It seems that their arrival in that theatre was not received with great enthusiasm by the Army Command there.

It is possible that the original decision in London to suppress development in the Middle East Command of their own form of sonic deception units still rankled, and certainly it seemed that the best opportunities for use of these tactics in the Mediterranean theatre had now passed. Nevertheless it was decided to investigate the possibility of conducting some sort of tactical deception operation on the high ground to the east of Monte Cassino. To this end both Light Scout Car company commanders set out on a reconnaissance of the area. Sadly they walked into an uncharted antipersonnel minefield and Mike was killed and his colleague seriously injured.

Following this disaster no further attempt appears to have been made to utilize sonic deception in the Mediterranean theatre and the units returned to the UK in August. Reviewing this decision in hindsight many years later, it would seem that some opportunities may have been lost. For example, a sonic deception operation to cover the abandonment of the downstream "Congo" bridging site during operations to cross the River Rapido in May 1944, might possibly have taken some of the pressure off 4 Division RE upstream at "Amazon" bridge.

Two other units were sent to the Far East, later in 1944, having been converted to jeep-borne equipment. These certainly carried out some sonic deception operations in Burma but I have been unable to discover details. One unit was trained for mountain warfare but never used and another, under command of John "Sapper" Hepburn, was seconded for special experimental work with the Admiralty during 1944.

Returning now to the units designated for operations under command 21 Army Group. 1 and 3 Light Scout Car Companies left Ayrshire for Essex in the early spring of 1944. After a night stop at the transit camp established on Doncaster Racecourse, we joined the long stream of military

traffic moving south on the A1 and eventually found ourselves in a farm complex at Coopersales near Epping. From this base we were able to carry out a few night exercises in the Essex countryside.

By this time 21 Army Group had established a new formation (known as "R" Force) designed to control all tactical deception operations in the Army Group area. In addition to the Light Scout Car element, the Force included 179 Camouflage Company RE (Major Papillon RE) and a Royal Signals unit (5 Wireless Group) especially organized for deceptive wireless traffic. The Commander chosen for "R" Force was Colonel David Strangeways, who had had considerable experience with the Eighth Army in dealing with deception operations. This was good for us as without direct control and interest at the highest level of planning, tactical deception operational possibilities are unlikely to be spotted and put in train early enough to be successful. Although there are occasions when ad hoc sonic operations could be useful, the more deliberate schemes coordinated with other agencies are those likely to produce greater results. And such schemes involve much staff coordination, proper reconnaissance etc.

The officers commanding the Light Scout Car companies at Coopersales, were summoned to meet Commander "R" Force at his HQ in Latimer Court (a block of flats opposite the old St Paul's School in Hammersmith) and were told that it had been decided to amalgamate the two companies. There were good reasons for this – the North West Europe theatre of operations was comparatively compact with reasonable communications, and it was therefore most unlikely that troops would be required for detachment over long periods. In addition the operational control philosophy prevailing throughout 21 Army Group was tight at all times. The second company HQ therefore became superfluous. Nevertheless the choice of OC would be devastating for the unlucky loser, and it was with enormous relief that I heard I would be the lucky one. In consequence 1 Light Scout Car Company was reformed with 4 troops under my command. It will demonstrate the all-Arms nature of the unit to note that my 2IC was from the Royal Signals and the troop commanders from the RA, RAC, and the Recce Corps.

As the spring of 1944 advanced, excitement increased as the move forward began. "R" Force HQ moved, with 21 Army Group advanced HQ, to Fort Southwick near Portsmouth. I was ordered to detach two troops to the embarkation area to cross over on D-Day but my request to go with them was denied. Instead I moved with the rest of the company to Worplesdon, where the other units of "R" Force were concentrated.

The two detached troops landed in Normandy on the evening of D-Day and put on a small sonic programme opposite a German strong point in the vicinity of Pierrepoint-Camilly. This strong point had been by-passed in the initial advance and the noises were intended to keep the occupants disturbed as well as to deceive them as to the true direction of attack. These troops were the first Light Scout Car sub-units to perform in active operations.

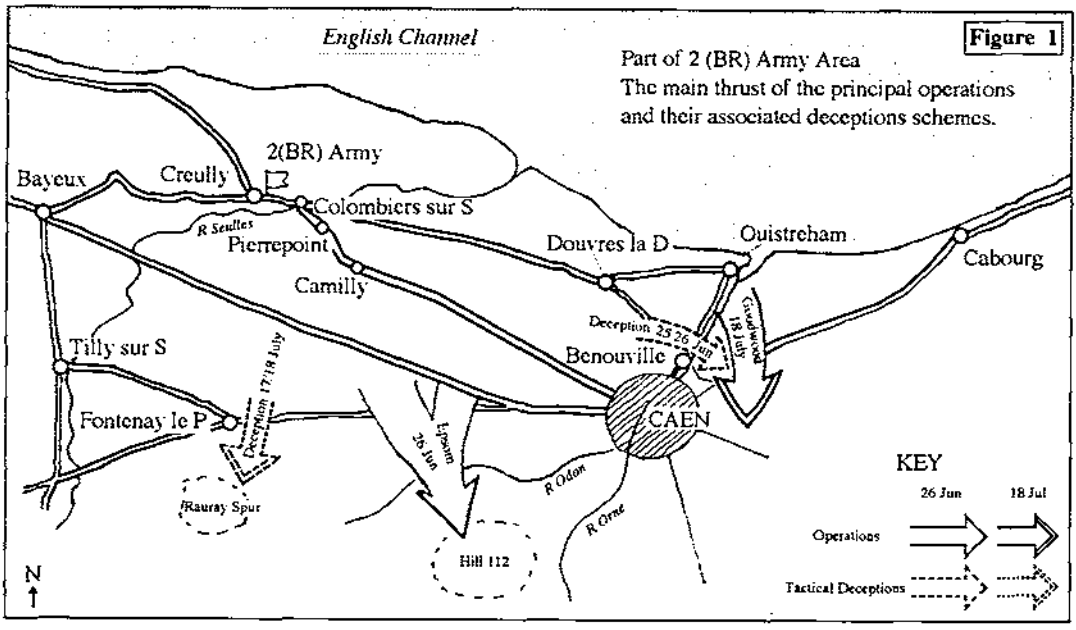
On D+2, the rest of the unit moved into the "Build-Up Control Area" and into a transit camp on Southampton Common, from where we were embarked in a US Navy Landing Ship (Tank) for the Normandy beaches.

The convoy assembled at Cowes and, in spite of a minor collision in the darkness and getting into the wrong swept channel, we arrived safely (but in the wrong place) at the beaches. We were directed to a field outside the village of Colombiers sur Suelles where we were reunited with the troops who had preceded us.

The location was convenient, being only a short distance from 2nd Army Main HQ where I could attend the daily briefings and could thus keep the unit informed about the progress of the battle whilst we waited for our first company operation. This was delayed (as were all major operations) by the "great storm" which severely interrupted the build-up process, but the time was well spent in getting to know the routes throughout the 2nd Army sector.

The first operation conducted by "R" Force as a whole, was planned to take place in conjunction with Operation *Epsom* of which the objective was to secure the high ground west of Caen near Evrecy – "Hill 112" as it came to be known (see *Figure 1*, over the page). The deception plan for this operation involved a simulated build up of armoured forces in the area of Benouville posing a threat of an attack east of Caen. It was hoped that such a threat would hold powerful German forces inactive on the "wrong" side of the city for a crucial period in the early stages of Operation *Epsom*.

We had had good notice of the role intended for us and I had spent some time visiting the formations in the area to let them know what was afoot and to coordinate arrangements. I was invariably well received even though I conveyed the news that we would be coming in to stir things up when they might otherwise have been reasonably quiet.



The deception (*Figure 2*) began with the transmission of bogus wireless signals in the eastern part of the bridgehead and the erection of dummy tanks and dummy vehicles in the area of Periers-sur-le-Dan. Then at nightfall on 25 June the Light Scout Car vehicles moved into the Periers area ready to provide the sonic programme.

I reported to HQ 185 Infantry Brigade and received the OK to go ahead, so we started a rolling programme of tank noises in Periers, moving through Benouville, over the Orne Bridge (now "Pegasus" bridge) and into the forward area at Ranville. It did not take long to provoke reaction and fairly heavy mortar stonks descended in the Periers-Bieville area. At least this showed that we had caused some alarm in enemy circles. Throughout the night enemy reaction continued with particular attention to the bridge area. We had had orders to withdraw the sonic vehicles before daylight and we got them back over the bridge by sending them back singly in the intervals between salvoes. We were lucky to suffer only one casualty in the operation.

A couple of days later David Strangeways visited the unit and told us that an enemy intelligence report had been intercepted which had indicated that the deception had been swallowed and that a powerful battle group had been retained east of the River Orne for several vital hours when it might otherwise have been used to counterattack the British forces engaged in the main operation. We heard later that by sad coincidence the Commandant of the Light Scout Car Training Centre at Ballantrae and his deputy, both of whom had returned to regimental duty and were commanding battalions in Operation *Epsom,* had been killed in that battle.

On 17 July we were sent to the other side of the 2nd Army sector. This time the main attack (Operation *Goodwood)* was to be directed east of the River Orne and our role was to foster the notion that other major operations were impending elsewhere. The area chosen for the deception *(Figure 1)* was near Fontenay-le-Pesnel and not far from the "Rauray spur". This was known to be a sector sensitive to the Germans (most were!) and a fraught tank battle had been fought in that vicinity earlier in the campaign. However by this time the German reserves and their ammunition were becoming scarce and the reaction to our efforts was correspondingly less impressive. Even so there was a rare and fairly heavy air attack by light bombers during the night but whether this was in response to our noises or to gunner harassing fire in the vicinity was not clear – perhaps a bit of both.

A few days later we put on a short performance near Gouvrix south of Caen but the audience had already left and the "house" was empty.

By this time the battle had become fluid and the company was called up to take on an unexpected and hitherto untried role. When a rapid advance is developing and a large city is expected to be liberated,

many small parties of specialists have good reason to want to get into that city immediately it is freed. For example, military government officials; technical experts dealing with utilities; intelligence personnel seeking information on alleg-ed war criminals; the press etc, etc. If allowed to proceed independently these small parties push on the heels of the forward troops and can prejudice operations. It was thought desirable to collect all such parties into one large controlled convoy and our small unit, being generously equipped with wireless communications, would be helpful in achieving this control.

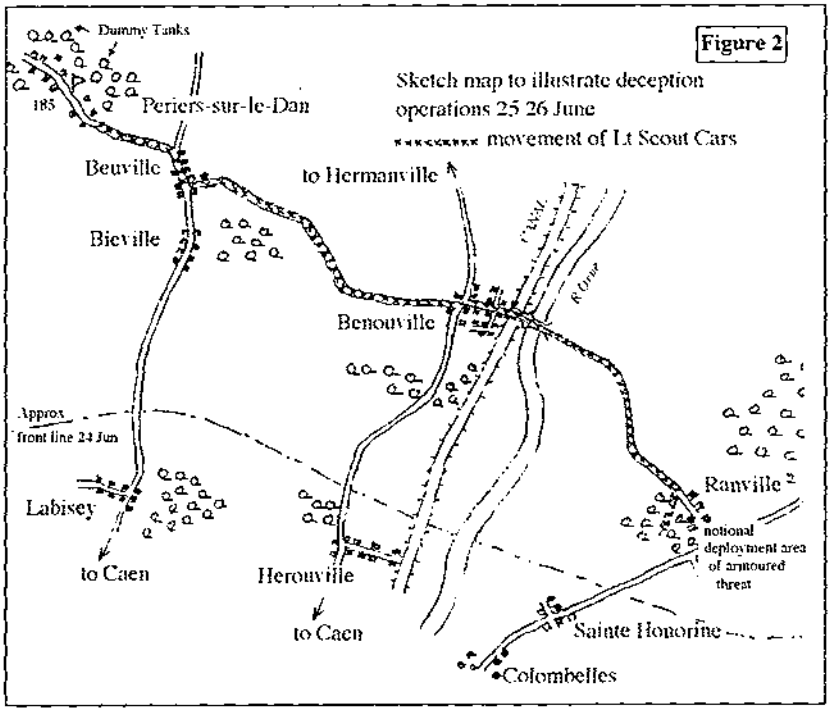


Figure 2
Sketch map to illustrate deception operations 25 26 June
movement of Lt Scout Cars

We were called to a rendezvous near 21 Army Group Main HQ, located in the American Sector, and the scout cars were spread throughout the convoy. By evening we had reached an area of open country near Bernay where we bivouacked to await the crossing of the River Seine and the construction of a Bailey bridge at Elboeuf. The next morning, the leading formations having passed the river, our convoy was set in motion and we all arrived safely in Rouen on the heels of the forward troops who had immediately moved on towards Le Havre.

It had been pleasing to have been given an important and agreeable role in the advance and to have carried it out satisfactorily. However, with hindsight, it seems possible that the Light Scout Car Company had been diverted from its primary role at a time when it might otherwise have made a valuable contribution in that role. If we had been readily available to 43 Infantry Division at the Seine crossing, could we not have helped them with a tactical deception? Perhaps also we could have been of help at Le Havre a few days later. To have been in a position to assist with either operation, the company would have had to have been placed in support of a division or of a corps for a short period and I wonder if this degree of decentralization was ever considered by Army Group.

We had been located at Mont St Aignan for a short time when we were again called upon to act in a convoy control role. There was some reluctance to resume the road so soon after arriving in the pleasant city of Rouen, but faces brightened when the new destination was announced – Brussels! It seemed incredible – the Army Group had still not crossed the Somme. But we did not know that at the same time as the new orders were being notified, 30 Corps was marching through the night to bounce the crossings over the Somme and open the whole plain of Picardy to our forces.

The convoy was reformed and the next morning found us moving past Amiens for a short halt on the downs outside Albert. We were now in unsecured territory, the leading formation (Guard's Armoured Division) having pressed on to secure the port at Antwerp. There were still enemy parties about and we were given an armoured car escort. However, apart from a near miss with a Tiger tank which delayed the move forward for a while, we got through to Hal without too much trouble. By this time nightfall was approaching so the whole group laagered in a large field with the scout cars (the only vehicles with any armour at all) on the perimeter.

The next morning before dawn we drove through Anderlecht and received a tumultuous and emotional reception in central Brussels. Temporary billets were found in the Rue de la Loi and later we were relocated just outside the city in the neighbourhood of Terveuren.

From Terveuren two troops were detached; one to Calais, the other to Boulogne. It was thought that some indirect threat of attack might persuade the garrisons in those ports to surrender but this idea did not produce results and the troops were later returned to the company.

Our next operation took place near Eekloo in support of Canadian operations to clear the "Breskens" pocket. It was a limited programme of tank and vehicle movement designed to distract attention from the main point of attack. Our efforts were rewarded with a fairly short but intense mortar concentration but fortunately this was directed into a field about 200 yards from where we were operating and proved harmless. It is not easy to locate the origin of sound accurately in night conditions. However for the deceiver any response is welcome, indicating, as it does, that at least some notice is being taken of his efforts.

The company was not involved in the initial stages of Operation *Market Garden* but we moved up to a village just south of the Grave bridge as the operation came to its close. From this base we were able to move into the "island" between the Rivers Waal and Maas and to provide sound indicating general activity (again mainly armoured vehicles) the aim being to preserve as long as possible the fiction that further operations in the direction of Arnhem remained a possibility. At the same time the Camouflage Company set up dummy tanks, guns etc. I doubt if this deception scheme had much effect on enemy plans and in any case when flooding affected the area and the dummies began to float downstream, the scheme tended to lose conviction. The unit returned to Terveuren.

I reconnoitred and prepared a scheme for an operation at Blerick (opposite Venlo) where a small bridgehead was being held by the enemy. But, this scheme was not put into effect. Then in December I returned to the UK to attend the Staff College handing over command to the officer who I had replaced in May when 1 and 3 Light Scout Car Companies had been amalgamated.

On the same night that I embarked at Ostend the Germans began their offensive in the Ardennes and the LSC Company was used in an infantry role to guard a crossing over the River Meuse. I have heard no reports of other operations during the winter until the company carried out a major deception operation in conjunction with Rhine crossing in the spring. Then at the end of the war the whole organization was disbanded.

The success or otherwise of strategic deception can be fairly accurately judged by posterity but tactical deception is more difficult to assess. "Deceptionists" (please excuse the word) are alleged to be prone to make exaggerated claims so I have to be careful. The fact is that we shall never know. The existence of a captured intelligence report apparently "swallowing" the deception is not necessarily conclusive. However, anything which adds to the confusion of information received by an opposing commander can be useful even though he may lack the resources or power to react. At the very least, false noises may disturb tired opponents and if the enemy expends scarce ammunition unnecessarily that too helps. Also I believe that a convincing performance serves to raise the morale of one's own side and the more so if it is seen to provoke wasteful and misdirected enemy reaction.

The number of men and vehicles used in sonic operations was not great but even small forces need to justify their existence. The operation we carried out (at Benouville) seems to have been successful but was not, I think , the major success that the founders of the Light Scout Car organization had envisaged when in 1941 that organization was decided upon. It is possible that more use might have been made of the units if they could, on occasion, have been deployed well forward and used by leading formations as opportunities occurred. Any reluctance to hazard the units in this way through fear of prejudicing the secret of their existence should have considerably lessened after mid-July 1944.

We shall never know whether the Middle East Command (if allowed to pursue their own ideas further after Bardia) could have developed sufficiently credible sonic units in time to have been effective in the later battles in North Africa or Sicily, but it does seem to me that, had they been able to do so, the conditions prevalent at that time would have afforded greater opportunities for a really stunning sonic deception than arose later in the war.

The Mulberry Harbours

PROFESSOR SIR ALAN HARRIS CBE BSc(ENG) HONDSC FENG FICE FISTRUCTE MCONSE

I MUST explain my own role at Mulberry.

I had landed at Port-en-Bessin as officer in command of advance party, 933 Port Construction and Repair Company, Royal Engineers, as soon as the village had been liberated by 47 Royal Marine Commando. A few weeks later we moved to Courseulles; it was touching to note, on a recent visit, that some of our installations were still in service. Sometime in July, I was posted to Mulberry under direct command of Col. S. K. Gilbert as Diving Officer; it was prudently foreseen that Mulberry might be needed for longer than originally estimated—though Cherbourg had been liberated, it had been comprehensively demolished, blocked and mined and would not be useful soon, despite the triumphs of speed in construction of the U.S. Corps of Engineers.

I had seven Royal Engineer, three Royal Navy and one Royal Marine diving crews plus a pair of civilian divers conspicuous in blue overalls from Portsmouth Dockyard, determined not to miss the party. We worked from French fishing boats from Port-en-Bessin and Courseulles each with skipper and crew; our job was clearing the sea-bed for incoming caissons, disposing of U.X.B.'s and mines (happily, not too often) and inspecting the various structures under water. Thus while I have memories of Mulberry which I share with few, I was not there in the crucial, the heroic days.

My experience is solely of Mulberry B; I know nothing of Mulberry A save for the great help always received from them, starting with the U.S.A. Motor Towing Launches (M.T.L.s) at Mulberry B from the beginning under John Hemin who worked in total unity with our own tugs under Capt Johnny Luck, R.E. Tugs were vital, and the American M.T.L.s were more handy than our steam tugs.

GENERAL

MULBERRY was not a technical innovation. Ingenuity, skill, effort—all at their limits—yes, but no epoch-making design, no quantum leaps in science.

Mulberry's claims to fame lie in the following:

–the audacity of committing the invasion to the success of this adventure, knowing that if it failed, so too would the invasion—and there would be no second chance. This audacity was shared by those who made the plans, those who adopted them, those who gave the orders and those who undertook their execution

–the speed and precision with which the elements of this project were designed and built in the U.K.

–the fortitude, the heroism with which Mulberry was brought to success on the far shore.

THE NECESSITY OF MULBERRY

To win the war we had to vanquish the enemy on land. Naval blockade would not do it; bombardment from the air might perhaps in the long run, but they had new and powerful weapons, nearly ready; delay was perilous. So it had to be invasion.

'You can always force an invasion but you can't always make it stick' (Gen. Bradley). The inevitable counter-attack, once resisted, must be followed by the build-up and supply of an army able to overcome the forces confronting it. Clearly, command of the sea was a minimum requirement; command of the air would be of immense value in obstructing their reinforcement, but what of ours? How to get the numbers of men and the tonnage of equipment and stores needed off ships, on to dry land and away to the battle?

History offered no encouragement. There was the Armada scattered by Drake's fireships—and the year after, Drake led an English fleet of comparable size and a larger army but failed to capture Lisbon and returned in disorder.

The seizure of a port had been dismissed even before the raid on Dieppe (18 August 1942); plans for alternatives were the subject of a Chief of Staff memoir dated 5 May 1942, and Churchill's famous note on floating piers was dated 30 May 1942.

The capture of a port as the keystone of an invasion was rejected for the following reasons.

–Even given sea command, powerful defences were difficult to overcome. Dieppe confirmed this.

–The enemy would be able to hold on long enough to render the port unusable for months (as at Cherbourg).

–The attack itself could destroy the unloading capacity of the port, as happened at Le Havre and Brest.

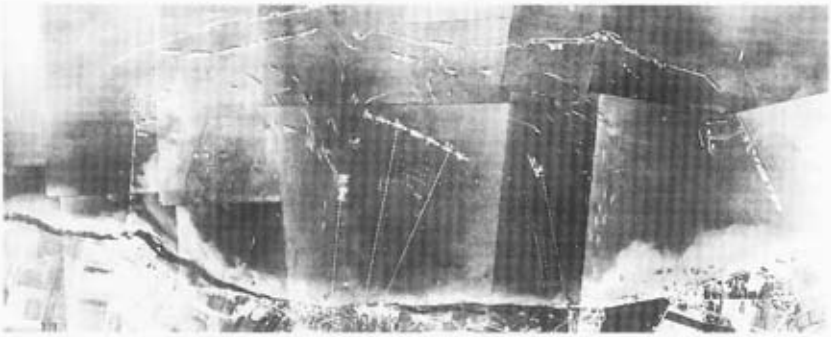


Fig. 1. Plan of Mulberry B fully developed. *Imperial War Museum*

The Allies were experienced in assaulting over beaches in the Far East, in North Africa and in Italy; not only landing craft but specialized armour and artillery had been developed; the assault was well prepared. But for the build-up, beaches had risks—rocky patches, peat and clay pockets, runnels parallel to the shore which would drop men and vehicles into deep water. How would even a good beach stand up to month-long pounding by landing craft and heavy vehicles? And what of the effect on the landing craft themselves? Anyhow, beaches were not viable in onshore winds.

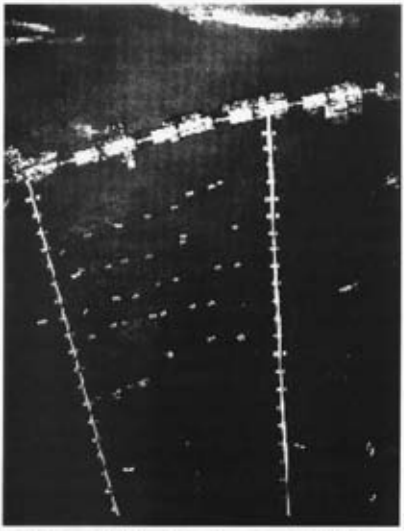


Fig. 2. Detail of Whale pierhead. *Imperial War Museum*

To invade assuming either the capture of a suitable port or the viability of beaches was not an acceptable planning prospect. There had to be something else.

The Audacity of Mulberry

The audacity of Mulberry lay in its magnitude, the complexity of the means needed to fulfil its functions, the vagueness with which, of necessity, the site was known and the phenomenal speed with which the component parts had be be constructed in the U.K. and assembled on the far shore.

Magnitude. *(Fig. 1).* A comparison is illuminating. The total enclosed area of Mulberry B at mean high water spring tide (M.H.W.S.T.) was 6 km^2; that of Dover (excluding the excavated docks) is 2.4 km^2. (Not all this area at Mulberry was useful; at mean low water spring tide (M.L.W.S.T.) the areas were respectively 4 km^2 and 2.27 km^2. Arromanches had a tidal range approaching 8 m and a beach slope of about 1:200; Dover with 5.9 m has steep-to shores.)

Functions. These were as follows.

Pierheads (Whale with Spud pontoons) which would rise and fall with the tide, permitted coasters to unload at any state of the tide and in shelter, directly on to vehicles *(Fig. 2).*

Floating roadways (Whale, with Beetle pontoons) allowed loaded vehicles to pass from the pierhead to shore.

Special Spud pontoon pierheads with buffer pontoons allowed Landing Ships (Tank) (L.S.T.) to unload tanks and other heavy military equipment directly on to floating roadways.

Shelter from heavy seas was provided by two expedients. Firstly, large concrete caissons manufactured in the U.K. were towed over and grounded (Phoenix). Their height depended on the depth of water; the biggest, 60 ft high, were meant to be sunk in 5 fathoms M.L.W.S. Secondly, blockships (Corncobs, lined up as Gooseberries), ballasted with concrete, steamed over under their own power and were sunk by explosive charges. Shortage of shipping meant that only small coasters were available; those used hugged closely the 1 fathom M.L.W.S. contour.

These breakwaters not only safeguarded the operation of the pierheads but provided shelter for Liberty ships to discharge their cargo using their own gear on to barges, on to rafts built up from prefabricated steel boxes (Rhinos) or on to amphibious vehicles (DUKWs). The first two would be unloaded at the water's edge by mobile cranes onto road transport, while the DUKWs would drive inland to a transit area where cargo would be sorted and reloaded. In addition a variety of small craft took advantage of the shelter, not only in bad weather; it provided a base for a naval coastal force, a minesweeping flotilla, repair ships, lifting ships and all the many boats needed for diving, maintenance, intercom etc.

Mulberry also served for loading; it was a great comfort for the wounded to know that they would soon be on a hospital ship and it was convenient for all to get prisoners of war on their journey to Canada. (The division occupying the Channel Islands was known to the Germans in Normandy as the 'Canadian Division'.)

Site Information. All harbour works, all, are site-specific and great care is taken with major civilian works to examine the site before ever commencing the design. Site investigation in Normandy before design tended to have unfortunate consequences to the person; information could not possibly be wholly adequate.

Speed of Manufacture and Construction. Thoughts of invasion of the Continent followed soon after Dunkirk. To describe the development of the various devices finally adopted recalls Wellington who, when asked to describe Waterloo, replied 'as well attempt to describe a ball-room'.

Describing the development of Mulberry is like that. At any moment ideas, politics, planning; manufacture and construction; transport to the far shore and installation—were in a state of flux, not always easily distinguished from chaos, not wholly devoid of internal conflict and in no way stabilized by the changing fortunes of war. Behind the scenes were men of a determination close to ruthlessness, Churchill at their head; faith was needed, sobbing and wringing the hands were unhelpful.

The ball took place; desperately prepared for a definite date, this fantastic party ended portentously.

Little more can be done to plot progress than to quote key dates and to name prominent names—Admiral Hughes-Hallett, close to the centre when the idea of a new port for landing was first considered; Lord Mountbatten, as chief of Combined Ops, a powerful advocate; Sir Harold Wernher, influential co-ordinator; Col. Steer-Webster, go-between with Churchill and Mountbatten of the central figure, Brig. Sir Bruce White.

It is idle to pretend that there was no inter-service conflict at high levels between Army and Navy, due largely to the latter's lack of any construction force. The American Navy, of course, had formed their own Construction Battalions, the famous 'Sea-Bees'. (It is said that if ever an American Admiral received a salute from a Sea-Bee, he would record it in the log.) The Japanese Army Engineers operated all their own maritime transport.

The conflict was of ill effect on Mulberry and would be both painful and tedious to recount; it was absent from operations in Normandy.

The story of Mulberry must be seen as starting in May 1940 when Maj. Bruce White (later Brig. Sir Bruce White) was posted to the War Office in the Directorate of Transportation (D.Tn.), Royal Engineers, commanded by Maj. Gen. Sir Donald McMullen; in June 1940 a department of D.Tn. known as Tn.5 was set up under the now promoted Brig. Bruce White with responsibility for port construction, repairs, maintenance and operation; for port repair ships, dredgers and floating cranes; with, of course, the recruitment and training of specialist troops including divers. As a first step, Bruce White established a list of civil engineers experienced in harbour works on whose experience he was to draw extensively. He recruited Lt. Col. (later Brig.) J. A. S. Rolfe, a civil engineer with experience world-wide which included jack-up platforms for dredgers, as his second in command. He had the support of Churchill ever since his positive response to the famous memo.

Then, in early 1942, Lt. Col. (later Col.) S. K. Gilbert R.E., who had joined Tn.5 in February 1942, was sent on a reconnaissance of the south coast for potential sites for embarkation hards, perhaps the first practical step in preparation for the invasion.

In late summer 1942 Lord Mountbatten issued a tentative specification for piers and pierheads;

three schemes were submitted. One, Hippo, by Iorys Hughes, was a rigid caisson; another, Swiss Roll, by Ronald Hamilton, was impossibly flimsy; a third, produced by Tn.5, who had recruited the brilliant Col. W. E. Everall, ex Bridge Engineer, North West Railways, India, became in due course the complex code-named Whale.

Trials were made of each; the date for decision was March 1943. Whale having been chosen, a full-scale complete installation was built at Garlieston on the Scottish shore of Solway Firth and demonstrated on 18 June 1943; its behaviour was observed during numerous gales.

In June 1943, Bruce White was informed of the decision as to where the landing was to be; Tn.5's projects were consonant.

The Quebec Summit Conference took place in 11-14 August 1943; the final decisions were made. On 3 and 4 September the Joint Chiefs of Staff made the design and construction of Mulberry a British responsibility, the Navy being given Gooseberry and Bombardon (a floating breakwater scheme of theirs) to carry out and the Army the rest, with confusing rules as to who towed what and who decided where.

Tn.5 commissioned tests on numerous forms of breakwater at the National Physical Laboratory (N.P.L.) in September 1943. Phoenix was chosen; detailed design began 1 October and the first base slabs were laid by the end of October. Tests continued at N.P.L. on stability in sinking of Phoenix, towing characteristics of Phoenix and Whale, and mooring forces on Whale pontoons.

By the end of May (i.e. effectively in eight wartime months) the following equipment had been completed:

Phoenix breakwaters: 147 (the eventual total was 212)
Whale Spud pierheads: 23
Whale floating piers: 10 miles length
Bombardon floating breakwaters: 2 miles length.

The Site Chosen. Col. S. K. Gilbert, in charge of breakwater construction, quotes his opposite number, Capt. Jellett R.N.V.R., as saying that a year before 'a letter had come to the Admiralty from a Dutch Engineer working in Portuguese West Africa, saying that after the Dieppe fiasco it was clear that we should be unable to capture a port on the Continent—we should therefore build one. He thought the best location would be on the Calvados reef at Arromanches.'

Well, it was not on the Calvados reef, but the reef provided valuable shelter. The reef is to the north-east of the east end of Mulberry at Asnelles; it dries out some 5 ft at M.L.W.S., when it can be reached from the shore by wading.

The charts show a gully running south-east of the Calvados reef, known locally as the Fosse d'Espagne. (Is this an historical memory? Tradition has it that the reef was named after the wreck of a Spanish galleon of the Armada—difficult to justify linguistically but Larousse says the name was Calvador which in English would be 'mast-buster'.)

The coast around Arromanches, from Cap Manvieux to Asnelles, was as good a place for it as anywhere in the Baie de la Seine. The shallow water inside the reef was ideal for the Gooseberry; the gulley gave access to moderate-draught coasters.

Detailed soundings before construction were needed. Such were carried out between D + 1 and D + 3.

Whale Pierheads and Piers

CHURCHILL's memo of 30 May 1942 (mentioned above) to Lord Mountbatten has been so often repeated in hagiographic terms that it has lost all sense of actuality. Let us read it again.

Piers for use on beaches

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

This trenchant utterance was seminal. First, the pierhead was the central, the vital element—a place where cargo could be unloaded confidently and rapidly.

Consider. A breakwater alone would protect the beaches during onshore winds, thus permitting the continuation of unloading beached craft. Given the right site (tides, nature of sea-bed, depths etc.), ships and barges could have continued to discharge cargo on to rafts and DUKWs. But beaching meant waiting for twelve hours, whereas the floating pierhead could turn around an L.S.T. in 40 minutes. Unloading on to rafts and DUKWs meant a slow trip from ship to shore, as well as double handling. A pierhead provided rapid unloading straight on to road transport.

On that coast, however, the pierhead needed to rise and fall with the tide. A rigid pierhead, however constructed (and caissons could have been used), would at low tide have been some 20 ft above the ship's deck, whose derricks could thus not have operated. Mobile cranes could have been used on the pierhead but were in short supply, would have occupied space and were slower. Cargo had, moreover, then to be got ashore; a rigid

pier was out of the question and a floating pier would require an immense span connecting to the rigid pierhead to give a practical slope at low tide.

The anchor problem was also vital. A large scope on a classic cable and anchor would be needed at high tide; at low tide the pierheads would drift around and the cables would risk fouling the ships.

Bruce White responded to Churchill's memo by describing a particular type of dredger used for mineral extraction. It consisted of a pontoon carrying robust vertical piles in guides; at the desired location these piles, which carried load-bearing slabs at their feet ('spuds'), were allowed to drop on to the sea-bed and the pontoon then jacked up to maintain negative buoyancy and transfer load to the piles. The pontoon thus firmly founded, the dredging gear would work from a stable platform. The literature records that one such dredger, built in 1923 by Lobnitz & Co. of Renfrew, by using its spuds for anchors withstood a hurricane in the West Indies when all other craft in the harbour were wrecked.

Clearly, the scheme could 'float up and down with the tide'. More, the anchor problem had been mastered.

As we have seen, three schemes were proposed and the Spud pontoon was chosen. Lobnitz & Co, still in business, designed the prototype.

Pierheads. The core was the Spud pontoons *(Fig. 3)*. They were intended for berthing coasters of 200-300 ft length and up to 20 ft draught and were installed just outside the 3 fathom M.L.W.S. contour. Eight seatings for floating bridge spans were fitted, one at each end and three down each side.

There was no need for them to be continuous; placed with 160 ft gaps, the pontoon decks were accessible from the holds of the coasters and there was room for berthing and for casting off. The gap was filled by an intermediate pontoon 80 ft by 56 ft by 15 ft deep—a useful surface for manoeuvring vehicles—with an 80 ft span telescopic bridge as used in the Whale piers.

Each Spud pontoon had accommodation for a crew of one officer, six N.C.O.s and 15 men.

L.S.T. Piers and Buffer Pontoons. Two Spud pontoons were placed in a T arrangement with the long arm pointing offshore. L.S.T.s came alongside the long arm and lowered their ramps on to special pontoons fitted to both sides of the cross-arm of the T and thus discharged their cargo of tanks and heavy equipment direct, ready to proceed ashore on the floating pier under their own power *(Fig. 4)*.

The buffer pontoon was in effect a floating beach hinged to the pierhead; the L.S.T. would approach at modest speed and force the buffer pontoon down

Fig. 3. Spud pontoon. *Imperial War Museum*

into the water, thereby decelerating the L.S.T.; the ship breasted an array of concrete gravity fenders (the idea of A. L. L. Baker, later professor at Imperial College) which conformed to its shape. After mooring, the doors would open, the ramps drop and the vehicles drive off.

The L.S.T. pierhead had an elevated deck with ramps whereby light vehicles carried on the L.S.T. upper deck could also drive directly on to the floating pier.

The assembly proved particularly successful partly because of rapid turnround and also because beaching L.S.T.s began to be unpopular. They suffered from repeated groundings as the beaches became obstructed by various military debris. And rocky outcrops were not unknown; at Omaha, by good fortune, such rock was soft and friable and could be planed off by a bulldozer.

Whale Floating Roadways. These floating roadways had to satisfy many requirements.

They would need to carry loads of up to about 40 t.

They would be subjected to a seaway, both in position and during towing over, causing bending longitudinally and transversely as well as torsion. Towing causes tension.

They would need to be grounded; the bed might be anything from mud to rock.

Certain effects of seaway with or without rise and fall of tide could cause changes in overall length.

Fig. 4. Spud pontoon with L.S.T. buffer. *Imperial War Museum*

Fig. 5. Whale floating roadway in use, with concrete Beetle pontoons. *Imperial War Museum*

A special pontoon would be needed to get off the bridge on to the shore.

Their length (approx. ¼ mile) would necessitate frequent transverse moorings to support wind, wave and coastwise current forces. These moorings would have to be secure—and it was desirable that they could be rapidly installed.

The remarkable assembly of associated structures and devices known collectively as Whale (*Fig. 5*) was designed by Lt. Col. W. T. Everall, R.E., ably assisted by Maj. A. H. Beckett, R.E.: the latter went to Arromanches early on to advise, observe and give a hand.

The basis was the steel bridge of 80 ft length and 10 ft clear-width roadway, hog-backed and fish-bellied for economy and so that maximum clearance was available for pitching motion. Each bridge sat on four spherical bearings, and the design was such that the inclination of the plane of support to the horizontal could be ±20°, giving a maximum twist to the bridge of 40°.

Two designs were used: one Class 25 loading and one Class 40.

The pontoons were of beetle shape (hence the code-name), with length 42 ft, beam 15 ft and depth 8 ft. Some were made of steel plate and some of precast reinforced concrete ribbed slabs whose skin thickness was 1¼in. The concrete beetles were used primarily where there was least chance of grounding on a hard bed—for preference, where they did not ground at low tide. They were more fragile than the steel Beetles even when fitted with timber fenders. Permanent buoyancy had been sought by filling them with inflated air bags, but a heavy impact would cause ruptured bars to penetrate the bags.

A version of the steel pontoon was made with lightweight spuds to carry the load where at low water the pontoon rested upon rock.

It was not enough to have spans articulated to the pontoon at each end; the pontoon could easily rotate about the support axis out of synchrony with the spans and damage them. In consequence, the main bearings were placed well off-centre of the pontoon and a link connection was made between girders and pontoons at the further bulwark. One pontoon was thus rigidly fixed to one span but hinged to the other.

The spans were towed in strings of six, 480 ft long overall; the spare end was supported on a cylindrical erection tank, which was freed and towed away after joining the string to its adjacent length.

To provide for the variations in length, a telescopic span was built based on the same structure enabling, for an extra structure weight of only 2 t, the span to vary between 71 ft and 80 ft. (If the wave length was 160 ft, a considerable change in overall length would occur.)

Anchoring the floating roadways presented major problems. The roadways were fixed to the pierheads at one end and to the shore at the other and were subject to wind and wave acting in random directions and to the regular reversal of coastwise currents. Too much transverse movement could overstress the various deck components and also render the roadway impassible to vehicles. In fact, a maximum transverse movement of 6 in had been specified.

The difficulty arose from the large tidal range relative to the depth of water. A mooring cable that is taut at high tide in 30 ft depth of water will be slack at low tide in 6 ft depth unless it is either very long or very elastic.

The solution adopted was as follows. Very long cables (length 14xdepth of water) were used tensioned with a force which varied from 5 t at low water to 12 t at high—a force which due to wave forces etc. could rise to 25 t.

Anchors with good holding power were needed. The C.Q.R. anchor, invented by Prof. G. I. Taylor, was already in being and Maj. Beckett designed a variant known as the Kite anchor which was capable of holding 30 t for a weight of 6 cwt.

Careful thought was given to the placing of these anchors and the setting up of their moorings; special craft were designed. The key craft was the 'mooring shuttle', a low-freeboard twin-hulled craft with a cable drum amidships between the hulls and an anchor fore and aft. The shuttles were

carried over on the decks of the Whale tows and were launched by rolling down a ramp on the cable drum which projected below the hull. Once afloat, they were picked up by a specially designed small motor-boat, flat-bottomed, small draught and freeboard, again made of plywood, known as a Slug (Surf Landing Under Girder), developed in collaboration with Camper & Nicholson.

Having picked up the shuttle, the Slug tows it to the upstream anchor position, where one anchor with cable is dropped by opening a flap; the Slug then tows the shuttle, paying out cable as it goes, *under* the bridge and *through* a bight of rope slung below the bridge to where the downstream anchor is dropped, again by opening a flap. The bight of rope is then hauled up and the cable comes up with it and is fixed by stoppers on the pontoon deck. A Yale 'pull-lift' winch grips the cable by a loose stopper, tensions it and the slack is taken up by the stopper on deck. No winches are thus needed on the pontoons: a very neat operation.

At Mulberry B it worked; at Mulberry A, due to a complicated series of misunderstandings and misinformation, the floating roadways had only one anchor cable every six pontoons instead of one each. This contributed to the failure.

The Whale tows had a habit of breaking up in mid-Channel: spherical bearings and torsional capacity worked as intended but there was a limit to what the bridge could stand in anything like bad weather. (Col. Gilbert asked for a meteorologist to be on every tow, but was rebuked.) After the gale, it was three weeks before any arrived from the U.K.; how fortunate that the goodwill of the Americans sent their salvaged or surplus equipment!

Breakwaters

Need for Breakwaters. The Whale complex was intended to function without shelter; in fact, the test length at Garlieston on the Solway Firth had so functioned over many months. However, whether or not the pierheads could remain in place (and it is well known that jack-up pontoons are most at hazard when they are neither wholly buoyant nor wholly clear of the water), no ship could unload unsheltered in bad weather. More, the shelter for a wide range of craft was desirable; the breakwaters used took, as we have seen, several forms.

Gooseberry. The blockships were of a length overall of between 320 ft and 420 ft and of a depth from keel to highest continuous deck of between 25 ft and 37 ft. It will be seen that with M.H.W.S. of 24 ft and exceptional tides of 26 ft, close limits of depth of water were imposed if the ships were not to be overtopped by waves.

The on site soundings had revealed the 1 fathom M.L.W.S. contour to lie further north, providing welcome extra sheltered space. The blockships, ballasted as noted above, were able to skirt the 1 fathom contour over most of the length of the Gooseberry, the deeper ones extending over the 2 fathom contour. In fact, many blockships were overtopped, but the upperworks attenuated wave effects sufficiently to maintain adequate protection.

The attraction of the blockships was their ability to steam to the site and provide instant protection; it was accepted that eventually they would need offshore protection by Phoenix, which was done. They were used at Utah, Omaha, Mulberry B, Courseulles and Ouistreham; they provided shelter for unloading on beaches, and unloading small coasters on to barges and rafts.

Phoenix *(Fig. 6 & 7).* The Phoenix caissons could be installed with only the minimum of site operations; anything other than straightforward sinking on to an unprepared sea-bed could not be considered.

At Arromanches, the sea-bed was of sedimentary rocks, bedded nearly horizontally, covered by from a few inches to a few feet of sand. This sand was scoured out by the coastwise currents (speed normally 1½ knots but, in places, due to the obstruction of the caissons, as much as 4 knots), leaving many caissons resting on rock. Some hogged, some sagged, some actually rocked but, while some cracked, none failed due to this cause within the required period of function.

The Phoenix caissons were nearly all of length 204 ft (a few of the very smallest were 174 ft), beam 53 ft 3 in (to clear certain lock gates) and overall depth up to 60 ft. Tests had been carried out to establish that a swim end (i.e. cut away underneath) reduced towing force adequately and, unlike a ship end (i.e. sharp in plan), did not yaw around in motion. (It did, however, increase scour.)

A much disputed feature—the 6 ft ledge at 28 ft height above base—was incorporated because in most construction sites there was not enough water to float out a full-height caisson. With the big caissons (60 ft and 50 ft depth), therefore, the hull would be cast up to the ledge, and the incomplete hull would be floated out and finished in deeper water, where the ledge provided support for scaffolding as well as means of access, both during construction and in handling. In use this ledge was little loved: when the

Fig. 6. Phoenix under tow. *Imperial War Museum*

caisson was being sunk and tugs were nudging it into position, as soon as the ledge was covered (a) the caisson would take a list and/or (b) the tugs no longer had anything to push against. After installation, it was inviting to come alongside at high tide; the unwary would be caught by the falling tide with one bilge keel on the ledge—capsizes were known.

On 9 August 1943, four consulting engineers had been approached for advice and assistance. Two declined, reluctant to be associated with so impracticable a scheme. In September 1943, a third, a large and well established firm, begged to be excused because 'the inevitable failure of Contractors to deliver the goods on time would hold the profession up to ridicule', quoting as example the 'mystery towers' of World War I, one of which, the Nab Tower, is still there between the Isle of Wight and Selsey Bill. Had they but known of the stampede to clamber on to the Mulberry bandwagon soon to follow! The fourth, R. G. Gwyther of Coode, Vaughan-Lee & Gwyther, became Chairman of one of two civilian committees; his was the Caisson Design Committee and the other, the Caisson Construction Committee, was chaired by Sir Malcolm McAlpine.

Detailed design based on agreed broad concepts, began, as we have seen, on 1 October 1943 and was carried out under the direction of Capt. (later Maj.) W. J. Hodge, R.E., of Tn.5, with a substantial team from Mouchel & Partners under C. R. J. Wood.

The time factor needs emphasis. From the day when pencil was put to paper, eight wartime months, during which all materials, all plant, all labour were in desperately short supply, had to suffice to construct 147 caissons the eventual total was 212). Building sites were scarce, and rare was the indentation in the British coastline in which some element of Mulberry was not being built. The penalty for delay was military disaster; seldom had a programme been so inexorable. In fact, the 147 were delivered before the end of May. There were 25 contractors concerned on 22 sites; unauthorized variations to cope with local problems have been alleged; the time to complete an A1 caisson varied from 2 months to 6 months.

To achieve such speed, the word of the Caisson Construction Committee carried weight, and at its behest fillets in corners were eliminated and hooks on bars (plain rounds) were abandoned. The decks were open and provided with sufficient steel bar cross-bracing to provide such torsional strength as was thought necessary for the sea passage; edge beams were dispensed with.

Doubts were expressed about waves overtopping the walls, but to replace the diagonal bracing by a solid deck would have so upset hydrostatic stability as to need a total re-design, clearly unacceptable at that stage.

Difficulties arose with 'parking' the completed caissons in their assembly areas on the south coast, mostly east of Selsey Bill. It had been intended to moor them afloat in deep water, but the heavy moorings available were monopolized by Bombardon and the Phoenix units had to be grounded. A caisson failed in torsion: it had been grounded in too great a depth of water and was refloated to be towed inshore, but for various reasons it was sunk in the same position and in the process swung and landed diagonally on its 'wallow'. The damage was such that it was left there. (Mr. Maloney of the British Sub-Aqua Club says that the underwater relics are still there and form a prime diving site, such is its richness in marine life.)

The real problem, however, came when the caissons were to be refloated—a huge concentration of pumps was needed and only by the most heroic (and on occasion unscrupulous) efforts were the pumps finally got together.

What of performance?

The caissons were intended to have 6 ft freeboard at M.H.W.S. We have seen that the first task on landing was to carry out rapid soundings inshore. These

Fig. 7. Phoenix in position in Western Detached Mole. *Imperial War Museum*

showed that the 5 fathom line, where the Liberty ships were intended to moor in the shelter of the detached mole, was nearer shore than expected; Port Operations, worried about being cramped for space, asked for the line of 60 ft high A1 Phoenix to be placed farther offshore. The engineers (Capt. J. H. Jellett, R.N.V.R. and Col. S. K. Gilbert) objected but were overruled and many caissons had only 3 ft freeboard at M.H.W.S. and it was at such where overtopping broke panels outwards *(Fig. 8)*. No panels failed under inwards pressure.

Some caissons were laterally displaced during the gale, but seemingly as much in the direction of seabed slope as by wave action or tidal current.

The modified Ax and Bx Phoenix, decked and properly reinforced, arrived in what seemed a remarkably short time after the gale and were wholly successful. The sad remnants of caissons to be found at Arromanches today are of the first sort which suffered successive damage and could not be refloated. The others were later pumped out, towed away and used elsewhere for rapid marine works. Some may still be found.

The construction of Ax and Bx caissons revealed that the simplifications imposed on the original Phoenix were largely unnecessary. The fillets in the corners were found to facilitate removal of formwork. Since the Phoenix were made of concrete slabs, the construction of concrete decks was merely more of the same, whereas diagonal steel bar bracing introduced different trades on a labour-intensive task with its own learning curve; concrete decks would have been faster to construct.

Bombardon. Floating breakwaters have a long and almost entirely unsuccessful history.

Iorys Hughes, the designer of Hippo, is quoted as owning a mid-19th century picture of Brighton pier with a floating breakwater, 'similar to Bombardon', anchored off the beach to shelter small craft. The eminent French harbour engineer, M. Paul Bastard, sent the author an extract from a speech to the Chambre des Pairs (at the time the French House of Lords) in Paris in early 1848 warning France of its naval weakness in the face of a power equipped with a floating breakwater. The speech is moving, detailed and convincing; alas, the speaker, none other than Victor Hugo, was soon obliged to seek shelter in Guernsey. No more has been heard of that breakwater.

Bombardon was a steel-plate structure of cruciform cross-section; 250 ft overall by 25 ft overall, the arms being 5 ft uniform width. It acted as a vertical barrier to the orbital wave motion in the water, stabilized to some extent by the horizontal arms. It was flooded to give about 6 ft freeboard. Performance depends upon strength and rigidity of moorings.

The utility of Bombardons prior to the gale is questionable; during the gale all broke loose and drifted downwind *(Fig. 9)*. At Mulberry A they were carried by wind and wave straight through the Phoenix and into the roads; disaster was complete. At Mulberry B, given the protection afforded by the Calvados reef, they had been placed north-west and most blew clear one or two approached the Western Detached Mole but were sunk by two Royal Engineer officers using PIATs (projectors infantry anti-tank).

Perplexity remains. A full-scale Bombardon breakwater was installed in Weymouth Bay in April 1944, and, says Lochner (Lt. Comdr. Lochner, R.N.V.R., of the Admiralty Department of Miscellaneous Weapons Development; the designer), withstood an onshore gale of wind-force 7 gusting up to wind-force 8 with a sea up to 170 ft long and 8 ft high. Why did it fail in weather no worse off the Normandy coast? Lochner had said that the Bombardon moorings were designed for 7 fathoms M.L.W.S. with a tidal range of 24 ft and a maximum depth of 66 ft; he claims that off Normandy some moorings were laid in 13 fathoms M.L.W.S., giving a maximum depth of 19 fathoms, to which he attributes the failure. But the charts reveal that to find 13 fathoms M.L.W.S. one has to go some 8 miles offshore, whereas in Weymouth Bay, with approximately 9 fathoms depth and 6 ft tidal range, maximum depth is 60 ft, much as it was off Arromanches.

Col. Gilbert has an explanation. Each Bombardon, he says was to be attached to its moorings at one end by a strong steel wire rope strop and at the other by a weak manila strop, so that in extremity the weak strop would break and the unit lie streamed to wind and wave and thus survive. In fact, he says, Bombardons were attached to moorings by pairs of like strops, so that when manila strops failed, two Bombardons would swing to one mooring side by side, colliding together as well as overloading the moorings.

There is a future for floating breakwaters, but they will not resemble Bombardon.

The Men on the Site

This was not an operation to be confided to the next men on the list for posting. In design and construction, the best had been sought and found; for operational command similarly – engineers with transportation and port construction experience in war. Brig. A. E. M. Walter, straight back from the East, a

Fig. 8. Phoenix after gale with offshore walls having failed outwards. *Imperial War Museum*

regular Sapper, was Director, Ports and Inland Water Transport, 21A.Gp., with, as his deputy, Col. G. E. Howarth, with an M.C. from World War I; Col. S. K. Gilbert commanded the Port Construction Force (he was recently back from North Africa and Italy, as was his opposite number, Capt. J. H. Jellett, and their relations were of the most cordial); Lt. Col. Mais (later Lord Mais and Lord Mayor of London), back from various tasks in Persia, 8th Army, Combined Ops, was to be in charge of floating pierheads and roadways; Maj. R. J. P. Cowan, also from North Africa and Italy, was to command the Port Floating Equipment Companies R.E., specially recruited to assemble the equipment over there.

These were distinguished, indeed brilliant, officers; they were successful against great odds. It is bizarre that they were brought into the operation only in early 1944—Lt. Col. Mais, for instance, joined Brig. Walter in March 1944. They had yet to get to know their troops; they knew little about the equipment, much less were they in touch with its evolution, design and construction.

Lord Mais has told how he pleaded for a training operation, only one, with floating roadways—and why not such-a-day next week? The pitying answer was 'Cannot even you Mais, think of a reason why you will be otherwise occupied that day?' 'That day' was 6 June, prevarication was needed to explain things to the troops without breaching security.

These officers saw to it that they were well served with warrant officers and senior N.C.O.s of their choice. What of the troops?

These, too, were to be elite; Tn. HQ had said so. To ensure it, orders were sent to all officers commanding port construction companies that each was to send a dozen of his very best men to form the brilliant units which were to ensure victory by the construction of Mulberry.

It did not work out that way, not quite.

Officers commanding units on their tip-toes, trembling with anticipation for D-Day, were not inclined to divest themselves of their best men; on the contrary, this was a heaven-sent opportunity to be rid of their worst. So it was done; the Port Floating Equipment Companies, R.E., were formed from men, in Ronnie Cowan's words, 'clutching crime sheets covering every known offence—insolence, theft, wife-beating, assault and battery, robbery with violence, larceny and desertion etc.' Note the etc. An inspecting officer observed 'These men aren't soldiers, they're bloody goons'.

It will be seen later that when it came to the crunch, they were superb. Mulberry was theirs.

Some crewed equipment being towed over. Discomfort was excruciating, danger was considerable—many men were lost—but after delivery they hastened back to England and, on their own initiative, made straight for the next batch. No sergeant-major was there to give orders; they knew what was to be done and that they must do it. They did not fail.

Fig. 9. Pair of Bombardon breakwaters after gale. *Imperial War Museum*

Crisis

It is a slight exaggeration to say that this harbour was in service a fortnight after landing, but a gale blew from the morning of D + 13 (19 June) until the night of D + 16 (22 June), direction north to northeast, force 6-7 most of the time; waves were a mean height of 8-9 ft with a maximum of 12-14 ft. The depression was not intense nor were the winds tempestuous but they blew from the same quarter for four days and, with a fetch of 100 miles, stirred up a dangerous sea.

Said Wavell to Liddell-Hart: 'If I were to write military history, I would concentrate on the actualities of war—fatigue, hunger, fear, lack of sleep, weather, inaccurate information, the time factor and so forth.'

Only those who were there can speak of the actualities of those four days. What happened, however, must be told in bare (and oh! how bare!) fact.

Here, surely, was the answer to the enemy's dearest wish—heavy weather onshore before consolidation of the beach-head; at least a relief of pressure, perhaps the opportunity of total repulse.

The Meteorological warning was short; the depression came up from the Mediterranean, not from, as is usual, the Atlantic; the Met. people, without weather stations to the east, were blind in that quarter.

Action was immediate. Lt. Col. Mais ordered all floating roadway moorings to be checked, harbour tugs to be fuelled and victualled fully and to be ready to grapple and tow away craft out of control, parties of Sappers to be allocated to various emergency tasks, orders to be given to fire on any craft attempting to come alongside pierheads, pontoons etc., all craft to windward of the the pierheads and piers to up-anchor and move to leeward. Warning shots were fired by the Bofors cannon on the Phoenix (reputed to be more dangerous than the Luftwaffe, they had already punched holes in the funnel of HMS *Rodney*); Capt Witcomb, officer in charge of pierheads, was told to hoist the pierheads up the Spuds as far as he dared.

Mulberry was intended to provide shelter for 1000 small craft in case of storm. The direction of the wind brought such refugees in at the eastern end; holding ground was bad; most were equipped with anchors much less efficient than the Kite—and the Beetles in deeper water were mostly of the more fragile concrete sort. To be awakened by some soldier with orders to sling the hook and move somewhere else (orders supported by dire threats) was not welcomed by skippers who, after a rough night at sea, had finally found shelter.

Most damage was done by just such craft hitting the L.S.T. pierhead and floating pier and the easterly Spud pontoons *(Fig. 10)*. A Landing Craft (Tank) (L.C.T), crewless, doors swinging, struck a stores pierhead and was smashing both itself and the pierhead to pieces, when out of the murk came the tugs, some British, some American, who grappled and towed it away. Capt. John Luck, R.E., (officer in charge of British tugs) and John Heming with his American M.T.L.s, by their skill and daring, saved the piers from destruction times without number.

So it went on for four days and nights, desperate avoidance measures at night (in no way helped by the regular nauseous smokescreen), equally desperate repair attempts during the day. No one got much sleep, all continued despite total exhaustion; miraculously, over 7000 t of stores were nonetheless landed during that time; even on the worst day, 800 t, mostly ammunition, was got ashore.

Calmer weather came on D + 17 (23 June) and damage could be assessed. Stores piers were more or less reparable by replacement of some moorings and Beetle pontoons. L.S.T. pierheads and piers were in a bad way, but by remarkable efforts were back in service within a few days (some say two, some say four, but it wasn't long). There was damage to such Phoenix as were in more than 5 fathoms depth and some had slid around but, by and large, the breakwaters, both Phoenix and Gooseberry, was still in being, though needing attention *(Fig. 11)*.

What of the rest of the beach-head?

Mulberry A was abandoned save for the Gooseberry part, behind which stores continued to be landed on the beach, without benefit of pierheads and piers. All recoverable equipment of value to Mulberry B was brought over. Col. Bronson of the U.S. Corps of Engineers, a close friend of Lt. Col. Mais, had already responded to an appeal for oxy-acetylene burning gear; help had anticipated the decision by General Eisenhower to concentrate all Mulberry equipment on Mulberry B.

The beaches were everywhere littered with wrecked craft piled on each other, sometimes two or three deep; corpses too. Pessimistic eyes at HQ, viewing the air-photos, despaired of the invasion.

The two small ports, Courseulles and Port-en-Bessin, could not be entered in the bad weather; an L.C.T. had tried at Port-en-Bessin but had smashed into the piled section of the western breakwater (we later repaired both and sent the L.C.T. joyfully on its way). No other damage had been done and both ports were to play their role in the enormous increase in tonnage landed with calmer weather: on D + 17 we unloaded 4600 t (mostly petrol) at Port-en-Bessin; by D + 20 the daily landings of the beach-head as a whole had reached 40,000 t.

It was about this time, it seems, that a voice was heard saying 'What price the bloody goons now?'

Appraisal

Whale Pierheads and Floating Bridges. The L.S.T. piers landing tanks etc. directly on to a floating pier were by common consent a huge success (they led directly after the war to the roll-on roll-off

Fig. 10. Whale on L.S.T. pier damaged by drifting barges. *Imperial War Museum*

industry). The stores pierheads with small coasters seemed slow and could have been accelerated. The barge pier (the most westerly) was of great value and received high marks from the staff, particularly with a floating crane capable of lifting very large loads.

The floating bridges, with their large twist, were unprecedented and hugely successful—apart from the losses during towing, surely avoidable. The last I saw of them was in 1962 when six spans still served as a temporary bridge over the River Vilaine at Roche Bernard; now replaced by a suspension bridge.

All elements were vulnerable to cannon-firing aircraft and no provision had been made for rapid temporary repairs. In fact, no strafe so no problem.

Breakwaters. Gooseberries were a great success wherever there was an offshore shoal, as at Omaha, Arromanches and Courseulles. Utah Gooseberry was close inshore and, it seems, only beaching was used. Ouistreham was long under fire and able to contribute little.

Phoenix was inherently sound and successful. One or two howlers in design and construction, remedied in the Ax and Bx series, were not disastrous within the required period. Bombardon, said Col. Gilbert, 'wrote its own epitaph on the walls of Phoenixes'. (He refers to Mulberry A.)

In general, the breakwaters were vital, not only for ensuring the workings of the pierheads but for many supplementary unloading operations and for the shelter they gave to a vast range of small craft.

Unloading on to DUKWs and Rhino Rafts. The DUKWs can be regarded as war-winners. Seaworthy, roadworthy, carrying 2½ t cargo, they made their mark around the world. At Mulberry, it was impressive to see a single cargo net full of ammunition dumped into a DUKW which took it straight away through the tangle of the village to the sorting area up the hill.

The Rhino rafts played a similar role but had to be unloaded at the water's edge—and wait for the next tide. At the peak, these devices were serving nine Liberty ships moored inside the Western Mole at the same time.

Conclusions

Mulberry may be looked at with or without hindsight. Without hindsight, we have the memo of the Combined Chiefs of Staff: 'This project is so vital that it might be described as the crux of the whole operation. It must not fail.'

With hindsight, knowing the unexpected capacity of the beaches and the availability of the two small ports (both dried out at low tide), Mulberry can be examined in two ways: over the whole period and at certain crucial moments.

Over the whole period, it justified itself. According to Eisenhower 'Mulberry exceeded our best hopes.' Average tonnage per day was 6000 t; 10,000 t was attained occasionally and, say some, 12,000 t was within reach but for the bottlenecks ashore.

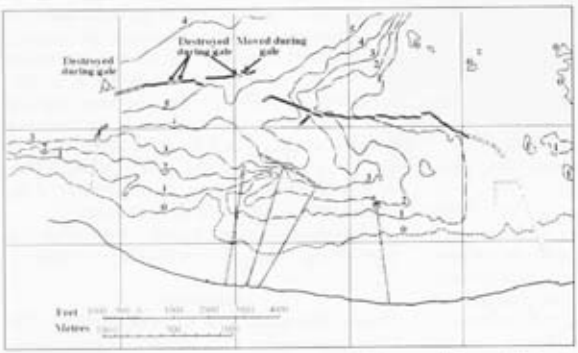


Fig. 11. Plan of Mulberry B showing depth contours in fathoms, with layout of Phoenix just before the gale and development soon after. *Imperial War Museum*

There were two crucial moments, the gale and just after. The 7000 t landed during the gale kept the battle going, but immediately after the gale, when the whole coastline was tightly locked with sunken craft, it would have been dire straits for the invasion were it not for Mulberry.

The psychological factor is important. Men landing, seeing what had been prepared for them, went ashore with heads high. Those in the field were confident that supplies, supplies of anything, were easily available and that wounded would be rapidly evacuated.

Let the last word be French; Jean Merrien, in *Le Livre des Côtes de France* says 'Port Churchill d'Arromanches fut realisé, aux prix d'efforts prodigieux, et tint bon—sans quoi la face du monde aurait pu être changée.' Or, in English, 'Port Churchill at Arromanches was brought to being at the cost of prodigious efforts and held up—without which the face of the world might have been changed.'

Bibliography

References concerning Mulberry, directly or indirectly, are innumerable; the following may be relied upon for technical details: *The Civil Engineer in War*, Vol. 2, (Institution of Civil Engineers, London, 1948); G. Hartcup, *Code Name, Mulberry*, (David & Charles, Newton Abbot, 1977); J. D. Ladd, *Assault from the Sea*, (David & Charles, Newton Abbot, 1976).

In addition, copies of the reminiscences of many of the officers active in Normandy on this operation are held in the libraries of the Institution of Royal Engineers and the Institution of Civil Engineers.

Correspondence

Mr. A. Jespersen, writing from Denmark, stated that some elements of the harbour survived in France after the war. A section also survived (presumably still) as a jetty on the Thames, with the Phoenix Timber Company, Rainham, Essex. The company took in most of their imported timber over this Mulberry jetty to their sawmill. Mr Jespersen had purchased timber there over the years, and had been shown the section.

Worshipful Company of Watermen and Lightermen

Mr A B Gray, Beadle

Lieut Colonel S F Sherry RE | General Sir John Stibbon KCB OBE | Mr P D T Roberts Master | Lieut Colonel C P Cameron MC RM, Clerk | Mr R A Prentice Barge Master

On 19 January 1994 the Chief Royal Engineer, General Sir John Stibbon KCB OBE and the Commanding Officer of 28 Engineer Regiment, Lieut Colonel S F Sherry, attended a ceremony at which our amphibious Sappers were honoured by the granting of a formal affiliation with the Worshipful Company of Watermen and Lightermen.

Worshipful Company of Waterman and Lightermen p65.

Brief Encounter – North Burma 1944

LIEUT COLONEL H W F PATTERSON MA

THE elephant was covered with mud and was advancing across the clearing at what might be described as a brisk trot. Whether he was cross at being disturbed at his ablutions or was just pleased to see us was not immediately clear. My "minder", who had the somewhat ominous name of Mort, decided that the former was probably the case and yelled "get behind that tree", taking similar evasive action behind a large teak. Meanwhile, Jumbo, gathering speed and giving a passable imitation of that Chatanooga Choo Choo, charged between us and disappeared into the forest – happily not to be seen again. We were worried that he might be back, bringing his pals with him.

This "brief encounter" occurred in April 1944, while looking for a suitable supply dropping area for a column operating against the Myikyina railway, the main Japanese lines of communication in north Burma. The clearing was small – only about 150 yards across – but the best that we could find and the drop duly took place two nights later, with a happy sequel.

Came the dawn, when most of the drop had been collected and the loads distributed amongst some 400 men and 60 mules, a number of chutes were seen to be caught in the upper branches of the surrounding teak trees, which were about 200 feet high. The chutes were of different colours, identifying the type of load – rations, ammunition, explosives etc. Most exciting of all was the one indicating the "luxury" drop – bread, bully beef, tinned fruit and rum. The column had to press on but I persuaded the CO to let me remain behind with half a dozen sappers and as many mules to blow the trees down and recover the most valuable loads. We had enough explosives, including some essential "Beehives", to fell several trees and were able to collect six mule loads including, needless to say, that luxury drop. When we eventually rejoined the column, we found ourselves the most popular lads in town, so to speak – especially as there was enough rum for a good tot all round.

The reader may wonder why the Japanese do not feature in this little tale. The answer is that we were in thick forest, some five miles from their lines of communication, away from which they were seldom to be found. I never heard of a case of the Japs following a column into thick forest – a daunting undertaking, even for those fanatical soldiers. They did, of course, react smartly when their communications were attacked and things then tended to get a bit messy. One forgets about that however and remembers Jumbo and the Luxury Drop.

With 4th Indian Division at Cassino

"Batting With Bradman"

MAJOR G V J M SMITH MBE CENG DIPBIA

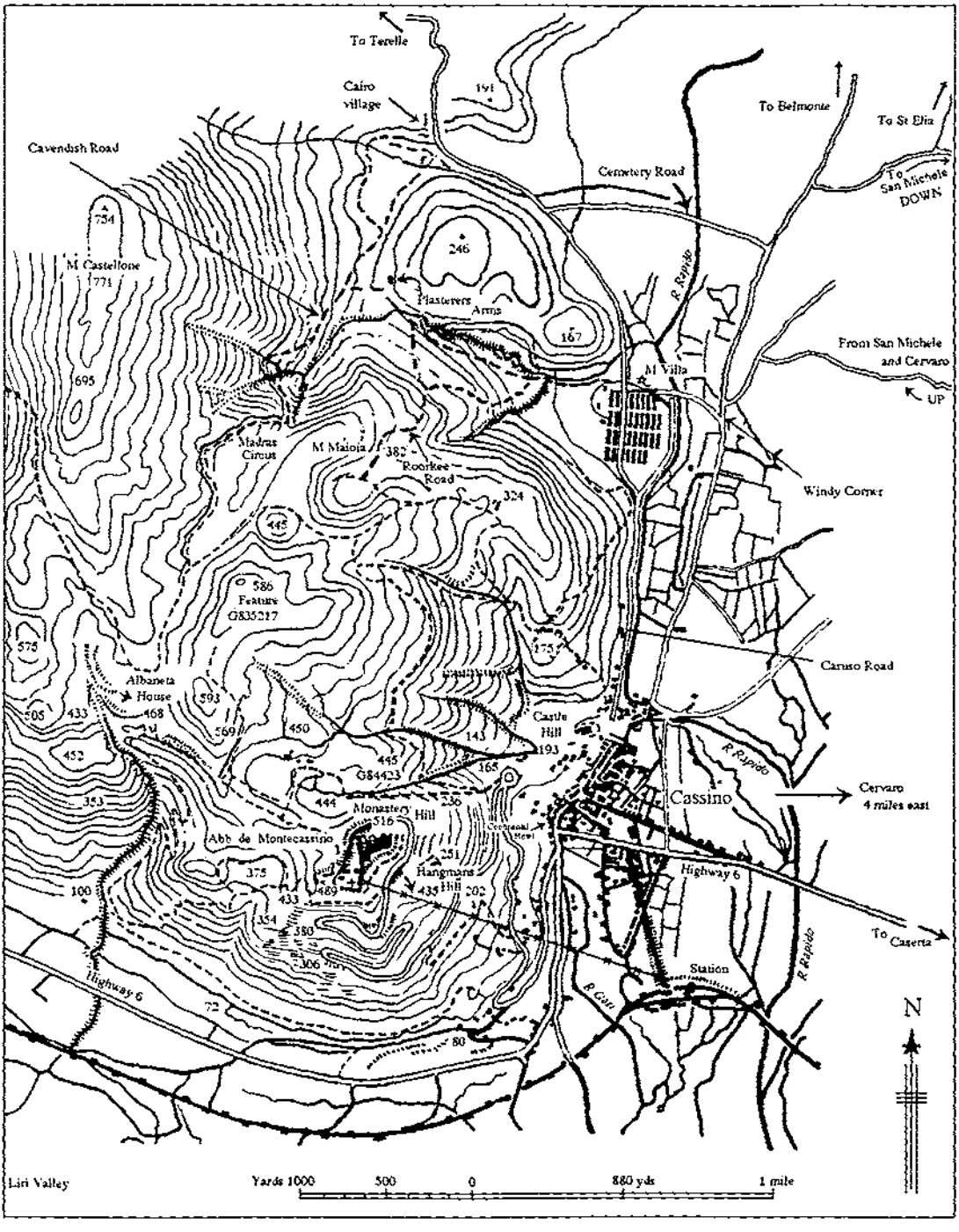
THE SITUATION

EARLY in February 1944, our 4th Indian Division moved from Orsogna on the Eighth Army front, to join the New Zealand Corps under command of Fifth Army. We were intended to break through up Highway 6 after Cassino was taken by 2 US Corps. Their 34th and 36th Divs were across the Rapido River and attacking from high ground northwest of the town. On Tuesday 8 February, I looked at the Benedictine Monastery from Mount Trocchio. Behind it Mount Cairo towered above Mount Castellone's 700m, the 500m monastery ridge, and the Rapido Valley's 50m. Shells were bursting on the slopes around the monastery, as we watched the American 34th Div striving to take the monastery from the west (the rear) and to enter Cassino from the north. Their attack failed and we were ordered to relieve them. On 9 February, General Freyberg, the NZ Corps commander gave 4 Indian Div the tasks of first capturing Point 593 and Monastery Hill, then exploiting south to cut Highway 6 and take Cassino from the west. Many books have described these mainly infantry battles at Cassino in the first quarter of 1944. This article concentrates on the work of Indian Sappers and Miners in support of their division during February and March.

The engineer support to our division was directed by the CRE, Lieut Colonel E E Stenhouse DSO. Although always addressed as "Sir", he was affectionately known to his officers as "Ned". His Adjutant was Captain Donald Orchard, Lieutenant Pat Minet his Intelligence Officer, Lieutenant Nelson Trayler and I were his Field Engineers. Our interpreter and "odd-job" man was Ben Friedman, a Palestinian known as "Freddy". After receiving orders on 9 February, Ned sent Donald, Nelson and Freddy to scour Naples for books about the monastery. Their research and Ned's advice led our GOC to advise that the monastery was a fortress whose walls could not be breached by his engineers. General Tuker recommended heavy bombing if it had to be assaulted, but preferred an attack aimed at cutting across Highway 6 well west of Cassino – a right hook with the French Corps. Our division moved forward. Ned sent me out on Sunday 13 February to contact 36th US Div on our right and inspect the roads and tracks forward of Cervaro. They were all very muddy with poor drainage and required my jeep's 4-wheel drive in many places. 2 US Corps had cleared gaps in the minefields and developed separate "up" and "down" routes to avoid passing problems. Unfortunately, shellfire made the river crossings safe only for single vehicles in daylight and earned the names of "Windy Corner", "Cemetery Road" and "Plasterers' Arms" for certain locations. By then our 7th Brigade had relieved the 34th US Div on Snakeshead Ridge, from Mt Maiola past Point 593 to Point 450 behind the monastery. Some 50 exhausted men of the 168 US Regiment were carried on stretchers two miles down to Cairo village before dawn.

OUR FIRST ASSAULT

ON the 14th, I drove Ned across the Rapido. At 7 Bde's Tactical HQ, Brigadier Lovett asked that we provide mule tracks, one up Maiola for 5 Bde and one for 7 Bde up the lower slopes of Castellone. The next morning first 12 Field Company IE, and then 4 Fd Coy IE, debussed and moved forward. Surprisingly, both companies were able to march across the Rapido with little interference from shelling. The normal company 2-wheel drive trucks were useless on the tracks forward, but we borrowed 6-wheel trucks from the American engineers to carry the essential stores. Terry Guilbride of 4 Fd Coy told me that when his truck came under shellfire, the driver said "Uncle Sam can get a new truck but he can't get a new me, good-bye." The driver took off. 21 Fd Coy IE moved over the Rapido on 16 February, relieved 12 Fd Coy for portering and worked on the mule track on Castellone. 4 Fd Coy worked on the other track and both were completed on the 19th. At the same time, they worked on our supply routes to Cassino. The maintenance required three



Map of area covered by article.

platoons, one from each company until we withdrew. In a typical understatement, Terry commented "We tried to do maintenance on the zigzag section of the San Michele Road across the Rapido and up to the Barracks. It was difficult as this had to be done at night with masses

of mule trains going up and then coming back. I used to go down and recce in daylight to see what was needed and where – quite scary!" Despite their difficulties, my diary records on the 19th, "the up route had been well patched with gravel on sapling paling, not yet sufficient but the track now takes 2-wheel drive." This was an optimistic forecast as shell damage plus torrential rains on the 23rd and 25th soon stopped those vehicles.

The NZ Corps' first assault was no more than a continuation of the 2 US Corps' attack and no more successful. It began with the bombing of the Benedictine monastery on a bright cold Tuesday – 15 February. Four days later it ended when 4 Indian Div's attack from the west of the monastery was halted and 2 NZ Div was driven back to the east from the Cassino railway station. The bombing took place without the forward brigades knowing the timing until the first bombs fell. They were not ready to attack and surprise was lost. To avoid any similar lack of communication from Army HQ, the signal for the next bombing was to be "Bradman will bat ..." There was to be a change of pitch. The NZ Corps planned to make their second assault on 24 February after the remnants of 36th US Div had been relieved on Castellone by 3 Algerian Div. 7 Indian Bde would remain on the ridge to the west. This time 6 NZ Bde and 5 Indian Bde would attack from the north after heavy bombing of the town.

Waiting For Bradman

Stormy weather delayed further bombing and gave us time to think and to work. Our mule trains were being decimated on the six-mile trek to the front. When our division's five-battalion assault on the 18th required over 700 men of other units to be employed as porters and stretcher bearers, Ned appreciated that there had to be a better way. Early on Saturday 19th, he ordered that both mule tracks be converted to jeep tracks – a jeep and trailer could carry an infantry section or many mule loads. Route changes and widening started on Sunday 20 February with two platoons of 4 Fd Coy on "Roorkee Road" up Maiola and four platoons of 12 and 21 on the longer Cavendish Road on Castellone. We were able to move two D4 dozers over the Rapido on Monday night. Both roads were fit for jeeps within that week despite work being stopped by shelling and the roads being damaged by heavy rain.

21 Coy seemed to suffer more shelling than most. Being last to arrive they had the "leftover" location near the Plasterers Arms and often preferred to go out before light and return after dark from work. My diary records items daily like "watched ammo dump hit and 12 Coy jeep" – "greeted with shelling, some damage on Roorkee Road but no casualties." "21 Coy were receiving a mortar stonk – so visited 12 Coy, got a pasting from shells but only the jeep was holed in places." 4 Coy found an ex-German dugout. It saved having to dive for cover with tea in hand. Terry reports, "one evening we heard the sound of cans being washed down the gully alongside. Nial tore out because, to protect himself from shelling he had put his bed under what had been a very dry cliff and which now was a waterfall! His stuff was strewn downstream as was a lot of the company stores which we had dug into the bank for safety. We were not popular with HQ as we tried to explain the loss of stores especially "controlled items."

More bad weather gave time to provide a surprise. I believe that Ned and Brigadier Lovett conceived the plan to send tanks up Cavendish Road onto the ridge west of the monastery. On 22 February Ned sent me from 7 Bde Tac HQ to look for an exit at the top of Castellone gully. On my way there, below Point 593 and around Snakeshead Ridge, I saw many German and American dead. Two days later, I saw even more when looking for the best exit. On Saturday 26th I went to Corps HQ and arranged for NZ tank officers to visit Cavendish Road. Ned issued orders at 12 Coy HQ, across the Rapido on the 29th (it was a Leap Year) to widen that jeep road and extend it to Cairo along an existing farm track. The 1800m extension required little work. The remaining 1700m rose 250m and could be bulldozed except at large rock outcrops about halfway up and at the top. On 1 March we began to widen Cavendish Road from 8ft on cut and fill to 12ft on solid cut. 30-ton tanks would soon push retaining walls down. At the top a new alignment was chosen to avoid a hairpin bend. Two platoons were employed from each company (the others being on road maintenance) together with divisional mechanical equipment. Four platoons and Morris compressors dealt with the large rock outcrops, while two platoons, two D4s and one D7 tackled the rest. After the D7 sheared its blade off on 3 March, the Chief Engineer sent over two D6s each with a trailer compressor operated by a

D6 working on widening Cavendish Road for tanks, looking south to Snakeshead ridge.

section of 6 NZ Fd Coy. This combination proved ideal for the long stretches of loose shale and boulders with intermittent rock outcrops. Drilling boreholes did not really start until the 6th because it was found that until a solid face was obtained, it was quicker to use crowbars, picks, Bailey jacks and charges judiciously placed by hand. Mortar stonks were a daily feature. It was impossible to dig slit trenches, but one got to know the likely timings and the gullies provided refuge. Somehow casualties were light although one visiting NZ captain was killed on the 6th. Night work was difficult. One compressor truck was driven over the edge in the dark. Low cloud and mist had helped them to cross the Rapido in daylight. By watching progress on each section and switching men and machines, all sections were completed by mid-day on Saturday 11 March.

On 29 February, the Rapido burst its bank at St Elia, three miles upstream of the up route crossing to Villa Barracks, requiring considerable work on cross-drains and rebuilding roads. Both the Free French in St Elia and 7 NZ Fd Coy were able to help with face shovel loading of trucks and spreading stone from 2 March. On 7 March, water still lay on the roads in front of St Elia and the Rapido ford there was impassable. Further crossing routes were investigated. On Monday 13, the weather had improved and crossing routes were drying out – just in time for Bradman!

Sunday was a day of rest for many after almost nonstop labour from their arrival on 15 February. It was a bright day for a change. Ned and Nelson journeyed to Caserta for baths. I spent it in our Cervaro Mess writing up a report on the tank road and in the evening, Donald and I had an "intense" discussion on trade unions and electoral reform.

About the same time, back over the Rapido in 4 Fd Coy's Officers Mess "dugout", Gus Murray had a birthday. To help him celebrate the others gave him their rum ration. It was not long before he was helpless and asleep so they pushed him under the lower bunk to get him out of the way in the confined space. Then all went to bed – Bill had a wooden frame camp bed which he put up, Nial slept outside, Terry on the floor and Colin was on the bunk. In the middle of the night, Gus woke up and wondered where he was. He felt about – above was wood, left was wood, the ends were wood and as luck would have it when he felt to the right he hit Bill's bed, again wood. So he thought "Good God, I must be in my coffin!"

Batting with Bradman in the March Assault

My diary for 14 March records "a glorious day, no bombing but ideal weather, I'll bet the front line troops are cursing the delay." For 24 days we have been losing 50 men per day over the Rapido from sniper, mortar and shellfire. Then Ned received the message "Bradman will bat tomorrow." 4 Fd Coy would support our 5 Bde in the assault. 12 Fd Coy would support 7 Bde. A clear blue sky and hard ground gave the ideal conditions on the 15th. From an observation post 300m in front of our HQ we watched the bombs sailing down over our heads to drop on Cassino town; twice the tonnage dropped a month before on the monastery. At mid-day, we watched the NZ tanks and infantry go into the town; later our 1/4 Essex Bn followed to relieve them on Castle Hill. That night Lieutenant Murray of 4 Fd Coy went forward with Sergeant Morris of 19 NZ Tank Regt to determine the work required to get tanks up the zigzag road to the monastery. It rained heavily that night. Ned and I went forward in the morning to 5 Bde Tac HQ and on into

With 4th Indian Div at Cassino (p70)

Cassino to find 4 Fd Coy. Sniping by light machine gun was too effective to be comfortable but one friend complimented the nifty footwork with which we avoided that sniping and some "88" shells. Gus was missing but turned up later to tell us how he escaped.

As dawn came during their reconnaissance, they found themselves below some German positions and moved down into the town to shelter in cellars from our artillery fire. Sergeant Morris was shot dead by a German. Gus shot the German and tried to grab another as a shield but had to shoot him when he shouted. Then he surprised some enemy, peeling spuds. By the time they got their rifles, Gus was up and running. Again, he was fortunate as a Ghurka officer saw what was happening and got his men to give covering fire.

He was lucky to escape. Previously he had forgotten his revolver bullets but Bill Gerry of A Platoon had given him some before he left. Bill told me "Gus made his way back at dawn and quite by chance found our position halfway up Castle Hill. During the day a mortar bomb brought a heap of rubble crashing down on Gus injuring his legs. Being Gus, he carried on. After taking about 16 casualties, we managed to thin out our numbers by sending small groups down the hill carrying stretcher cases. Happily the Germans did not fire on stretcher bearers." Compare that version with Terry's, "I remember standing in the town looking up at houses on the approach to the Castle. Bill was backing out of a house carrying one end of a stretcher. At that moment I thought 'that is an extremely brave thing to do. The Germans have the place under observation and could pick him off with ease. It is just like him to go first.' "

During the 16th, A Platoon's position was attacked and Bill was hit in the knee by a splinter from a rifle grenade. He thought little of it and like Gus, he carried on for almost another week. They were both awarded the MC.

On the 17th, I took stores forward for a cable way but it was not feasible. By this time a company of 1/9 Ghurkas had reached Hangman's Hill and 4 Fd Coy started night work as porters. Terry described this as a nightmare involving a considerable cavalcade going up. They did a great job taking ammo and rations up and they brought back ten wounded on stretchers by daylight on the 18th. They portered the next two nights and had to "stand to" twice by day on the 19th, when German Sappers were used to attack the Castle with explosives.

At 0600hrs on 19 March, some 43 Sherman, Stuart and Honey tanks moved up Cavendish Road. They shot up German positions on the ridge. The Shermans had to withdraw when they could not negotiate steep going but the light tanks pushed on. Back in Cervaro, we heard that an intercepted enemy signal said, "Enemy tanks through main defences and infantry attack expected." 12 Coy had moved up in support but no infantry unit was available. On the 20th, I found 12 Coy back below Maiola. They reported that now there were plenty of antipersonnel mines and some Tellers near Albaneta House. That night 2/7 Ghurka failed to take Point 444 northwest of the monastery but they might have succeeded in support of the tanks on the 19th. The enemy captured Point 165 on the monastery road and stopped our counterattack with "S" mines. Ned and I got a warm reception beyond San Michele on the 21st and had to jump a 4ft crater at speed. We found 4 Fd Coy in good spirits after a night's rest. Ned ordered them to improve our defences. Terry describes events that night.

"Bill's A Platoon laid wire and mines in the gully below the Castle, and B Platoon, on the forward slope of Point 175. Bill's *Jemadar* Abdul Sadiq was wounded badly. Colin Fraser sent me to get him back. The sapper who had been with him could not remember the way in the dark so we returned. As soon as it was light, I went back picked up a stretcher and a Red Cross flag (after leaving my pistol at the First Aid Station) and went to look for the *Jemadar* with some of his platoon. That whole area was under close observation, so we brandished the Red Cross flag and prayed the Germans would not fire! We found him and got him out. It is possible we brought back some of the dead too. Abdul Sadiq told us later that just before we arrived, a German doctor had come and wanted to take him to their base but he told him 'No, my people will be coming for me'."

Their native languages were Urdu and German but they communicated in English and I wondered "Will that be the common language tomorrow?"

Bill and Gus were sent to hospital on the 22nd. Norman Needham their 2IC was also wounded in Cassino. Ned was really angry as Norman should have been back behind Cervaro with 4 Coy's B Echelon to ensure that their needs were met. Ned went forward and took Nelson to join 4 Fd Coy that morning. I wrote up the recce book and stayed in Cervaro to greet CRE 6 Armoured Div. As he arrived, we

were dive-bombed with a "string" across the back. One bomb hit the langar (cookhouse) where 13 *Jawans* were having their morning meal. What a shambles, "no stretchers!" I went down, got the lightly wounded out and sent them off in jeeps with Pat. Donald did first aid until the ambulance came. I went out in the afternoon with Ned to NZ Div and 78 Div HQ to clarify the situation. The 23rd was a miserable day with sleet, bad news and shelling to end the day. Infantry failed to retake Point 165 which controlled the route from the Castle to the Ghurkas on Hangman's Hill. Ned was anxious to ensure our defences were improved. I drove out with him next morning to find that the companies had worked through the night on defences. At some stage, Nelson was wounded. 4 Fd Coy was again short of officers and their A Platoon was down to one *Naik* (corporal) and eight sappers. On Saturday 25 March, I drove out to get 4 Fd Coy out but 5 Bde agreed only after much argument. They insisted on two field companies for portering. Ned arrived with CRE 78 Div. They were to relieve us. I went back in a 12 Coy jeep as mine had two flats from shelling. We joined a jeep queue on Cemetery Road where a dud landed three yards ahead, and received more parting shots at the Rapido. 4 Fd Coy spent the night in San Michele. On Sunday morning after his first sleep in a bed for weeks, Terry turned on the radio and enjoyed the glorious music of the Orpheus Choir singing "Jesus Joy of Man's Desiring." That morning I drove out to arrange 12 and 21 Company's return and take my jeep back to Cervaro.

We moved out early on 27 March. I drove my jeep without brakes, arrived safely in the harbour but turned it over on a hill there. I went on to Caserta with Donald and had lunch with Colin Cowan in Allied Forces HQ. We visited Bill, Gus and Norman in hospital, Norman was not too well. Next day, after a long sleep, I moved to 4 Fd Coy to take Norman's place and spent the day making out stores replacement lists. By 5 April, we had re-equipped and moved to train in the Benevento area. Bill, Gus and Norman rejoined and I returned to HQ.

The Scorebook

On 8 February, as I watched the action on Monastery Hill, I remember thinking that it would be crazy for infantry to attack in daylight up slopes too steep for tanks. Later I learned that this was exactly what the Free French were asked to do – and did. An Algerian regiment of three battalions made a surprise morning attack on 25 January and fought continuously for a week to take the Abate massif (770–915m) six miles north of Cassino. They were relieved on 3 February after losing over 60 per cent of the infantry employed. It was an incredible ten-day effort. By the time we relieved the American 34th Div, they had lost 50 per cent of their infantry as estimated by John Ellis in his "Cassino, a Hollow Victory." In the last week of January, they had built tank crossings over the Rapido, established a bridgehead and taken Cairo village. During the first week of February they took the high points 586 above Maiola and 771 on Mount Castellone. After 20 days, they were exhausted but the dead I saw behind Point 593 were a testimony to their determination. Majdalany describes the 34th's performance as one of the finest of the war.

Ellis also reports that our division lost about 40 per cent of the infantry used during the six weeks covering our first and second assaults. The German 90th Panzer Grenadiers and 1st Parachute Divs showed their fighting skill in repelling these onslaughts. It is ironical that the latter division, after repelling our attacks at Orsogna should have moved to stop us at Cassino.

Forty years later, I saw the "final scoreboard" as represented by the cemeteries surrounding Cassino, clockwise from the Free French in the north, past the British, the American and the German to the Polish in the west. In that time Roorkee Road had been used to plant our battle area in forest.

Acknowledgments

I would like to acknowledge the assistance of Captains D S Orchard ARICS, W A G Gerrie MC ARICS and F T L Guilbride, who provided anecdotes included in this story.

References

1. "Fourth Indian Division" (Chapters 22, 23 and 24) by Lt Col G R Stevens OBE. Published 1948 by McLaren & Sons Ltd, Toronto, Canada.
2. "Cassino" by Fred Majdalany. Published 1957 by Longman, Green & Co, London.
3. "Monte Cassino – A German View" by Rudolf Bohmler as translated by Lt Col R H Stevens in 1964 from the German original of 1956 (R Bohmler commanded a combat team at Cassino).
4. "Cassino – the Hollow Victory" by John Ellis published 1984 by Andre Deutsch, London.

The Tunnel – a Feasibility Study, 1967-71

BRIGADIER J CONSTANT

Brigadier John Constant, MA EurIng CEng, FICE, FIMechE, MIEE and, until recently, FCIT, FCIArb, FIQ, FInstD, a prewar regular RE officer, spent his early years at regimental duty in armoured divisions in the desert, before becoming an Indian infantry brigade major in the Burma jungle. Subsequent postings at each level, both on the Staff and in command, led him to raise an Arab regiment in Jordan, to be successively MI 1 Colonel in the War Office, the last Chief Engineer of Middle East Land Forces, Commandant of the Defence NBC Centre and Commander of the Engineer Support Group.

Introduction

With Eurotunnel due to have its official opening in May 1994, readers of the RE *Journal* may be interested to know that the Corps has lived up to its motto "Ubique" by some of its members taking part in the tunnel's early planning stages.

Background

When I left the Shop in 1935 to be commissioned into the Corps, I gave little thought to the future and, if I had done so, it would never have occurred to me that I might have such a variety of appointments as I did during, and after, my military service.

Ever since that time, I have been envious of brother officers, who seemed so effortlessly to climb the tree of promotion, filling jobs they obviously understood. My progress, in contrast, seems to have staggered from one "early learning curve" to another, such as the sudden transition from the command of an Arab regiment in the Jordan desert to a desk in Whitehall, trying to organize the multifarious facets of military intelligence worldwide. Other changes were just as surprising and none more so than the day I was offered the chance to undertake the feasibility study of a "Fixed Link" between Britain and France.

I was given little time to make up my mind, as Mrs Barbara Castle, then Minister of Transport in Mr Wilson's administration, was deeply concerned by the very active way in which Monsieur Pisani, her French opposite number, was seeking her agreement to what amounted to the extension of the French Railways (SNCF) under the Straits of Dover to Folkestone, or even deeper into Kent. British Rail (BR) was equally keen, though demanding a fair share of the cake.

Our Prime Minister, Harold Wilson, was adamant that the costs of the project, if undertaken, should not fall on the British taxpayer, and there were already three groupings of British and French banks, one with some US interest too, vying with one another for a concession to finance the construction of just such a project.

The French Government was supporting the concept of the SNCF hierarchy in pursuit of a rail tunnel, and both had good reasons for assuming that one could be bored through the stratum of chalk believed to lie continuously beneath the English Channel. They had appointed one of their senior treasury officials to watch over the political, diplomatic, legal and financial aspects, but much of the urgency emanated from the economic decline of the most northerly part of France – the Pas de Calais – for which the senator was Madame de Gaulle's brother, a delightful character, with direct access to the great general himself.

On the British side, within the Ministry, the railway inspectors, led by Denis McMullen,

Brig J Constant
The Tunnel - a feasibility study (p73)

themselves retired Sapper officers, were keeping an eye on the matter as and when they could spare the time from their real task of railway safety.

Consultants had been appointed to forecast the levels of traffic thought likely to use such a fixed link in the decades ahead, and hence to consider its commercial viability.

On the British side there was, especially at that time, little if any political enthusiasm for the whole idea, and deep suspicion of the French motives. Here BR did not enjoy such general esteem as the SNCF did in Paris, and our road interests seemed to resent any progress in railway development – they wanted more motorways – and vociferously demanded that if there was to be a fixed link, it should be designed for road vehicles to be driven across; of course the Seamen's Union and the ferry companies preferred the status quo. I frequently encountered traditional British thought abhorring the idea of our blessed island being joined in any way to the Continent – with all that word implied!

Starting Up

Some 34 years after first putting on my khaki uniform at the Shop and barely aware of the political and commercial background, I fell for the opportunity offered by the Transport Minister and sent in my papers to the War Office. Impressed by the apparent urgency, I waived my resettlement course and my terminal leave, and set up "my" new division "Channel Tunnel Engineering", in the Ministry of Transport. My team consisted of a handful of civil servants, including Ted Glover who had done his National Service in the Corps, and several part-time specialists.

The name of my division was itself somewhat surprising, as our task was manifestly to investigate every option for a fixed link, whether tunnel or bridge or any other solution. Most of my friends thought that I had sacrificed my last four years of comfortable Army life for the lure of a "wild goose chase."

Reading myself into the project, I found that the thinking about such a link had been going on since Napoleon's day, and at the peak of Victorian self-confidence a Sapper, Captain Beaumont, when Garrison Engineer of Dover Castle, had invented a tunnelling machine, which he later built after his retirement as a colonel, and had started to bore a Channel Tunnel under Shakespeare Cliff there. His sponsor, the Channel Tunnel Company, I discovered, was still in existence in 1967, by then under the Chairmanship of Leo d'Erlanger, a delightful Edwardian, who kindly entertained my wife, Jay, and me to dinner at his elegant Mayfair house, with the Duchess of Devonshire (one of the famous Mitford girls) acting as hostess.

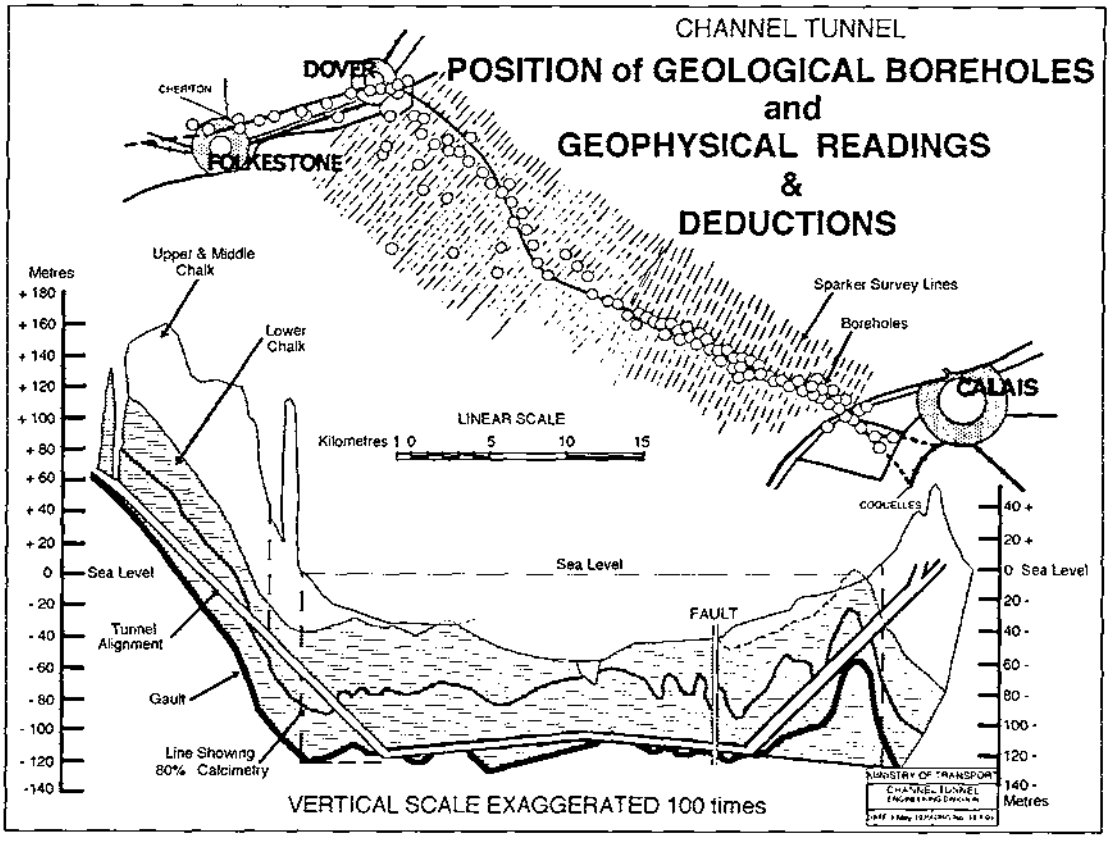
Other entrepreneurs had had similar ideas and Whitaker's machine still lay abandoned in the chalk from the 1920s . There was a great history on the subject to be absorbed, though most cogent was the analysis of the geological investigation just completed as I arrived.

In my ignorance a few months earlier, when sailing my yacht up Channel, I had passed what I took to be an oil rig, and I now learnt its true purpose. Over a hundred boreholes had been drilled right across the Channel, as well as some on both shores and inland; all the cores were neatly stored, half in Dover and half in Calais; the latter in what the French described as a *carottotecque*.

Sir Harold Harding, at that time probably the most eminent tunnelling consultant in the world, was examining these cores, and he confirmed that there appeared to be a continuous band of chalk marl going right across from one side to the other, between 30 and 50 metres beneath the seabed, the sea itself no more than 50-60 metres deep. Since this stratum was almost perfect for mechanical boring, one could believe that the Almighty had intended its use for a bored tunnel, which at its deepest would not be as much as 100m below sea level and could be worked without compressed air.

Our consulting engineers all agreed that however carefully bored tunnels were to be lined, there would remain the probability of some water seeping in, so that drainage would be essential, quite apart from the possibility of a disaster, even sabotage, creating a flood. It was therefore proposed that the line to be followed should be such that the chalk marl stratum would be exploited to give a W-shaped vertical profile to the whole tunnel. In that way the drainage system under the middle of the Channel would flow towards the coasts, near which the lowest points would harbour capacious sumps, with powerful pumps discharging up to the coastal shafts.

The sight of all the geological activity in the Channel, and a general awareness of the various proposals on hand, had led to exaggerated rumours about the effects on Kent of any fixed link. The county authorities had quite correctly placed a "blight" on any development, which could inhibit the construction of such railway lines and motorways as might be required. Almost before I had grasped the essentials, my political masters pressed me to resolve all these planning implications.



The results of the 1964-65 survey of the Channel have been recorded in graphical form. The bored tunnel will be almost entirely within the lower chalk and close to the stratum of the lower chalk with a calcimetry of 80 per cent – the ideal material for tunnelling. The longitudinal section of the tunnel will be in the form of a flat "W" with the highest point in mid-Channel and gradients of 1:1000 to the low points and 1:100 to the portals. Drainage tunnels and shafts will be used to drain water from the low points.

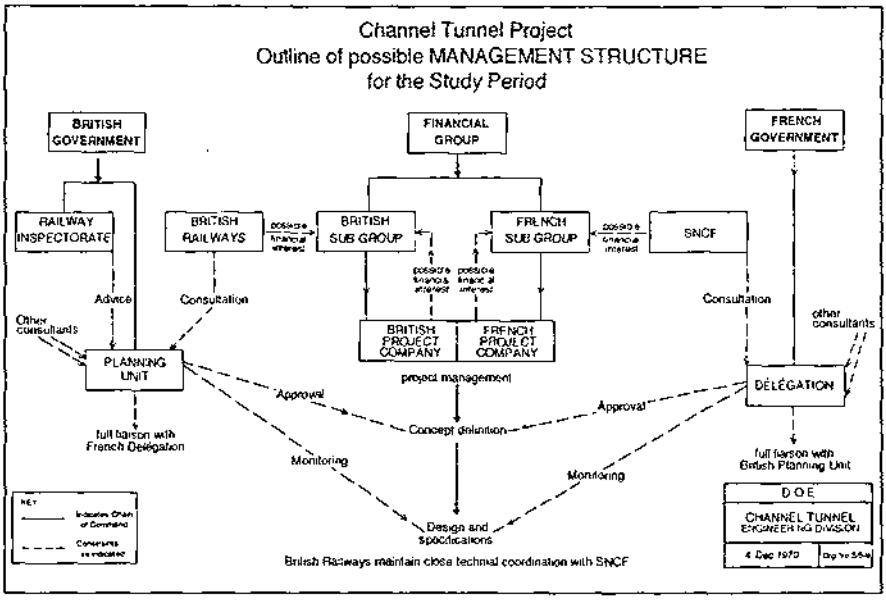
At the time I joined, the Ministry was moving office from Southwark to Pimlico, where it is still situated, and we were fortunate in obtaining agreement that the work on the fixed link could take place separately in Church House nearby, where my division and our opposite number "Channel Tunnel Administration" (CTA) could be set up.

Whilst my division was to handle all physical, defence, health and safety aspects of the work, CTA looked into the political, diplomatic, legal and non-material matters, and we shared the finance and commercial forecasts. Of course, the work of both sections was very closely entwined and we were allotted good offices on the top floor, with wonderful views over the roofs of Westminster. I took a pied-à-terre close by, so that I could avoid daily commuting, going home only at weekends.

During the first few months I found it difficult to be sure of the extent of my task, as it was clear that, if the project was to go ahead, the financiers awarded the concession by the two governments would appoint their own engineers to do the design and specification of every aspect.

The Task as it Evolved

My masters must have wished to keep the role of my division as flexible as possible, so that it could be given any task that came up; I was urged to go through all the physical information, accumulated from every imaginable source, and to sort it out into a cohesive entity from which outline Reference Designs could be agreed by all the parties involved. These included many departments both in the British and in the French governments, as well as the local governments planning departments on both sides of the Channel, but especially in the SNCF and in BR, where my day to day contact was Jim Manson, himself a wartime Sapper officer; his patience and charm were major factors in the study's smooth running. Where convincing



conclusions could not then be made, we were to get the necessary researches undertaken, so that our minister could be assured of the feasibility of whatever option we were recommending. In practice, our political masters wanted to be able to give faultless answers to whatever parliamentary questions might be posed!

Gradually the political, commercial and environmental backgrounds became clearer; with the decline of Empire trading, British commerce was increasingly concentrated onto targets in continental Europe, but the cost of passing British imports and export freight through the docks on both ends of the short sea routes was too expensive for competitive trading, whether by traditional transshipment or by roll-on roll-off trucking.

An essential element in the proposed fixed link's freight service was the concept, already established in Britain but not then in France, of assembling a complete trainload of ISO (International Standards Organization) containers at a suitable base, all with the same destination, so that a close-coupled "freightliner" train could travel to its destination without any marshalling on the way. With this in mind, I took a party of French officials on the Manchester express, to see the container base there, and to discuss electronic methods of tagging each container so that its exact contents could be "read", if necessary on the move, as it passed appropriate checkpoints. Although the French party expressed interest in the container idea, regretting that they had not thought of it first, their main concentration appeared to centre on the good English breakfast in the dining car; a meal they had never previously encountered.

The European Rail Network

Taking soundings fairly widely, I visited the Chambers of Commerce in Liverpool and Glasgow, to hear their opinions of the potential trade they might enjoy by using the fixed link to carry such trains from their ocean-docks right through to central Europe, without the delays of shunting in marshalling yards. They acknowledged that the economic benefit to the nation of such a railway system would be too valuable to miss and so expressions like "Manchester to Milan" and "Birmingham to Budapest" came to the tongue, voicing deeply felt emotion.

The long wall of our new conference room was soon covered with maps from the Atlantic to the Urals, showing the continuity of the standard track gauge all the way to Brest-Litovsk but, to my surprise, excepting the Spanish railways.

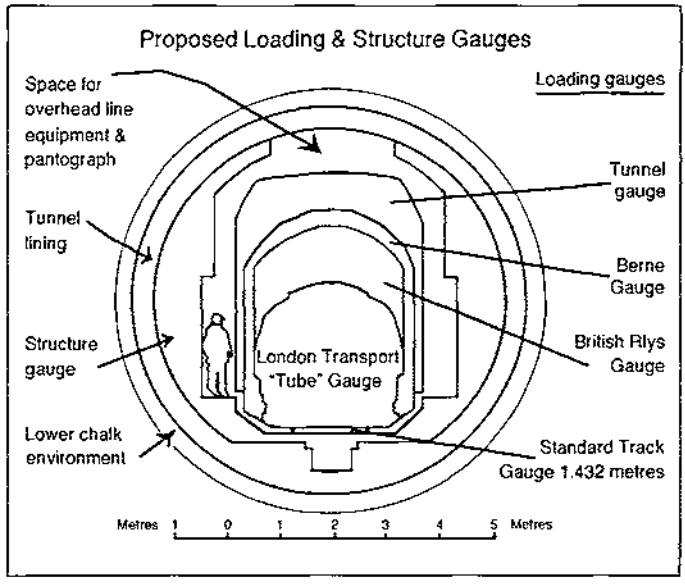
Structure Gauge

I became aware that "Berne-gauge", used on the Continent, referred to the structural size of the rolling stock able to pass through the bridges and tunnels, and of the consequential limitations that continental trains would find, if the SNCF was to be extended through to Britain. However, it was mooted that the rolling stock dedicated to the fixed link might have an even bigger size, both for commercial and for defence reasons, if such a big link could be built economically.

Traction

Whatever the gauge, there was also the mode of traction to be decided, since SNCF would in any case be extending their 25kV AC overhead system up to Calais, whilst our southern region used third-rail 750V DC, and there were other electrical

standards elsewhere. Diesel traction was not considered to be suitable, except for a handful of shunting locomotives to be used in emergencies only, and for specially designed service and maintenance vehicles.



Loading and structure gauges. This diagram illustrates the size of trains that will use the tunnel. The tunnel gauge is compared with: Berne gauge, BR gauge, LT "tube" gauge. Also shown is the structure gauge with clearance between it and the loading gauges.

Passenger Trains

Our studies also had to take into account the proposal that, if there was to be a fixed link to provide through trains for freight, it should also be available for the movement of passengers "on the hoof", since their travelling by air was thought to be uneconomical in both time and cost, when the distances flown were to be less than about 1000km. The increases in such movement between London and Paris/Brussels were predicted, by the end of this century, so to overload the various London airports, that the requirement for a through passenger train service became equally pressing. If and when such a service became available, it was thought likely that a good proportion of the passengers from further afield could be expected to use the same passenger train services, with a corresponding reduction of load at provincial airports on both sides of the Channel.

Both the freight and the passenger trains would be permanently coupled, unless under repair, so there would be no additional shunting or sidings necessary for the fixed link on the British side of the water. With modern safety standards and signalling, it was seen to be possible, even essential for true economy, to utilize the permanent way of a fixed link to the fullest extent and, in so far as the market would bear it, trains should be as frequent as possible and as long as could be handled by the locomotives. Our railway advisers indicated that the freightliners could be as much as 1km in length, and that most of them could be passed through the link at times when its other traffic was not intense.

A question to be carefully studied was whether a single tunnel or bridge was a practicable operation, even temporarily, but this idea was soon discarded.

Three Tunnels

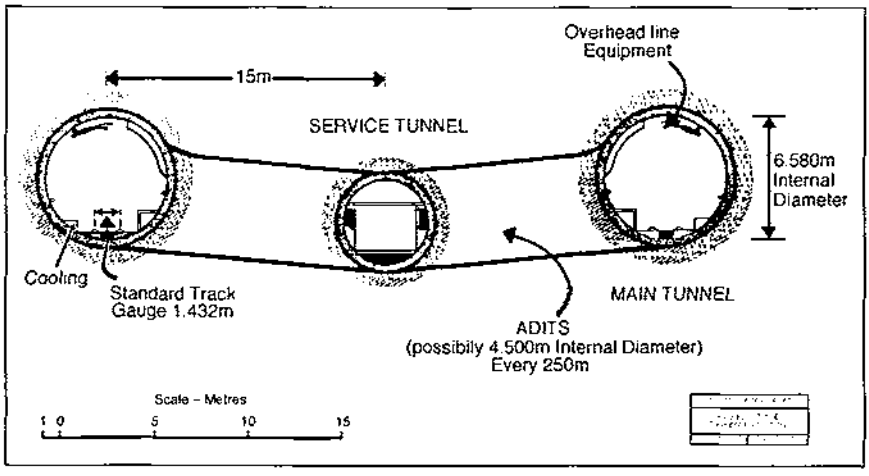
With the width of the Channel at its least, plus the essential connections to road and rail on each shore, the link was unlikely to be less than about 50km long, for which single line operation would be neither efficient nor safe. It was concluded that a railway line in each direction was essential and that a minimum of two crossovers would be required, so that reasonable "possessions" for maintenance could be accorded.

In addition, a third path would be required for services, maintenance vehicles and, in case of breakdown, fire or other disorder, for safety purposes. Since the safest cross section for a tunnel in the chalk is circular, it would not be practicable to put both the lines and the service path into one big tunnel, as its height would, in many places exceed the depth of the preferred stratum, and any derailment or sabotage would block the whole operation.

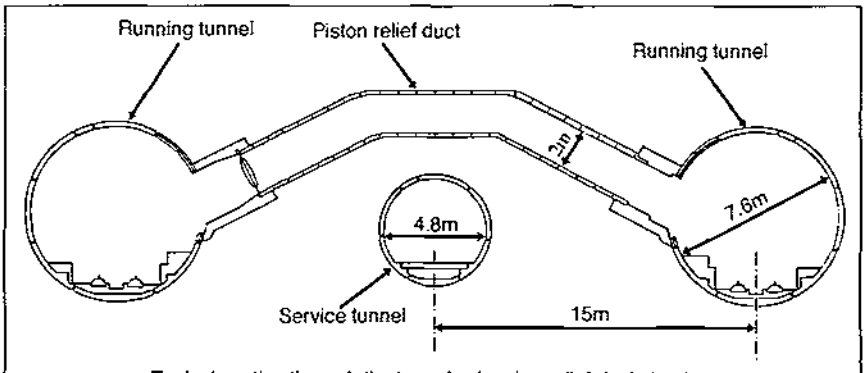
Two separate running tunnels with a third (smaller) service tunnel were therefore, preferred. This need for separation was acknowledged as being a major disadvantage for any railway bridge solution, as damage of any sort would almost certainly affect all three paths and thereby hinder the efforts to clear the lines.

Speed

Nevertheless, during the early part of our studies we kept all the options, including bridges, open for consideration. For commercial appeal, it was agreed



A pair of running tunnels (one each way) would be linked by cross-adits to a service tunnel, usually between them, but which could be displaced when necessary eg at crossovers or at portals. As the operators demanded higher train speeds in the running tunnels, separate blast passages at frequent intervals were recommended, both for safety and to relieve the "piston" effect. The lower drawing shows how these have



Typical section through the tunnels showing relief duct structure

that the speed of the passenger trains using the link must be such that the whole journey from the centre of London to the centre of Paris/Brussels would not take longer than the corresponding aircraft passage; this assumption was made in the belief that both BR and SNCF would improve their connections to the link to achieve this high standard.

In considering such speeds, there would have been some aerodynamic advantage in a bridge solution, if the trains could have travelled in the open air, unconfined; however, the strong winds experienced in the Straits of Dover, blowing roughly at right angles to the line of a bridge, would have necessitated substantial baffles, or more probably complete enclosure, so that any possible advantage would be nullified.

In a confined tube, whether tunnel or enclosed bridge, a train will push a column of air ahead of it; if the tube is much bigger than the train, a good proportion of this air may slip by, but that would involve making the tube much bigger than otherwise necessary, so the most economical compromise would have to balance between excessive excavation for the tube versus the excess of power required to overcome the resistance of this "piston" of air. The faster the train, the more power would be required, and this in turn would lead to the temperature being raised so that the air in the tube would require refrigeration, inevitably another cost to be balanced against a bigger tunnel.

Whilst this problem could be alleviated by operating the freight trains at slower speeds, the inclusion of passenger trains in the same service made it essential that all trains move one after another at the same speed. The minimum safe interval between them is dictated by the distance required for a fully loaded freight train to come to rest, if the path ahead is obstructed. In practical terms, this indicates that the interval could be reduced to three minutes, and possibly less in the future, if braking could be improved.

A Ferry Service For Road Vehicles

As far as could be seen in the years ahead, the capacity of the link could not possibly be filled by through trains, both passenger and freight, and there would be ample capacity to offer a frequent ferry service for road vehicles. We could see that

such a service just for cars would present no size problems but how about lorries, coaches, artics etc? Would it be commercially viable for those too?

I found that the Ministry of Defence supported the project for the strategic mobility of large fighting vehicles, which would be less at risk in the tunnel than they would be if carried by merchant ships. A structure gauge suitable for them would be big enough to accommodate almost all the road vehicles used on the Continent, and could also contain two decks of most types of private car. For our Reference Design we settled on this (larger than Berne) structure gauge, which we felt would appeal to the commercial instincts of any would-be concession holder.

The Kent County Council being briefed by the author, on planning aspects of the project, as envisaged in 1968.

We assumed that the demand for such a ferry service – nowadays called the "shuttle" – would inevitably prove to be much less at night; it followed that the timing of the freight trains could be such that most, if not all, could pass through then, leaving the maximum capacity for passengers, and especially for shuttles, in the daytime. Outline timetables were now discussed, allowing the commercial staff of the two railways to postulate a basis of one express passenger train leaving the terminal in central London every hour on the hour, with the same from either Paris or Brussels, and, on both routes, as many additional trains as the market would bear.

With a capacity of at least 20 trains an hour in each direction, an opening bid for six or more shuttles could easily be accepted; these would operate between terminals on each side of the Channel, and as close as possible to the coasts.

In the case of the French terminal, there was a great deal of flattish space at Coquelles, just south of Calais, where the French visualized a comprehensive terminal complex, with loading arrangments for the shuttle service, a passenger station for local trains, some siding capacity for freight trains, and good facilities for maintenance of the shuttle trains.

The situation was more difficult on the Kent coast, where the geology indicated that the best site for a portal was likely to be at Holy Well, on the northern outskirts of Folkestone, leaving little space for facilities comparable to those envisaged for the French terminal, though just enough at Cheriton for the shuttle by itself. However, in what already appeared to be the unlikely event of a bridge option being chosen, it would be necessary to find an alternative site for the shuttle terminal further west, and some land near Sellinge could accommodate enough for this in either case; a station at Ashford for local passenger trains was also planned.

Land Use Planning

One of my earliest tasks was to agree with the Kent County Council (KCC), which of the two shuttle sites should be "blighted", to reserve it for the possibility of the fixed link going ahead. It was difficult to explain to laymen (and to politicians) just what such a shuttle terminal might look like, especially as I myself had taken a long time to be convinced of its essentials and size.

I had the good fortune to be friendly with Peter Shepherd, a wartime Sapper and distinguished architect, whose prestige was immense, as he had been president both of the Royal Institute of British Architects and of the Landscape Architects. He was kind enough to draw a "bird's eye view" of the way I visualized this terminal, so that I could use it as an illustration of the prospect.

In conjunction with planning officers of the KCC, we agreed to set up a little exhibition at various places in that area, so that members of the public could express views about the relative merits of the two possible sites for the terminal. The outcome, not surprisingly, was clearly in favour of Sellinge, as far away as possible from Folkestone, but with the disadvantage of extending the length of the shuttle accordingly, unless a bridge solution was chosen.

The Tunnel - a feasibility study (p79)

At that time, KCC was led by Robin Leigh-Pemberton, later Governor of the Bank of England; they invited me to attend one of their council meetings to explain the general arrangement of the facilities required, and to justify the size and environmental impact. In their wisdom, they made sure that both sites would be kept available, and gave positive support to the whole project, as being the best way of preserving the county from becoming ravished by motorways full of road vehicles rushing to and from the ports on the shortest sea route to the Continent.

We agreed to form an ad hoc working party to bring together representatives of both highways and railways, as well as the planners and others appropriately, to harmonize such of the different aspects of the Reference Design of the project, as might affect the County.

While all this was going on, we were also having to listen to the many enthusiasts for types of fixed link other than a bored rail tunnel, the latter being already the clear choice of the French Government, as well as both BR and the SNCF.

Bridges

Nevertheless, my political masters were determined, for reasons of "public relations" to appear to be open to all proposals. The bridge builders and their lobby found it difficult to accept that Dover Strait is probably the most heavily trafficked international seaway in the world, and it could only be obstructed by general agreement of the maritime powers. The Foreign Office made clear to us that the Russian Navy and their merchant marine would never agree to any obstructions further out than the three mile limit from each coast. Even if they did so, the very real danger of a ship's steering system ceasing to function correctly, whatever the visibility, would place the piers of any bridge in considerable jeopardy, however well protected.

Nor was such protection easily envisaged: the calculations of shipping experts showed that a fully laden 300,000 ton tanker steaming at 16 knots up Channel with the tide could only be stopped by stranding the ship on a bank big enough to bring her to rest before she hit a bridge pier. The size of such a bank would be so great that even with bridge spans double the longest now in existence, the necessary artificial islands would so obstruct the Channel that navigation would no longer be practicable.

It became clear that for these, and several other reasons, the bridge option was not really worth pursuing. However, it still spawned other variants, including a bridge-tunnel-bridge, which would limit the obstruction to the inshore one-third of the Channel on each side, leaving the middle third in a tunnel between two artificial islands, based on existing sandbanks.

Immersed Tubes

Nor was that the full range of options suggested by members of the public, usually through their members of Parliament, which entailed a procedure wasting much of our time and effort. Several well-known water obstacles in the world had been successfully traversed by "immersed tubes", giant steel or reinforced concrete structures laid end-to-end in pre-dredged trenches. They were built in docks, then floated out into position, and carefully lowered. I had the opportunity of witnessing just such an operation near Antwerp, and I was convinced by the experience that however suitable such an operation might be for a sheltered site with a soft bottom, I could not possibly champion such a programme of some ninety units, each as big as a great tanker, being deposited accurately right across Dover Strait, with its hard chalk seabed, and the well recorded frequency of gales.

As I hinted above, another regular source of objections to the concept of the bored rail tunnel was the vociferous road lobby; at the very time when almost all planners were trying to shift freight, and to a lesser extent, passengers, from road to rail to reduce pollution and real national costs, one MP after another would forward letters from proponents of a highway across the Channel. Those involving a bridge were dealt with as described above, but the road tunnel needed accurate data before it could be eliminated as an option.

Ventilation of Road Tunnels

As well as assembling as much information as could be found on the subject in America and elsewhere, I called a conference of all road tunnel operators, reasonably available. From them it was concluded that those tunnels with economical cross-sectional dimensions, should not exceed about 4km in length between massive ventilation installations. Illustrating this from his own observations, the operator of the Mont Blanc road tunnel, which is 11km long and without intermediate ventilation, told us that the cross section of his tunnel was some four times as big as was necessary for the passage of even the biggest vehicles, with

the rest of the excavation merely for passage of air – an expensive solution.

Even then, at busy times at Mont Blanc, he had had to permit only one-way traffic, with vehicles at very large intervals, to utilize their piston effect to reduce the exhaust smoke, and chemical pollution in the air, to acceptable proportions; the massive fans at each end of the tunnel could not cope with the problem on their own. More modern Alpine tunnels were being built with smaller cross sections, for economy in excavation, but with frequent vents to the surface and, for that reason, the route taken might not be the shortest in length. It was clear that a line of ventilation shafts across the Straits of Dover would be just as vulnerable to shipping disasters, as would a line of bridge piers.

In all, we had to do a great deal of research on the ventilation of road tunnels, and this was considered as of sufficient value to warrant my reading a paper on the subject to the Institution of Civil Engineers (the Civils) in London, many distinguished authorities were at the meeting, and these included an American consulting engineer, who was considered to be the leading world expert on immersed-tube tunnels, as well as the Chief Engineer of the New York Port Authority. I was relieved to find that both gave unreserved support to our conclusions.

Road Safety

Incidentally our statisticians calculated that, with the amount of traffic predicted, a road tunnel of the length required to traverse the Straits of Dover, would be likely to suffer some 18 accidents/breakdowns at any given time with all the resultant chaos, even with a pair of 3-lane carriageways – and what a monstrous structure!

By now it had become clear that the only really feasible fixed link we could recommend, was the bored rail tunnel; it would consist of three tunnels: a central service tunnel and two running tunnels, one in each direction, sufficiently seperated for structural strength, and for isolation in case of disaster.

Services

Without ventilation shafts under the sea, massive ones would be necessary as close as possible to each shore, associated with comprehensive air conditioning. Electric locomotives would be used to power all the trains, whether "through" or "shuttle"; and any automotive plant used underground would use diesel fuel, NOT petrol, for reasons of safety as well as for toxic emissions.

Each running tunnel would carry continuously-welded permanent way, set on a firm concrete base, with drainage below, as well as power cables for traction. Since the SNCF was providing 25kV AC overhead catenaries to power its main lines, and BR had used the same so successfully on the Euston-Manchester line, it was agreed that traction in the tunnel would conform.

Power would be brought in from both ends of the tunnel, so that the most economical source could be used at any time and, in case of failure, a standby power station would be provided, probably at the French terminal site.

SNCF trains could come through to Ashford, where they would meet the Southern's third-rail system, until some future date when a new dedicated line could be provided with the same standards, structured accordingly.

Also, through each running tunnel there would be signal cables to control centres ashore, so that the train drivers would be in continuous touch. In case of power failure, trickle-charged battery lighting had to be incorporated and there would be pipes for fire fighting water, and cooling water pipes to assist the ventilation control of the temperature. The service tunnel would have a smooth roadway for automotive service vehicles of various sorts, with drainage below, and intercommunication cables, so that service crews could remain in touch with control and with each other.

Between the three tunnels there would be cross-passages at frequent intervals, not only for maintenance purposes but also, in the case of a train breaking down in a running tunnel or going on fire there, passengers could be evacuated swiftly along a continuous walkway and through the nearest cross-passage(s), which could then be shut off by fireproof doors. Such passengers could then be transferred to a train in the other running tunnel for travel to the nearest terminal. Trying to explain all that to the many interested parties, both political and technical, led me to have a model made of the concept.

Aerodynamics

Using the model for our discussions, we found increasing demand for little nooks and crannies to be excavated in the sides of the cross-passages, to house switchgear, transformers, telephones, loos for maintenance staff etc, so we began to question whether the passages could successfully provide piston relief from the running tunnels, as the trains went by. Leeds University had some aerodynamic expertise, which was particularly appropriate.

We let them a contract to investigate the piston problem at the speeds likely to be demanded. They recommended that additional cross-passages should be provided separately, to connect the running tunnels, but by-passing the service tunnel, so that work could take place in the latter, well insulated from the piston-blast.

Crossovers

At first the railway operators said that four crossovers would be necessary for efficient working of the tunnel system, but they relented when it became clear that the immense size of such a crossover would limit the number of sites where the chalk marl stratum was itself deep enough. Also, bearing in mind the horrific cost of such crossovers, it was agreed that two should be sufficient, and that these should be excavated approximately one third of the way from each portal, but subject to local adjustment to allow for siting at places where the rock was proved to be very sound, and the stratum thick enough to allow for an elliptical cross section at least twice as wide as each running tunnel. Because of the inevitably broad span of its roof, each of these crossovers was considered to be the most risky part of the whole tunnelling process.

The Route for a Bored Rail Tunnel

Having now assembled so much information from the geological cores, and from the seismic surveys conducted by the geophysicists, we set up a "Tunnel Alignment Working Party" of all the appropriate specialists, to agree on the detailed 3-dimensional route for a bored rail tunnel to be incorporated in our Reference Design. They recommended one leading from the proposed portal just north of Folkestone, where the chalk marl stratum outcrops, and down at a gentle gradient roughly eastward under Dover Harbour. There, it would turn at a radius big enough to allow for high speed railway operation, before striking out under the Channel to go under the cliffs west of Calais, to emerge a few kilometres south of there at Coquelles, which had been chosen by the French planners as their comprehensive rail junction and shuttle terminal.

As the latter part of that line did not follow the best of the geology, it was appreciated that there would be difficulties in tunnelling there, but the French considered that the diameter of the ventilation shaft, just inshore of their coast should be enlarged to provide space for any eventuality. From this shaft, they envisaged driving tunnelling machines both outwards under the sea and inwards to the French portal, as well as using the shaft for mucking out and for bringing in the tunnel linings. When construction was complete, this shaft would revert to the role of ventilation and air conditioning of the French side, combined with access for maintenance and emergencies.

By the same token, there was a place on the reclaimed land in Dover Harbour, directly under which the recommended route of the tunnel would run, where a comparable shaft could be sunk, with the additional advantage that the spoil to be mucked out of the tunnel could be carried away by the same barges which had brought in tunnel linings already prefabricated elsewhere; we also found a route clear of the town for an access road to be dedicated to the tunnel's construction traffic.

Maps

One of my first requests, when I arrived at the Ministry, had been for suitable maps for the project, because there was no continuous cover, especially needed for plotting the geological information.

Through the good offices of the Director General Ordnance Survey, at that time Joe Edge, a Sapper himself, I was able to arrange a meeting of his representative with that of his French opposite number, and representatives of both the British and French hydrographers, which took place in Paris, as did most of our meetings for the simple reason that we could get the Ministry to pay for our travel to Paris, but the French civil servants had problems in coming to London. Contrariwise, their Ministry would pay for our lunch there, while ours would barely cover a beer and a sandwich – totally insufficient, as it might be the only meal they had time for in the whole day, with the inevitable result of our having to subsidize their meals out of our own pockets.

We decided that the project work would require a pair of maps at a scale of 1:50,000, both of which covered the whole width of the relevant part of the Channel and then each covering the hinterland of one country or the other, to show the existing railways, roads and urban sprawl. We also ordered a set at 1:10,000, covering the whole of the recommended route of the tunnel itself, showing not only the contours on land, but also the soundings of the sea in contour form, and the accurate position of all the boreholes.

We were told that such maps could not have been made to the same accuracy in earlier years, because the relative position of Britain and France had only just been established to survey standards with the

development of satellite positioning. In those days the standard scale had been 1in to one mile and our request for the new scale resulted in ours being the first OS maps to be produced at 1:50,000; likewise the 6in maps were converted to 1:10,000. Both the British Museum and the Royal Geographical Society invited me to make a presentation of each set, which gave me some pleasure.

Frontier Controls

One of the most obvious problems of joining Britain to France was the risk of rabies or other diseases being introduced through the fixed link itself, by wandering animals, reptiles, insects or fungal spores. All the health and veterinary authorities were most helpful in proposing practical measures to deal with such situations.

By contrast, we had tried all along to explain to the customs and immigration authorities that it was unthinkable that the existing cumbersome controls should remain in place when the tunnel was in operation. Their officials always proclaimed their inability to adopt any new system, in desperation, I took on one more meeting on the subject, which all agreed would take place in Calais.

With a CTA rep, since it concerned us both, I went over there in the evening to stay at our hotel ready for an early start the following day, and found that the hotel staff had given me their best room with, as the manager said with a flourish, a connecting door to the British Customs Commissioner's room. Surprised as I was then, I was even more so when I found that the official concerned was a large Scottish lady!

The Ministry of Defence gave us appropriate advice on measures to deal with sabotage, terrorism and war.

The carriage of dangerous goods in the tunnel, either by freight train or by ferry, had to be carefully examined, and we were given advice by both road and rail tunnel operators.

Politics

Some while after I had joined the Ministry, Mrs Barbara Castle had moved to another Cabinet position, and her place had been taken by Richard Marsh, a charming character, who sadly had a difference of opinion with Mr Wilson, losing his seat in the Cabinet; to my chagrin, he resigned from the Ministry as a result.

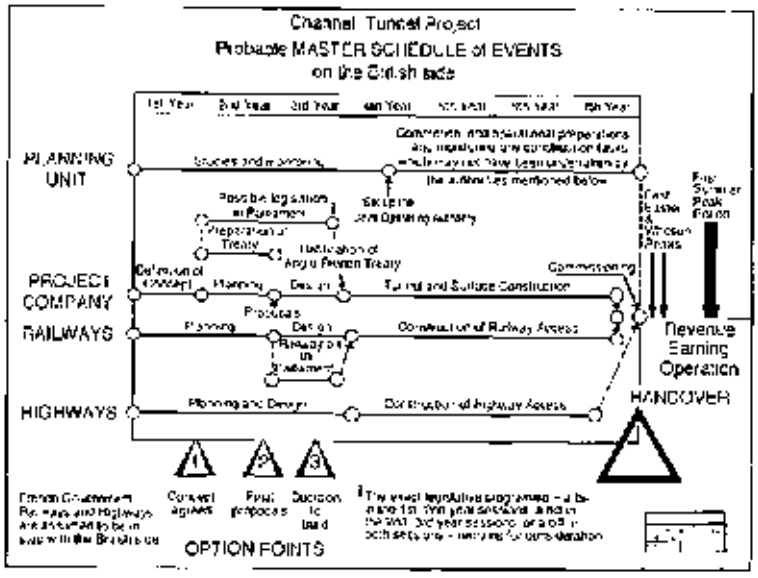
This was a personal setback, as he had been an active supporter of the project, to which by now I was mentally committed, and I had greatly enjoyed his sense of humour, when accompanying him on several outings; he later became the Chairman of BR. His successor, Fred Mulley, appeared to have little thrust and was not a member of the Cabinet. Worse was to come! In the summer of 1970, Wilson called a snap election, and lost to Heath, who appointed John Peyton to be Minister of Transport, not with a separate government department as such, but part of a "super-ministry" set up under Walker. Peyton had the disconcerting habit of greeting my advice with the words "You do surprise me" followed by a silence to give him time to mull it over.

Nevertheless, he was quite sympathetic and it was he, in due course, who accepted our advice that the project really WAS feasible, as described later.

Tunnelling Expertise

As it had become increasingly clear that a bored rail tunnel was indeed the only satisfactory option, I was worried to find so little practical tunnelling experience of the size and volume we were envisaging. With some 150km of tunnels to be driven, it seemed clear that the hand excavation methods mostly used on the London underground would be out of the question, as being much too slow, and it seemed doubtful if the road headers, used by the coal miners, would be suitable for the main tunnelling runs, though they could be used for crossovers and passages. Full face tunnel boring machines (TBMs) seemed to be the only practicable approach, and those used should include a number of features including the erection of iron or concrete linings as they moved forward.

The consultants Mott, Hay and Anderson had recently completed the second Mersey Road Tunnel and it was one of many visited at this time to learn what we could. The contractors, Nuttall, were particularly helpful, and Bill Adams, of the same YO Batch as myself, had retired to join that firm. Talking to all the known experts in the field, we found that John Hay, a retired Sapper with British Coal, had produced a TBM with good qualities; also, John Bartlett, a National Service paratroop Sapper working for Mott, Hay had invented a relevant Bentonite seal for such TBMs, and it was being taken up by the Japanese. It appeared that Robbins in the USA had progressed further than anyone in the UK, but the French, who had no potential of their own, kept saying that the Russians had the answer. A visit seemed to be essential, so we obtained authority to sponsor a small team to visit Moscow, Leningrad and Kiev, to see the tunnelling in progress at each, and to



To satisfy ministers' demands for a forecast of the extent and likely progress of the project, we had to make assumptions about the deployment of tunnelling machinery during the construction phase, as well as providing a master schedule of events to show the political and commercial aspects of the project management.

visit the factory where the machines were made; we also had some amusing debates with the ministers and top officials concerned.

I had not previously visited Russia, and was delighted to obtain security clearance from the War Office, so I sought permission for members of the team to take their wives, at their own expense. None of the others took the bait, preferring, as they said, to have the chance of meeting a beautiful Russian spy; but I took Jay, and as she admitted afterwards she would never have believed my stories if I had gone without her.

Suffice it to say that we did NOT encounter the tempting ladies, beautiful or otherwise. The two KGB men allotted to us seemed more in need of our help, than vice versa; the lavish hospitality contrasted with the general deprivation of the people; the engineers we met were frustrated, complaining of the talent being (in their opinion) wasted on security and aerospace. We found the Russian machines were archaic in design and construction, and we learnt nothing useful for our immediate purpose, other than to be able to refute the French enthusiasm, based perhaps on their anti-American sentiments.

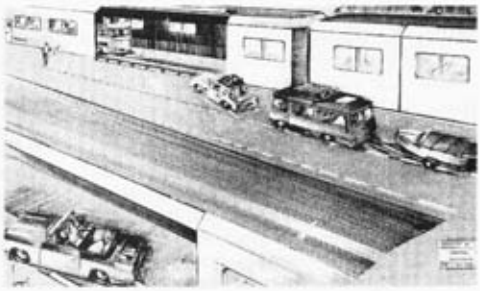
The old Road Research Laboratory, with its name now preceded by the word "Transportation &" (TRRL), was willing to set up a series of research projects to investigate the best method of excavating the chalk marl mechanically. Whereas there was a role in excavating cross-adits and side-chambers for road-headers, as used in the coal industry, it was clear that the 150,000m of main tunnel-drives involved in the project would require full-face tunnel-boring machines (TBM) to cut and evacuate the rock, whilst shielding the roof and sides until they had been fitted with permanent concrete (or sometimes cast-iron) linings. With the excavation for the main running tunnels some 8m in diameter, a flat "wheel" of that size is rotated up against the rock; the face of this wheel has a multitude of pockets, into each of which is set a tool, which may be in the shape of a freely rotating disc, as favoured for harder rocks, or a sharp pick, as was found most effective during extensive trials at Newcastle University, using massive samples of chalk-marl of exactly the same composition as would be expected beneath Dover Sands.

In addition, these TRRL studies clarified many aspects of our thinking, and I found that my own experiences, when cooperating with the Military Engineering Experimental Establishment at Christchurch, turned out to be very useful in accelerating the research workers' procedure. All this information became available to our consultants and manufacturers through papers read at the institutions. We began to feel able to give forecasts of the progress probably achievable in our project, utilizing both portals and shafts to launch the 12 underground drives envisaged. Since ministers were now clamouring for estimates of the time required for the project, and for its construction costs, we began using a computer to work out a critical path for its major aspects, assuming that satisfactory TBMs, when produced, might each advance at an average of 1km a month.

All this activity led to the formation of the British Tunnelling Society, as an offshoot of the Civils, and our meetings attracted many bright engineers keen to get involved with what then seemed to be the answer, not only for the fixed link, but also for urban highways and mass transit railways.

Loading Ferry Trains

An aspect of the project about which I continued to harbour some doubts, involved the practicality of loading large numbers of road vehicles of all types onto and off the shuttle trains as proposed. The TRRL staff were delighted to carry out some practical experiments at full scale, by building mock-up single and double deck wagons, to which they invited suitable firms and members of the general public to bring their vehicles. In wonderful summer weather this took place over one week, with a representative assortment of big and little cars, some towing caravans or boats, vans, campers, trucks, coaches and artics. I was amazed how easily and speedily one "train" after another was loaded and discharged, while the engineers of the TRRL took their stop watches and their measuring tapes to record all the data needed for their eventual recommendations.



Single deck trains will be designed to carry private cars, caravans, minibuses, coaches and small freight vehicles. Side loading will be effected by sliding doors. Platforms will be marked with traffic lanes and directional markers and "batmen" will probably be needed to guide vehicles to appropriate loading points.

Parliamentary Procedure

Over the years the ministers came and went as I have described, but there was another layer of more junior politicians called Parliamentary Secretaries (PS), who usually gave the official replies to MPs at Question Time in the House of Commons. On these occasions, the civil servant directly concerned would sit just behind them, to provide additional information if necessary; on one of them, a PS I was supporting had mistakenly turned over two pages of the brief I had given him. As the MP's question had been purposely "planted" as a convenient way of making an interim statement without causing too much fuss, it was important that no item of the brief should be left out of Hansard, the official record. I therefore tore the equivalent page out of my own copy of the brief and put it in front of him.

Taking no apparent notice of my action, he ploughed on, but the questioner must have seen what I had done and immediately caught the Speaker's eye, asking a "supplementary", which enabled the PS to fill the gap by reading out my note.

Another Ministry of Transport PS for a while, was the somewhat excitable Michael Heseltine, who was then MP for Tavistock, and used to travel to his constituency on Friday evenings in the same train as I did; whether he did anything much for the tunnel I do not remember, but he certainly gingered up the highways staff and had the motorway/ trunk road to Plymouth accelerated, to my delight.

What Operator?

A matter of great importance to both BR and SNCF, on which all the politicians had strong views, was the question of which authority would actually operate the tunnel railway. For many reasons, some diplomatic, some political, but mostly commercial, we favoured an independent operator with total control of all aspects of the tunnel itself and of the shuttle service, to include both terminals; with close liaison to the two national railways abutting the tunnel lines, and with contracts to them for the trains they would wish to pass through them.

Public Relations

In the summer of 1970 I had been surprised to be asked by the Civil Service to run a week's seminar on Project Management at my old Cambridge College, Peterhouse. Individuals from a variety of ministries were invited to attend as well as representatives from industry and from France. As well as several less spectacular projects used as case studies, we examined the progress of the Anglo-French Jaguar aircraft, which had involved both governments and both aviation industries in a race against time.

Another major feature was the study of the massive hydroelectric scheme built at Churchill Falls, northern Ontario, by a management team from RTZ. The seminar served a useful purpose in bringing together many brilliant brains, with whom I could discuss the tunnel project in the intervals.

As a result, we received a good deal of interest from potential consultants, contractors, equipment suppliers, and many found it difficult to

The Tunnel - a feasibility study (p85)

understand that we were limited to the assessment of the feasibility of the project, and that it remained for the bankers, when the time came, to appoint their own representatives for the actual design and construction.

However, several times a month I would be asked to give a full briefing of the job, as we saw it. One of these was an invitation by the Minister's PR staff to escort a party of Continental journalists, who specialized in motoring and travel, from Boulogne by hovercraft to Dover, with a view to giving them a briefing about the advantages expected from the tunnel. I duly went over in the hovercraft and met them on the beach, where they were looking anxiously at the sea. As soon as we were aboard many of them started to feel queasy, and they refused the hospitality on offer.

Soon, I found that only one of them, an enormous German, was sharing the drinks and canapes with me, and he turned out to have been a wartime U-boat skipper. There was no doubt that all the remainder were potential customers for a rail crossing.

Another briefing of note was arranged for a group of Japanese engineers working on the Seikan tunnel to carry the railway northward from their main island of Honshoo under sea to Hokkaido island. Needless to say, they were very knowledgeable and asked all the right questions; as we already knew, their project was indeed difficult for many reasons, especially the dangerous geological conditions, but they said they were NOT hampered by lack of money nor by pressure of time. Rather naively it was admitted their job had more to do with prestige, both for Japan and for their railways, and they intended it to be the longest tunnel in the world; having carefully measured our plans for the Channel tunnel, they said they would move their portals to give theirs the necessary additional length.

Some of these briefings took place in our offices at Church House, and others were held on the ground near Folkestone. At one of the latter we had the leading figures of the merchant banking industry from the City of London; a really crucial briefing. On such occasions we were usually helped by a representative of BR, who was able to provide a coach for me to take the party round the best viewpoints in the area; just as were ascending the lane up to Castle Hill, the coach stopped and was found to have run out of fuel. With fury in my breast, I ordered the miserable driver to find the nearest telephone to summon a replacement, and, while he did so, we all got out and pushed the coach into the side of the lane.

The sight of all these eminent bankers pushing away made us all laugh, and Lord Harcourt, then Chairman of Morgan Grenfell, wearing his "Anthony Eden" type of hat as always, told me that if we had had a suitable camera we could have sold a photograph to the Press for a large sum. As often happens, adversity brings its reward, and I realized, from that time onwards, that "the City" was giving us every support.

The Next Phase

This was just as well as the French Government wanted to go ahead, and had become impatient with the procrastination caused by our change of Government the year before. In conjunction with our opposite numbers in CTA Branch, we now felt quite confident about confirming the feasibility of the project. We had delved deeply into the practicality of the various options and had come down firmly in agreement with the French Government, the SNCF and BR that a bored rail tunnel was feasible from every point of view.

We had checked the geology, the civil, mechanical and electrical engineering, the technical and commercial aspects of transportation, the defence and security, the health and ventinerary problems, the frontier controls, the costs and financial viability, the political and diplomatic procedures, and, indeed, every question anyone had raised. Our Minister of Transport, therefore, obtained Cabinet agreement and invited the French Minister and the Bankers to meet in London in autumn 1971.

Agreement

As I was put in charge of the physical arrangements, looking after the French team and setting up the meetings themselves in Lancaster House, the Government Hospitality Centre, I went there to check all the details with the retired brigadier who ran it. I asked to see the menu, which sounded excellent, but he was reticent about the wines and I wondered why. On the great day we all met in the gilded conference room, with the ministers on opposite sides of a very long table, each with their staff stretched out beside them; the proceedings, as prepared by CTA, went according to plan and the proposed joint government agreement was approved.

We moved to the dining room, where the seating brought the two ministers side by side and the rest of us were suitably paired. It was a great relief to

find that the food and wine were of a high standard, and all went well.

As might be expected, our Minister said all the right things; then, the Frenchman stood up and began by telling us that Sancerre was in his parliamentary constituency, and the wine of that name, which had been served with the fish course, was of a higher quality than could now be obtained there as "all our best wine now has to be exported to England, by Government decree": an exaggeration no doubt, but charming.

At the appointed moment we reassembled in the conference room, this time with an even longer table as all 22 financial representatives were aligned down one side, with Lord Harcourt in the middle, as their doyen, sitting opposite the two ministers; all of us officials, both British and French, on our side of the same table. It was a most impressive sight, but I got quite worried as the time approached 6pm, when I had arranged for champagne to be served – and still NO agreement had been concluded. Beautifully staged by the ministers, I'm sure, on the chime of 6 o'clock Lord Harcourt announced that all on his side were in accord with the proposals and we all trooped into the drawing room to drink to "The Tunnel."

By general agreement, the Bankers entrusted the whole execution of the project to a joint Anglo-French consortium, of which the British principal was Rio Tinto, headed by Val Duncan, a close friend of Edward Heath, our Prime Minister.

From then onwards, my task was nearly over, being mainly the smooth handing over of the results of all our researches to the Rio Tinto team, whom I had met the previous year on the Project Management Seminar at Cambridge. Their leader, Alistair Frame, later Chairman of RTZ, sadly, died in 1993, just when the tunnel was being commissioned.

Conclusion

The feasibility study had come to an end, and the project was going ahead, so my official participation was concluded, but I have ever since felt compelled to continue to take a close interest in it.

When the RTZ team came to make their detailed plans, they found that one of the Ministry's mandarins – who was also a director of the Dover Harbour Board; what a conflict of interest – had overruled our reservation of the site for the shaft in Dover Harbour and its access route, and had authorized construction on it.

RTZ with their chosen consultants Mott, Hay, reappraised the proposed line of the tunnel so that it had to go through the fissured rock, about which Sir Harold Harding had specifically warned us. The new site for the shaft at Shakespeare Cliff did not have access for barges, so a railway siding was put in to bring the tunnel linings.

Long after I had moved elsewhere, RTZ invited me to visit the work in progress, and I saw where they had access to the little tunnel, which Colonel Beaumont had bored nearly a hundred years before; it was still in reasonably good condition.

Soon after that all work on the project was stopped by the financiers, when the British government sought to delay the necessary Anglo-French Treaty for a year, so that the emotive issue of the Referendum about our entry into the "Common Market" would not be prejudiced. The French government and the SNCF were furious, though never themselves abandoning their intention to pursue the tunnel project, when they could raise sufficient enthusiasm again.

Now, Eurotunnel has been successfully driven, achieving TBM speeds of advance as fast as we had hoped, and I have been privileged to enjoy two visits to see the work in progress. The sheer size of the TBMs in the running tunnels quite amazed me, and it was really gratifying to see these enormous caverns, which had been "in my mind" for all these years, now actually taking shape. My last visit was to see the end of the construction phase, just before commissioning began. I particularly wanted to see the pumping arrangements, and also one of the crossovers, since the latter had always given us some anxiety, in spite of the confidence of our consultants. When I saw it, looking immense, I was deeply impressed, it is as high as three double deck buses one on top of another, reminding me of the greatest cavern inside the Rock of Gibraltar, which we built in 1948 when I was commanding 32nd Fortress Squadron.

Trans Manche Link (TML), the contractors, have handed over to Eurotunnel, the client, who will operate the whole system including the shuttle, but allowing BR and SNCF, and perhaps the Belgians, to buy access for their through-trains, both freight and passenger. Within a few years it will be essential for BR, or their successors, to build a dedicated new fast line from the tunnel to London, and it should (one would hope) be built to Berne-gauge, as a minimum.

A Nation at War: a People Without Hope

MAJOR A D MACKLIN MA(H)

Major Macklin was commissioned in 1979 after three wonderful years at Cambridge. Tours with 50 Field Squadron (Construction) and the Independent Field Troop ACE Mobile Force(Logistics) showed him a glimpse of the world: Germany, Canada, Falklands, Denmark and Norway. A tour in PB7 showed him a lot about people. A tour in Main Building showed him all he wants to know about Whitehall. His next course at the Joint Services Defence College will continue his aspiration to be a well trained staff officer without attending formal Army staff training. For now, he counts his blessings as one of the very few officers to have commanded two field squadrons and fitted in two emergency tour plots as an OC: the Falklands with 51 Field Squadron (Airmobile) in 1992 and currently Operation Grapple *with 11 Field Squadron Group.*

Bosnian Croat in traditional dress. (Or is it the author turned native?)

OPERATION *Grapple* is an engineers dream: there were more Sappers than Cheshires on Operation *Grapple 1* and, although the number of Sappers has been reduced, it is Sappers that succeed or fail to achieve COMBRITFOR's mission of creating the conditions by which humanitarian aid can be delivered. Recent issues of the *Journal* have featured various articles on Sapper activity in Bosnia but what of the other side of the coin: what do Bosnians make of all this? Bosnia is a nation at war; no one is neutral and everyone is affected. This portrait of one Bosnian, paints a sad background to the excellent, satisfying, engineering work we are doing.

In happier days, Sarajevo was a beautiful city: host to Winter Olympics, prosperous, multiracial and peaceful. Then the war came. My subject, a Christian Bosnian Croat, joined the muslim led BiH official Bosnian army fighting the Serbians to defend his home.

After ten months things were bleak: men spent day after day in static trenches with an AK47 and 40 rounds but no food, warmth or prospects for the future. For many on the front line, drugs are the only thing that maintain sanity (as many Americans found in Vietnam). The front line was 200m from his own house: the wrong side. His family had fled and his commander was more a mafioso than military commander. The final straw was the creation of "special" platoons whose tasks made them little better than suicide units. "Volunteers" were invited to join at gunpoint, he was one.

The only alternative: desertion. The only route: across Sarajevo airfield. The dangers come from Serbian machine gunners strafing the tarmac at knee height and the French UNPROFOR (United Nations Protection Force) troops whose mandate is not dissimilar to that of the boat sections around Hong Kong. Normally recovery by the French merely involves return to Sarajevo but, in his case, it would have been return to execution. The dash was made with three others and, sure enough, he was singled out by the French APC (armoured personnel carrier). Illuminated by a spotlight, there was no alternative to hitting the deck as the light provides target identification for the Serbian gunners. As the French APC pulled to a halt and turned off its lights prior to bundling him inside, encouragement from his colleagues, who had reached safety, inspired him to a last burst. Desperation brought him to his feet for the final 30m dash through the gap in the fence with bullets at his heels.

The next stage was a lonely walk over Mount Igman and into Kiseljak. His luck held as he travelled on up the valley to Busovaca. Only ten days later, the route was closed to all (it has since been reopened to UNPROFOR but remains a line of confrontation). Born under a lucky star, he found work with the UNHCR (United Nations High

Maj A D Macklin
A Nation at war (p88)

Commission for Refugees). Under the protection of a UN pass, he is currently free to travel around Bosnia in the course of his work. This took him to Stupni Do, when the massacre occurred, and the Vares area, when he escaped with the Canadians at 6am on the fateful day in November that saw the start of the muslim offensive which wiped out the HVO (Bosnian/Croat army) enclave.

As pressure began to be exerted on the Kiseljak pocket by the BiH, his organization moved out of their hiring in the town. On their return a week later to collect the last of their belongings, they found that a 120mm mortar round had wrecked the bedroom. They now live on the Dalmatian coast and work in Bosnia for a few days at a time. It was on the balcony over an evening barbecue, gazing out over the beautiful, calm, Adriatic, that this story was revealed, initially with some reluctance, encouraged by some local wine.

But what of the future. His contract runs out in a couple of months' time with no guarantee of renewal. He holds a Croatian passport which will allow him entry to Germany. Speaking no German and with their employment problems following unification, the prospects there are not bright. This is compounded by his fiancée. She is a Bosnian muslim with Bosnian papers. Attitudes have polarized to the degree that he asserts that they cannot get married here and she has no entry rights to Germany. So what are the options: his former commander has been "removed" so he could return to Bosnia without facing execution. However, if he returned as an individual he would be mobilized; as he said "Do I fight against my family or against my friends?"

For a man born under a lucky star, life looks bleak. In his own words, "the batteries will run out some time." Life for many is simply a matter of survival. Although it is said "Where there is life there is hope", for many it is hope that is running out; worn away by the prolonged war. And there are those who, with some justification, will claim that in this respect the UN presence does not help. We provide aid to the hungry and have, on many occasions, been able to intercede to prevent massacres. Indeed some would argue that the UN presence prevents genocide. However it is also true that we maintain the warring parties and so prolong the war. Distribution of aid is undertaken by the local communities and a large proportion goes to the fighting troops: that part of the Squadron Group in Tomislavgrad lives in a warehouse which it shares with the local HVO quartermaster. His stores are full of UNHCR aid either stolen or given as the price of free passage. Route *Triangle*, that we are rightly so proud of as a feat of engineering, is the HVO main supply route that forces from Tomislavgrad, Livno and the HVO army headquarters in Posusje use to reach and resupply the war effort in Gornji Vakuf.

War is never pleasant, it is certainly not the glory of the movies and we are grateful not to be a part of the war in Bosnia. But for the local people intimately involved, Bosnia is a nation at war. For some, they are a people who are losing hope. And when hope is gone there is nothing left.

Bombed houses in Gornji Vakuf. (40 gallon drums are filled with explosive and rolled down the hill to explode in the town.)

A Nation at war (p89)

Operation Grapple 1

Some Lessons Learned

CAPTAIN T A WEBER

The author was commissioned into the Canadian Armed Forces in 1987 upon graduation with a Bachelor of Electrical Engineering degree from the Royal Military College, Kingston, Ontario. After completion of his military engineer training, he was posted to Canadian Forces Base Petawawa, Petawawa, Ontario, as planning officer, and then as design officer for the Base Construction Engineering Unit. During the two-year posting, he completed a six-month tour in Cyprus as the CANCON engineering officer.

Posted, in 1990, to 2 Combat Engineer Regiment, Special Service Force, Petawawa, as regimental training officer, he then served as OC 23 Field Squadron and the Airborne Engineer Grouping.

In the summer of 1992, he was seconded to 42 Field Squadron, 35 Engineer Regiment, BAOR, where he is currently serving as squadron operations officer. He deployed with the squadron on Operation Grapple *as operations/projects officer.*

Introduction

With the United Nations (UN) becoming more committed to peacekeeping, the likelihood of western nations sending large contingents of soldiers to support peacekeeping operations has increased. Because commitments are normally for six months or longer, the troops sent require semipermanent or permanent accommodation together with the infrastructure and services to support it. Countries requiring this kind of assistance are unlikely to have appropriate facilities and even if they are available their suitability would depend on the stability of the area and the relationship possible between peacekeeping forces and the unreliable local forces. Financial responsibility may rest with the UN, or the contingent's government, or a combination of both; however the responsibility for constructing, maintaining and modifying the above-mentioned facilities will always fall on the shoulders of the contingent's engineers. This was the work that 42 Field Squadron found itself concerned with when it deployed to Vitez, in the former Yugoslavia, as part of UNPROFOR 2, in support of 1 Cheshire Group.

Background

During the five-month deployment, the squadron's main task was the construction of camps and the installation of services necessary to support and protect 1 Cheshire Group.

A school, located approximately 4km east of Vitez, was to be the location of the main camp housing 1 Cheshire Group's Headquarters, the Mobile Surgical Team's (MST) facility, and accommodation for approximately 700 personnel. 3km from the main camp, a Renault service garage became home for the supporting echelon with approximately 300 personnel. 500m from the garage, a large field was converted into a bulk fuel installation (BFI) site, accommodating 12 personnel and a few hundred thousand litres of bulk and packed fuel in an area approximately 100m x 300m. A company plus deployed to Gorni Vakuf, a small town approximately 70km south of Vitez, and set up camp in a newly constructed factory, with 7 Armoured Workshops. The workshop relocated during the tour, leaving the company at the factory and reducing the accommodation requirements to approximately 200.

Prior to returning to BAOR, the squadron had completed all major construction tasks required

Captain T A Webber
Op Grapple 1 (p90)

to make the camps self-sufficient. When the final chalk left, each camp had its own power generating and supply system, water storage and supply system, sewage disposal system and food storage and preparation facilities. The main building blocks for the camps were ISO container-sized units that were either shipped from the UK or purchased in Croatia. Although some units were purchased preconstructed, the majority were flat-packed, which required on-site construction. The school camp alone contained 183 units, providing accommodation, dining, cooking, hospital and dental facilities, as well as all services.

Bastion wall construction around the medical centre.

Water was stored in 50,000 litre tanks and supplied to the ablution units through an underground distribution system by independent water pumps. Waste was collected in septic pits and processed through Rotating Biological Contactor (RBC) units. The camps were powered by 255kW and 150kW Dales generators, connected to a power distribution system through a specially designed switching gear. The total capability of the school camp system was 1.6MW. Each camp had buildings hardened, and collective shelters constructed for protection against artillery, utilizing over 60 ISO containers and 2km of bastion wall.

Working conditions throughout the tour were generally good. Temperatures varied from the mid-twenties to minus twenty, not considering the wind-chill factor. However, the colder days tended to be clear. Fortunately it was a mild winter so although snow was an occasional hindrance it could have been much worse. The soil in the Vitez area consisted of approximately 300mm of clay on top of mixed gravel and stone. One to two metres further down was bedrock. The ground at Gorni Vakuf consisted of clay soil for at least two metres down. In both areas water tended to remain on the surface especially when vegetation was removed. Tensions in the local areas were relatively low for the majority of the tour allowing the squadron to work in exposed areas without the hindrance of wearing flak jackets and helmets. It wasn't until later, in March 1993, that local tensions became a factor, limiting exposed work to those tasks deemed necessary.

Lessons Learned

From the squadron's experiences on the Operation *Grapple* tour, invaluable lessons were learned that would assist in the planning and preparations of other, similar, tours. As it should be, hindsight is 20/20 and looking back now at pre-deployment activities, certain aspects of the training, stores allocation and planning process would have been changed.

During the training period the emphasis was on support to convoy escorts, completely overshadowing other training. The squadron was aware that it would be involved in some camp construction but we never inquired further. The squadron had recently completed a tour in Northern Ireland and everyone was confident in the abilities of the tradesmen and junior officers with respect to construction projects. If we had managed to grasp the scope of the task prior to deployment, emphasis would have been placed on ensuring that our tradesmen such as plumbers, fitters and electricians were trained on the specific types of equipment and stores they would be working with. Some questions that should have been asked were: "What was the camp going to be built out of?"; "How was water going to be stored and distributed?"; "Where was the electricity for this camp to be produced and how was it to be distributed?" The STRE, which was working on the camp designs, would have been able to answer these questions at least in part, which would have allowed us better to prepare our tradesmen.

Op Grapple 1 (p91)

Engineer stores area and tented camp.

Another consideration would have been some planning of the camps prior to deployment. If you have to build accommodation then it is likely that temporary tent facilities will have to be erected in the interim. We therefore needed to find out if 200-man tent packages or other tent combinations were to be used. Pre-*Grapple* training would definitely have included classroom work for junior officers and recce sergeants on tented camp and marquee tent construction. Calculations determining the real estate required to park all the vehicles in the camps should have been made. If this information had been added to the camp design criteria initially, significant time would not have been wasted on re-design to accommodate a major shortfall in parking areas. The types of vehicles must also be considered. Tracked vehicles, especially Warriors, destroy gravel parking areas and track edges if turning, especially neutral turning, is required to park. Parking areas for tracked vehicles should be separate and significantly larger than those for wheeled vehicles.

The actual equipment and stores list that the squadron deployed with would also have been changed. Toolkits and general stores for construction would have deployed with the squadron as opposed to with a supporting echelon. Although the echelon management insisted there would be no problems with supply, factors such as transport priorities, weather conditions, local insurrections, MSR conditions, and a long line of communication resulted in at least a 48-hour delivery time. The squadron needed to be as self-reliant as possible.

A final aspect would have been the addition of a detailed engineer recce prior to deployment. Only one recce was conducted, consisting mainly of the COs of the units deploying. The composition of the party, the time constraint, the amount of ground that had to be covered and local tensions in the area did not allow the gathering of essential engineer information. A second engineer recce to the chosen campsites with the points mentioned above in mind and before the rest of the force deployed, would have proved invaluable. Unfortunately this was not possible due to the urgent political need to deploy elements of the force as early as possible.

The advance party for the squadron deployed two weeks ahead of the main body with the OC leading a packet of Rovers and a Bedford, complete with the operations officer, three troop commanders, three recce sergeants, the SQMS, a section of sappers and a handful of drivers.

The concept of operations was to conduct recces of the campsites and preliminary route recces for support to convoy escorts in preparation for the arrival of the main body. A section was deployed to accomplish any small engineer tasks that may have been encountered.

This was not to be. The main body of 1 Cheshire Group was to arrive in three weeks' time and the camp was approximately 500-bed spaces short.

Coincidentally a 200-man tented camp pack arrived the same day as we did, so the advance party was immediately tasked with camp construction and started unpacking boxes that afternoon; 22 days later the 450-man tented camp was completed although squadron personnel would agree that a few precautions and different approaches to problems would have made the task easier.

The most painful lesson learned from the tented camp construction was to ensure that the tent skirts were secured with sandbags. On 12 November 1992 freak gusts of wind came whistling through the valley and the camp. Even though all the tents were properly constructed and all the storm ties were secured, 25 out of the 31 tents were lifted and in some cases twisted out of shape. Attempts were made to save as many tents as possible, however once the tent was lifted up by the wind anybody hanging on was sent for a ride. Two tents flipped up

into overhead powerlines knocking over two power poles, breaking the power cables and cutting power to the school. Fortunately there were enough tent spares in the camp to replace the damaged kit so the only major loss was two days' work. The priority of work quickly switched to sandbagging the skirts of the erected tents and for the remainder of the tour there were no further problems with the wind.

Extra parking required.

The tented camp could have been completed a week earlier but it was delayed due to the slow supply of wood for the duckboards and floorboards. Duckboards and floorboards were a necessity prior to occupation. Without them the camp would have turned into a mud pit after the first drops of rain. Fortunately wood was a readily available and inexpensive commodity in Vitez, although it took the local lumber yards a couple of days to cut the timbers. Wood or some type of material to provide duckboards and floorboards should have been ordered almost immediately upon if not prior to the arrival of the tent packages. Ideally the materials should have arrived with the tented camp. Also, we learned a couple of lessons on the construction of duckboards: ensure the tread boards run at right angles to the direction of traffic; ensure they are close enough together to prevent a small foot from slipping through; and ensure the supporting timbers sufficiently elevate the tread boards to allow for some sinking.

When the main body of the squadron arrived in camp, 8 Troop deployed to Gorni Vakuf to support that site while the remainder of the squadron worked on the completion of the tented camp and started the layout and construction of the camps and BFI site in Vitez.

The STRE, which had also deployed on Operation *Grapple*, provided the initial designs for the camps and was readily available throughout the tour to provide technical advice and support.

It is extremely important that a good working relationship is established with the STRE if it is to be involved in the design of the camp. If it is not located on the construction site then members of the team need to visit frequently and remain on site during critical periods of construction; specifically they should be there for the initial camp layout, the installation of the water supply system and the installation of the power distribution system. The team's designs and solutions are not necessarily the most practical ones and if something seems suspect it should be questioned and talked through. Normally a compromise can be reached for a practical solution, taking into account the local situation.

As stated earlier, the original design of the camp had to be modified because there was insufficient parking space for the vehicles. This became the first of many modifications as outside influences dictated changes to camp requirements. Camp layouts were changed in the middle of construction as units were relocated to other camps midway through the tour due to operational requirements. Room had to be made for ISO containers, bastion wall and collective shelters, when the threat from artillery increased. Fuel storage and distribution systems were added to the power stations during the latter stages of construction. Arguably these alterations and additions should have been included in the original design, however the unique conditions ensured that the squadron had to remain flexible and maintain a sense of humour.

As the construction of the camps began, an important lesson was learned with respect to the placement of ISO units in rows. We learned not to attempt to measure and set the first ISO and then "eyeball" the remainder off the first. The first and second rows in the main camp accommodation area contained 30 and 31 ISOs respectively with one metre between each ISO and a firebreak every eight ISOs. It was not until these rows were completed that the OC noticed that

Op Grapple 1 (p93)

Portacabin city, Vitez.

both rows had an identical inward curve in the centre. The curve was obvious when you stood back at an angle, however it was not apparent when you were standing close to the ISOs. A plumb line was strung and due to the fact that a crane could no longer access the ISOs they all had to be manhandled with crowbars and levers. The remainder of the units were aligned from a plumb line.

During the construction of the flat-packed units the need for power tools, especially cordless power drills, was critical. The squadron deployed with insufficient toolkits to begin with and no cordless power tools. When the construction of the flat-packed units started, a request for eight to ten cordless drills was submitted to Split. Two were purchased in Split locally and arrived in the camp within the week. A team of three sappers with one of these tools could do the work of a section. The speed at which the cabins were completed depended on the cordless drill. It almost became a chargeable offence to forget to charge the drill overnight. Due to the excessive cost of the drills in Split the remainder were ordered from the UK. These drills took over two months to arrive. We needed at least two drills per section for two troops prior to deployment in order to construct the poorly designed Croation flat-packed units.

At the end of December 1992 the United States' Government was threatening to implement a "no fly" zone over Bosnia and to shoot down any violators. Serbia countered with threats to target UN camps with artillery, in retaliation. Due to the proximity of the camps to Serbian positions, hardening became the immediate priority.

Taking into consideration the various accommodation and working conditions at the camps, different methods of hardening had to be applied. The school building in the main camp was two storeys high with reinforced floors supported on load-bearing walls. The bottom floor was designated the shelter area and the ceilings in all the rooms were shored up. All the glass windows were covered in blast film and boarded up. ISO containers were stacked two high along the outside wall and the inner wall of the ISO was sandbagged. Bastion wall stacked two high was used in areas where an ISO container would not fit. The garage utilized the large grease pits with overhead protection from sandbags and timber to create a large bunker complex in the middle of the garage. Due to the spacing and the quantity of accommodation units it was not practical to attempt to harden them individually. In lieu, collective shelters were designed and constructed in strategic locations around the accommodation to provide safe cover when necessary.

A near accident during a COs briefing in the intelligence room brought a point home with respect to shoring. Four large (300mm x 300mm x 3.3m) posts were wedged with blocks on the floor to support large cross beams used to shore the ceiling. During the briefing an officer leaned against one post and it swung out like a pendulum. There was a scramble to get out from underneath the beam though fortunately it did not fall due to the nails used to tack the wood in place during construction. When wood dries out it shrinks and it takes a long time for large timbers to dry out. The wood used to shore the room had been indoors drying out for over a week. It quickly became standard practice to check the wedges in shored rooms on a regular basis to remove any slack.

Some interesting points were also discovered with respect to the use of bastion wall, which is the name given to a series of steel mesh baskets attached to one another in a row and filled to provide a free-standing wall for protection against artillery attacks and small arms fire. The baskets

Op Grapple 1 (p94)

arrive in location packed like accordions. When opened up they are 9.3m long, approximately 1.5m high and 0.8m wide with both the top and bottom open-ended, and the interior of each basket is lined with a membrane.

The preferable filler is gravel; it is easy to work with, holds little moisture and is less likely to leak out if the membrane is torn or the mesh damaged. The use of earth was avoided as it did not settle well and held moisture, resulting in movement due to settlement, freezing and thawing, causing the wall to lean and or twist; for this reason earth was unsuitable as a filler when stacking bastion wall two high. It was important to make sure the base constructed for the wall was stable; bastion wall is heavy and once it leans it is difficult to straighten. When stacking bastion wall two high we learned only to fill the bottom wall about ¾ full and then attach the second wall. This allowed the two walls to join together more smoothly. Finally, when bastion wall was being used as load-bearing wall in construction, it became apparent that even gravel will settle over time, therefore causing the ceiling to drop a few inches.

Throughout the camps, ISO containers were used in a variety of different ways to expedite construction: for ammunition bunkers and compounds, as storage facilities, pan washing areas, hardened walls and collective shelters. They may look sturdy, especially when you see them full of stores and stacked on top of each other, however this is a misconception. Specifically designed to take a load on the floor and at the top of the four corner posts, any significant load applied to any other part of the ISO will collapse it. Two ISOs were buried and 0.8m of earth was placed on top to construct an ammunition bunker. Over a period of two months the top of one of the ISOs dropped about 0.3m as the sides and the roof slowly collapsed. The only thing that should be placed on top of an ISO container is another ISO container.

As the project moved towards completion the tasks became more tradesman oriented, specifically for plumbers, electricians and fitters. Tradesmen were gathered together from the troops to form trade specific sections. The concept was that these sections would concentrate on installing the services in one camp and then move to the next camp until all the camps were complete. This idea was brought one step further with these sections being placed under command of the respective clerks of work in location, who then reported to the projects officer. The concept worked outstandingly in practice. The clerks of work no longer had to worry about upsetting the chain of command in the squadron while working on-site and dealing with the tradesmen, and the projects officer now had a hands-on highly qualified supervisor as opposed to a stand-off adviser. It also allowed the troop command elements to carry on with other tasks.

Summary

This has been a brief disclosure of some of the main problems and revelations on camp construction that came to light during the squadron's tour on Operation *Grapple*. It is by no means exhaustive or conclusive. Besides camp construction the squadron was heavily involved in route recces, bridge construction, EOD clearances, and supporting the battalion during its various operations.

Hopefully some of the points mentioned will be of use to fellow engineers who may find themselves at some time and place in a similar situation. With world politics as they are, there is little doubt that there will be a continuing need for "Operations *Grapple*."

The Corps, Construction, and the Future

LIEUTENANT W H K MAINWARING BSc

Lieutenant Bill Mainwaring completed Young Officers' Course 107 in January 1993. On posting to 26 Engineer Regiment he became the Project Officer for the rebuild of the Ladyville Explosive Storage Area in Belize as part of 25 Field Squadron's roulement tour. Since returning to Iserlohn, he has run a JNCOs' Cadre and has taken the regimental Nordic Ski Team to Austria to train in preparation for the 1 (UK) Armoured Division championships in January 1994.

Ladyville Explosive Storage Area – Belize 1993

In this article I hope to explain how the experience gained from large scale construction projects in less advanced countries than our own can be of great value to us all as members of the Corps.

Towards the end of the Young Officers' (YO) Course at the Royal School of Military Engineering I found out that I was to be posted to 25 Field Squadron which had just started a Belize tour. I was to be the Troop Commander of the Airport Camp Troop and as such was also to be the Project Officer for the Ladyville Explosive Storage Area (LESA) project.

The PB7 recommendation to the Training Adjutant, Captain Tom Isaac, worried me somewhat. It advised that my new post should be filled by a civil engineer graduate of good quality. Although I was an engineering graduate my degree was not in civil engineering and my only experience of a construction site was as a concrete spreader on the three-day long Exercise *Borderline*, as part of the YO course. Nevertheless I wrote to the CO 26 Engineer Regiment and the OC 25 Field Squadron to find out exactly what fate awaited me in the Caribbean. Their replies, using phrases such as "thrown in at the deep end" and "the biggest project currently being undertaken by the Corps", did nothing for my confidence but intrigued me nonetheless.

The last two weeks of the YO course flew by and the day after it had finished I was in a VC10 on my way to Belize International Airport via Washington DC. On arrival, after 12 hours in the air, I was met by Lieutenant Simon Croft, who informed me that the weather was going through a cool patch and it was only 30 degrees.

Setting off for work the next day at 7am, in my newly acquired tropical combats, it became apparent that this was no ordinary job. The sun was hardly visible and yet the temperature was already in the high twenties, and the Belizian contractors' vehicles arriving in camp looked like something out of a 1950s film; the MOT was obviously something the Belizians had not inherited from the British. Having met the squadron personalities, taken over my G1098 and met my new staff sergeant and troop (who were far more sensibly dressed in shorts and T-shirts), it was time for me to visit and learn the "ins and outs" of the project.

The LESA is the main storage site for British Forces Belize (BFB), and was originally established as a field storage site unlicensed by DLSA. However, in order to secure a DLSA licence, the following improvements were

Lieut W H K Manwaring
The Corps, Construction, and the Future (p96)

Aerial view of the Ladyville site looking from south to north

required: first, safeguarding of the safety areas around the site, second, extension of the existing compound in order to allow reorganization of ammunition stocks and finally, an improvement to security, fire systems, site wiring and lightning protection.

The reconstruction project was divided into two main phases each of six months and corresponding to the dry season RE roulement tour. Phase One was undertaken by 1 Troop 50 Field Squadron (Construction), attached to 9 Parachute Squadron, from November 1991 to May 1992. Phase Two was undertaken by 2 Troop 25 Field Squadron from November 1992 to May 1993.

The project involved a wide variety of tasks many of which, although not technically demanding, had not previously been encountered by either of the construction troops. These tasks included the reclaiming of the majority of the site from the surrounding jungle and mangrove swamp, which was inhabited by poisonous snakes and crocodiles; one of the latter was captured during Phase Two and became the project pet. The project also included the construction of five steel storage sheds, complete with huge clay traverses, site roads, both concrete and stone hardstandings, extensive electrical wiring to provide power to secure bunkers and to incorporate an intruder detection system (IDS) into both the bunkers and the perimeter fence, and finally the laying and commissioning of an 8in diameter pressurized fire main around the site complete with pump, pump house and 12 hydrants. The project also required a total of nearly 8000 plant hours both for the construction of the new site and the demolition and landscaping of the old site.

As Simon Croft left on the next flight out of Belize, wringing his hands in glee and uttering those immortal words "it's all yours now", it has to be said that I felt wholly unprepared for the task ahead. Due to time constraints on the YO course, the period spent on project management is limited and tends, naturally, to base its teaching on the ideal situation using constants and time factors accordingly. Belize, however, is far from ideal in almost every respect. Not least was the fact that we were some several thousand miles away from the UK from where the majority of the more technical and expensive stores had to be acquired. Then there was the weather, the varying quality of local materials and last, but certainly not least, was the factor which does not appear in any pamphlet, the Belizian factor. It was this last element that possibly caused more problems and heartache than any other.

The Belizian factor, which no doubt applies to a greater or lesser extent in many of the less advanced countries around the world, states that yes means maybe, maybe means never, today means tomorrow, tomorrow means next week, next week means possibly next month and a full working day for Belizian contractors is nine thirty to three with at least two hours' sleep at

The Corps, Construction, and the Future (p97)

View from west of newly constructed ammunition storage sheds. Earth traverses with topsoil covering are clearly shown together with a drainage ditch illustrating the water table even though this was the "dry season".

lunchtime. So both my troop and I had a great deal of adjusting to do and fast. I also found myself with a near vertical learning curve both in terms of troop management and the technical aspects of the project. Fortunately for me I had a garrison engineer adviser, an excellent staff sergeant and troop, and together we managed to adapt, improvise and overcome most of the problems that came our way.

The troop was made up of myself, Staff Sergeant Cork BEM, and three sections. Two of these sections were weighted with class 1 and 2 tradesmen in all disciplines. The third section was predominantly combat engineers and was double hatted as the Harrier Support Section Belize, as well as being heavily involved in the project. The whole troop, as well as being the LESA construction troop, was also responsible for engineer support for the defence of the airport camp. The project had attracted much interest both at a high level in the Corps and within BFB and as a result the project was given priority over our other tasks.

Towards the latter stages of the project a Royal Engineer Specialist Advisory Team, consisting of Lieut Colonel G R Marsh (V), Managing Director of Gallifords and Major A Vest (V), a construction cost consultant, visited Belize. Their aim was to review the design, construction and supervisory standards achieved on the LESA project. Rumour also had it that they were assessing the effectiveness of the Corps at carrying out such tasks in comparison to civilian contractors, and the training value the Corps, and ultimately the Army, gets out of such projects; it was this, true or false, that was the main motivating element behind the writing of this article.

The phrase "with experience will become" appears in many reports from courses run by the Corps. There is quite naturally only a certain amount a course, particularly an artisan trade course, can teach. The proficiency of a soldier in his chosen trade depends very much upon the amount of practice and experience he has had carrying out his trade away from the classroom. The same applies to civilian counterparts whose expertise comes not from passing tests but from practice and experience in the "field." It follows that if our tradesmen are expected to perform to a standard equivalent to their civilian counterparts or are expected to be practically proficient in their trade, then they must be given good quality practice and experience.

If we are to look at the employment of the Corps around the world today, it is clear that the pressures on our tradesmen are enormous. With engineer units serving in the former Yugoslavia, Northern Ireland, Belize and deployed, or ready to deploy, on disaster relief in countries such as Nepal, where there is great emphasis on construction, it is obvious that the need for good experienced tradesmen is more important then ever before. In fact, it could be argued that at present, the requirement for good quality tradesmen outweighs the requirement for combat engineers. This point would seem to be emphasized by the reorganization of training of Royal Engineers' recruits, with all new recruits leaving training establishments with a class 3 artisan trade qualification. In theory this will give units far more flexibility, particularly in peacekeeping operations with the United Nations. But is it training and practice in the

The Corps, Construction, and the Future (p98)

classroom and workshops that make a good tradesman or is it practice and experience on a construction site that makes him proficient and a more worthwhile asset?

In Belize on the LESA project not only were my tradesmen given the opportunity to practise their trades and to improve their skill, but they were also forced to adapt and improvise in order to overcome the many problems faced as a result of varying quality of materials and the ever-present meteorological element. Bricklayers and concretors had to cope with pouring large concrete slabs in temperatures exceeding, at times, 40°C; they had to construct complicated reinforcement cages unlike anything encountered before, while lending a hand to a wide variety of completely unrelated tasks. Carpenters had to make extensive formwork, roof trusses, window frames, doors etc out of untreated local hardwood which was invariably badly warped before it even arrived on site. My plumber and pipefitter completely replumbed the site guardroom, fitted connections to the mains water supply and was heavily involved in the laying of the 8in, solvent weld jointed, pressurized firemain as well as installing and commissioning a 15 bar electrical fire pump. Electricians rewired the guardroom and secure storage bunkers. They fitted a complicated IDS to the security fence and bunkers as well as installing a fire alarm system around the site, and provided lightning protection to all storage facilities. Plant operators were involved throughout the project in a wide variety of detailed and extensive earthmoving and shaping tasks. And finally combat engineers were involved, without any prior training, in almost all of the tasks mentioned above.

This leaves me and Staff Sergeant Cork. As I have mentioned, my construction project experience consisted of three days on the YO course and Staff Sergeant Cork, despite being a very experienced combat engineer, had never been involved in a project of this kind before. Staff Sergeant Cork took it very much in his stride and was extremely valuable to me both in terms of his advice on my responsibilities as troop commander and as the project Staff Sergeant on site. I can safely say that I learnt more in my first few weeks in Belize, both about being a troop commander and about the running and managing of a construction site, than I did in the whole of the YO course. Staff Sergeant Cork also learnt a considerable amount from the project and benefited greatly from broadening his horizons.

It took me about two weeks to become familiar with the project requirements and this seemed to coincide with the start of many Belizian factor difficulties. First a breakdown of equipment at the region's only hardcore supplier, followed by the breakdown of the only concrete supplier's vehicle, and then the weather and local ground conditions. These problems and others were to plague the project from start to finish and resulted in the requirement for a considerable amount of hot planning. In fact the project cascade had to be rewritten frequently in the final four months. It was this planning under pressure, combined with the requirement to maintain the morale of a troop who were working long hours in very difficult conditions that has given me considerable confidence which I have found invaluable since returning from Belize.

Despite the Belizian factor and related difficulties, the project was finished on time and almost to budget. The quality of work was deemed to be satisfactory by the technical audit team, the underlying theme to their findings would seem to relate to the lack of experience we all had, individuals and the Corps alike, in projects of this magnitude. What was more difficult to assess, and not fully covered by the audit, was the benefit gained, by both the Corps and the Army. My personal view is that the experience gained by all involved with the LESA project was invaluable. Not only has a fully operational ammunition complex of a standard well up to that of a civilian contractor been provided, but the Corps now has 30 soldiers of all ranks who, as a result of experience gained, are far more confident and able to cope with the problems which will face them in the future. This is particularly important when consideration is given to the fact that their likely employment in the future may be in geographically and possibly militarily hostile areas – for has not the history of the Corps ever been thus?

A Curious Plan of Defence for Gibraltar

COLONEL E P F ROSE TD MA DPHIL MIWEM CGEOL FGS

WHILST delving into the history of geological research on the Rock, an incredible "new plan of defence for Gibraltar" dating in concept from Napoleonic times came to light (*Figure 1*). It forms one of a series of proposals, including the fanciful use of rockets and balloons, that may amuse engineers with an interest in historical curiosities (*Figure 2*). My thanks are due to Alex Donald (Mrs John Dodge), Administrator in the Department of Geology at Royal Holloway & Bedford New College, for drawing my attention to these in a recent article by Mrs Joan Leach concerning their author, Charles Rogier.

Rogier was by all accounts a colourful character. He probably served as the model for Monsieur de Chalabre, the key personality in a short story entitled My French Master by the Victorian novelist Elizabeth Gaskell, a contemporary of Charles Dickens and Charlotte Brontë,

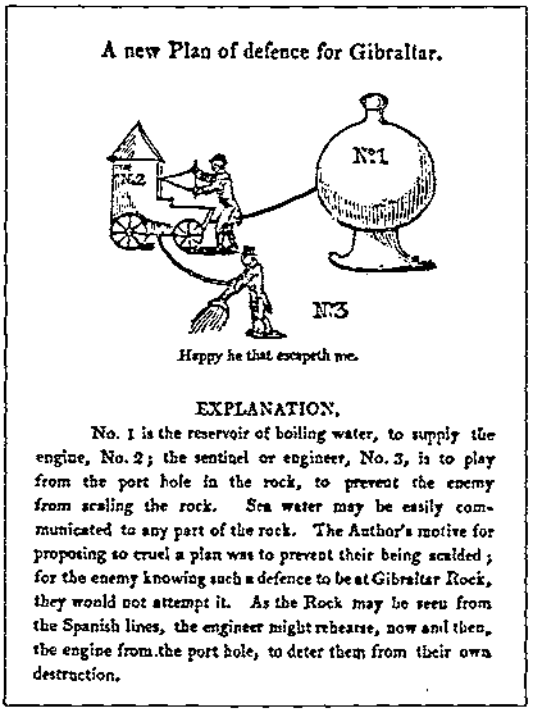


Figure 1. Facsimile of the "new plan" illustrated by Rogier (1818), with original caption and illustration.
(Figures 1 and 2 both reproduced by permission of the British Library.)

for he was a prominent figure in society at Knutsford, Cheshire, during Mrs Gaskell's youth there. Some of the characteristics ascribed to Chalabre may therefore by those of Rogier.

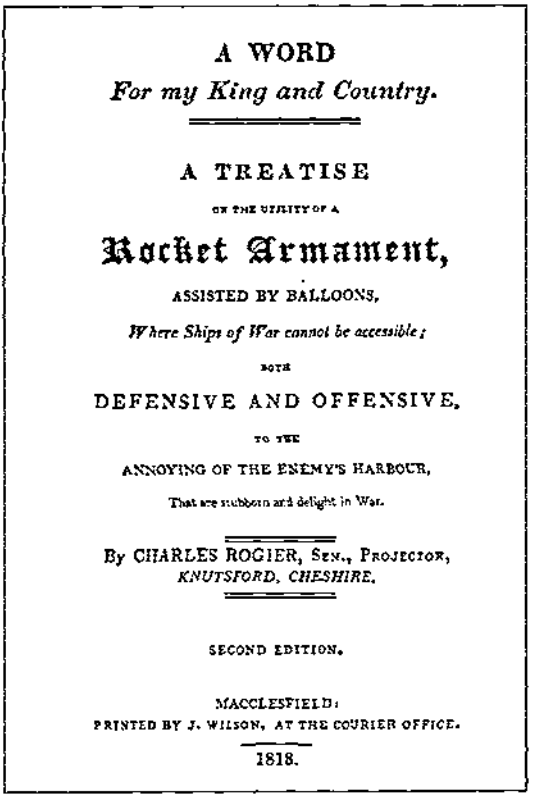
For certain, it is known that Rogier was by profession not an engineer but a dancing master. In Knutsford he "had the honour of instructing respectable families and scholars in the science of dancing, so as to promote a genteel, personal address; and likewise a useful, bodily exercise, which may be innocently attained to be a health exercise" (Rogier, 1818, p22). His father, whom he claimed to be the son of a Count of the Holy Roman Empire resident in Paris, had been a figurante dancer in Garrick's theatre company, so Rogier had also taken to the stage as a dancer until the age of 21. In consequence he was physically very fit, if renowned for his lack of common sense.

His fitness is attested by Henry Green, the Unitarian minister of Brook Street Chapel Knutsford from 1827 to 1873. Green (1859, p134) records that Charles X of France, then "The Count D'Artois, for he was not yet king, had a rage for rare plants, and his floral passion was known to a French Dancing Master, then resident in Knutsford, – Rogier was his name. the Professor waited on the Count ..." who told him about the rare marsh saxifrage which grew on the Moor, "together they set out exploring, – ditch after ditch they successfully crossed – when, lo' one wide and deep with the peculiarly unctuous mire of the locality, arrested their eager progress; Rogier, being light and a dancing master, pirouetted across the abyss, but the Count, being heavy and not a dancing master, floundered in ..." and "having an alacrity at sinking, experienced no little trouble to get out again on the firm ground". Green infers that Rogier and a Cheshire bog thus came close to changing the succession of French Bourbon kingship.

Rogier's impracticality is recorded by the Reverend Harry Gray, Vicar of Knutsford from 1809 to 1824, whose memoirs (cited by Leach, 1991) claim to have found him "weak in secular matters and so improvident that I was at length obliged to raise an annual subscription, a little

scanty income sufficient for himself and his wife, and dole it out to him by periodical payments".

Henry Green knew Rogier when first taking up his post in Knutsford, and refers (1859, p135) to him as one who "was in truth an original of the purest water. He was one who delighted in obtaining introductions to persons high in authority or in writing long letters to them upon most extravagant projects ..." "He had extraordinary ideas for paying off the national debt, for assailing impregnable fortresses, and for defending the Rock of Gibraltar". His plans "were almost glorious for the very absurdity." According to Green "The plan for the defence of Gibraltar was one which would certainly have been worthy of a Cheshire man. Scalding butter milk was to supply the place of the red-hot cannon balls which [General] Elliott used; let a sufficient quantity of that boiling liquid be poured over the decks of the French and Spanish men-of-war, and, said Rogier, 'they would not stand it a single minute, – the ships would at once surrender'." Green reported that Rogier approached the then Prime Minister, Earl Grey, with his proposed defence plans, who "in an unwonted spirit of waggery, or whiggery, referred the ingenious projector to the War Office." However, his novel schemes were never tried!



A WORD

For my King and Country.

A TREATISE

ON THE UTILITY OF A

Rocket Armament,

ASSISTED BY BALLOONS,

Where Ships of War cannot be accessible;

BOTH

DEFENSIVE AND OFFENSIVE,

TO THE

ANNOYING OF THE ENEMY'S HARBOUR,

That are stubborn and delight in War.

By CHARLES ROGIER, Sen., Projector,
KNUTSFORD, CHESHIRE.

SECOND EDITION.

MACCLESFIELD:
PRINTED BY J. WILSON, AT THE COURIER OFFICE.

1818.

Figure 2. Title page of Rogier's brief treatise.

References

Gaskell, E C 1906. My French Master, p506-531. In: *The Works of Mrs Gaskell*. With introductions by A W Ward (the Knutsford Edition). Vol 2 Cranford and other tales. Smith, Elder & Co, London (First published in *Household Words* on 17 and 24 December 1853).

Green, H 1859. *Knutsford, its traditions and history: reminiscences, anecdotes and notices of the neighbourhood.* Smith, Elder & Co, London, 156pp.

Leach, J 1991. The French Master. *Gaskell Society Newsletter*, for Autumn 1991, P12-16.

Rogier, C 1818. *A word for my king and country.* 2nd edition, J Wilson, Macclesfield, 23pp. (1st edition of 250 copies circulated privately).

Euro NATO Training Engineering Centre (ENTEC)

WARRANT OFFICER CLASS 2 C J MORTLOCK

The author joined the Royal Engineers in 1978 and, after tours in Germany, the Diving School and HQ UKLF, eventually ended up as a staff sergeant in 16 Field Squadron, 25 Engineer Regiment. On their disbandment he was posted as the first resident QMSI to the Euro Nato Training Engineering Centre in Munich, in April of 1992.

Background

72 hours ago, the Allied Rapid Reaction Corps (Land)(ARRC(L)) deployed the Multinational Division (C) (MND(C)) to secure a seaport of entry and an airport of entry. The main body of the ARRC has started to arrive. During the first 72 hours the MND(C) has been severely reduced in capability by a determined opposing force.

The Commander ARRC decides to replace the MND (C) with the UK 1st Armoured Division.

Questions:

As a Commander of a Sapper squadron, do you understand all about the following:

- STANAG 2082 – Relief of combat troops.
- STANAG 2101 – Establishing liaison.
- STANAG 2036 – Land minefield recording and reporting.
- STANAG 2989 – Transfer of barriers.
- ATP 35 – Land force tactical doctrine.
- AAP 19 – Glossary of engineer terms and definitions.

And do you really know what happens on the ground? Do your subordinate commanders know the procedures for a handover-takeover of an obstacle, or how the firing systems that other countries use within the ARRC are laid out? Even more important do you and your subordinates know which countries can support which in an armoured assault?

Answer:

If the above questions were answered in the negative then take heart, there is a multinational engineering school within NATO which covers these subjects and provides interoperability training from section to division level. But where is it and what other functions does it have?

History

It was during Exercise *Makefast* in 1972 that problems of interoperability between engineer units from different nations were first recognized.

ENTEC was established as a result of a proposal by CENTAG (Central Army Group) to the Commander-in-Chief, Allied Forces Central Europe (CINCENT), General Blanchard, in 1977. At that time plans called for the forces of seven nations to be employed in the central region and it was very clear to General Blanchard that unless engineers were able to function efficiently, be it across formation boundaries or when conducting relief operations, procedural and obstacle handover problems could arise that would seriously jeopardize operations.

Euro NATO Training Engineering Centre (ENTEC)
p102

General Blanchard, US Army, said:

"In the absence of standardization, the only practical means of overcoming these problems is for nations to train in the use of each other's equipment."

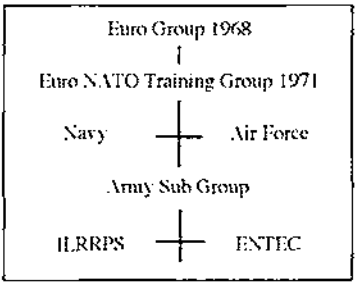
At a NATO army subgroup meeting in Rome, it was decided that courses of instruction for the improvement of cooperation between allied engineers should be established. Out of that decision ENTEC was born.

ENTEC is a part of the Euro NATO Training Army Sub-Group, which belongs to the Euro Group. This latter group was formed in 1968 at ministerial level with the following aims:

- To improve training programmes.
- To develop new training programmes.
- To reduce training costs.
- To obtain maximum training benefits.

Times have now changed, and the alliance is moving towards lower levels of interoperability than before, because the emphasis on the central region is now no longer justifiable and the ARRC could deploy to any number of locations.

ENTEC lies in the same family tree as the International Long Range Reconnaissance Patrol School (ILRRPS). As you can see below, ENTEC has a direct line into the Euro NATO Training Group.



And it is based in the German Engineering School in Munich, Southern Germany.

Mission

The aim of ENTEC is that the nations that have signed the Memorandum of Understanding (MoU), (and these are currently Belgium, Canada, Germany, Netherlands, Norway, the United Kingdom and the United States) conduct training on member country's mines and demolition equipment, and with this training, increase their engineers' ability to support or take over sectors from each other successfully. Towards this aim, ENTEC has trained almost 4000 students up to October 1993.

In addition to present members, Italy and Denmark are currently showing interest in joining and France regularly provides students.

Interoperability Problems

NATO set itself the problem of trying to improve on its initial Interoperability Treaty signed in 1949. This treaty resulted in the formation of the Armaments, Standardization and Interoperability Division at HQ NATO.

There are two aspects to the problem of interoperability and these are:

- To encourage equipment standardization.
- To develop interoperability procedures.

ENTEC is actively involved in both, but the question which has to be asked is, "why has progress, if any, been slow?" The answer to this is simple, not one NATO member is willing to surrender the lucrative spin-offs from defence sales and development, or to become dependent on another nation for the supply of defence hardware which may affect the security of a nation in times of tension or open war.

Engineer equipment standardization is the responsibility of Panel IX at NATO and ENTEC is a member of this committee. It is ENTEC's view that too much emphasis has been placed on major projects for standardization, such as armoured vehicles and mine laying equipment, which have little or no hope of progressing. Instead smaller items should be discussed, such as electric blasting equipments and detonating cord connectors.

With the following number of engineer mines and explosives available within Allied Forces Central Europe (AFCENT) alone (each of a different design), you can see why it would be more sensible to start on the smaller items:

- 39 antitank mines,
- 29 antipersonnel mines,
- 7 types of safety fuze,
- 57 initiation/firing devices,
- 17 detonating cords,
- 10 flash detonators,
- 8 electric detonators,
- 66 demolition charges.

But what about interoperability procedures? This is a matter of commanders agreeing on command and control as well as reporting procedures

for their respective equipments. Obviously the different levels of performance must be taken into account, but for command and control this is not vital. Interoperability of procedures for command and control can be gauged by the number of standardization agreements that are in use by engineers or affect engineers today:

- 2154 Regulations for military motor vehicle movement by road.
- 2174 Military routes and road networks.
- 2259 Terrain.
- 2269 Supply.
- 2818 Characteristics of demolition accessories to determine their operational interchangeability.
- 2868 Land forces tactical doctrine.
- 2929 Airfield damage repair.
- 2963 Coordination of artillery delivered scatterable mines.
- 2019 Military symbols for land based systems.
- 2025 Basic military road traffic regulations.
- 2029 Methods for describing ground locations, areas and boundaries.
- 2079 Rear area security and rear area damage control.
- 2082 Relief of combat troops.
- 2101 Establishing liaison.
- 2136 Minimum standards of water potability.
- 2236 Stopping power of land minefields.
- 2395 Opposed water crossing procedures.
- 2430 NATO study – the exchange of engineer information.
- 2002 Warning signs for the marking of contaminated or dangerous land areas.
- 2394 Land force combat engineer doctrine (ATP 52).
- 2885 Emergency supply of water in war.
- 2889 Marking of hazardous areas and routes through them.
- 2990 Principles and procedures for the employment in land warfare of scatterable mines with a limited laid life.
- 2991 NATO glossary of combat engineer terms and definitions.
- 2010 Military load classification and markings.
- 2017 Orders to the demolition guard and firing party commander.
- 2021 Military computation of bridge, ferry, raft and vehicle classifications.
- 2036 Land minefield laying, marking, recording and reporting procedures.
- 2096 Reporting engineer information in the field.
- 2123 Obstacle folder.

The differing levels of command structure also give rise to interoperability problems, as these different levels have various modes of operation, philosophies and interpretation of the meaning of STANAGs (Standardization Agreements). For example, nations have different ways of interpreting the state of "readiness 1" on a demolition target; at the moment there are approximately six different levels of "state 1" preparation. Even more disturbing is the fact that some countries even place live mines in a phoney minefield!

With nearly all NATO countries restructuring their forces to cope with the changing face of the world as we know it (in the military sense) differing doctrines and operational requirements for each country's units are being produced.

There are of course, areas of interoperability that have not yet been touched and, with the formation of the ARRC, areas such as host nation support, line of communication bridging and engineer support to the deployment of forces into an out of area (OOA) theatre of operation, need to be addressed rapidly.

ENTEC has already been active in these areas, and has made a major contribution to the development of the new NATO engineer reporting and returns procedure. This will allow information to be transmitted using pencil and paper at troop level to be collated at battalion level. It is ENTEC's belief that all information is required up to this level of command and that it be held on computer. Above battalion level, it is proposed that all information be available but only on a request basis, with a filter system so that only the important information is brought to staff officers' and commanders' attention.

A major difficulty encountered with interoperability is language. ENTEC produces a variety of books to help overcome this problem such as:

- Engineer glossaries that enable translation of every day engineer terms from English to German to French and vice versa.
- A checklist for the handover-takeover of obstacles, produced in four languages.
- Handbooks which cover arming and disarming of mines, and capabilities of engineer munitions, also in three languages.

Staff

ENTEC staff are broken into two groups. The first group consists of personnel from five nations. The course director is a German lieut colonel and the 2IC is an American captain. The five permanent instructors' ranks range from staff sergeant to lieutenant.

The second group consists of the liaison officers to the German Pioneer School, one each from Canada, France and the United Kingdom.

Courses

ENTEC runs four different levels of courses, each with a "best" and a "max" attendance limit, divided up so that each member country is allocated "x" number of places. When courses are attended by students from nonmember countries, they are invited to instruct on their country's equipments, formations and doctrines.

Not only formal courses are run by ENTEC, the staff are also actively involved in the professional development programme, mobile training teams, the production of ENTEC handbooks, the review of standard NATO agreements and central region directives.

The strategy of training at ENTEC is covered by four main headings:

- National subjects.
- Host nation subjects.
- NATO subjects.
- General subjects.

The first, national subjects, is training which covers the equipment and organization of the MoU permanent countries and, during the instructors' course, includes a live demolition day.

The host nation subjects deal entirely with the German Army system and the support that they can give to other Allied armies deployed in the AFCENT area. The lessons not only include the correct opening procedure of the ammunition bunkers to be found around Germany, but also a very interesting tour of the Inn Valley, Peacetime Prepared Obstacle (PPO) Plan, conducted by the *Wallmeister* team for that area. The students on both the instructors' course and the platoon leaders' course gain firsthand experience of obtaining access to and preparation of all the PPOs in the area. Although host nation support from Germany may be considered old hat by some, the experience gained from over 40 years of supplying that support cannot be ignored, in fact some of that experience can easily be copied to other nations.

The next group of subjects come under the heading of NATO. In this category there are five subjects:

- NATO command structure.
- STANAGS.
- Obstacle documentation.
- Obstacle transfer.
- Mine warfare.

The lessons are varied and are designed to enforce what the students already know.

The final group covers general subjects:

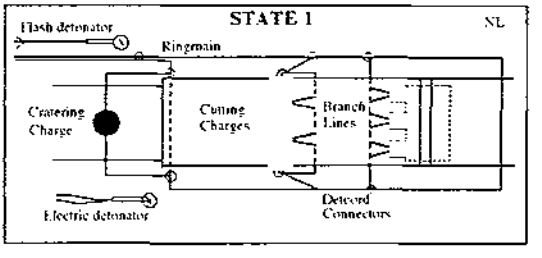
- Threat mines.
- Terrain documentation.
- Working groups.
- Social events.
- City tour.

There have been discussions, during ENTEC working group meetings, as to whether some of these subjects should still be taught. Experience has shown, however, that some subjects are now more important than in the past when the Warsaw Pact was still in existence – threat mines being an example. Information on mines is being passed to the national instructors from many sources and this makes ENTEC an excellent source for information; in fact twice in the recent past ENTEC has given lectures to nonengineer troops deploying to Cambodia, and recently instructors went to Dutch and American units to give a briefing on threat mines and NATO equipments.

One popular item occurring during this part of the course is where students, working in small syndicates, are given a set of situations to discuss and resolve, keeping in mind the various doctrines used by the nation of the individual students involved. After a set time each syndicate is tasked to present the answers they have decided upon to the rest of the course; this can lead to some very interesting comments even from students from the same nation who are in different groups.

One of the problems set is:

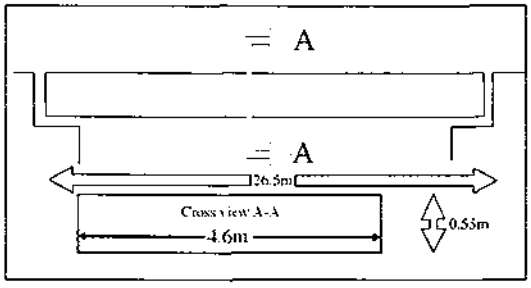
Would you change another nation's firing circuit to your own national doctrine, after taking over a prepared reserved demolition? For example, one of your units has to take over a Dutch prepared reserved demolition as shown:



Do you disconnect the horizontals from the verticals or not?

Second example: A field-type preliminary demolition obstacle has to be prepared for

demolition; there are no cutting charges available. The dimensions are as shown:



According to the GE manual you should need 1265kg of TNT, according to the UK manual you should need approx 100kg of PE4. When you have to take over this target would you accept the GE way of calculation or not?

These are only two problems which could arise during a transfer between two different nations.

During these working groups ENTEC try to make the senior NCOs and troop commanders aware of the problems which could arise on the actual work-floor.

Now to deal with each level of course in more depth. The first and the longest is the instructors' course, with usually 24-28 students. This type of course is run seven times a year and the objectives, which are mainly aimed at hands on training, are:

- To recognize the different types of NATO engineer munitions.
- To understand the different minefield specifications of Allied nations.
- To carry out demolition tasks using materials of Allied nations, this also includes a live range day.
- Finally to carry out the handover of obstacles at platoon level.

The next step up the ladder is the platoon leaders' course which is designed to provide officers with the theoretical knowledge required to advise their superiors on the subjects taught at ENTEC. The course is one week long and in the case of the UK is aimed at lieutenants and captains. It is held three times a year and each course has 24-28 students.

Both the platoon leaders' and the instructors' course students have the opportunity to exchange information freely. This is achieved in two ways, firstly the students are accommodated in two-man rooms, each occupant being from a different nation and secondly, during lessons students sit in multinational groups. Both approaches help overcome the language barrier and promote interoperability.

The last two courses run at ENTEC are aimed at field grade officer level for the UK.

The first is the company commanders' course, run twice a year, which is one week long with 30-35 students. Dealing with subjects up to brigade level, by the end of the course the student:

- Can work in a multinational brigade staff in a multinational headquarters.
- Knows the capabilities of the Allies.
- Can plan brigade level barrier operations, including transfer, control and execution.
- Has a better understanding of the variety of mines and demolition equipment as well as the organization and deployment methods of ACE engineers.
- Is better able to prepare his unit to deploy to any of the current NATO operations.
- Has a better understanding for OOA operations and the planning they require.

The final formal level of course held at ENTEC is the battalion commanders'/senior staff officers' course, for majors and above working up to divisional level. Also one week long, between 50-60 students can attend and the course prepares student to:

- Work in any multinational headquarters in NATO.
- Plan for engineer aspects of divisional, Corps and multinational operations.
- Understand OOA operations.
- Execute passage of lines, river crossings and relief in place operations as well as barrier control and execution.

These students also work in multinational groups and work on a mapex which involves:

- Host nation support.
- Passage of lines.
- Relief in place.
- Counterattack.

ENTEC also runs other courses with the aid of the mobile training team (MTT). The team is able to run courses within the country requesting such training, and in recent years three such sessions have been carried out in the USA. The objective of these courses is to provide troops who may deploy to the ACE area with some idea of what to expect in terms of engineer assets in theatre.

Finally there is the professional development programme. This is where a unit can request to

come to ENTEC to carry out a training period of one or two days and cover any subject specifically requested by that unit. This type of course unfortunately does not have an international flavour but does give some insight into interoperability problems.

The Changing Face of NATO

The changing face of NATO has made interoperability a byword for the future and to this end ENTEC is changing its approach to the subjects taught. In addition contact is being made with the old AFSOUTH countries such as Greece, Italy and Spain, thus making ENTEC one of the focal points for engineers in the Allied Command Europe.

Summary

The reasoning behind writing this article was mentioned at the beginning. As the UK is the leading element in the future of the ARRC, I have tried to make readers more aware of ENTEC, a place where interoperability training can be carried out at a relatively cheap cost. In the age of the new management strategy, COs have to account for their unit's expenditure and yet in the case of ENTEC courses, the only bill the unit has to pay is for subsistence and travel.

The investment return on a student attending such a course, at whatever level, far outweighs material costs; a man with knowledge of our Allies' doctrine and equipment, in these times of change, will be a great asset to his unit and to himself.

ENTEC – The Way Ahead?

I believe that the way ahead is to provide multinational engineer training at all levels at the Euro NATO Training Engineering Centre. ENTEC is currently in the process of reviewing all its training objectives and schedules to reflect the climatic changes for engineers in the future, therefore ensuring that it stays at the forefront of engineer interoperability training through the 1990s and beyond.

The Gulf War 1991

This painting was commissioned to commemorate the part played by Sappers during the Gulf War in 1991. Johnny Jonas, whose previous painting for the Corps depicts the Indian Sappers and Miners, accepted the commission, and used contemporary photographs and eye-witness accounts in its formulation. The painting was unveiled by the Chief Royal Engineer, General Sir John Stibbon KCB OBE, at the Corps Guest Night in the RE Headquarter Mess on 10 February 1994 in the presence of the artist.

The scene symbolizes the essential logistic work undertaken throughout the theatre. The pipe in the foreground represents the many miles of fuel and water pipeline laid across the desert, whilst the combat engineer support to the advancing brigades is represented by a Centurion AVRE, a Chieftain Bridgelayer, a Combat Engineer Tractor and a Chieftain AVRE, complete with their special modifications. In the background can be seen the smoke from the burning oilfields in Kuwait, and the vapour trails of the attacking coalition air forces.

The Gulf War 1991 (p107)

An Irish Reconnaissance

This is the story of a Very Secret mission which was carried out in 1941. It is not suggested that its execution should be regarded as a model. It was first printed in the *Joint Services Staff College Gazette* in 1957 and is reprinted here with the kind permission of the editor.

Northern Ireland was an armed camp, with a British Corps ready to race south the moment the much-expected German landing materialised. My division was to move with all speed to a concentration area west of Dublin, to cover the city, and secure the airfields.

The country there is flat, rather boggy, and intersected by canals. There are hump-backed bridges over these canals, which presented formidable obstacles to our troop-carrying vehicles. These last had started life as respectable English touring buses, and they looked raffish in their coats of khaki camouflage paint. With their low clearance and long wheelbase the smallest hump – of which we had had ample experience in Ulster – would bring a bus to a grinding halt. There it would stay, immovable and malignant, and constituting, with its companions held up behind it, a particularly effective road block. One had to be very careful when passing bridges as safe for buses.

We had to be sure that our division could in fact get into its concentration area. There were no air photographs, and severe restrictions governed visits to the South. Private travel was forbidden, and even reconnaissance for our operation was limited to clandestine work by some very secret people at Corps HQ. The Irish police had found an enthusiastic officer inspecting a bridge over the Boyne, with a gridded map in one hand, and a foot-rule in the other. The sentence was six months' imprisonment for espionage.

The secret men at Corps seemed reluctant to risk their reputations on the performance of our motorbuses. We could understand their point of view.

Three days before Christmas an unexpected message arrived from Corps. A very clandestine Lieutenant Colonel from Corps was to take a WD civilian car over the Border to go to a secret meeting with a high personage in Dublin. Peter, the division's intelligence staff officer, was to go with him, together with someone who knew about buses and hump-backed bridges. The party was to drive down two days before Christmas, spend the night at a hotel in the concentration area, and return on Christmas Eve.

My feelings were mixed when I was detailed as the expert on bridges. But in the Mess opinion was unanimous that there could be no better way of recouping our rocky finances, drink being much cheaper in the South. The Brigadier let it be known that he was partial to Green Chartreuse, which could not be bought in the North.

We got off to a good start, and were more than fifty miles on our way when the Colonel asked Peter sourly if he knew he had khaki socks on. Peter retaliated by discovering an Army vehicle log book in the car's front pocket. We went on in silence with our (gridded) maps under our seats.

The first bridge was simple. It had recently been widened, and good approach ramps had been built up. But as I got back into the car I noticed that the tyres were of brand-new Government supply, liberally marked with broad arrows.

The second bridge was in the middle of a village, and it looked very doubtful to me. It had to be measured carefully – a tedious and obvious business. The Colonel stayed in the driver's seat, while Peter and I cavorted round the bridge, hoping we looked like young men from the County Surveyor's office. Perhaps we did better than we thought, for a woman came out of a cottage and said that if we wanted to know more about the bridge, she was sure her husband, the village constable, would know; he would be home for tea any minute. We assured her we had found out all we needed, and departed hurriedly.

We drove round the concentration area, and then stopped at the third and last bridge, which was only a little way from the hotel we had chosen for the night. The Colonel stayed at the wheel, and Peter and I got to work with level and tape-measure. Suddenly we heard a car coming. We tore the bonnet open, stuffed our tools in, and pretended to be very interested in the engine. The car stopped and the driver got out. He was anxious to help, and asked if petrol was the trouble. We assured him that we had just put it right, and Peter hurriedly closed the bonnet; even in Ireland it would be difficult to explain the presence of forty-odd feet of tape-measure draped over the cylinder block. Our would-be benefactor was a friendly

soul, and he chatted for some time. He had a roving eye, though, and I saw it fix on the front wheel, by which Peter was standing. Was it the socks, or the tyres, or both?

At last he went, and we repaired to the hotel. The Colonel had a cold, and went to bed early. It was a gloomy place, so we asked the barman what went on in the town. After two rounds – barman included – we learnt that there was a poteen still at O'Flaherty's place down the road. We were just making sure of the way, when in walked our friend of the third bridge. "Well, isn't that splendid now," said the barman, "Here's Mr O'Reilly, and he'll be going to O'Flaherty's himself ..." Sure enough he was, and there was no escape from him.

It was a memorable evening. The poteen – if such it was – was quite a drink; raw Calvados, laced with petrol, might equal it. Mr O'Reilly, between glasses, said he was a businessman, and very sympathetic to the English; he was also a close friend of the Chief of Police. It was a fine car we had, and particularly the tyres. He had a car of the same make. Would we not sell him our tyres, and go home on his old ones? We explained that we could not possibly offend the owner by doing such a thing. Mr O'Reilly said again that he was a friend of the Chief of Police, and he was sure it would be all right – and anyway there was plenty of money to be had in Dublin, if you knew where to go. I remember little more, but we got away in fair order, and I last saw O'Reilly conducting an intricate verbal fugue with his bottle of poteen, on the double motifs "a new set of tyres" and "friendship with the Chief of Police."

Next morning, atrabilious, we crept down to breakfast, to find the hotel deserted. There wasn't a soul in the place. Came a thunderous knocking on the front door, and a policeman peering through the window. Memories of O'Reilly and the Chief of Police came back to us. Peter dashed upstairs, to destroy the maps by eating if need be – an excellent but impractical thought, as he had left them in the car. Meanwhile, ready to protest my innocence to the last, I opened the door. There was a policeman, but no O'Reilly. It was only the hotel staff, who had locked themselves out when they went to Mass. The policeman was the cook's husband.

The Colonel came down later. He remarked that we looked as if we were getting his cold. We did not disillusion him.

The next move was to Dublin. We bought the stock of drink for the Mess while the Colonel had his meeting. The wine merchant told us to be careful at the Border, as it was forbidden to import any alcohol into Ulster.

On the way, we discussed our tactics at the Customs. The best way seemed to be to declare a single bottle as a diversion, and leave the rest to charm and improvisation.

It was a small Customs post. The officer was a very big man, with a contemplative eye. He bade us a grave good-day, and asked if we had anything to declare. Any firearms? Or livestock? No. Subversive literature, maybe? No. Or alcohol, perhaps? Well, yes, we did have a bottle – truly a soft drink for the Brigadier. Indeed, and what sort of a drink might that be? He was becoming more and more thoughtful, and at any moment he might have delved into the precious pile on the back seat.

Hastily we opened the bottle and poured him a mugful of the lovely green liqueur. He drank it in one, and wiped his massive jowl. "Faith," he said, waving the mug, "Tis a wondherful drink ... Drive on!" We took the hint and refilled the mug. My last memory of the Free State is of a landscape dominated by a vast figure waving a mug, and gyrating slowly as he drank.

On the other side of the hill we stopped and finished the bottle. The Colonel was expansive; his visit had been a success, and we asked politely about it. "Yes," he said, "A nice man, the Chief of Police. But the chap who really interested me was a fellow called O'Reilly."

MAJOR GENERAL HENRY BAINBRIDGE CB CBE

Born 1 September 1903, died 12 September 1993, aged 90

HENRY Bainbridge came from a military family. His grandfather was a general in the Indian Army, who served throughout the Indian Mutiny and Lord Napier of Magdala's Abyssinian Campaign. His father was Brigadier General W F Bainbridge CB CMG CBE DSO, who saw service in Peking, the Sudan and the Third Afghan War.

Educated at Haileybury College and the Royal Military Academy, Woolwich, to which he won a prize cadetship and a cadet scholarship, he was commissioned into the Royal Engineers in 1923.

Following the young officer course at Chatham, he saw service with 1st Searchlight Battalion at Blackdown 1925-9; was Garrison Engineer of Northern Ireland, Jamaica, Portsmouth and Plymouth between 1929 and 1935; and instructor at the School of Anti-Aircraft Defence in 1936, from which he passed the competitive examination into the Staff College. At Camberley, he found his vocation in handling complex organizational problems in the field of Staff Duties.

Henry was a staff officer *par excellence*, who could handle staff appointments better than most of his contemporaries. From the time he graduated from Staff College in 1938, he was employed almost exclusively in the Staff Duties branch of the General Staff, responsible for organization and executive decision-making, or in planning appointments.

When the Second World War started in 1939, he was in the Staff Duties Directorate of the War Office. Sent out to the Middle East in 1940, he served as a GSO1 in GHQ, Cairo, until 1942 when he was brought back to the War Office Staff Duties Directorate to become one of its deputy directors.

At the end of the war in Europe, he was sent out to Singapore as the Brigadier General Staff (Staff Duties) in CHQ Allied Land Forces South East Asia. He carried through the complex withdrawal of British troops back to the United Kingdom, Indian troops to India, and the Japanese prisoners of war back to Japan (an operation appropriately codenamed *Nipoff*. At the same time, he was managing the Dutch and French reoccupation of their Far Eastern Empires, and relaying the foundations of the British postwar deployment in Hong Kong, Singapore, Malaya and Borneo.

Promoted major general, he returned to the War Office in 1949, this time as Director of Manpower Planning at the time when hopes of real peace were being drowned in the rising tides of the Cold War, and it was clear that Britain would have to retain National Service into the foreseeable future.

His last appointment in the Army was as Deputy Quartermaster General in 1952, a post he held throughout the Korean War, the worst period of the Malayan Emergency, and the build-up of NATO. These commitments required the resolution of many major logistical problems and made full use of his agile and analytical mind.

After retiring in 1955, he joined the management consultants Urwick Orr and Partners, becoming a senior partner before he finally retired in 1969.

Henry married Margaret Letitia (Peggy) Oldaker in 1930, and they had three boys, the eldest of whom died in early childhood. Henry was very proud of his family; at his death he had eight grandchildren and eight great-grandchildren. A

Major General Henry Bainbridge CB CBE

crowning event was a group photograph taken at his 87th birthday party, which included all his direct descendants and their spouses.

When he retired from the Army in 1955 Henry and Peggy moved to Peaslake in Surrey, where they threw themselves with gusto into the life of the village and its church. Henry soon became a member of the PCC and its Stewardship Committee, and shortly afterwards was appointed Churchwarden, a post which he held for 20 years. During much of this time he was also Treasurer. He served on the Management Committee of the local Memorial Hall during a critical period of rebuilding.

In 1971 the village policeman started a branch of the Boys' Brigade. Henry was asked to become its President, a responsibility which he undertook with great zeal and pride. He is remembered by the branch leader as "a figurehead, a mentor, always ready to listen and advise, watching the boys' progress with interest."

Henry and Peggy were keen members of the Gardening Association. After Peggy's death in 1976 Henry continued for many years as President of the association, and presented major trophies including the Peggy Bainbridge Rose Cup.

Being well aware of the "use it or lose it" element of village life, he supported local amenities and events, and in his closing years played a major part in the campaign to resist closure of Peaslake primary school.

The Peaslakers, amongst whom he lived for more than 38 years, remember him with affection: "...one of the best...a real gentleman...a very model of a modern major general...a peppery, outspoken man, who could be stubborn, but who would acknowledge his errors with the same outspoken directness...a man who mellowed with the years, and who bore the difficulties of extreme age with forbearance."

Henry and Peggy are buried together in a simple grave in the wooded cemetery on the hill above St Mark's, Peaslake, the church where they worshipped for so many years.

RIR JRB

LIEUT COLONEL N J GELL MC*

Born 21 December 1918, died 13 November 1993, aged 74

Lieut Col N J Gell MC

NIGEL Gell came from a family with a long tradition of service, military, church and the law – his father was Captain of the RN Navigation school and was responsible for organizing the 1935 Jubilee Fleet Review. Following education at Stubbington Preparatory School and Wellington College, he entered The Shop in January 1937. JHF records: "From this early date I owe him a great debt, because I had passed in low but he taught me how to work and play sufficiently hard to pass out as a Sapper." Commissioned into 40 YO Batch on 25 August 1938 he went up to Corpus Christi where, although he had not come from a rowing school, he stroked the 1st VIII in the 1939 May races.

In January 1943 Nigel was posted to 1 London Motor Division RE (later to be retitled 56 (London) Divisional Engineers) but was sent on detachment to the BEF during the retreat to the coast. He was evacuated from Bologne in company with the Duke of Gloucester and a canvas grip full of champagne! Soon after rejoining the Divisional Engineers he was appointed adjutant (aged 21). He had been the Flame Warfare Officer to the Engineer Forces in Kent preparing the coastal defences.

After volunteering for service in the Western Desert, he joined 572 Army Field Company in

1942 and began the construction of a 30-mile-long water pipeline from Tobruk to the Free French Troops. It was during the battle of El Alamein that he earned his first MC – "On 23rd October 1942, near El Wiska, whilst Major Gell's Field Company was clearing gaps in the enemy minefields to permit the advance of an armoured division, the OC became a casualty. Major Gell at once took over. His unit was working on three different routes and W/T communications had failed. He constantly visited each section, under shell and machine gun fire showing complete disregard for his own safety, encouraging and leading his men on to their dangerous work. On one occasion when a section had been forced to take cover owing to heavy fire, by his personal example he led them again into the mine belt and successfully opened the gap. He displayed a magnificent example of coolness and courage during the minefield clearance operations."

In January 1943 Nigel was posted as SO11 RE to Headquarters 8th Army and was involved in the planning for the invasion of and subsequent conquest of Sicily. Following attendance at the Staff College he was appointed (having pulled some strings) Brigade Major of 12 Army Group RE which was given the responsibility of constructing the forward fighter airfields in Normandy and was to land on D+1. On 4 July Nigel assumed the appointment of OC 246 Field Company RE a part of 3 British Division. Within 12 days of his arrival the Company was involved in Operation *Goodwood*. It was during his period with the Company that he was awarded a bar to his MC – "This officer has shown a most remarkable standard of personal bravery in leading his troops throughout the four months during which he commanded 246 Field Company RE. Amongst many examples of courageous leadership his action at Escoville, Sanneville, the Escaut crossing, Overloon and Venrai are characteristic ..." It was at Molen Beck whilst under intensive enemy fire that he personally reconnoitred mine belts, discovered a crossing place over the Beck and despite having been wounded in the hand and leg insisted on reporting details of the situation before allowing himself to be evacuated.

Volunteering again, Nigel was posted as SO1 RE to the Chief Engineer of 14 Army Headquarters in Burma in early 1945 and remained with them throughout the Burma campaign. Very few individuals have achieved the distinction of wearing campaign stars for North Africa, Italy, NW Europe and Burma.

In 1946 he was pulled back to attend the misconceived No 1 Supplementary Course at The SME, despite being a Lt Col. As "senior subaltern" he maintained morale without acrimony from either staff or students. In 1947 having closed down the School of Military Engineering Middle East, he was posted as DAA & QMG of a brigade in Palestine. With the end of the mandate in 1948 the brigade was pulled out to Moascar in the Canal Zone. As a result of his war wounds Nigel was subsequently invalided out of the Army in 1951.

On retirement he settled in Bath taking up employment in printing and publishing. He became a building conservationist and for 15 years, from 1976, was one of the Trustees of the Bath Preservation Trust. Bath owes him a great deal and will be a much poorer place without him.

Nigel also worked for nine years as the fund raiser for the Royal Commonwealth Society for the Blind in the southwest region. He established a close contact with schools and organizations, visiting them and giving talks on the work of the Society and persuading them to support the enormously successful sponsored walks that he organized with his usual meticulous planning. The result was an eight-fold increase in the money that was raised for the Society.

The account of his wartime career may give the impression that Nigel was merely a fire-eating soldier; this is not so, he was extremely intelligent, appreciative of the arts and a very sincere and sensitive friend. It was characteristic of him that he had pre-planned his funeral service which was held in Bath Abbey and was both crowded and most moving.

He married Patricia Low in 1958, who survives him as do his two sons.

JHF ACD CStAW

GEORGE LE DAIN

EULOGY GIVEN BY SENIOR CHAPLAIN RSME
BROMPTON GARRISON CHURCH 5 OCTOBER 1993

Born 19 May 1919, died 25 September 1993, aged 74

WE have come here today to give thanks for the life of our brother George. It was a life lived well but it is impossible within the limitations of the time available to review the whole of George's life, as we say goodbye to his earthly remains; but an era has passed.

Where do I start with George, who spent over 35 years in the service of the Royal Engineers where he was renowned as a Corps historian and raconteur? As well he was server and sacristan at this Garrison Church for over 25 years and an official guide at Rochester Cathedral.

George Le Dain was born in St Helier, Jersey, his forefathers having fled from France in the 17th century during the persecution of Protestants by Louis XIV, so he was very much at home in La Providence. He served in the Royal Jersey Militia before coming to England in June 1940 prior to the Nazi Occupation. When attempting to enlist however, he was medically down-graded and put in a reserved occupation in the north of England, but succeeded in joining the Royal Engineers in March 1943, eventually being posted, as a regimental policeman, to Brompton Barracks, Chatham, in July 1944. It was a job he did not enjoy and when the Headquarters Mess returned to Chatham in March 1946, George seized his opportunity and took over Reception as Mess Corporal, changing into civilian clothes but remaining in the Mess on his demob in 1947; and there he stayed until he finally retired on 27 April 1979.

Over the years his knowledge of the history of the Corps and the Mess became legendary. He never forgot a face or an incident and everyone from young subalterns to retired generals would be greeted by name and reminded of some past event in their lives. He was later to reveal his closely guarded secret, that just occasionally he had to refer to his comprehensive collection of Young Officer course photographs which he always kept close at hand in case of emergencies!

On the night of 3 December 1975 his prompt action almost certainly saved the HQ Officers' Mess from being burnt to the ground, and for this the Corps will always be particularly indebted to him.

George was a complete Royalist and saw three Royal visits to the Mess. He was very proud to have had his photograph taken with HM the Queen whilst opening the door of her car. That photograph had a special place in his flat and

George Le Dain

when showing it to his visitors, he would say "there is the girl who jilted me!"

George was happiest when advising the Chaplain on ceremonial for special services, and he would borrow the mace and carry it if the Bishop came for Confirmation. On one such visit, when the Bishop of Tonbridge came instead of the Bishop of Rochester, he commented loudly in the Bishop's presence "Oh it's not the proper Bishop."

But there is one thing which must be said and that is that George died in the faith of Christ. He would have wished us to recognize this today, to make public what the drive behind his life was, what it was that motivated him and carried him through the ups and downs of the years. This commitment showed itself in service to the Church in general, and Brompton Garrison Church in particular, where he served so loyally as Sacristan, was the centre of his life. Indeed this Funeral Requiem reflects George's wishes and his favourite hymns. Our Offertory hymn "Bright the vision that delighted" on one occasion had to be sung for and recorded by George before the Garrison Church Choir were allowed to indulge themselves in one of his famous Choir Teas!

His was not a narrow religion; it gave a spiritual perspective to all that he did. But for George, each day had become a waiting on God for the completion of his purposes in his life, and that was not a weary acceptance of fate. Rather it was a final affirmative expression of faith: My hope is in Thee.

As Christians, our hope is founded on God's expression of himself in Jesus. And in particular Jesus's resurrection.

Our joy today is the experience of Easter. It is the love of the woman who went to the tomb early on Sunday morning, it is the excitement of Peter and John who raced to the tomb, and yes, for some of us it is the doubt of Thomas. Yet the bottom line of resurrection is that the death of Jesus on the Cross was not a defeat, but a victory. A victory over the powers of evil and over death, the last enemy. So let us rejoice that George who was dead , now lives with Jesus and the saints, and to God be the glory.

Amen

COLONEL J H CLARK MC* DL

Born 27 April 1919, died 24 September 1993, aged 74

Col J H Clark MC DL

No appreciation of John Clark's life would be complete without taking account of the immense influence and support that Ruth gave him all their married life. They made a very good working partnership and woe betide anyone who fell below their standards of service. Every minute of every day seemed to be filled with activity.

As a boy he was shy and retiring and an excellent athlete. He left King's School Canterbury as Head Boy and passed high into the Shop. It was his time at King's which gave him an appreciation of old church buildings, for the school was in the precinct of the Cathedral and members of the school took part in the public services. He understood the importance of doing things properly and learning from tradition in the pursuit of excellence.

In January 1939 he passed out of the Shop 22nd and obtained the last place offered by the Sappers – which was his ambition. He spent his first three years after commissioning in a Field Company building defences against invasion. In 1942 he volunteered for the Far East and joined the Royal Bombay Sappers and Miners. His first field posting was to the Arakan in 1943

where he saw action for the first time and was Mentioned in Despatches.

In early 1944 he took command of 92 Field Company and was involved in the siege of Imphal when the Japanese advance into India was finally halted by the stubbornness of the defence, overstretched lines of communication, and disease. For his leadership and the part the company played from May 1944 to July 1944 in maintaining the vital Silchar track, removing mines and repairing craters under enemy observation and sniper fire and at night, he was awarded the MC.

It was decided to pursue the retreating Japanese and destroy them. John's Field Company supported the leading Brigade of 20th Indian Division in their deep penetration of the jungle to cut off the enemy force. When they came to the River Chindwin in March 1945, 92 Field Company had the task of ferrying the infantry in an assault crossing at night. The far bank was strongly defended and the infantry established only a foothold. The ferrying operation had to be continued during the following day and night in the face of intense and accurate artillery and mortar fire. The action was successful and the enemy driven back, but during it John was wounded in the shoulder and the knee and had to be evacuated. For his conduct in this operation he was recommended for an immediate award of the DSO which was eventually downgraded to an MC.

By the time he was out of hospital the Far East War had ended and in August 1945 he rejoined his old Company and Division in Saigon, Indo-China. Their task was to repatriate all allied POW and hand the country back to the French in the face of violent opposition from the local people. After three months he was unable to bend his leg at the knee at all so he decided to take leave to UK where he entered hospital to have the shell splinter removed from the knee joint. It was while he was in hospital that Ruth visited him frequently and before he finished his recuperation leave they were married in April 1946.

Having passed out from the Staff College in early 1949, he escaped to the Far East HQ at Singapore which was dealing with the growing Communist threat in Malaya.

His subsequent career followed the normal pattern during which he commanded the Officer Cadet Training Squadron at Gillingham. His spell there, in the early 1950s, was one of his happiest times. He had inherited an unusually lively staff (including two future members of the Army Board) and the relentless throughput of cadets included many young men who would become leaders of their professions in engineering, quantity surveying, architecture and business. John took all this in his stride, carrying everyone along with his infectious enthusiasm, whether the project in hand was strictly in the line of duty or just simply high spirits. He astonished one (rather bookish) member of his staff by professing a great liking for gym and PT – which was undoubtedly genuine. One evening, after some celebration, the officers took it into their heads to jump into the Medway (some distance upstream of Rochester, where it is narrower) and swim across. John thoroughly approved of this and took part with gusto. One project which he viewed with misgiving was the infants' school started and run by Ruth. It was a great boon to the Garrison, but John was afraid of hordes of small children roaming about the campus out of control (which they were not). John must have been one of the best, and certainly one of the most enthusiastic commanders that the Cadet Squadron ever had, and his influence will have affected many hundreds of young officers for the good. He then went to Christmas Island and saw the last atomic bomb set off there, served in Cyprus, during the early EOKA troubles, and in Germany. On promotion to lieutenant colonel he commanded the Bomb Disposal Unit and School before going out to Aden as the principal staff officer and later Deputy Commander of the Federal Regular Army where he was involved in the fierce battle of the Radfan and was Mentioned in Despatches.

Again promoted, he took command of a territorial army engineer group at Durham. He left 28 Engineer Group (TA) to go to Cairo as the Defence and Military Attaché in the British Embassy. A few days after their arrival diplomatic relations were broken off by Nasser over the Rhodesia crisis, and the family returned to UK. His final appointment was as Colonel AQ at HQ Eastern District at Colchester.

He retired at 51 after 30 years of varied, distinguished and active service. His service was marked by his single minded and uncompromising determination and considerable energy to tackle whatever task he was given. To him a thing was Right or Wrong, Black or White, no grey areas. He often said "Is that being really

honest?" or "it's the principle that matters". With all that, he was a kindly man and generous with his time and assistance.

In retirement he and Ruth gave up most of their summer weekends organizing the opening of Essex Gardens for the benefit of SSAFA. The public was persuaded to part willingly with its money for a really good day in the country, which raised tens of thousands of pounds over the years for SSAFA – £7000 a year for five years.

Both of them took a leading part in the Friends of Essex Churches and John became an expert in the use of redundant churches. He must have been a thorn in the side of the Church Commissioners. He considered that if a church was no longer needed it should be used in a seemly way after many years as a place of worship and certainly if it was of historic value it should be preserved.

They both supported Pebmarsh and District Conservatives and the Royal British Legion, and John was churchwarden until his illness forced him to give it up. In 1983 he was appointed a Deputy Lieutenant for Essex.

These days there is much talk of what is meant by "Back to Basics". John Clark was in no doubt what "Basics" were. They were loyalty (to one's country, comrades, friends and family), honesty, integrity and a sense of fun. John had these characteristics in abundance. He was what we all believe a true Sapper should be.

SHC, WGHB, IHLG, AEY, FRB

COLONEL W H JOHNS OBE

Born 30 May 1908, died 27 July 1993, aged 85

Col W H Johns OBE

In 1929 Henry Johns joined the Army as a "boy soldier" with the immediate ambition to be in a military band. During this early formative period he studied surveying and at the conclusion of the course was the only candidate to pass the RE Survey exam. From 1934 to 1936 he was posted to Mersa Matruh, in Egypt, with the Desert Force, for survey work during the Italian campaign in Abyssinia. He returned to England and was married on 2 June 1937 to Marion Jones who died in 1982; their daughter Elaine was born in 1941.

World War Two broke out and one of Henry's tasks was to investigate an old sewer system in the Pas de Calais; perhaps this was where he saw the cigarette smoking, multi-coloured rats that formed part of his story-telling repertoire, or it could have been some other similar location during his full and varied career. With the advance of the invading German force, he escaped with the Dunkirk armada after six days on the beaches, his meagre rations supplemented only by a bottle of wine pilfered during the retreat. He was rescued after three hours in the water following an enemy bomb attack. Commissioned in 1943, he was awarded the "Cane of Honour" for his intake at Officer School and was then posted to Egypt for survey work prior to El Alamein. It was during this time that he was captured by the Germans, subsequently escaped, only to be arrested as a "spy" by the New Zealanders. In 1944, he was assigned to carry the sealed instructions to the Middle East Command prior to the Normandy landings.

During the two years from 1945, while serving as a Captain with 512 Field Survey Company, based in Cairo and Fayid, he was appointed

MBE for directing the photogrammetric survey of the Lar Valley dam and irrigation project in Iran. The project, estimated by an American team to take three years to complete, was in fact completed in six months under Henry's command. From 1948 to 1950 he was DAD Survey at the War Office as an aide to General "Bruno" Brown; he attended Queen Juliana's coronation in The Hague and went to the USA with the British Mission.

From 1952 to 1958 he was at GHQ, FARELF in Singapore as Assistant Director of Survey with the rank of major. During this period he directed the air survey of Thailand, on completion of which he was offered the "Order of the White Elephant" which he was not allowed to accept; instead he was made an Honorary Colonel of the Thai Army. He also led the British Team for the SEATO conference in Tokyo. From 1958 to 1962 he was with NORTHAG in Rheindahlen, Germany, as Director of Military Survey and promoted to lieutenant colonel. It was from this post that he retired from the Army as a colonel on 9 May 1962 and was appointed OBE, and by way of celebration of this honour, he bought a Bearded Collie and named it Obee. He was very proud of both his OBEs!

Henry Johns joined Oxford University Press in the summer of 1962 where his job was to promote sales for the Cartographic Department, The Clarendon Press. Under his tenure the number and variety of maps inserted into bibles rose to new heights. His big successes during this time were the contracts for the BEA (later BA) flight maps and selling the Oxford School Atlas to Rainbird. It was also during this period that he was approached by the editor of "The Atlas of Historic Towns" to publish the project, which was rejected by the OUP after some consideration. On seeing the importance of the publication he applied for and was appointed to the position of Topographical Mapping Editor. He resigned from OUP and formed a new company to produce and publish the atlas series.

Lovell Johns was founded on 13 May 1965, with the primary task of producing mapping for "The Atlas of Historic Towns" under the direction of the project's Topographical Editor and the General Editor, Mrs M D Lobel. The quality of the publication is testament to the professional dedication of the team and the leadership. It was at this early stage in the history of the company that a certain "ethic" was instilled in the workforce that has been carried through to this day.

His work on the Atlas called for all the qualities and techniques acquired during his earlier careers. The collation of information from several disparate sources, and liaison with historians and other contributors who had little or no familiarity with maps; all this was just the starting point. Once the "data" was assembled it had to be interpreted into a map compilation, which entailed much deliberation over the documents, both written and graphic, to identify the differing opinions and then to referee which was the correct form. For the first time a unique record of towns from earliest times to about 1800, constructed on sound survey principles was achieved. This task was carried out with painstaking dedication by Henry and whilst he revelled in the glory of a new discovery, he complained long and loud of anybody's incompetence, including his own. The first two volumes (1969 and 1974) of the series were universally recognized as establishing a new world standard in historical cartography. The third volume, "The City of London: from Prehistoric Times to c.1520", published in 1989, was a new and in some ways, more difficult challenge. The problems were that there was too much information and opinion available. To quote from the introduction to the maps by Henry: "Before the publication of the present volume no medieval mapping record of London existed. Our task was to provide the missing dimensions of the periods of c.1270 and c.1520 using scientific methods of topographical survey and cartography in the reconstruction of ground features in their proper historical setting. The topography of London has fascinated generations of scholars but the methods had eluded them whereby the mass of medieval records, mainly in the form of the written word, could only be used to reconstruct the topography of London as a related whole for any selected period of its history". One of Henry's greatest triumphs was the discovery of figures on Leake's map denoting the pre-Great Fire street widths in feet. These annotations had drawn many theories but it was only through topographic skills, which he had, that the significance of this detail was recognized. Henry, of course, was delighted with this find, but also noted the plight of the poor draughtsman who had to redraw the map for the umpteenth time.

Throughout all this period of happy days, he subjected his young staff to "the learning process". Under his exacting gaze aided by his "prismatic lenses", with which misaligned type was spotted from ten paces, "we were all trained and charmed by this gentleman." On one noted occasion when wearing his monocle at our annual Christmas dinner, he came to a part of his speech which called for some emphasis. With his normal flourish, and to give some sense of theatre, he donned his famed prismatic glasses on top of his monocle to look at his notes. On realizing that he could not see a thing, he quickly joined in the hilarity of his guests.

There are many other facets to his life and times, from his time at Pembroke College, Cambridge, studying astrophysics, to the period he was on Martin Hotine's team calculating the zenithal projection needed for the first polar flight. The staff of Lovell Johns were subjected to many reminiscences as well as an education in the way to conduct oneself in the world. The respect with which he was held by everybody was wholly deserved and lasted throughout his retirement, when he was Honorary President of the Company he founded, right up until the sad day that he died.

JB, BH, EJ, CC

COLONEL THE RT HON LORD MAIS GBE OBE ERD TD DL

Born 7 July 1911, died 28 November 1993, aged 82

RAYMOND MAIS achieved a great deal in life not the least of which was becoming Lord Mayor of London in 1972/73. One of his most important interests was that of the Territorial Army in general and the Royal Engineers in particular.

He was commissioned into the Royal West Kent Regiment in 1929 and transferred to the Royal Engineers in 1931, and he took much delight in recounting how this transfer took place.

Apparently, when leading his men on a march he was passed by a mounted column of Sappers with the commanding officer at its head who, in an aside to Mais, suggested he would be better off joining a unit where he could ride instead of march. This, he said, impressed him and hence his transfer. There is obviously a lot more in it than that; but he certainly enjoyed telling the story.

At the outbreak of the war he went to France as a major and subsequently served with Special Force MET in Iraq and Iran where he was twice Mentioned in Despatches. He was also awarded the Russian Order of Patriotic War, first class, for his efforts in keeping open the supply routes to Russia. It was his connection with special forces that encouraged him to persuade the Worshipful Company of Paviors (of which he was a past master) to adopt 131 Indep Cdo Sqn (V) as their representative TA Unit.

From December 1943, he was closely involved in the Mulberry Harbour Project, landed near Arromanches on D-Day, and played a pivotal role in completing his task under the very difficult conditions created by the terrible storm. For his services in Normandy he was appointed OBE.

After the war he returned to the TA by being appointed CO of 101 Engr Regt (TA) when it was reformed in 1947. Following his tour of command he became CRE 56 Armoured Division (TA) and the Commander Engineer Group AER. He was subsequently Honorary

Col The Rt Hon Lord Mais GBE OBE ERD TD DL

Colonel of 101 London Corps Engineer Regiment, an appointment he held for nine years. He received the TD in 1944 and the ERD in 1958.

In 1948 Mais joined the City firm of Trollope & Colls Limited, and became Chairman in 1963. During this time he was very active in the City itself and became Alderman for the Ward of Walbrook in 1963, Sheriff in 1969/70 and Lord Mayor in 1972 when he was appointed GBE. He was the first and only Lord Mayor of London ever to serve as a peer having been created a life baron in 1967. At his Lord Mayor's procession he involved the four TA units in London with the marching contingent of 217 Fd Sqn and 135 Indep Svy Sqn (V) being led by the Corps band which also played at the Lord Mayor's banquet. During his year of office he said that the evening spent as guest of honour at the Corps Dinner at Chatham was the most special event, to him, of his year. he was appointed a DL for the County of London in 1951 and Kent in 1976.

Following his year as Lord Mayor he continued to hold many senior positions in the City including presidency of the London Chamber of Commerce, 1975-78, and pro-Chancellorship of City University, 1979-84. He was also a director of the Royal Bank of Scotland. His interest in the TA never waned and he was always available for advice on TA affairs and more recently on the reforming of 101 (London) Engr Regt (EOD) (V).

He is survived by his wife Lorna, who he married in 1936, and by their two sons and daughter.

PEW

Memoir in Brief

A brief memoir is published below on a distinguished man whose death has been notified recently in the national press and who served in the Royal Engineers during World War Two.

The Rev Keith Brinsmead, who has died aged 87, was awarded the DSO in September 1943 at Salerno, where he commanded a battalion of Royal Engineers in the assault.

While the battle was in progress, and there was a chance that the Allies might not be able to consolidate their landing, Brinsmead was astonished to be approached by the mayor and council of Salerno, who insisted on surrendering the town and port to him.

Brinsmead protested that, as a major, he was hardly the right man to accept responsibility for some 150,000 people, but his arguments were to no avail.

A year earlier he had been Mentioned in Despatches when commanding 573 Field Company Royal Engineers in the battle of Alamein. His unit was required to clear a 16-yard-wide gap in the German minefields so that tanks and infantry could pass through.

The Germans, aware that a British attack was impending, had buried a variety of mines in front of their positions. The Sappers crawled forward in the dark, hoping that the moon would not betray them to the German snipers, and then delicately poked in the sand until the mines were located and could be lifted out.

Underneath some of the mines others were buried, primed to explode when the upper ones were disturbed. Lifting them out required nerves of steel, sensitivity of touch and considerable technical knowledge. The cleared path was marked by white tapes and shaded lights.

Periodically the whole area was swept by enemy fire, killing Sappers and destroying the markers. At the height of the barrage one of Brinsmead's men crawled up to him and said: "I hope it doesn't thunder, sir, or I'll be really frightened." Brinsmead recalled it did wonders for his morale. The team finished their task ahead of schedule.

Keith Brinsmead was born on 3 May 1906, into a well-known piano-making family, and after education at Uppingham and Imperial College, qualified as a civil engineer. He then worked for the railways on bridge-making projects. A Territorial since 1930, he was called up into the Royal Engineers in 1939 and fought in North Africa and Italy.

After the war he returned to civil engineering, working for what had become the nationalized railways, and took a prominent part in fighting the floods in East Anglia in 1953.

In 1978, at the invitation of the Bishop of Salisbury, he was ordained; he ministered to the parishes of Ebbesbourne Wake, Fifield Brabant and Alvediston, in Chalke Valley.

He married, in 1940, Nance Golden, who died in 1990; they had one daughter.

Correspondence

SAPPER TRAINING AT NO 1 TBRE CLITHEROE

From Col J H Frankau

Sir – With regard to the article in the December 1993 *Journal;* clearly the captions on the illustrations on page 294 have been transposed. Furthermore, the photograph at the top of page 295 is NOT of "Folding Boat Equipment etc" but of the "old" pontoon equipment, Class 24. The pontoons illustrated became the "bow sections" of the much better known Bailey pontoon piers – usually Class 40, but, because of the flexibility of the Bailey Bridge, anything from Class 12 to Class 70. Yours sincerely – J H Frankau

RE JOURNAL VOL 107 NO 1: THE WEE, WEM, WEC AND EVEN A WEP

From WO1 M W Roberts BEM

Sir – It is with honour that I may respond favourably to the above article.

Through much consideration and debate and with the positive support of the Clerks of Work from all disciplines, results from an initial survey indicate some 88% so far support a title change to "Military Works Engineer" (C) (E) or (M).

The justification is well addressed in the article written by Major Robinson.

My personal experience and contacts with industry and institutes are also positive on this title change.

May I request that further action is taken within the Corps to relate positively to the recommendation for the future and benefit of all. Yours faithfully – M W Roberts

ENGINEERING CADETS

From Colonel J Eastwood

Sir, – Having been an Engineering Cadet and a contemporary of Dr Phil Bulson, I was fascinated to read his article in the December 1993 *Journal.* His reporting of the facts is both accurate and comprehensive, though my own experience varies a little from his own.

First, my own training course was at University College, Nottingham, and lasted for 21 months. After Primary and Corps training I was sent to the infantry OCTU at Mons, Aldershot, followed by the Field Company Course at Newark OCTU. Then after the Ripon YO course I joined 65 Field Company in Palestine. I believe I was the only engineering cadet to follow this route, but would be interested to know whether there were others. Yours sincerely – J Eastwood

THE EAST INDIA COMPANY MEMORIAL (1862)

From Maj R L Smallman

Sir – Readers may recall that the plinth to the East India Company Memorial (1862) has been missing for many years (*RE Journal* August 1993 p240). Happily the plinth has now been found at the National Army Museum, where it became separated from its top at the end of a long loan period at Sandhurst and Chelsea. The Museum is carrying out some restoration work after which the two halves will be reunited in the RE HQ Mess.

I am most grateful to the staff of the National Army Museum for their assistance in the reunification of this important item of the Corps' history. – Leslie Smallman

BAILEY BRIDGE IN PERU

From Maj E Davies

Sir – During the course of a visit to Peru last year I was surprised to see a Bailey bridge being used to cross the Urubamba River on the road to Machu Picchu.

The bridge is a double single and is used as an alternative to an old suspension bridge. Being so far away I wondered who would have supplied and built the bridge.

In the event of you having any information on this subject I would like to know more about it.

Your help would be much appreciated. Yours sincerely – Eric Davies

BRENNAN TORPEDO

From Michael Kitson

Sir – I read the letter from Brigadier A C Ross with great interest and think his comments lie at the centre of the problem of gyrostatic forces acting on the torpedo. This problem seems to me to be, for the present, still unresolved but perhaps further work will solve it.

Brigadier Ross is quite correct about the diameter of the wire, which was 0.04in in 1887 (not 0.4in) and subsequently for the Mk II Brennan 0.07in. This error was (alas) not typographic, but one I made myself when typing the manuscript. As the prime purpose of my article was to establish the known facts about the torpedo and to correct some of the numerous errors which have been repeated in print over the years, I would not want to perpetuate errors of my own making. Especially as the diameter of the wire is important when calculating the weight of the rotating drums. Yours sincerely – Michael Kitson

From Lt Col M P Lonnon

Sir – Further to my letter to you of 9 April, I still cannot understand how, by itself, a pull can move anything in the opposite direction.

There must have been an onboard source of power eg electric motor, compressed air or rocket turbine or something.

Possibly someone can explain. Yours sincerely – M P Lonnon

THE END OF AN ERA AT CHRISTCHURCH

From Colonel J H Joiner

Sir – I note with sadness the closure of the Barracks at Christchurch at the end of February. The Barracks was first developed as a cavalry and artillery barracks at the end of the 18th century, during the Napoleonic Wars. The Sapper connection with the town did not start until the end of the First World War however, when Major G le Q Martel, later Lieut General Sir Gifford le Q Martel, was posted to Christchurch to command a newly formed Royal Engineer Tank Bridging Battalion. Its formation was overtaken by events however and soon after the War ended the short-lived battalion was reformed into the Experimental Bridging Company, Royal Engineers, on 28 February 1919. Exactly 75 years later, on 28 February 1994, the Defence Research Agency (Christchurch) ceased to exist, responsibility for research into equipment for the Corps passing to the DRA at Chertsey.

In 1925 the Bridging Company was disbanded and was replaced by the Experimental Bridging Establishment. This was a largely civilian establishment, although Sapper officers continued to be posted to Christchurch and military command was not relinquished until 1957, when Sir Donald Bailey became the first civilian director. By now the unit, which had become the Military Engineering Experimental Establishment, or MEXE, soon after the war, commanded by a brigadier, had considerably increased in size. Indeed by the early 1960s MEXE was one of the largest employers in the town with a strength of about 1000. Its role had expanded correspondingly, and it was then responsible for research and development for all equipments for the Corps, except those associated with our survey role.

With reductions in the size of the Army, rationalization of R and D establishments saw the amalgamation of MEXE and FVRDE Chertsey into the Military Vehicles and Engineering Establishment, or MVEE, in April 1970. This was followed by a further amalgamation with the establishment at Fort Halsted in April 1984, when it became the Royal Armament Research and Development Establishment (Christchurch). In April 1991 the Defence Research Agency absorbed all service R and D establishments, and by now the staff at Christchurch had fallen to barely 100. All development of equipment for the Armed Forces was now being undertaken within industry.

Over the years a vast range of equipments have been developed for the Corps at Christchurch, ranging from the Folding Boat Equipment of the mid-1920s to the excellent Tank Bridges of the 1970s, from the Mechanical Minelayer of the 1950s to the Combat Engineer Tractor of the later 1970s, and from the Twynham Hut to the RE Machinery Lorry, both of the 1950s. Two equipments probably stand out as exceptional however. The Bailey Bridge first came into service in 1941 and is still in use in may parts of the world today; without doubt it made a tremendous contribution to the successful completion of World War Two, and is universally acclaimed as an outstanding bridge. The second is the Medium Girder Bridge, designed in the early 1960s as a replacement for the Bailey; the bridge has been purchased by no less than 36 overseas armies, and sales throughout the world have exceeded £M450 – surely a sign of its excellence.

A small five-acre area will be retained within the Barrack Road site, to include the Bridge Test Rig and the Fatigue Test Rig, but the rest of the 30 acres site will be cleared. The present planning brief includes an industrial, housing and leisure development, possibly including a riverside heritage park. It is to be hoped that the Corps' 75 years at Christchurch will be suitably recorded in such a park. Yours sincerely – J H Joiner

Reviews

WAVELL IN THE MIDDLE EAST 1939-1941
HAROLD E RAUGH JNR

Published by Brassey's UK, 165 Great Dover Street, London SE1 4YA
Price – £32.50
ISBN 0 08 040983 0

THOSE interested in military history may be surprised that yet another biography of Wavell should have appeared in 1993 to accompany the many studies already published. However, Wavell's reputation amongst the military figures of the last war still remains enigmatic, and this new volume, written with objectivity after deep research into new sources, adds much to our understanding of the Field Marshal, though it may not prove to be the final verdict.

The author, Harold Raugh, an officer of the United States army and a former assistant professor at West Point, contributes handsomely to the history of the Middle East Command during those critical years 1939 to 1941, which were dominated by the personalities of Wavell and Churchill.

On page five of his book, he reveals where his sympathy lies by expressing the hope that "this study will prove that Wavell's accomplishments as Commander-in-Chief Middle East entitled him to be seen as a general who ranks as the most far-sighted and able of all the British Army commanders of the Second World War."

It will be for the reader to decide whether his enthusiasm has carried him too far.

After initial chapters describing Wavell's upbringing, his early military experience and his attractive personality, which appealed greatly to those who established sympathy with him, but baffled those, like Churchill, who did not, the author moves to the period 1939 to June 1940 described as "bellicose non-belligerency".

Here he reveals how Wavell, with little direction from Whitehall but with remarkable far-sightedness, repeatedly made bricks without straw, and secured many areas of imminent risk by skilful manipulation of his limited resources. Moreover, in a period of great discouragement for the nation, Wavell's staunch character, his personal leadership and his sympathy with the front-line soldier served to maintain morale, while his command waited defensively to meet the daunting possibilities that lay ahead. This could be described as Wavell's "finest hour."

We then move on to COMPASS, the operation against the Italians in Cyrenaica and Libya, a triumph of British Arms after the failures of Dunkirk and Norway. Wavell, the originator of the operation, carried out brilliantly by O'Connor, was in Raugh's words "propelled overnight from a position of relative obscurity to a pinnacle of prestige and public adulation."

There followed the expedition to Greece, a Greek tragedy in every sense of that phrase: we watch the hero of the hour meet total disaster through a combination of circumstances beyond his power to control. The operation was a very costly failure, the gains of COMPASS were not exploited, and with the arrival of the *Deutsche Afrika Korps* in Tripolitania, North Africa became a theatre of deadly menace.

Even before the Greek tragedy, the author records a number of justifiable criticisms of Wavell which are hardly reconcilable with the verdict for which he hoped on page five. But what of Wavell's responsibility for the Greek tragedy? Were the military risks properly assessed? Were the political imperatives so overriding that he had to accept them?

As to the risks: de Guingand, the leader of the Joint Planning Staff in Cairo, who accompanied the Commander-in-Chief to Athens and carried out a reconnaissance of the Aliakmon Line, wrote with hindsight in "Operation Victory" published in 1947: "...from the military point of view an intervention in Greece, never had any chance of success." He summarized his reasons as superior German strength compared to the available resources of the Allies; the poor state of the Greek Army, especially their munitions; the RAF was likely to be swamped by the German air force in a very short time; lines of communication from Egypt were very vulnerable; once Salonika fell, communications in Greece were inadequate to supply both armies, Greek and British; the Royal Navy was stretched already, and shipping was very scarce; active cooperation from Turkey and Yugoslavia could not be expected,

and it was extremely doubtful if our full strength could be deployed before the German attack commenced.

Putting forward his views to Churchill at a much later date, he was told magisterially that there was much in the story that he did not know. Nevertheless, Churchill himself, talking to Colville, his secretary in 1941, said that so far, the Government had only made one error of judgement: Greece. He had instinctively had doubts. Colville in his diary, published in 1985, remembered the Prime Minister influencing the decision in favour of an expedition, and Dill, the then CIGS being against it: Dill, in fact, was later persuaded to back it, when he visited Cairo with Eden.

Alan Brooke, who relieved Dill as CIGS in November 1941, wrote in his diary "I have always considered from the very start that our participation in the operations in Greece was a definite strategic blunder."

In military history, there can be few instances of an expedition in which, at the very moment of embarkation, the responsible planners were preparing plans for a subsequent evacuation. There can be little doubt therefore that the military risks were evident and very formidable.

As to the political imperatives which Raugh analyses: it was thought at the time that to renege totally on the Treaty of Mutual Assistance would have a deplorable effect on neutral opinion worldwide, and particularly in the United States Congress, where legislation on Lend Lease was imminent. However de Guingand comments, in his book, "non-intervention might have had a serious effect in America, but I do not consider failures, even gallant ones, in the long run help a nation at war, in the eyes of neutrals. Success is the thing that matters." This opinion is difficult to refute.

If Churchill, Alan Brooke and de Guingand regarded intervention as a strategic error, what alternative had they in mind to reconcile the political imperatives with the military risks? Perhaps some much smaller contribution could have been negotiated diplomatically? This would not have been easy, bearing in mind that, on Wavell's first visit to Athens on 13 January 1941 , Metaxas had stated that only if the British could land sufficient numbers of troops to act offensively, as well as defensively, should they land any troops at all.

Wavell, for many weeks, was in the middle of this maelstrom of conflicting opinions and exacting priorities. Some clarity, if unwelcome, was created when on 12 February 1941 he received from the Prime Minister an order that his major effort must now be to aid Greece and/or Turkey ... "This rules out any serious effort against Tripoli."

The author shows very clearly how the Prime Minister himself, although intent on establishing a Balkan bloc to impede Hitler's exploitation of his conquests towards the east, vacillated repeatedly over the decision, while Dill and Wavell did likewise. It was Churchill who finally made up his mind, and imposed his decision on the Chiefs of Staff and the Cabinet.

The author produces an interesting and convincing analysis of Wavell's changing attitudes, initially fervent against intervention but, on receipt of the Prime Minister's decisive signal of 12 February 1941, loyally bending his mind to the discharge of his orders, notwithstanding their deplorable effect on the gains of COMPASS. A week later, when Dill and Eden arrived in Cairo, he wholeheartedly supported the expedition to Greece.

Raugh rightly states: "It was Churchill's silent hand on the rudder which steered the course unswervingly to inevitable military defeat."

Critics may rightly question the responsibility of Dill, the CIGS, and thus the senior military advisor to the Cabinet; but under the strains of war his vigour had been sadly diminished and his relationship with Churchill had suffered. De Guingand suggested that Wavell should have resigned, but this might have been improper for a subordinate and certainly ineffective, whereas Dill with his prime responsibility could well have done so "on the grounds of failing health". Churchill replaced him with General Sir Alan Brooke in November 1941: had he done so earlier, he would have found at hand a powerful military adviser, who could have steered him away from the Greek tragedy.

In history's court of honour, Wavell will be acquitted of responsibility for the "strategic blunder", which not only offended blatantly the first principle of war – concentration, but also had the disastrous consequences described by Raugh in later chapters, leading to the reversal at great cost of all the triumphant gains of COMPASS.

CLR

THE 51ST AGAIN AN ENGINEER COMBAT BATTALION IN WORLD WAR II

BARRY W FOWLE AND FLOYD D WRIGHT

Distributed by Jerboa-Redcap Books, PO Box 1058, Hightstown, NJ 08520 USA – Price £19.50 incl p&p
ISBN 0-942597-35-4

THE United States engineers' 51st Engineer Battalion only existed for the three years from May 1942 to October 1945. In that time they trained themselves from scratch, crossed the Atlantic to Europe and took part in some of the hardest fighting of the Second World War; in the Battle of the Bulge and the crossings of the Rivers Roer and Rhine. They also bridged the Danube at Ingolstadt under fire in one of the last operations before the German surrender.

This book is the story of the creation of the unit and its operations and work through to its eventual disbandment. The events in the Ardennes were particularly testing. On the day of the German attack the commanding officer had only been in post for two days. The battalion was scattered over a wide area on the relatively peaceful task of running 16 sawmills. They were flung into the line using their Sapper skills in obstacle creation as well as fighting as infantry and held on desperately until a proper defence could be organized. In the words of one of the contributors to the book: "This was probably the first time in military history that an engineer battalion had been relieved by five divisions." The Rhine was bridged at Remagen, only the second crossing to be achieved after the famous intact capture of the Ludendorff bridge.

The book has been contributed to by several authors who have pieced it together from survivors and material gathered some 50 years after the events. Despite the epic events, there is a rather modest homespun style to much of the book written as it is primarily for the battalion's own members. To the general reader the detail about promotions and postings does tend to detract from the main flow. Nevertheless the volume is extremely well produced in hardback and makes good use of personal photographs taken at the time. It glows with justifiable pride at the unit's record of courage and professionalism which earned it a Presidential Unit Citation and a French *Croix de Guerre* with silver star. GWAN

BURMA THE TURNING POINT

IAN LYALL GRANT

Published by The Zampi Press, 6 St Martin's Square, Chichester, West Sussex, PO19 1NT – Price £18.00
ISBN 0 9521083 0 5

THIS book describes the seven battles that took place in 1944 on the Tiddim-Imphal road, one of the main axes of the Japanese offensive that year. The author sets the scene by outlining the campaigns in Burma in 1942 and 1943 and in particular the part played by the 17th Indian Division which was to be the principal player on the Tiddim road. The reader is introduced to the senior officers who were to direct the operations on both sides and given the background that shaped their strategy and tactics. The main part of the action took place in the period February to June and covers the tactical withdrawal of the Division from positions in the mountains round Tiddim to Bishenpur on the Imphal plain 145 miles away.

Ian Lyall Grant heads two of his chapters with quotes from General Sir Ian Hamilton's account of his time as an observer with the Japanese Army during the Russo Japanese war 40 years before. Ian Hamilton prefaced his first chapter with a quote from W E Henley that "one witness is worth a wilderness of sentimental historians". Our author was present throughout the battles he describes, commanding 70 Light Field Company of the Bengal Sappers and Miners in the 17th Indian Division. He has also talked with Japanese officers who took part and consulted Japanese as well as British records. His account and analysis of events take one right to the scene of the fighting and portray vividly the courage and tenacity of both sides.

When the Japanese planned their assault on the British base on the Imphal plain in the early months of 1944, they made one fatal erroneous assumption that turned initial success into disastrous failure. They considered that the British Indian forces, which they had beaten so decisively in 1942, would once again be defeated thus giving them quick access to the stores, equipment and all-weather airfields on the Imphal plain. As Ian Lyall Grant shows, the Japanese tactics of encirclement and roadblocks failed to dislodge the 17th Division until eventually they were no longer able to sustain their

forward troops or give them much needed air cover. The British on the other hand were able to withdraw and regroup, reinforce their units and provide effective offensive air support. They were also able to maintain isolated forward positions by air drop.

One theme that runs through the book is the contest between the Japanese Infantry and the Indian, Gurkha and British battalions. These were arguably the best trained, best led and toughest infantry that fought each other in any theatre in the 39-45 war. In summing up the campaign the author says "it was the skill and bravery of the individual infantrymen that was the deciding factor." Nine of the 15 battalions that came under command of 17th Indian Division were Gurkhas and all of them had casualties in excess of 300 in these battles. The 2/5 R Gurkhas had over 700 in the year November 1943 to November 1944, the majority of which were suffered in the battles on the Tiddim road from March to July. It is interesting that Ian Hamilton, 40 years before, had compared the qualities of the Japanese infantry with those of the Gurkhas that he knew so well.

The description of the part played by the Sapper and Miner units is of necessity briefer than the accounts of the infantry battles. Their tasks of maintaining mobility for the Division, extricating its vehicles and equipment during the withdrawal and delaying the enemy were considerable in this very difficult terrain. The road ascends to nearly 9000ft in places and descends to 2000ft in others, whilst the monsoon was breaking as the battle progressed. One forgets that Assam is the wettest place in the world!

As the author says, some of those who fought at Kohima and in the Arakan may dispute his contention that the battles on the Tiddim road turned the tide of the Burma campaign. The central front in Assam was however the only feasible land gateway for a Japanese advance into India and, conversely, for the British back into Burma. It was here in 1944 that the 17th Indian Division turned the earlier defeats of 1942 into a crushing victory and annihilated its old enemy the crack Japanese 33rd Division, which was supported by armour and much powerful artillery. They did this, as the author says, by turning the old Japanese tactic of encirclement and roadblock to their own advantage. The Japanese sources that the author has researched indicate that it was this defeat on the Tiddim road which finally convinced them that the campaign was lost.

With the help of excellent maps, appendices and photographs the author has produced a clear and absorbing account of these complicated and grim battles in this very difficult terrain. This book will be read with great interest by those who fought in Burma, and also, because of its new sources of reference, by anyone wishing to study this campaign. It is also an excellent book for those who like to read about the 39-45 war. It should also be read by all who talk in terms of throwing troops into situations like Bosnia where the likely enemy is tough, well equipped and has intimate knowledge of the difficult terrain. As Field Marshal Slim said, "Fling is a term for amateurs not professionals." It is as well that he did not take the advice of those who urged him to fling his divisions across the Chindwin in early 1944, but waited until the 17th Indian (and others) had first crushed the offensive of the Japanese, an epic that Ian Lyall Grant has so well described in his book.

SEMG

GORDON
The Man Behind the Legend
John Pollock

Published by Constable and Company Limited, 3 The Lanchesters, 162 Fulham Palace Road, London, W6 9ER – Price £19.95
ISBN 0 09 468560 6

"Charlie Gordon" to family and friends; from his early thirties famous as "Chinese Gordon", "Gordon of Khartoum" after his death 22 years later: this Sapper of genius was one of the most extraordinary and paradoxical of all the eccentrics thrown up by the British on the high tide of empire. He came from a distinguished and quite wealthy family. Though rather slow at mathematics, he set his mind to gain a commission in the Corps to please his father, and when he had done so he ceaselessly sought action in far off places. Almost all his exploits were in a comparatively low key and the majority were unsuccessful. Nevertheless he caught the imagination of the Great, the Good and of the public at large to a degree matched perhaps only by his contemporary David Livingstone. As a captain, commanding a force of roughly brigade strength, of highly irregular and indisciplined Chinese

(half of whom had recently deserted), he saw nothing untoward in corresponding direct with the Secretary of State for War. When he left London for the last time on his way to the Sudan, still only a major general, he was seen off at Charing Cross by the Foreign Secretary, the Secretary of State for War and the Commander in Chief. Lord Granville bought his ticket. The Duke held open the door. Wolseley, discovering at the last moment that Gordon (as usual) had no cash, emptied his pockets and handed over his gold watch. The train left only ten minutes late. The Queen, of course, had been fully informed. Gordon's clear instructions from the Cabinet were to evacuate the Sudan. Gladstone clearly understood that the fate of the Government might be riding on Gordon's success. Yet Gordon did the precise opposite of what he had been told to do and in the process gained immortality. Books have been written about him in almost every decade since then and will probably go on being produced forever.

Charlie Gordon was a short man with pale, piercing eyes and a slight lisp. His personality was almost literally magnetic; everyone who met him was spellbound, for good or ill, and most remembered him for the rest of their lives. He was a great conversationalist, with a clear and vibrant voice, his manner frank and fearless. He had a fabulous and instant memory for faces and names. Children loved him. He had a genius for saying and doing exactly the right thing – in the sense of the truly loving gesture or action – that would earn him the utter devotion of people (particularly lowly people) of all races. He was completely without side or condescension. His mind was original and he cared little for other people's views, though frequently changing his own. He was intensely obstinate. After an abortive few months spent as Commandant General in Basutoland he wrote "I did not attempt to follow the wishes of the Government ... I acted entirely on my own initiative and was and am perfectly convinced that what I said was and is now the best thing that could be done". Victorian administrators were a self-confident bunch. The young Winston Churchill was to write, (following Lord Cromer) "Of course there is no doubt that Gordon as a political figure was absolutely hopeless. He was so erratic, capricious, utterly unreliable, his mood changed so often, his temper was abominable, he was frequently drunk ..." but when Gordon died the Queen and the nation were devastated. Cabinet met for three hours. The Duke of Cambridge wrote "Nothing can equal the intense interest and excitement raised by this grave event since the period of the Crimean war and the Indian Mutiny." They raised a great statue to Gordon just in front of the National Gallery in Trafalgar Square, which stood there for 60 years.

Churchill's judgement was damning and some of it was justified. The accusation of secret and excessive drinking was, however a calumny, as was the suggestion (not by Churchill) that Gordon was addicted to opium. He did, however, smoke heavily and drank great amounts of tea. But he was alarmingly immune from the most prevalent weaknesses of men in power. He seems to have suppressed his sexuality completely. Emin Pasha (a German doctor) is recorded by Stanley as saying "I cannot conceive how any mortal man could restrain himself from sexual intercourse. But Gordon was free from any carnal desire." Gordon himself wrote to his sister from Gravesend "There is a Miss Dykes here, the nicest girl I ever met. But do not be afraid, the dead do not marry." It is an obvious suggestion that his devoted care for young males at Gravesend was driven by repressed homosexuality; but whatever vestige of truth this may contain it is a complete dead end en route to any understanding of Gordon's complex character. What has never been doubted is Gordon's complete indifference to the accumulation of wealth. He refused all bribes, gifts and gratuities, accepted the minimum in pay and gave most of that away. He even gave away his treasured medals. More strikingly still, he seemed to be immune to fear. When action was in hand he was always up in front, almost never armed; famously smoking a cheroot and carrying a slender cane. On one occasion, when a Chinese soldier was shaking so much with fear that he could not properly aim, Gordon knelt down and provided his own shoulder as a rifle-rest. Despite this reckless courage he was almost never wounded. Only God knows why.

Whatever Gordon's weaknesses at the levels of strategy and policy, he was an unrivalled tactical commander in battle. His specialist subject was fortification (the one topic on which he had shone at Woolwich) and perhaps fortunately most of his famous actions were in reduction of fortresses. The danger and technical difficulty of these operations suited his talents perfectly and he never faltered. He also had an unerring talent

for the command of irregular "native" troops. Utterly ruthless when the need arose – he would have a mutineer shot out of hand – he achieved instinctive empathy with Chinese and all types of African, he was impatient, restlessly (even formidably) energetic and ran his subordinates into the ground. In return they gave him devotion little short of idolatry.

In this book John Pollock seeks to tell the story straight, through the eyes of Gordon himself and his contemporaries, warts and all. Having served in the Coldstream Guards during the war, and then for a time been a country parish priest, the author has been a professional writer for the past 35 years and has written good biographies of Shaftesbury, Wilberforce and the Apostle Paul. The great strength of this book is the use Pollock has been able to make of the mass of manuscript material in the British Library, the Royal Archives, in the United States and at Chatham. Pollock makes light of his scholarship and the result is an excellent read – learned without being laborious, accurate as well as entertaining. Its weakness is that the social, political and strategic background to the great affairs Gordon was involved in are rather lightly sketched. (The campaign in China, for example is much better described in Anthony Nuttings 1966 biography of Gordon.) There are pitifully few maps – probably the publisher's rather than the author's fault. There is the occasional misprint. But all in all it is an excellent book. Two aspects deserve special mention .

The first concerns the six years when Gordon, still in his thirties and fresh from the adventures in China which had made him famous, was posted as a lieut colonel at Gravesend to work on forts on the Lower Thames – a complete waste of public money as Gordon was not slow to point out – and there spent the happiest years of his life. Occupied on his official duties from 8am to 2pm, he spent the rest of his long day in works of mercy in the town, devoting himself particularly to the care of teenage boys, the very roughest and poorest, working on shrimp-boats or, more often, unemployed. Gordon, fed and clothed them, taught them to read, write and count, found them work, nursed them through scarlet fever. Where he could he placed them in jobs (often the merchant navy) and took them back if they could not cope. Pollock's three chapters on this stage of Gordon's life are admirable. And he also deals excellently, as his background would lead one to expect, with Gordon's christianity. It was while at Gravesend that Gordon underwent a classic Pauline conversion: "something broke in my heart, a palpable feeling and I knew God lived in me". His faith was in many ways as simple as could be. He would let a bible fall open and treat whatever text his eye fell on as literal instruction for the day. He would pray his barges up the Nile, rapid by rapid, as he said he had prayed his Chinese soldiers into battle. His letters were filled with theology. Pollock does not make a meal of this. He tells us that Gordon's view, while sometimes original (not to say wildly unorthodox) were for the most part "an unintegrated mixture brewed from early Christian Fathers, gnostics, medieval and 17th century mystics, Evangelicals and Tractarians". He founded no school of thought. His assessment of the church in England was bleak: "a religion of grumpiness, spite, unhappiness, pharisaism etc ... if He did come and suffer He came for a more effective religion than that." Gordon was beyond and above denomination. He lived his religion hour by hour. His cast of mind had much in commons with Saint Francis of Assisi. Like him, and most strangely, all his life Gordon rejoiced at the thought of death: "Thank God, to die would be joy to me. The coming glory must far transcend this fading world's joys." He liked to attend the dying – whether old women or young children. He must have been of the greatest comfort to them as they were, he said, to him: "it brings the future nearer to me." For that future he had to wait another 20 years and we shall never know exactly how he died. Surely the Mahdi did not want him killed. But dying at the hands of Muslims brought Gordon honour that he did not seek. He was a great Christian and a great soldier. This book does him proud.

HB

(The author of this review was Chairman of the Gordon Foundation from 1986 to 1992.)

Journal Awards

The Publications Committee announces the following awards for articles of special merit published in the December 1993 *Journal*:

Vran – Sapper Mountain, Operation Grapple, November 1992 to May 1993
by CAPTAIN A H HAY – **£75**
Operation Lecturer – Cambodia
by WOII (QMSI) J FORAN MM – **£50**
A 500kg Unexploded Bomb in Cleethorpes
by LIEUT COLONEL E E WAKELING ERD – **£25**
The Road to Pak Nai
by LIEUTENANT E W JUDGE – **£25**
With Eighth Army on the Adriatic Sector in 1943,
"The Best Laid Plans O' Mice and Men Gang Aft Aglae"
by MAJOR G V J M SMITH MBE – **£25**

Annual Awards

Further awards for articles of special merit published in 1993, were made as follows:

Montgomerie prize:
Vran – Sapper Mountain, Operation Grapple, November 1992 to May 1993
by CAPTAIN A H HAY – **£75 or a set of Corps History**

Arthur Ffolliott Garrett Prize:
Jedan Most Previse. Bridge Inspections in Bosnia – Operation Grapple
by CAPTAIN J F PELTON – **£100**

Best Article:
Engineer Support for Operation Grapple
by COLONEL J S FIELD OBE – **£100**

Best Junior Officer:
Vran – Sapper Mountain, Operation Grapple, November 1992 to May 1993
by CAPTAIN A H HAY – **£50**

Special Awards:

The Brennan Torpedo
by MR MICHAEL KITSON – **£100**

Sapper Geology
by COLONEL E P F ROSE TD and
COLONEL N F HUGHES TD ERD – **£50**

New Annual Award For Warrant Officers

The Publication Committee announces a new annual award of £25 specifically for the best article written by a warrant officer and published in the *RE Journal*.

Junior Officer Award

The new junior officer award announced in the December 1992 issue of the *RE Journal* is to be discontinued. Please note that the annual award for the Best Junior Officer article will continue as before.