

# Against the Tide



# **Against the Tide**

**An autobiographical account of a  
professional outsider**

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**For Coral and her Sisters**



**Coral, 1944–1993**



# Contents

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Preface	ix
List of Illustrations	xi
1 Growing Up	1
2 University Days	32
3 Learning to Fly	54
4 Flying about New Zealand	75
5 On Active Service	98
6 Rehabilitation	127
7 Kiwi at Oxford	151
8 Research and Lecturing	177
9 University of New South Wales	200
10 University of Oxford	217
11 Struggles in Research	247
12 The Tokamak Fiasco	272
13 Ebb Tide	302
Index	313





# Preface

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When in 1993 I learnt that Coral, my eldest daughter, had only months to live, I decided to write her an account of the part of my life which by a failure of communication I had not described either to her or to my other children. It is sad to realize that, at least for most people, one's knowledge of the life and times of one's parents falls so short of a real understanding. There are too many events in a father's early life which are not passed on to his children in later years. What do I know of my paternal grandfather's life in New Zealand in the late eighteen hundreds? Sadly very little, except what I could glean from a book written by his eldest daughter when she was in her eighties.

Coral was only able to read a dozen or so pages before she died on 24th April, 1993. Towards the end she said I should continue with the story; my other daughters and a dozen grandchildren might be interested in my tales of a not entirely misspent youth. I have had a number of contrasting roles—fisherman's son, fighter pilot in the Pacific, scholar at Oxford, university professor in Sydney, Fellow of Balliol College, head of mathematics departments in Oman and Oxford and serial husband. Although I have lived in Oxford for most of my life, I remain a New Zealander and still appreciate the advantages of having grown up in an almost classless society.

I thank friends who have read some of the chapters, not only as a check on my memory of events from long ago, but also to remove some of the more disparaging of my observations. These include the late Kendrick Smithyman, a leading New Zealand poet, Bernie Hoskin, who flew Kittyhawks and Corsairs in the RNZAF, Alastair Howatson, Fellow of Balliol College, John Ockendon, a mathematical colleague with an interest in aeroplanes, Trevor Gallagher, a New Zealand pilot who was the Chief Flying Instructor in the Oxford University Air Squadron, Ray Bryant, my successor in the Nuffield Research Professorship at the University of New South Wales and three ex-research students—Christopher Brennen, now Vice-President of Caltech; Grant Deane, who believed my tokamak theory and is now at Scripps Institution of Oceanography, San Diego; and Jason Reese, lecturer at Aberdeen University. I also greatly appreciate the advice of the dis-

tinguished solar physicist, Bob Bray. Dr Joanna Ashbourn, co-author on solar physics papers, has contributed much astute and perceptive editing advice throughout which has substantially improved the presentation and insights.

Finally I am ever grateful to Cyril Maloy who, as a secondary school teacher in Auckland, raised my expectations at a critical stage in my life.

It is my hope that my daughters Jill, Diane, Liz and Pat, and a dozen grandchildren, will find these chronicles of some interest.

**L C Woods**

July, 1999

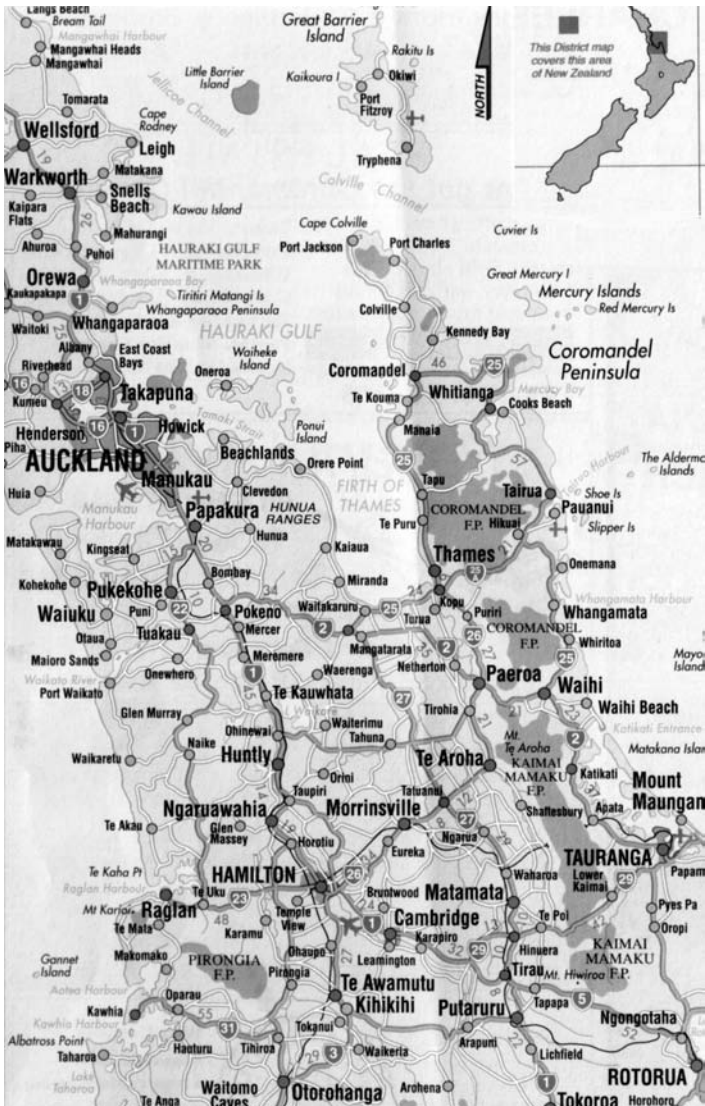
# List of Illustrations

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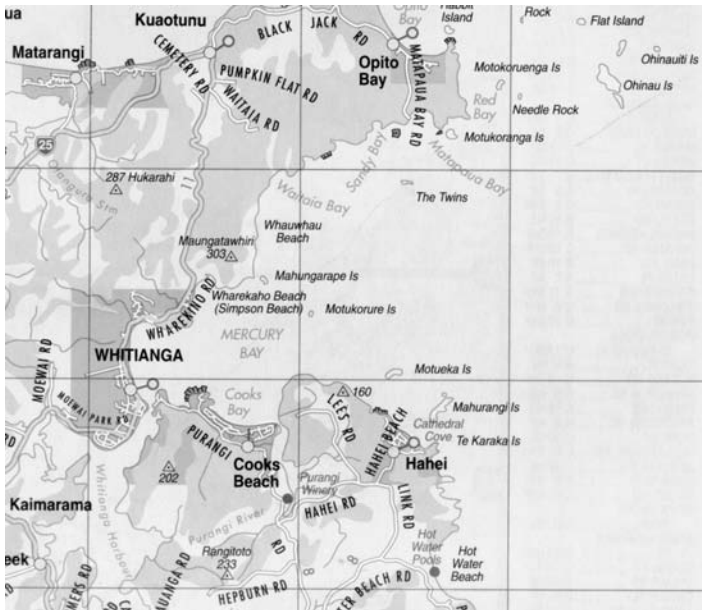
- Page xiv Map 1: Auckland and the Coromandel Peninsula.
- Page xv Map 2: Mercury Bay fishing area.
- Page 2 LCW and Father at the entrance of Purangi River (the crayfish are being placed in the storage tank).
- Page 6 Whitianga Wharf (~1928); Father's launch on left in foreground.
- Page 10 Buffalo Beach, where I learnt to swim, and Whitianga from Cooks Beach side. Reproduced from 'Seaspray and Sawdust' by Janet Riddle, by permission of Janet Riddle, Gumtree Publishers, ©1996.
- Page 14 Hahei Beach: pre-war there were only two houses.
- Page 16 Cathedral Cove, Mercury Bay.
- Page 18 Aunt Flossie with her Queen's Medal and Father with his sister's autobiography.
- Page 27 Octopus on display.
- Page 27 LCW prepared.
- Page 39 My parents with Uncles Dave and Jack and Grandfather Woodhead.
- Page 53 Map 3: Main RNZAF wartime establishments.
- Page 57 LCW centre front row.
- Page 57 Drawing of a Tiger Moth.
- Page 81 Pilot Officer.
- Page 81 Wedding day, 1943.
- Page 83 Vickers Vincent: used as a patrol bomber until the end of 1943. They were later used to tow drogue targets.
- Page 92 Kittyhawks of No 14 Fighter Squadron over NZ. Reproduced by permission of the Royal New Zealand Air Force.
- Page 99 Map 4: Southwest Pacific—the operational area of the RNZAF. Reproduced from 'Wings Over the Pacific' by A Horn, by permission of Random Century New Zealand Ltd, ©1992.
- Page 103 A swimming pool on Bougainville Island. Reproduced by permission of the Royal New Zealand Air Force.
- Page 105 Map 5: Guadalcanal Island.

- Page 105 Map 6: Bougainville and neighbouring islands.
- Page 107 Green Island, a base for RNZAF fighter and bomber squadrons. Reproduced by permission of the Royal New Zealand Air Force.
- Page 109 Map 7: The main islands the RNZAF operated over in 1944–45. Reproduced from ‘Wings Over the Pacific’ by A Horn, by permission of Random Century New Zealand Ltd, ©1992.
- Page 112 Corsairs over the Guadalcanal coast. Reproduced by permission of the Royal New Zealand Air Force.
- Page 156 Merton College viewed from Christ Church Meadow. Reproduced from ‘A History of Merton College’ by G H Martin and J R L Highfield, photograph by Wimm Swaan, by permission of Merton College, Oxford.
- Page 187 Farewell to LCW at Cromer House, NPL, Teddington, Middx, 1954: N Gregory, J T Stuart, LCW, R A Frazer, H B Garner, W E A Acum, W P Jones, C S Sinnott, J Williams, R C Pankhurst.
- Page 206 Inaugural Meeting of the Australian Institute of Nuclear Science and Technology: LCW, J P Baxter, Sir Leslie Marton, H Messel, C N Watson-Munro, E Titterton.
- Page 218 Oxford’s Spires: Balliol’s Front Quad in the foreground.
- Page 225 Balliol College Hall, 1985. Reproduced from ‘Balliol College History’, by permission of John Jones, Dean, Balliol College, Oxford.
- Page 240 My beautiful daughters. Pat, Jill, Coral, Diane and Liz at Coral’s wedding.
- Page 248 The Joint European Torus. The largest tokamak in the world. Reproduced by permission of EFDA-JET.
- Page 249 Tokamak currents and fields.
- Page 256 NZ Rhodes Scholars in the UK and the Warden of Rhodes House. (At New Zealand House, 1976.) Professor N Davis, Dr M Barak, Lord Porritt, Sir Edgar Williams (Warden), Sir Robert Aitken, Mr W Kalaughter; Messrs D B G McLean, C R Laidlaw, D M Stewart, V R Ham, G L Cawkwell, Professor M Cooper, Dr K A K North, Mr D M Davin, Sir Geoffrey Cox, Professor L C Woods, Professor D L Shultz, R W Burchfield, Mr E P Haslam, Mr C B Cato, Dr J A Matheson, Mr R B Stewart.
- Page 268 At sea off the south coast of England.
- Page 270 My ‘Trotski’ period  $\sim 1964$ .
- Page 270 Degree day for Helen.
- Page 273 Figure 1. Fluid shear generating a heat flux  $q_2$ .
- Page 274 Figure 2. The three components of heat flux in a magnetic field.
- Page 275 Figure 3. Transverse heat flux in a strong magnetic field.

- Page 282 My parents in the 1960s.
- Page 288 Department of Mathematics and Computing, Sultan Qaboos University, 1986. Ibrahim Eltayeb on my right; Peter Robinson on my left.
- Page 292 Market square at Nizwa, Oman.
- Page 294 Fellows of Balliol College, 1989.
- Page 298 Suzanne and me in Queenstown, South Island, NZ.
- Page 306 First solo in a glider. Instructor, John Stuart.
- Page 307 My sister Beverley in 1998 and LCW in Sydney, 1998.
- Page 309 Nuffield Research Professors at the University of NSW (1998): Brian Milton, LCW, Al Willis, Ray Bryant.
- Page 311 My patron, Cyril Maloy, with me in Auckland.



Map 1: Auckland and the Coromandel Peninsula.



Map 2: Mercury Bay fishing area.  
(Purangi River is at the right-hand end of Cooks Beach.)





# Chapter 1

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## Growing Up

### Purangi

It only took me minutes to fly from Auckland over the Coromandel Range to Mercury Bay in my World War II fighter plane. I flew the Corsair low along Cooks Beach, flashed past Purangi River, pulled hard on the control column and soared to two thousand feet in a climbing turn to make a second pass at my childhood paradise. The area on the east bank of the creek, where my father had pitched his tents 20 years before, seemed to have shrunk with time. There was no little boy sliding on the mud-slimed, volcanic slabs at the edge of the stream, no tents under the spreading trees and very little native bush. Everything had been scaled down. I turned back towards the Coromandel Range and Auckland, saddened at realizing that my romantic playground had vanished. Perhaps it was just in my imagination...

My first memories are sombre but not unhappy. My parents and I lived in a two-roomed tent beneath a pohutukawa tree on the banks of a small river. I remember that at night there was usually a morepork in the tree, whose eerie calls scared me as I lay still in bed, with firmly closed eyes, waiting for a possible attack. Naughty boys, my mother told me, were sometimes pounced upon by these owls, which could claw out their eyes. Before my parents went to bed, usually long after my fears had melted into sleep, they sat and worked in the part of the tent that served as both our dining and sitting rooms. About 20 yards away was Purangi River, where Father moored his first fishing boat—a converted whale boat about 22 feet long. At that stage of his life he made his living as a fisherman, with practical skills like making crayfish pots and small dinghies and mending nets and petrol engines. My mother was a capable dressmaker; she made all my clothes and most of her own. My parents spent their short, usually silent evenings in the main part of the tent, working at their tasks by the light of a Tilley lamp. They had a cabinet gramophone and a few dozen

records of the popular hits of the twenties. The only one I can remember was called 'The Whistler and His Dog'. Halfway through the record the music would stop, the dog would bark and the music would resume. It was the dog's performance that gripped my attention. Music remained a void for me until I started going to dances in my teens. I blame that dog.

It was 1926; I was four years old. Apart from an old couple living in a cottage about 200 yards downstream, there were no near neighbours, no children of my own age and very little noise: just the natural surroundings of New Zealand coastal bush, with bird song to raise the spirits. I was allowed to wander barefoot up and down the creek, where I slid at speed over flat rocks covered with slimy mud—a favourite pastime—climbed trees over the creek and sometimes fell into the shallow water below. We were camped not far from the mouth of the creek, which opened out to the waters of Mercury Bay near one end of Cooks Beach. About 150 years earlier Captain Cook had observed the transit of Mercury from the Bay, thus giving the region its pakeha (European) name. The village nearest our camp, about three miles away on the other side of an estuary, was Whitianga.



LCW and Father at the entrance of Purangi River  
(the crayfish are being placed in the storage tank).

Crayfish (now called NZ rock lobsters) were plentiful in the waters near Purangi. My father would set his pots in about eight fathoms of water, typically some 50 yards offshore, baited with kahawai or trevally. The next day he could expect to find a dozen or so crayfish trapped inside them, often accompanied by an octopus and sometimes a conger eel. Each day's catch was stored alive in a large wooden 'tank', floating almost submerged

in the water and moored in the river near the open sea. The tank allowed sea water to flow in and out, keeping the crayfish in good condition, until enough had been accumulated to make it worthwhile to take them to the market in Whitianga.

The bait was obtained by cruising slowly up to a school of fish and then blowing them up using two or three sticks of gelignite tied together. Schools of kahawai—a fish about 18 inches long, rather like a mullet—could be identified from a great distance by the canopy of birds feeding on the same plankton as the fish. My father would have the ‘jelly’ prepared with the detonator and fuse in place. The fuse was quite short and once lit, the jelly had to be promptly lobbed into the centre of the school, about ten yards away from the boat. The fuse was just long enough to allow the jelly to sink a few feet into the water before exploding. The stunned fish were quickly gaffed into the boat before they recovered; many died instantly. A hundred fish caught this way was not unusual, but occasionally the school would take fright just before the jelly was thrown into the sea. My father used to talk of the one-armed fishermen who, he claimed, had made the error of waiting for the fish to return before throwing the explosive. Naturally this method of fishing was illegal. The village policeman, Mr Cannon, was a close friend of my father’s. He liked crayfish.

By today’s standards in affluent countries the life I am describing might seem austere, but we never went hungry—there was always fish.

Catching snapper by handlines was another of my father’s tasks. He had built a smoking shed; this was a building about six feet square and eight feet high and inside were wires running horizontally across it and well above ground. He would hang the cleaned, opened-out snapper on the wires. Green tea-tree bush provided a suitable slow-burning fuel for a fire below the fish. This produced a dense smoke and with the shed sealed, the fish would be smoked for some hours. The snapper were fresh, caught the day before, and the taste was very different from today’s so-called ‘smoked’ fish. Of course, we had no refrigeration in the 1920s—well not in Whitianga anyway, so smoking fish was necessary to preserve them.

I had few toys but lots of treasures found on nearby beaches and in the mud under the mangroves that grew further up the creek. These included the usual range of shells, curiously shaped pieces of wood, birds’ eggs and a precious greenstone Maori axe. The latter was soon confiscated as being too valuable for me to possess; later my mother used it as a convenient hammer to mend a rickety table and I was indignant when it shattered into pieces. Some hurts never fade.

My brother Trevor was two years younger; I have only a vague memory of him, mainly of being annoyed when he was allowed to play with my possessions. I used to complain to my mother. I have no memory of his disappearing; he was there one minute, bothering me and then he was gone. Curiously, although remaining aware that I had once had a brother, I never

thought much about him for many years. But the mystery grew—I could not understand why his name was never mentioned, so at last I asked my father what had happened. I had never seen him weep before and have only once since. He explained that Trevor had been born a mongol (nowadays he would be said to be suffering from Down's syndrome) and that his death from pneumonia at Purangi at the age of two had been a fortunate release for the family. But my parents were still shadowed by the tragedy.

Before we left Purangi to enable me to attend school in Whitianga, there was a macabre event that still haunts me. A fisherman named Watson Oxley wanted to put down a mooring near the entrance of Purangi River for his boat, a large dinghy. He found a sufficient weight in an old petrol engine, which he took in his boat to a suitable point. He attached one end of the rope to a float and the other end to the engine, which he then manoeuvred to the stern and levered up, probably using an oar. A final heave put the heavy engine into the water. The rope snaked out but a loop circled his leg and took him overboard. He was probably knocked unconscious on the side of the boat. My father had to recover his corpse, which was floating back and forth in the tide, still attached to the rope about a fathom down in the dark green water.

I was not born in Whitianga. The plaque should be attached to a bungalow in Reporoa, a village consisting of nothing more than a few houses about 25 miles from Rotorua. I don't know which house it was, but that's my own fault. The main road between Taupo and Rotorua misses this hamlet by several hundred yards so if one's attention is fixed on reaching the Maori capital before the restaurants close at 7.30 p.m. or so, it is easily missed. About 50 years after my birth on 6th December, 1922, I was driving along this road, taking my mother and father on a brief holiday, when Mother suddenly said, 'Les, there's the house you were born in! Do you want to see it?'. She pointed to a group of old wooden houses off to the right of the highway, but by the time I had focused on the indicated house, we had missed the turn-off and the town was receding fast. Besides it was about 6.30 p.m., so I made a mistake I have regretted since. I answered 'no' and kept my foot down on the accelerator. It occurred to me much later that the house might also have held some interest for my mother, so I should have stopped.

My father's name was Alexander Binny Woodhead. He was born on Boxing Day, 1898, a convenience that always helped with presents. I usually made one cover both his and the Lord's birthdays. He was a fourth generation New Zealander and claimed Humphrey Davy as a fourth cousin on the distaff side, his mother's maiden name being 'Davy'. Sir Humphrey has been described as the 'Newton of Chemistry', achieving considerably more than that miner's lamp which teachers used to dwell on at school. My father was very proud of this connection.

Father had three sisters and two brothers. Uncle Dave was a soldier in the First World War. The other brother was too young for that adventure, and Dad was rejected from serving by having extremely flat feet. Perhaps I owe my life to his flat feet. His eldest sister, Florence Harsant, died in 1994, aged 102. She was a remarkable woman, becoming an author in her eighties, and being awarded the Queen's medal in her nineties for services to the Maori people. I will return to Aunt Flossie later.

My grandfather, Ambler Woodhead, was a school teacher, clever at mathematics and music, but also an alcoholic, qualities that took him at the crest of his career to a small Maori school at Waitahanui on the Lake near Taupo. He was the only qualified teacher there but he followed the custom in such schools of employing his family, so my grandmother and eldest aunt became assistant teachers. Apart from his younger children, all the pupils were Maoris. Grandfather would have had no difficulty managing this challenge on the bottle of whisky that my father claimed he consumed each day. My father never touched alcohol until his fifties; his sister Florence became the Maori Organiser for the Women's Christian Temperance Union.

Ambler was a keen chess player and engaged in correspondence chess with people all over New Zealand. As the climax of a particular game drew near, letters gave way to telegrams of increasing frequency. He won a gold medal for winning a competition in Taranaki. I cannot recall the details since this prize, passed on to me by my father just before his death, was recently stolen from my house with many other more valuable but less treasured items.

My mother's maiden name was Gwendoline Tew. She had emigrated in 1910 at the age of twelve from North London to New Zealand. Her father was skilled at sign writing, glass etching and decorative painting, but after emigrating he took on the management of a farm some distance north of Auckland. He had never been on a farm before, or not to work. My mother was the eldest of seven children and when my uncles and aunts visited us, I could rely on hearing hilarious tales of my grandfather's incompetence at controlling farm animals. How to give a horse some medicine was the tale most often related. The problem was how to get the horse's mouth higher than its neck in order that the liquid would flow downwards from the bottle. Apparently this problem in hydraulics was eventually solved with the aid of a clothes line stretched tightly under the horse's neck. There would be several children in attendance to steady the horse. As this part of the story provoked great laughter, I never did hear whether or not the horse survived.

Grandfather Tew soon gave up farming and returned to the urban occupations that he best understood; he eventually set up a sign-writing business in Anzac Avenue, Auckland. I preferred him to Grandfather Woodhead since he was a kind man, although pocket-money may have had something to do with it. He was always short of suitable tins in which

to mix his paints. Later, when we moved to Auckland, I volunteered a service. He agreed to pay me a penny per dozen tins, mostly jam tins, cleaned and ready for use. I visited rubbish dumps and carried away loads of filthy tins, cleaned them, beat the jagged edges smooth with a hammer and very soon glutted the market.

## Whitianga

I was five when we moved into a large wooden house near the centre of Whitianga. This was a fishing and farming community with a population of about 400. It was served by one elementary school, one hospital, one hotel, a four-celled prison and a small post office—just one of anything necessary in an isolated village on the New Zealand coast in the 1920s. The place is very different now, with motels everywhere, especially along Buffalo Beach where I learnt to swim when I was five. The change from the isolation of Purangi to village life, buzzing with children, was not easy for me. I was slow at mixing and making friends.



Whitianga Wharf (~1928); Father's launch on left in foreground.

Our house had an outside lavatory, which boys at least always referred to as being the 'dunny'. For paper we used newsprint cut into rectangles and fastened on to a nail conveniently placed. The seat was a wooden plank with a circular hole, usually uncomfortably large for small boys, and below was a can, which Father had to empty into a hole in the garden every week or so. Remembering where he had dug the hole the previous week was important. I used to watch the burial exercise with close interest until

I made an error of navigation, which gave him some amusement. I walked across the garden just after he had concealed the excrement; I cut it too fine and slipped into the soft patch up to my waist. He was a great believer in the educational value of direct experience. Once, when he was preparing lead sinkers by melting lead and pouring it into a mould, he watched me reach out to pick up one of the bright new weights, still cooling down. When I had stopped crying with the pain, he said I had been taught a lesson. I had, but not the one he had had in mind.

We had a number of subtropical fruit trees in our garden—oranges, lemons, figs, plums, peaches and so on. With the vegetable garden, the fruit trees and the fish, our family was largely self-sufficient. The fig-tree particularly fascinated me. When the fruit was ripe dozens of birds were attracted to the tree. I made a catapult using rubber from an old inner tube, fastened to the arms of a Y-shaped piece of wood. I would wait quietly under the fig-tree until the birds were so numerous that the chances of killing one were favourable. I became quite accurate with this weapon, killing many birds. Collecting and blowing birds' eggs was another of my pastimes that would hardly be approved today.

Sunday was the day for wearing shoes, at least for the time spent attending Sunday School. The Methodist Church was the nearest, so that was where Mother sent me. This 'nearest' principle operated in the several areas in which we lived until I was about 16. I patronized several versions of the Christian religion—Anglican, Presbyterian, Methodist, Free Methodist—perhaps one too many, for my faith vanished at the last of these earnest gatherings. Sometimes, I must admit, the penny given to me for the plate made its way over a sweetshop counter. It rather depended upon the geographical arrangement of home, shop and church.

School was on the other side of the village not far from Buffalo Beach. On the way there were usually piles of sand and stone inviting attention, so making sandcastles became a way of avoiding too early an arrival at the playground. I tended to be alone, so was identified by the bullies as a potential victim. My sandcastles were kicked down once too often, so I arranged a few traps. There were two versions—either I built the castle over a pile of stones, or I gathered some fresh cow manure to give the structure a soft centre. Like me and most other young children my tormentors wore no shoes. It was an effective response, but I had to move fast if I wanted to both enjoy my triumph and escape retribution.

In those days there were few teachers in Whitianga. The four primer classes were taught together by one teacher, who addressed different sections in the classroom in sequence. When I was in Standard I, I missed some days of schooling due to an event on my father's new launch that nearly took my life. During my absence the class moved from addition to multiplication, so on returning to a test in arithmetic, I could not understand why the teacher had written all the '+' signs lying down, like '×'. I

continued to add the figures. Fortunately the teacher was kind to me and took extra time out of school hours to explain multiplication.

When I was about six, Dorothy T. and I took a fancy to each other. Once behind some tall cutty-grass bushes, she took her knickers off to show me that her thingy was not the same as her brother's. I had suspected this and was pleased to have it confirmed. We were in the same class and sometimes walked to school together. On the last occasion I found a metal ring on the road, which I slipped on to one of her fingers as a mark of my love. An hour or so later the teacher saw this on her hand and told her to take it off, but it wouldn't come off. 'What is it doing on your finger?' she was asked. 'Leslie Woodhead gave it to me,' she answered in an unnecessarily loud voice. The class was entertained and the teacher laughed. I was asked to come forward and explain myself—I was very embarrassed. The mocking lasted for weeks and I ignored girls for several years after that betrayal.

One of my father's interests was flounder fishing at night using a spear. This consisted of a wooden pole about four or five feet in length to which was attached a sharp metal tip a few inches long. About a mile up the estuary, above the township, Whitianga Harbour was broad and shallow with mangroves growing here and there. The fishing technique was to wade in water about 12 to 18 inches deep, carrying a lamp hung over one arm and towing an empty punt. The spear was raised ready to strike the flat fish as it was disturbed and became momentarily visible in the light. The speared fish would be thrown into the punt and in an hour or two it would be fully laden. When I was allowed to go along, I would sit in the stern of the punt enjoying the adventure. Incidentally, New Zealand flounder makes Dover sole seem mediocre in both size and flavour.

Father had prospered. He had found a patron who lent him the money to buy a small fishing boat from the village dentist. It was called the *Rawhiti* and had a cabin containing a petrol engine and two sleeping bunks in the bow. He fished around the coast of the Coromandel Peninsula, from the township of Coromandel up to Cape Colville and down the coast to Tairua, some 15 miles south of Mercury Bay. But his main fishing grounds were in a spectacular group of islands ranging from Ohinau Island 12 miles north-east of Whitianga up to the Mercury Islands a few miles to the north. (There is a map at the beginning of this chapter.)

One fine sunny day in 1930 he took a party of friends on a fishing trip to Castle Rock about 13 miles south of Whitianga. This was notable for snapper fishing, so all were in anticipation of a happy day, including my mother and I. Bored with the adult conversation, I sat on the very stern of the boat watching its wake spread over the calm, glass-smooth sea. This finally wearied me so I decided to go forward into the engine-room and sleep on the sails that were spread over the bunks. It was dark and I soon dozed off.



After a while my father realized that I was absent. He looked into the dark cabin and satisfied himself that I was not lying on one of the bunks. Perhaps I had fallen overboard? Immediately the boat was turned round and our journey retraced. As the sea was calm and he knew I could swim, he expected to see me in the water somewhere along the return passage. After half an hour and with no sighting, my father had given up hope, having inspected the cabin more than once. Now he made a more careful search. I was lying in the shadows on the floor, with my head an inch from the heavy spinning flywheel. I was unconscious, not breathing, rigid and probably dead. He tried artificial respiration for several minutes with no response. He made one last, desperate attempt to save me and I finally started to breathe. By the time we had returned to Whitianga and my father had carried me ashore across Buffalo Beach to the hospital, I was wondering what all the fuss was about. I did not need to go into hospital—I was perfectly well! But no-one understood what had happened, so I had three days in hospital. In an effort to keep me in bed, my nurse taught me how to knit. Years later, to impress a girlfriend, I knitted her a complicated jumper in white wool and later entered it in a NZ-wide competition. Unfortunately the colour was a poor choice since I neglected to wash my hands each time I started. Needless to say, I did not win a prize.

My father found that he could get a better price for his crayfish by transporting them in his launch from Mercury Bay around Cape Colville, and across the Hauraki Gulf to Auckland, a distance of about 70 miles. When he had accumulated about a ton or so of fish, he and his mate (assistant fisherman), would make the trip, spending all night doing it. One night after clearing Cape Colville, a dangerous stretch with reefs extending from several headlands, my father handed the task of steering the boat across the Gulf to the mate and lay down to rest in the forward cabin. After a few minutes, anxious about the navigation and feeling rather dizzy, he opened the forward hatch just above the engine-room bunks and gulped the fresh night air. He then guessed why I had nearly died—the closed engine-room cabin was probably filled with carbon monoxide. Later the next day he checked the gaskets on the exhaust pipe and confirmed that they were leaking their poisonous fumes into the sleeping cabin.

## Mercury Bay

Near the beginning of the estuary there were the remains of an old saw-mill with logs scattered along the shore. When I was about eight years old, I found two small logs about six feet long, which I was able to push into the water. I floated them upriver to the point closest to our house, which was about 50 yards in from the shore. I found some boxwood, ‘borrowed’ my

father's hammer and nails and constructed a raft from the logs; I was very proud of this float. It was stable provided that I did not stand up and I was able to paddle it out into quite deep water near Whitianga wharf. I didn't trouble my parents about the raft; anyway by this time I was a good swimmer so there could be no danger. The school was near Buffalo Beach, so it occurred to me that perhaps I could go to school via the raft, paddling downstream at least as far as the entrance to the harbour and returning the same way after school. With my school bag on my back, I set off on the raft to go down river a distance of about 300 yards. True, the seat of my pants got a bit wet, but at least there was no problem with shoes.



Buffalo Beach, where I learnt to swim, and Whitianga from Cooks Beach side.

I moved well out into the estuary to take advantage of the stream which was running out to sea. Unfortunately the tide was ebbing at its maximum speed and I covered the distance to the entrance more quickly than I had expected. I paddled desperately towards the river bank, but was unable to reach the saw-mill, which seemed to flash by. Now the raft was beginning to pitch in the waves off one end of Buffalo Beach. I was about 30 yards from the shore in the deep water of the channel entrance and moving rapidly out to sea. It was not my situation that worried me, but the certain knowledge that soon more than the seat of my pants would be wet. I abandoned the raft and struck out for the shore. It was not too difficult a swim, but I was soaking wet, which put attending school out of the question. Nor did it make sense to walk home until school had ended for the day, by which

time I would have dried out. I was disappointed about the raft, but never bothered to construct another.

My father was an amateur photographer, developing and printing films that his friends described as being of very high quality. The cameras of those days were quite primitive, but were steadily improving. Father was attracted by an advertisement for a very advanced and expensive machine and, it being close to my mother's birthday, decided that the expense could be justified by giving it to her as a particularly generous present. So he sent to Auckland for the camera. My mother was not as pleased as he had expected; anyway it was a bit too complicated for her, so he said he would accustom himself to it and then teach her the tricks. One day at the end of Whitianga Wharf, with the camera at the ready in its unfastened case, Father noticed some small fish swimming in and out of the piles. He leant forward to improve his view and the camera slid smoothly out of its case to join the fish below. He was very upset and, as his status over the camera was already low, he wisely said nothing. This did not matter as Mother was not really interested in photography and did not request the camera back. After some weeks he secured a replacement and later told the truth from the safety of a year's grace.

As a boy living near Taupo Lake, my father had mastered the art of tickling trout. To do this he would lie on a river bank at a spot where deep water could be reached and where trout were frequently found. As the trout became accustomed to the presence of his hand trailing in the water, they would swim close enough for him to touch. He would then gently stroke their undersides, bringing them closer to the bank, until they were in a favourable position to be scooped out of the water on to the bank. A poor man's version of this technique, using sprats, gave me great pleasure. I would lie on the bottom landing of Whitianga Wharf, just above the lapping water and soak a loaf of stale bread in the sea. Teasing the loaf with my fingers, I would generate a trail of particles of bread, which drifted away with the tide. Sprats—small fish up to about six inches in length—would soon appear, at first just a few, then dozens and finally hundreds. They would be so enthused by the food that they would brush against my hand, even forcing their way through my relaxed fingers to reach the loaf. A sudden scooping action would put one or two fish into a bucket of sea water standing on the platform behind me. After catching several fish in this way, I would take them home with a view to keeping them as pets. I was always surprised to find them floating belly-up after an hour or so.

My first criminal acts occurred when I was seven; I can recall two of these. The first had a very limited shelf-life in a village of only about 400 people. The trick was to take a small tin matchbox, put two shells in it and enter the store, ask for some sweets costing threepence and then rattle the tin to imply that the threepence was inside. On receiving the bounty, the tin was passed over and then I ran! My father knew about this escapade

even before I got home, since Mr Cannon, the policeman, lived opposite us. In his yard he had four cells at his disposal. I was taken to him by my father, given a severe and frightening talking-to and then locked up in one of the cells. I had no idea that I should ever be free again, but after an hour of crying and asking God to intervene, I was released.

I was more successful with my second crime. The hotel manager would pay for empty beer bottles returned to him, a halfpenny for a small bottle and a penny for a large bottle. Small boys would scour the village for this treasure, usually tossed aside by drunks. The returned bottles were collected into a large pile in the hotel yard to await transportation to the breweries in Auckland. The yard was enclosed by a tall, wooden fence; however, one of the vertically hanging slats was insecure at the bottom and could be swung aside so that a little boy could just squeeze through the gap. There was always the danger that someone in the hotel would see me either crossing to the stack or returning with an armful of bottles to the escape hole. It was only a minute's walk to take the stolen bottles round to the back of the hotel and to sell them back to the manager or to a barman. I made the mistake of boasting about my cunning to a friend, who promised to keep my secret. Two or three days later so many boys were involved in the trade that the manager realized that he was being deceived. The fence was secured and a large dog joined the hotel staff.

Sometimes I was able to go on fishing trips with my father and his mate, especially when the trips lasted only two or three days. Fishing for rock-cod, snapper and other edible fish was interspersed with the routine of crayfishing. The 'Mercurys' were an attractive scatter of islands about 25 miles north-west of Whitianga. When we were moored close to one of these islands, I used to love rowing ashore, landing on a beautiful, white beach lapped by the crystal-clear water and edged with deep-green flax bushes. Except for those on the launch, no humans could ever be seen. When I was older, I was allowed to row the dinghy in and out of the rocks near the shore. Sometimes I would let the dinghy drift slowly across bays, with the seabed of rocks, seaweed and sandy patches clearly visible through three or four fathoms of water. With a fishing line trailing along, almost reaching the bottom, it was possible to see the rock-cod (a round fish about 18 inches long, weighing between three and five pounds) take the bait just before the tug on the line advised success. While my father, or more likely the mate, was preparing lunch on the boat, I often managed to catch half a dozen or more fish.

One particular fishing trip always fascinated me. This was the one that after 40 miles or so took us to the Alderman Islands, named by Cook after the London Court of Aldermen. These lie to the south-west of Mercury Bay about 20 miles off the coast. When about halfway there, we would pass by Castle Rock, a small, steep-sided island, perhaps 100 yards across and around which the ocean swell would generate turbulent water. The

Aldermans were another two or three hours' journey, almost out of sight of land. Years before, my father had by chance discovered a subterranean hill, where the depth was only 54 fathoms instead of the usual 100 or so fathoms of the surrounding sea. This place was excellent for hapuku fishing. 'Hapuku' is the Maori name for a large, grouper-like fish, which is excellent for eating and obtainable only by deep sea fishing. Typically a hapuku may weigh 40 to 80 pounds and fish over a hundredweight have often been caught.

My father's fishing lines had three or four snoods several feet apart, attached to the main line. Each snood terminated in a big hook baited with large pieces of octopus, eel or other suitable fish. With over 300 feet of line to pull in, Father usually waited until two or more fish were hooked before starting the long haul. Considering the size of hapuku, those fishing with him were content with a single catch. For me these fish were so powerful that Father usually started me off by pulling in the first ten or more fathoms before letting me continue the struggle. At about the halfway mark the line came up more and more freely and the last ten fathoms or so were merely a matter of reeling in slack line. The stomachs of the hapuku would become filled with gas under the reducing water pressure, giving them enough buoyancy to float to the surface. The fish would belly-up a few yards behind the boat, with their stomachs bulging out of their mouths. Landing them would then simply be a matter of lifting very heavy, inert fish from the sea.

On some fine evenings when the sea was calm, small phosphorescent creatures would glow in the bow wave of the launch as we steamed along through the night. This phenomenon fascinated me, especially if the porpoises were playing just in front of the launch. I would stand on the bunks, with my head out of the forward hatch, watching the display until the cold forced me to retreat. The phosphorescence briefly illuminated the porpoises, particularly when they were streaking close to the bow. A dozen or more of these beautiful animals would escort us for several miles before suddenly disappearing. Overhead, scattered like diamonds on a black velvet cloth, the bright southern stars added grandeur to the lovely night. I was alone in a magic world.

## **Aunt Flossie**

Cooks Beach lies just to the south of Whitianga and at its southern end is Purangi. A few miles further down the coast is a beach for which I have the fondest memories—it is Hahei. This beautiful stretch of white sand, bracketed by two impressive headlands, is about half a mile long, with Mahurangi Island extending out from its southern end. On a fine day the view from the beach is breathtaking, with a range of enchanting islands



Hahei Beach: pre-war there were only two houses.

scattered in the distance as far as one can see. The beach and a few square miles of its hinterland comprised a sheep farm that belonged to my uncle, Horace Harsant, and his elder brother, Walter. Horace married my father's eldest sister, Florence, in 1918.

Horace and Florence had three sons, Fred, Vaughan and Charlie, and two daughters, Joan and Janice. When the partnership between Horace and Walter was dissolved, Fred and Vaughan purchased Horace's portion, each obtaining half of the valuable beach frontage. There was not enough land for two viable farms so they each added more to their holdings. The land around the cottage was left to Florence for her lifetime and then passed on to the five children. Charlie purchased some virgin land from the Crown in the hills behind his brothers' properties and with hard work and the support of his English wife, Ann, he became a farmer. He has now retired to a house at the end of Cooks Beach on the Purangi River opposite to where my father's tent was pitched in 1926.

As a small boy I loved visiting my cousins on their farm. We would run along the clean, white sands, slide down the flax-embroidered dunes and swim in the creeks at either end of the beach. At that time, before the War, there were only two houses—one known as the 'big house' and the other as the 'cottage'. Horace's brother, Walter, occupied the big house whilst Horace had the cottage.

Except for a decade or so, Aunt Flossie lived in the cottage from 1918 until she left in 1991 to go to a nursing home in Thames, a town on the other side of the Coromandel Peninsula from Hahei. During the War she worked as a postmistress in the Bay of Plenty, where the population was mainly Maori. She describes her early life at Hahei in one of the chapters of her book, *'They Called me Te Maari'*, published by Whitcoulls Limited in 1979. The account on the cover of her autobiographical work begins:

Here is a book rich in both human interest and historical observation. It is the personal story of a remarkable woman as well as being a fascinating account of a significant period in the history of the Maori people.

In 1913 Florence Woodhead was appointed Maori Organiser for the Women's Temperance Union. She was a young Pakeha woman who had grown up in unusual circumstances. Her father was a schoolteacher in a Maori village in the then-remote Lake Taupo region of the North Island. Florence thus gained an early fluency in the Maori language as well as an enduring love for the Maori people and an understanding of their way of life. To her Maori friends she was 'Te Maari'—from her second name, Marie. (The Maoris, it is claimed, were unable to pronounce 'Florence'.)

To carry out her mission as Maori Organiser she travelled through the lawless gumfields area of the far north, through rugged and remote terrain, in conditions that would have made most men quail. On horseback and often alone in the 'roadless north' she endured floods, the now almost-forgotten smallpox epidemic and the insults of hostile tavern-keepers—not to mention the caprices of a recalcitrant packhorse, 'Satan'. In the Maori villages she encountered unforgettable warmth and hospitality and formed friendships which endure to this day.

My father also knew some Maori and liked impressing visitors with his command of it, but Aunt Flossie had a superior grasp. When we occasionally visited her in Hahei, Father would sometimes show off by using a word or phrase of Maori. It gave me particular pleasure to hear her firmly correcting his pronunciation or grammar. He needed checking at times and none could manage it better than his elder sister.

Hahei is now a holiday resort covered by scores of houses, in streets extending for several blocks away from the beach. My cousins Fred and Vaughan abandoned farming to become affluent property developers, whereas Charlie, lacking a beach frontage, remained a struggling sheep farmer. Auntie Flossie was sad but philosophical about the transformation of that paradise, lost to the post-war motor car invasion. She lived in the cottage with few amenities for another 17 years after Horace's death.



Cathedral Cove, Mercury Bay.

Each time I visited my Auntie in recent years I would leave with the tactfully expressed remark that I did not expect I would have the chance to see her again. On each subsequent visit, usually after three or more years, she derived some amusement from the fact that she had proved me wrong by surviving for another meeting. Now that she is no longer in Hahei, the place will never be the same for me or for many other of her Maori and Pakeha friends. I loved and admired her very much.

My wife, Suzanne, and I visited Hahei in 1990. We stayed for two nights in Aunt Flossie's modest cottage. Although nearly blind and close to her hundredth birthday, she rose each morning to cook and serve our breakfast. I felt humbled by such a will. She was proud of her Queen's Medal and the fact that the first Maori Governor General of New Zealand—Sir Paul Reeves—was an old friend.

In April 1992, when Aunt Flossie was six months beyond her hundredth birthday, I received a long letter from her, describing a weekend of celebrations with her Maori friends. Some extracts follow:

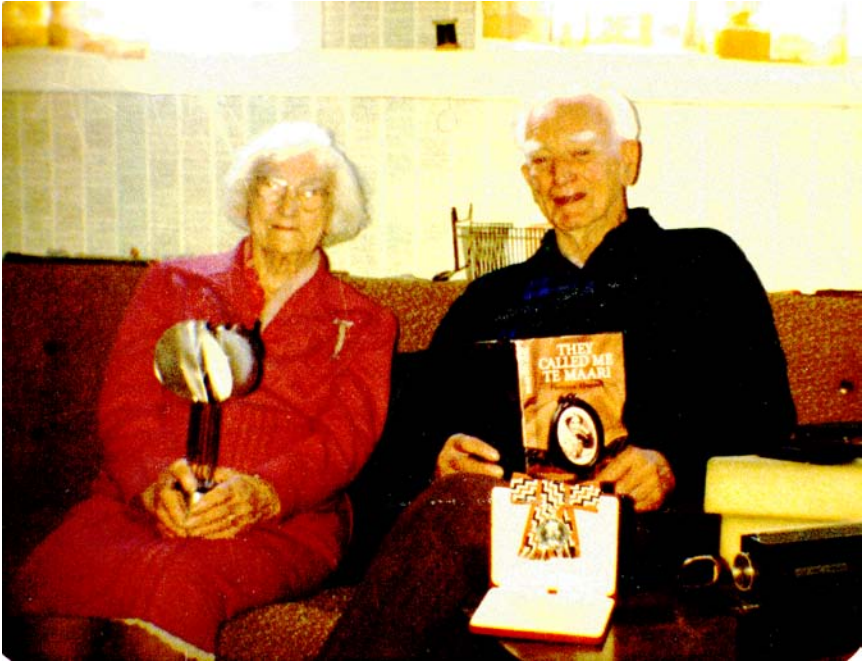
Next morning, Sunday, we were due at the Meeting House at 10.30 a.m. and there was a great big gathering of Maoris. Oh it was a very large Meeting House and it was pretty full, besides all the others who were outside. We were seated on the side halfway along the room and another party was seated just opposite where we were. They were the receiving guests. You remember the woven belt I used to have which was made for me by the Maori women when I was 15 years old? Well I've had it all these years. I used to wear it when I was small enough around the waist and



it is really a lovely piece of work. Well, when on my birthday the Maoris gave me that beautiful medallion made of greenstone, I thought I would give them something of value in return. The only thing that I had that would be suitable was that belt, so word was sent to them that it would be presented to them. The time and date were fixed and we were all there plus Margaret Northcroft (Tai Rawhiti, one of her father's first pupils at Waitahanui). She had had it framed—a black wooden frame with a strong glass top and it was laid down in this frame so no dust or anything could soil it or touch it. We had that beside us and first of all there was the usual karanga—the call of welcome to us and I replied in Maori and then came the business of handing this belt over to them and that was done with great ceremony. They don't clap but you could hear a pin drop in that great hall while I was handing it over to one of the Te Heu Heu. The Te Heu Heu are the highest ranking Maoris in the district and I used to know them when we were living at Waihatanui. They lived in Te Kanu and their sister was a great friend of mine. . .

Then, as I sat there, one Maori after another came and either kissed me or hongied me. Well a hongie there is not a pressing of noses but their nose taps the side of your nose twice and on the other side of your nose twice and that is the hongie. I guess if my nose had been made of putty it would have been well dented by the time all that was over because there were many of them that came up to me, kissed me or hongied me. A few merely shook hands. I was very warmly greeted by them all and I was very proud to be there. Then that was over and people began to mingle and ones who had remembered me from way back in the past, well they are pretty old because I am 100 so a lot of them would be in their 80's or 90's, I suppose now. Then we went back to Teresa's aunt's place for dinner and we had a meal of smoked trout. . . and then after dinner was over, we just sat there, at our ease, and one after another people came in to greet me personally and I was made such a fuss of—all in Maori—it was a completely Maori affair. . .

We stopped at the school and the children were all gathered in my honour and they sang three songs for me. It is a three teacher school now. The children were told that my father was the first teacher at the school and the young people were absolutely astonished that anyone as old as I am could have come all that way to see them. Also they were amazed that I could speak their language when some of them couldn't. I found it quite easy to go back to the Maori language altogether because that's what



Aunt Flossie with her Queen's Medal  
and Father with his sister's autobiography.

it was—they didn't speak English at all to me and they didn't call me Whoroni as the old Maoris used to, but they called me Florence.

Besides the Queen's Medal, my Auntie was awarded a Media Women's award for her Anglican Mission work with the Maoris. Florence was born on 19th September, 1891 and died in Thames, NZ on 19th June, 1994. Later that year I met Sir Paul Reeves at a function in Lady Margaret Hall, Oxford and we talked about her courage, spirit and great dignity. He told me that he had conducted the service at her funeral. It is paradoxical that my grandfather's weakness for whisky had taken her as a teenager to Lake Taupo and thence into a remarkable relationship with the Maori people.

Beyond Hahei there is another beautiful beach that I visited two or three times from my father's launch. It is called Hot Water Beach and in those days it was completely deserted. On one sunny occasion the launch was anchored just offshore, beyond the surf, and we rowed ashore in the dinghy. Father had decided that we would have crayfish for lunch, which were too difficult to cook on the boat's primus stove. A fire was made from driftwood and a four-gallon petrol tin filled with sea water was balanced

on some stones arranged around the fire. Ideally crayfish should first be 'drowned' in fresh water, otherwise they kick so vigorously on being put live into boiling water that some of their legs detach, allowing water to enter the body and spoil the flesh. They take about half an hour to cook. During this time, following Father's advice, I scooped out a large depression in the wet sand, just beyond the range of the surf. I was surprised to find that this hollow slowly filled with quite hot water, seeping through the sand down the beach. I took off my clothes and had a hot bath with sea water occasionally reaching me, giving a sudden temperature change. Of course New Zealand is famous for its geothermal regions, and these are widespread throughout the North Island. To find such a region so close to the shore line is unusual, however.

## **Panmure**

We moved to Auckland when I was nine years old since it made more sense for Father to be based near the place where his fish was being marketed. After a few weeks in a hilly suburb called Parnell that overlooked the railway yards, we moved to a house on the edge of a tidal basin at Panmure, about 12 miles south of the city. The basin is about half a mile long and a quarter of a mile wide and is connected to the Tamaki river by a narrow neck, about 30 yards across. At low tide the basin turns into exposed mud flats with only a central water channel remaining, while at high tide there is about ten feet of water covering the mud. This was an ideal position for my father, for at the bottom of our garden there was a stone jetty where he could moor his launch. He was still crayfishing, but had moved his pots from Mercury Bay to a region about 20 miles north of Auckland, which included Whangaparaoa Peninsula, the nearby Tiritiri Matangi Island and Kawau Island further to the north. Sometimes he would travel as far as the Little Barrier Island, which was (and still is) a bird sanctuary.

Rowing around the basin early in the morning, when my father's dinghy was available, became one of my amusements; this was promoted to some extent by the fact that at one end of the basin there was a grove of orange trees. I would land, slip quietly over the farmer's fence, climb a tree and fill my shirt with its fruit. On the other side of the basin there were market gardens, which I would explore for vegetables that could be eaten raw; but lettuce and carrots were all I ever found. I would wash them in the sea water of the basin and eat them before rowing back to our jetty.

Near the neck of the basin was a field running down to a small beach suitable for swimming. Moored about 30 yards out from this beach was a pontoon, which made a useful swimming platform for diving and sunbathing when the tide was in. The pontoon was constructed from two rows of sealed drums over which a wooden platform was fixed, and which were

concealed by skirting boards. I used to enjoy dismaying other children on the pontoon by diving off into the muddy waters, swimming away and down out of sight and then returning underwater to the pontoon, surfacing quietly in the air gap between the drums. After a minute or so I would swim underwater, back to the position where I had last been seen and then come up, pretending to have been down for two or three minutes. I gained a reputation for being a great underwater swimmer until I got caught. The local school used to hold its annual swimming festival in the basin off the beach. I gained my half-mile swimming certificate when I was ten, but could have continued swimming for another half mile. Sometimes I would stay in the water until after dark, swimming in the middle of the basin, until I would hear my mother's anxious voice calling me home.

On Saturdays Mother would sometimes send me to the local grocery store, which was about 300 yards away. The direct path to it lay across fields bordering the basin, so I never minded this task. I would play on the beach, wade in the water and climb trees near the neck of the basin, slowly advancing towards the shop. It usually took me the best part of an hour to collect the items Mother wanted. Once, when she gave me a list of goods to collect which she needed for the weekend, she said 'Please hurry back with the groceries.' An hour or more elapsed before I reappeared; she was angry.

'I told you to hurry!' she said.

I replied, 'But you told me to hurry *back* and I did. You said nothing about how I should *go* there.' Fortunately, this quibble amused her, and she did not punish me.

The school I attended was about 200 yards from our house. It stood on the main road leading from Auckland City to the Tamaki bridge, not far from the neck of the Panmure basin. It was a tough school with almost as many Maoris as Pakehas. Playground fights were common and the cane was used freely to keep classroom discipline. Serious offences required a visit to the Headmaster, who would apply a leather strap with full force to one's outstretched hand. He did not strike across the palm, but maximized the pain by striking parallel to the arm, allowing the end of the strap to reach almost to the elbow. The frequent punishments were audible throughout the school. Six blows, three on each arm, were the maximum. I did well to have to pay only two visits to this enthusiastic disciplinarian, once for being ten minutes late returning from organized swimming in the basin and once for swearing.

I can remember that going to school in the winter months without boots presented a minor challenge. My feet would become numb, but as the sun warmed up the ground at morning playtime and circulation was restored, there was a particular pleasure in rubbing my feet gently against the rough ground. The tingling and fading of the numbness was almost worth the initial discomfort.

At the age of ten I was in Standard IV, having made no more than average progress with my studies to that stage. Then something important happened, which greatly boosted my confidence. Our examinations were complete and the teacher presented our results and report forms to us in order of merit. She read the total marks for each student and invited us to clap the first half dozen or so in turn. The top boy or girl in a class of about 30 got, say 320 marks—I cannot recall exact figures—and I was placed about tenth with, say 241 marks. The clapping had stopped by the time I received my report. I added up the subject marks in the report and got 341. I couldn't believe it at first. There was some mistake surely? After the report ceremony, I approached the teacher with my discovery; she didn't believe it either and said she would check the whole report for me. About 15 minutes later she called me up to her desk and in a quiet voice congratulated me on coming top of the class. There was no clapping.

My morning routine was to rise at about seven o'clock, get dressed, take my parents tea in bed, feed the ducks, collect the eggs, eat two Weetabix smothered in sugar and milk, boil and eat two duck eggs with bread and butter and wash this down with a mug of cocoa. In the warm months I would then go looking for mushrooms in the open fields around the basin. The idea of purchasing mushrooms in shops did not exist then; they grew near cow-pats in the fields and had to be gathered. I soon discovered that the milking paddock of a nearby farmhouse was an even better hunting ground than the open fields. At certain times mushrooms as big as dinner plates could be seen scattered throughout the well manured enclosure. The farmer caught me on one occasion and was very fierce; they were his mushrooms! This warning meant that I had to rise well before dawn to reap the harvest; my mother was impressed by my skill as a mushroom hunter.

There was a blacksmith's shed on the way to school. I often spent time watching him or his assistant perform miracles with glowing pieces of iron on the anvil, and watching a horse being shod was a special treat. One day the blacksmith invited me to try my skill at tossing a penny into a funnel. He said it was difficult and that not many boys could manage it. If I succeeded I could keep the penny. I was eager to try, since what could I lose? The penny was placed on my head and the funnel was inserted into the waistband of my trousers so that it was secured by my belt. I was to close my eyes and when told, to nod my head to try to drop the penny into the funnel. At the signal, I nodded my head and the penny reached the funnel about the same time as a pint or two of cold water. The blacksmith was still laughing as I made my way to school, wondering if the teacher would draw the wrong conclusion.

Aunt Flossie told my last wife that I was a lonely little boy; I do not remember my childhood quite that way. True, I did spend a lot of time alone, going on bicycle trips, walking through the bush, swimming long distances, and reading. One of the best presents I ever received was a

torch. My bedroom light was usually switched off not long after I was dismissed to bed; it was my illusion that a torch under the bedclothes would not be visible from the doorway of the bedroom. In this fashion I read many books, usually borrowed from the school library since we had few at home. If it was fine on a Saturday, I would often cut some sandwiches, hard-boil two eggs, pour some milk into a bottle and package this onto the back of my bike, together with my swimming togs and a towel. Then I would set off for Buckland's Beach, about eight miles away, near the entrance of the Tamaki River. This area had a number of shops and a convenient wharf running into deep water—excellent for diving. I used to enjoy swimming down amongst the piles, reaching the sea bed and looking for objects to bring to the surface. The piles were dangerous, being encrusted with sharp-edged shellfish, small mussels, barnacles and so on. More than 60 years later, on the inside of my left arm, I can still see the marks of a deep gash I received from a shell. It cut a vein so deeply that any shark in the neighbourhood of the wharf would have had no difficulty in finding me. I quickly got out of the water and wrapped a handkerchief tightly around my arm. In today's world, I would have had stitches. I have avoided swimming under wharves ever since.

I may have appeared aloof to my schoolmates, and my name 'Wood-head' did not help. Name-calling and other forms of bullying were commonplace, and no doubt will remain so until the end of time. I was usually called 'Woodenhead' and was expected to accept it. There was one particularly aggressive and strong boy, feared by most. One day he addressed me contemptuously by my nickname, expecting the 'other cheek' as usual. I decided in a flash of temper to punch him in the face, and did so as hard as I could. He was so surprised that he did not fight back. The other boys who saw the exchange were immediately impressed. I had taken on the school bully and won! Perhaps I would become the 'top boy' in the playground? But my superiority was short lived. The bully caught me after school, determined to restore his status. In a field just opposite the school we fought for a long time, wrestling, punching and kicking. Just as well neither of us wore boots. Fresh cow-pats were rolled through, back and forth. I like to think it was a draw; anyway afterwards we pretended to be friends. When I got home, stinking and bleeding, with some story about falling over on slippery grass, my father said 'And who was the other boy who fell down with you?'. He had walked past the battleground and wisely not interfered.

I never had any trouble with smoking. Some older boys told me that cigars could be made by using dried pine needles wrapped tightly in brown paper. I tried this but was not hooked, since I just coughed a lot. I couldn't understand the appeal of smoking at all. Then it occurred to me that I should try one of my father's cigarettes, so I stole a packet he had left on

the sideboard; I didn't return it in time. My memory of the subsequent thrashing has lasted a lifetime, but I suppose that the real prophylactic was my early insulation from peer pressure.

## Dominion Road

In 1933 my parents moved to a shop in Dominion Road in a block just beyond what was called the Astor Theatre. It was really a cinema, but since in Auckland at that time real playhouses hardly existed, there was no confusion. My mother was able to maintain an income for the family by her dressmaking skills and the shop was hers for that purpose. I attended Brixton Road Primary School, about a mile from the shop. On the first day I arrived barefooted and carrying my few books and pencil-case in a sugar bag. I noticed that most of the boys wore shoes or boots. The school was much larger than the village school at Panmure and everyone seemed smarter. I told my parents, who bought me some boots and a proper school-bag and after a while I adjusted to the new environment. Some bullying was attempted, but my experience at Panmure stood me in good stead. After landing a few punches here and there, I was soon recognised as someone not to tangle with. Unfortunately, the teacher of my class, Miss Wilson, caught me one day in the playground successfully beating off a challenge by one of the bullies but of course she didn't know what had led up to the fight. She made me stand at the back of the next class for half an hour, having told me off for being a bully from a tough country school. It seemed unfair. Fifteen years later the same dear Miss Wilson sent food parcels to me in Oxford, when food rationing was still being imposed in England.

The cleverest boy in the class was Graham S. He regularly came top in the examinations and was expected to have a brilliant academic career in later years. In the first five terms of Standards V and VI I steadily improved my class position from about sixth to second. There was one term still to go before we left school to begin our secondary education. Miss Wilson favoured Graham; he was polite, never rough in the playground, played the violin, was always well dressed and acted as the class monitor when she was absent. A real smart-arse, I thought, with a touch of envy. I have to admit that I do not recall doing much homework, just enough to stay out of trouble. But to Miss Wilson's surprise I beat Graham in the final Standard VI examination. He went on to the best grammar school in Auckland; I was sent to Seddon Memorial Technical College, which was mainly a trade school<sup>1</sup>. That there were some academic courses available in the day school

<sup>1</sup> Seddon Memorial Technical College has now evolved into a very different place called the 'Auckland Institute of Technology'. Like many other Technical Institutes, it seems likely that it will eventually become a university.

was not known to me and in any case irrelevant, since my father was doing the career planning for me.

When she learnt that I was due to go to the Technical College, without any prompting from me, Miss Wilson tried to persuade my father to send me to a grammar school instead. I was completely neutral in the matter, since I lacked any academic ambition at that stage. Father had been to Auckland Grammar School, boarding with a family in Symonds Street until trouble with his father caused him to leave and find his independence with a job. He used to boast that he was the only fisherman in Auckland with a knowledge of Latin and Greek, and he was certainly not going to let his son waste time learning such useless dead languages! The Technical College, where one could learn something practical, was the right place for me. Accountancy offered a good career he thought, so I was initially enrolled to study this subject. Then by chance, he met an acquaintance from his grammar school days, who was an accountant. This was at the end of 1935, when the economic depression was still heavy on the country, so he was told that jobs in accountancy were impossible to find.

‘What about a practical subject like engineering?’ the accountant advised. Here ‘engineer’ really meant ‘mechanic’, an unfortunate confusion that still persists in the English-speaking world. So Father altered the application form and at the beginning of 1936 I set off for secondary school to become a mechanic.

About this time I became quite interested in astronomy. I couldn’t afford to buy star maps, so I used to visit the Auckland Public Library in Wellesley Street and, with the help of tracing paper, I would copy the southern constellations from books containing star maps. I had to conceal this activity from the librarian, but I was careful not to press too hard with my pencil so that no damage was done. The southern skies boast 11 of the 19 first magnitude stars and, since they are often cloudless, the nights are brilliant. I soon became familiar with dozens of constellations and the names of the brightest stars in them. Orion stood on his head, with the dagger in his belt pointing ‘upward’. The Southern Cross, reproduced in the national flag, was my usual starting point, and expanding away from it, I was able to locate even quite small and unimportant constellations. I particularly enjoyed identifying the planets and explaining something of their nature to any captive audience. I knew their sizes, distances from the Sun, rotation periods and so on. Sometimes on clear evenings I would entertain the girls and boys in my street with my ‘erudition’. I doubt if this increased my popularity. Anyway I gave up this form of boasting after one particularly embarrassing failure concerning Mars. One of the girls pointed to a red object low in the sky and asked me what its name was.

‘Oh, that’s Mars,’ I replied, with great assurance. ‘No it isn’t, Stupid!’ one of the boys asserted. I then explained about the red planet, giving a



few irrelevant statistics. 'That's *only* the light on top of Mount Eden,' my tormentor exclaimed. 'Anybody knows that!'

To earn pocket money I took on an after-school job delivering newspapers. Bundles of the *Auckland Star* were delivered to a distribution point at the corner of Dominion and Valley Roads. The agent employed a gang of boys with their bikes, who were ready to distribute the papers to customers in nearby streets. I was given about a hundred papers to deliver to houses in three or four long streets—most houses in each street took the *Star*. The papers were carried in a canvas bag divided into two compartments, which fitted over the top bar of the bike. The technique that I used—not approved by the agent—was to tightly roll each paper, bend it in the middle so that it would retain a boomerang shape and then ride down the middle of the road, throwing the rolled papers to the left and right into each front garden on my list.

There were two problems with this, the most serious of which was breaking windows with the papers. I managed this now and again and, if caught, would have to pay for the damage. The second problem was that if the paper was too tightly rolled, the action of bending it could shear it into two separate pieces. I would then have no choice but to deliver both pieces, naturally avoiding houses where this had happened before. However when the agent went to the houses to collect the *Star* money, complaints were sometimes made. The wage was five shillings a week, enough to enable me to buy a new bicycle on hire purchase and to go to the cinema once a week.

Seddon Memorial Technical College had a motto: 'We learn for life, not for school'; at least I think that is how it translated. It was written in Latin, a subject not taught at the 'Tech', so the Headmaster had to translate it for us. It would have been more appropriately expressed as 'We learn for work, not for enlightenment'. The Technical College buildings were most unattractive and, being situated almost in the centre of town, had no sports grounds. There were about a thousand pupils, most of whom expected to leave and find a job after two years, the official school-leaving age being 14. Courses were offered in accountancy, engineering, typography, woodwork, metalwork, domestic science and some other trades that I cannot remember. Those studying accountancy were considered to be the élite; they were being prepared for the matriculation examination, after which they expected to continue their studies at night school, not at the University. The accountancy students remained at school long enough for some of them to become prefects.

My class was named 'E1F'—first-year engineering, class 'F'—not very inspiring, although in the first year the grading was alphabetical, not on merit. At the end of my first year, the only subject in which I failed to come top was sheet metalwork, where I had to settle for second place. With a few exceptions, the bright boys were in the grammar schools learning those 'useless' subjects—Latin, French, mathematics, history etc. Of

course we had ‘mathematics’, but it was taught by rote. For example, I was taught that adding the logarithms of numbers was equivalent to the logarithm of the multiplied numbers for reasons ‘too advanced for you boys to understand’. In my second year I advanced to E2A; merit now played a small role. At the end of the first term, I had a stroke of great fortune: Mr Cyril Maloy entered my life. His principal role was to teach mechanics and physics to engineering cadets released by employers to attend part-time classes. He had taught me mechanics in E1F and was aware of my potential. He suggested that I should transfer to accountancy for some arts subjects so that I could enter for the matriculation examination and perhaps afterwards go on to the University. I had no objection and my father was not consulted.

So at the age of 14 my academic education at last began, but I had to make up a lot of ground. A foreign language was required and I had only 18 months in which to learn it. Extra early-morning classes were available in French and I worked on my own in Mathematics, Mechanics and Physics, with occasional tutorials from Mr Maloy and one or two other teachers, who had become interested in me as a project. Two other students, Rudolf Belin and Douglas Piggott, were in a similar position. We had to do laboratory work in physics and mechanics on our own, as very few Tech boys had previously made it to the University in these subjects.

Rudolf and I made a good team. He was excellent with experiments and had been appointed as a lab boy some time before. So in physics and mechanics I first learnt the theory from the set books, and then explained it to Rudolf, who in turn carried out the experiments described in the books while I watched. In the science subjects we had complete freedom over our timetable and were trusted to work by ourselves; in the arts subjects we attended the classes for accountancy students who did not have science or mathematics in their examinations.

## **Sandringham**

About this time my parents moved from the shop in Dominion Road to a modest house at 24 Royal Terrace, Sandringham, where they were to live for the rest of their lives. Royal Terrace is just two streets away from Eden Park—any Englishman who is a rugby fan will know of this famous ground, since it is where the Auckland Provincial team often spoils the record of the Lions, Wallabies and Springbok touring teams. In 1937 I watched the Springboks being surprised by the strength of the Auckland side, but I cannot remember the final score. All I can recall is the name of one of the Springboks, to which schoolboy humorists insisted on adding the definite article: it was ‘Bastard’. Why did I complain about ‘Wood-head’?

Bruce Morrison was the school junior champion at athletics. He also had a quality that I evidently lacked, nowadays called 'charisma'. We, together with about a dozen other Tech boys, would meet at the Valley Road tram terminus at about 8.30 a.m. to travel the three miles to the College in Wellesley Street East. Sometimes there would be two trams waiting for us and Bruce would always decide which one we should take. He would walk out and we would follow. I could never understand how he managed this. True, he was a school champion, but I was cleverer than he. Perhaps it required confidence? So one day before Bruce moved, I said 'Let's take *that* tram' and walked out. No one stirred until Bruce led them to the other tram; I travelled to school alone. But I decided that I did not want to be a follower in life and as it appeared that I was not a natural leader, I settled for being an outsider and later seldom regretted it.



Octopus on display.



LCW prepared.

However, I did eventually become a leader, although establishment rather than *ad hominem*. I joined the Boy Scouts, behaved in a diligent manner, earned a lot of badges and eventually, when the boys a little older than I had handed in their toggles and departed, I became the troop leader. I was good on discipline, especially when the Scout Master left me in charge. I didn't actually thump the smaller boys, I just threatened violence. I par-

ticularly enjoyed the annual scout camp. One camp I remember especially was a week at Piha, a holiday resort on the west coast about 25 miles from Auckland. This is a beautiful surf beach, bisected by the imposing Lion Rock, towering a hundred feet or more above the white sands. We camped about half a mile from the coast near the banks of a river. The Assistant Scout Master, who was all of 18, was in charge and I helped him. Our food, principally bread, butter and jam, was stored in boxes. In true scouting tradition the meat was kept cool in string bags hung in the trees around us. Once when the younger boys were sent off to the river to have their morning wash, the ASM stayed at the camp to prepare breakfast—bread and butter, with sausages as a special treat. I returned from the river before the others to find him studiously removing prosperous maggots from the sausages before putting them into a frying pan. He asked me to delay the return of the others, adding that we should sacrifice our treat to the younger boys, and compensate by having extra bread and butter. I learnt a lot in the Boy Scouts.

When I moved into A3A at the beginning of 1938, I found that several of the accountancy students had been made sub-prefects or even prefects. I have never been one to covet rank, but I couldn't understand why I had been overlooked, especially given how much cleverer I thought I was. If crawling to the masters was required, I could forget it; I lacked the talent. I asked one of the successful plodders what his secret was. He replied 'Play games. I play cricket for the First XI in the summer and football for the First XV in the winter. You should try it.' I should remark here that when I was a boy, 'football' in New Zealand meant 'rugby football'; like tennis, soccer was for sissies. I had no football boots and Father was sparing with extra pocket money, so I purchased a second-hand pair and set about training to become a prefect. I lacked the finesse to become a back, but was aggressive enough to be made a break-away forward in the First XV after a few games. Of course, like most other New Zealand boys, I had played football before, barefooted and in ordinary school clothes, in the playing fields of the primary schools I had attended. The game is a religious rite, which explains why a knighthood in New Zealand is inferior to being capped as an All Black.

I was 14 when my sister was born. She was born on 22nd May, 1937, too late to help me adjust to the opposite sex. I simply looked after her occasionally, bounced her on my knee and pretended to Rudolf that she spoke to me in a baby language that only I could understand. I used to repeat the sounds she made and when he could make no sense of them, say 'There you are then, *I* know what she is saying.' This was my first venture into metaphysics. Rudolf, my close friend for many years, was quite gullible, or at least pretended to be. I repeatedly warned him against catching VD from touching the handrails leading down into public lavatories. It became a ritual.

Another Tech boy who had an important influence on my life and who remained a friend was Kendrick Smithyman. He developed into a distinguished poet and *litteratus*; Auckland University later conferred an honorary doctorate on him in recognition of his achievements. He published 13 books of poetry, and I was grateful to receive some of the early volumes, although my literary education was hardly equal to the task of interpreting them. Ken had a poet's command of language, an excellent memory and was widely read. His witty conversation was a pot-pourri of acerbic quips and good-humoured instruction. I greatly appreciated the time he spent in correcting some early draft chapters of this autobiography. Some typical remarks were:

'This last is meaningless. Delete it.'

'"Hessian bag". For God's sake call it a *sugar bag* and don't piss about.'

'Why not just say "We practised on the Domain..." and forget explaining to the Brits. Queen Victoria is dead.'

'"Many of the lorries were drays" strikes me as odd. A dray is, as far as I can see, identified as a cart and associated with being horse-drawn. The only exception to this that I know about is in San Francisco, where I noticed some haulage firms described themselves as *drayers*.'

Two months before his death at the end of 1995, he wrote me a brave letter, warning me that the end of his life was near—his letter ended with:

Doesn't Dr Johnson say somewhere that there is nothing like the prospect of death [to] extraordinarily sharpen the focus of one's mind? As in so many other respects he is wrong, I'm more woolly-headed, digressive, garrulous, and yet in some way focussed, than ever.

In my reply I wrote about our friendship and what it had meant to me, adding how much I had enjoyed his books over the years and how the next time I took one from my shelf, I would spend a long time thinking about him and our friendship.

In 1979 he gave me a copy of his collection of poems strangely entitled '*Dwarf with a Billiard Cue*'. Inside the cover is written:

'Smithyman at his best, said our publisher's reader, offers "tight, verbally intense, highly individual glosses on the business of living" in a way which no other New Zealand writer approaches. This is the fourth Smithyman collection we have published, the first two being out of print. Smithyman is not only admired: he is bought and read.'

Ken was in the third year of the accountancy course when I first met him. He usually came top in the arts subjects, leaving maths and science to me. At that time I was struggling to gain conviction about God

and some of his reported works. Ken explained it all to me in one sentence of three words, but before explaining this miracle I should first give some background. At that time I was attending Bible Class in the Free Methodist Church in Mt Eden Road. We were working our way through Genesis chapter by chapter. The barbaric bits made no sense to me and I repeatedly challenged the young leader to explain what God was really up to. Deadly floods and transmutation into pillars of salt did not convey much compassion. My attacks evolved slowly into the more fundamental question, 'How do we know He exists?'. It was suggested that if I attended a Christian revivalist camp at Ngaruawahia over Easter, my doubts might be dispelled and conversion to the faith would follow. I was willing, for I had no alternative philosophy. Religion was certainly full of confident, if inscrutable, explanations of the world in which we lived and most of the Bible Class would go to the Easter camp.

Ngaruawahia is about 70 miles south of Auckland on the Waikato river, a rather long bike ride. The camp was set in grounds not far from a high bridge over the river. The swimming was excellent; when I arrived some boys were jumping off the bridge. I had a try too but baulked, since I was not yet ready for heaven. There was a surprising number of attractive girls swimming too. The devil was up to his usual tricks. Each night there was a large tent full of 'believers' listening to breathless preachers and singing the usual praises. I recall a black minstrel singer whose pathos was quite stirring. The climax was a passionate pleading for us sinners to accept the Lord's forgiveness, to come forward and to openly declare our conversion before all present. We were asked to bow our heads in prayer.

'Who will declare for the Lord? Please raise your hands now and come forward.' Bruce Morrison was sitting next to me; I looked sideways and noticed that his hand was raised. Other raised hands appeared across all parts of the tent. It was going to be a stampede—I fought temptation and kept my hand down.

Back at the next Bible Class meeting, the leader asked which of us had declared for God. It appeared that I was the only failure. What I couldn't understand about Bruce was that he didn't seem to be any different, despite his conversion. He certainly swore just as much and remained the same arrogant, born leader.

One day at school in the prefects' room—football had since paid off—I said to Ken, 'Who made Man? Surely *some* God was involved?'. He replied, 'God didn't make man. It was the other way about. Man made God.' I thought this statement was very profound and his answer immediately converted me to atheism. I have remained an unbeliever ever since and I hope to make it to my deathbed without relapsing.

At the end of 1938 I easily passed the matriculation examination in eight subjects (five were sufficient for university entrance), coming first in New Zealand in geometry and algebra. I looked forward to going to

Auckland University College the following year, but that depended on my father paying the fees. These were not large by today's standards and would have cost him about £200 per year, which I knew he could afford; the crayfish were still crawling into his pots despite the Depression. I expected to continue living at home, so there would be no other expenses. But my father pointed out that when he had been *my* age he was earning his own living, and had I stuck to the engineering course as I was supposed to do, I could also have achieved this. It seemed that there was no question of my going to university.

'How about going to the Teachers Training College where you would be paid 30 shillings a week while being taught to be a schoolteacher?' he suggested. I agreed as there seemed no alternative. Mr Maloy tried to persuade him to let me go to university, but without success. Maloy then advanced another plan—I could try for an entrance scholarship which would pay all fees and even give me £25 a year for books. It was a long shot, as only 30 such scholarships were available for all of New Zealand, and it would require my going back to Tech for one more year and preparing for the exam under his supervision. My father reluctantly agreed to support me for one final year, after which I must get a job and pay board. He also added some restrictions: I was to work for him on the launch during the school holidays and I was to maintain the garden by working on it every Saturday morning.

My father was not given to displays of love and affection. He never praised me, since that might have encouraged pride, and never said 'Well done' when I took home my school reports. When I came second in the class at Brixton Road School, he looked at Miss Wilson's glowing report and asked 'Why didn't you come first?'. When I went back to school for the final term and satisfied his request, he rewarded me by sending me to a trade school, despite the strong recommendation of my teachers that I should go to a grammar school. He was a hard man. I wanted his love, but he seemed incapable of giving it. Perhaps my sister saw a different father, but that would be years later.

The beginning of 1939, that ominous date in world history, is a good time to say goodbye to growing up. I was almost a man and there was the possibility that I would find a way to university. That this ambition could be thwarted by a war in Europe never occurred to me; I would soon be free. Girls were beginning to interest me, but I had no idea of how to approach them. Then there was Josephine.

## Chapter 2

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### University Days

#### The Scholarship

At the age of 16 I needed to win a university entrance scholarship if I were to be allowed to attend university; few if any from the Technical College had previously managed this. The odds were certainly against me, since less than two per cent of university entrants would receive awards, and the successful students would be those who had been well coached in sixth-form grammar-school classes up and down the country. Going to university in those days was much less common than today, although New Zealand was rather better than most countries with about 400 university students per 100 000 of the population—still less than ten per cent of the age group. The student population of Auckland College was then about 1200<sup>1</sup>.

At that time the University of New Zealand consisted of four colleges, distributed between the main cities—Auckland, Wellington, Christchurch and Dunedin—plus two small agricultural colleges, Massey and Lincoln. It was usual for students to attend their local college and to live at home with their parents. The scholarship included maintenance only if the student's home was too far from one of the colleges to allow easy commuting.

The University had adopted a curiously inverted system of awarding scholarships based on studies pursued one or even two years *after* the university entrance examination had been passed. In practice this meant that those students who had modest success in the matriculation examination proceeded directly to one of the colleges, presuming of course that they obtained financial support for both fees and accommodation from normally ambitious parents. The students who did particularly well in matric were encouraged to remain in short pants for another year or two to try for a scholarship, usually more for prestige than for money. Thus when they

<sup>1</sup> By 1997 it had increased to 26 000, while the population of NZ had little more than doubled in that time.



finally arrived at university, they were a year behind their previous contemporaries and knew a good deal more than the other first-year students in their classes. This absurdity smacks of the old Oxford and Cambridge scholarship system, although I am not complaining, since for me at least it offered a ladder upwards. But as I was to discover, the snakes were waiting.

Although I had the support of Cyril Maloy and two or three other teachers, I had to work mainly by myself. Rudolf was still around, but had not yet sat his matric. His cross was that he had to support himself and I think to some extent his family by undertaking a milk round. This required him to get up at 3 a.m. each morning and to work at full speed delivering milk. There were no bottles—Rudolf carried a large, heavy pail and used a dipper to transfer the milk to billycans placed near the front gates of the houses on his round. By the time he got to school, he was tired and often dozed in classes, but, despite all this, he never complained and remained a cheerful extrovert.

The boy scout experience was good for me, since I learnt to mix more easily with other boys and, even better, how to walk up to a girl and ask her to dance with me. The Balmoral Scout Troop had a weekly dance organized by a committee of parents with the object of using the entrance money to improve the Troop's amenities. It was held in a nearby hall on Saturday nights, commencing at 8 p.m. and finishing at midnight. A four-piece band would play the dance hits of the time, and halfway through the evening there would be a supper of sandwiches, cakes and tea provided by the mothers on the committee.

The Assistant Scout Master, Mr Davies—not the 'chef' I mentioned earlier, but an older man (who had lost a leg in the First World War)—had two attractive daughters. Josephine was the youngest and had a twin brother, Bert, whom I had met at the Tech. Bert was now a motor mechanic and had finger nails to prove it. He was good-hearted and said that I should take his twin sister to the scout dance and that he would arrange it. Mr and Mrs Davies readily accepted this, as I had been to their house many times and they liked me. Their home had a happy, relaxed atmosphere, sadly lacking in mine, and I have a lot to thank them for. In fact they organized my very *first* birthday party when I reached the age of 16. There were about 20 young people there; I hadn't realized that I had so many friends.

One Saturday evening I arrived at the Davies' house *en route* to the dance hall. We had about half a mile to walk and when we left the house, I walked beside Jo and tried to take her arm. I thought this was required, but she wasn't of the same opinion. Conversation lapsed. The entrance fee to the hall was half a crown, and, just before we arrived, Jo pressed one into my hand. I protested weakly, but she insisted, 'Daddy is paying.'

At the dance I took her to a seat on the benches arranged around the hall and then retreated to the entrance area, where most of the young

men were standing. Few of them had come with partners and, even if they had, they were certainly not sitting with them. We spent the time in between dances looking at the girls from our collective safety. When the band started to play a waltz, a fox-trot, the gypsy tap (usually termed the 'tipsy Jap'), the 'Lambeth Walk' or any of the other exotic dances of the time, each chap would quickly advance to a girl already targeted, and invite her on to the floor. If you were too slow you could end up with a pug.

Josephine was an attractive girl of 16 with a nice soft body, which she pressed against me on the dance floor. It was heavenly, but a problem quickly arose—surely everyone could see! I performed more seemly with the military two-step, a side-by-side ritual with less body contact. At supper time I was all manners and walked Jo across the room to where the food was laid out on benches and helped her to fill her plate. I think she liked me, despite my crab-like style of dancing. But I improved and we had several dances together, finishing with the 'Now is the Hour' last waltz, which one was expected to have with one's escort. She let me take her arm on the walk home and I was over the moon. I made a half-hearted attempt to kiss her goodnight; perhaps I had halitosis. Better luck next time I thought.

At this time I became conscious of things like clothing, cleanliness, hair appearance, body odour and bad breath. I was still playing for the first XV on Saturdays with practice on Wednesdays at the nearby Domain, which guaranteed two showers a week. But Mother had failed to instruct me about men's underwear, so I never wore any, until in the changing sheds I wondered why I could dress so much faster than the others. I started buying minor items of clothing, underwear, socks and occasional shirts. Finding the money was not easy, as the paper round had been given up. I used to visit the local sawmill after school, collecting scrap boxwood and packing it into old sugar bags as in the winter I would be able to sell these bags for about two shillings each. To get permission to enter the sawmill to collect the wood, I had to see the foreman, who was an overweight Swede with a loud voice appropriate for a mill. I thought it might help my case if I took my matriculation certificate for him to inspect. He pretended to read it, then laughed.

'Unnecessary rubbish,' he said, handing me back the paper. Later during the school holidays, I got a full-time job at the mill, separating strips of boxwood according to their widths. The noise was quite deafening and the work unbelievably monotonous. I also took on odd gardening jobs, which sometimes required exaggerations about my ability to distinguish weeds from flowers.

I started using hair oil. I was particularly attracted by a brand made from coconuts and used it generously, so that when I went out into the cold night air, it would solidify and feel stiff to the touch. This amused

me—I liked the feel of it. I would have been less amused had I realized that it also changed the colour of my hair to coconut white. But once in the dance hall, it would quickly melt, restoring my natural hair colour. A handkerchief was sufficient to mop up the excess oil running down my face.

The scholarship examination covered a wide range of academic subjects, each of which was allocated a maximum possible score. The subjects that I decided to attempt were: Mechanics (300 marks), Mathematics (600 marks), Additional Mathematics (300 marks), Magnetism and Electricity (300 marks) and Heat (300 marks). But this was not enough since a total maximum score of 2200 was required, and hence another topic was essential. The grammar school boys had a wider range, including Latin, but there was no other subject I could offer with any confidence, and there was the added problem that if the marks on any paper fell below 20%, these would be completely omitted from the total.

Owing to my late start in the subject, I was well behind in French and had only just edged through it in matriculation. But it seemed to be my only possibility and carried exactly the 400 marks I needed. With hindsight I should have offered Chemistry, which, although new to me, could perhaps have been mastered sufficiently during the year to get marks comfortably above the 20% cut-off.

By this time I had mastered the skill of learning by myself directly from textbooks; teachers were only required if the text was badly written. I also discovered that the best way to learn a subject was to teach it to someone else, with a little preparation naturally. Rudolf was an ideal pupil and he did the experiments for me.

French was another matter however. The French Master, Mr Fulton, did his best, but I was not comfortable with the language. In addition, compared to the other subjects I was studying, it was absorbing far too much time. As the year wore on even a modest target of about 30% appeared to be too much to expect. Whether or not I got a scholarship seemed to depend more and more on my ability with the language of a country 12 000 miles away.

I was seeing Jo most Saturdays now and taking her to the scout dances. She had a job in a clothing factory not far from the Tech, and after school I would often collect her from work and take her home on my bike. It was called doubling, and she would sit uncomfortably on the top bar whilst I pedalled vigorously, with my arms on each side of her as I held the handlebars. It was hard work—Auckland is a hilly city and Jo was not undernourished—but I loved it and the sense of freedom it gave me. On some Saturdays Jo's elder sister Eve, her boyfriend, Jo, Bert and I would take packed lunches (prepared by Mrs Davies) and set off on our bicycles for a local beach. There we would swim, picnic, walk through the coastal bush, play games and be happy. I found that I didn't have halitosis after all.

## At Sea

In 1939, my last year at school, I had achieved some sort of equilibrium in life. I had a girlfriend, I was a school prefect and with the support of several teachers, especially Cyril Maloy, I was studying hard to win a university entrance scholarship. I was also a sergeant-major in the school cadets which all male pupils had to join. A war was looming in Europe and if it happened, New Zealand, as a loyal member of the British Commonwealth, would immediately be involved and with conscription certain as in 1914. But it all seemed far away at the time.

During the school holidays I fulfilled my obligation to my father to work on his launch. His mates seemed to come and go, none staying with him for more than a few months. I was never sure, but I suspect that when the school terms ended, he would invite his current assistant to take a holiday in order to save some money. Although I would have preferred to remain with my friends in Auckland, once the boat cleared the Devonport Heads on the way north to Whangaparaoa Peninsula, my spirits would rise. I would take some mathematics and science books with me to read during slack periods. During the three-hour journey I would sit on top of the cabin with my feet hanging down through an open hatch and resting on the steering wheel. This way I could enjoy the view and fresh air and steer the boat at the same time. There were seldom any other boats visible, so I could also read my books without stress. The whole trip would usually last three or four days.

A typical day would begin with the hunt for bait, using gelignite as described earlier. There were about a hundred crayfish pots to lift, empty and reset with fresh bait. Father would manoeuvre the launch close to the float of a pot which I would gaff. I would then haul in about eight fathoms of rope to reach the pot, which almost always contained some crays, but sometimes other creatures. I would leave the conger and moray eels to my father, who would take a knife and put his hand into the pot and try to decapitate these belligerent fish. Octopuses appeared more frequently than eels. They would enter the pots and attack the crays, and often only crayfish shells would be left. I could manage to remove the octopuses when they were in their normal, blue-tinted state, but sometimes they changed to a dull red colour, in which case they were twice as aggressive; Father had to be called. One of his entertainments was to allow an octopus to fasten a tentacle along his bare arm and then to remove it slowly, listening to the popping sounds made as the successive suckers lost their grip. I was content to applaud.

At the end of the day Father would moor the boat in a sheltered bay and turn on our wireless set. My first task was to wash the planks that were used to bridge over the catch of crayfish. These would be covered with slime, bits of stale bait, pieces of octopus and blood from the eels.

After this I would strip off, dive into the sea, swim around the boat, climb into the dinghy and thence back on board. An alternative, provided it wasn't dark, was to dive down and swim under the keel and up the other side. For this I needed to be able to see the boat's silhouette overhead as I passed under the keel. Once I saw the shadow of a large fish, or it may have been a porpoise. There were sharks about, but that never worried me. New Zealand sharks do not have the bad reputation of the Australian man-eaters.

My final duty for the day was to cook our dinner on a primus stove. Father avoided cooking until near the end of his life. I usually boiled potatoes first and put them aside nearly cooked while I fried the fish. The usual alternatives were bread and cheese or beans on toast. When the bread became too stale, I used to fry it and serve it with pickles. Finally I would at last be free to read my mathematics and science books in the light of the boat's Tilley lamp. An hour or so of this, sometimes followed by a game of chess with Father, would see the day out. As I lay on my bunk, I soon fell asleep listening to the rhythmic slap of the water against the hull and hoping that the weather the following day would be bad enough to encourage Father to return to Auckland a day or two earlier than planned. I cannot say that I enjoyed the fishing trips as a whole, although there were moments of excitement landing fish or seeing occasional whales and porpoises.

On our return to Auckland, the crayfish would be delivered to a wholesale fishing company which paid about tuppence a pound for them. I would ask Father to sell me three large male fish, typically weighing between five and seven pounds, at this cost. I would put the fish in a sugar bag and take them home in the taxi that Father always ordered after a fishing trip. Mother's copper—a large metal cauldron for washing clothes—would be cleaned, filled with water and the fish drowned. They would then be removed, a fire lit, the water boiled and the fish returned to the copper. Half an hour later I would have three sellable, cooked crayfish, and would charge interested neighbours half a crown per fish, a bargain compared with the usual retail price.

The scholarship exam was held in December and the results announced late in January, 1940, just before the beginning of the school term. I had no idea how well I had done, except for being confident that I had failed French. The results were delivered by post while I was away on a fishing trip, thus my return from Whangaparaoa to Auckland was a mixture of excitement and apprehension. At last I had the official envelope in my hand; had it been worth all the effort? The names of everyone who had attempted the examination—about 200—were set out in order of merit. The first 15 candidates were awarded Junior Scholarships and the next 15 received National Scholarships, but the emoluments were the same. To be on the list anywhere in the first 30 was prestige enough for me. My name

was there, in 26th position—a close call. My French mark was 22%, with no wasted effort on that subject—just eight marks to spare!

The individual marks in the five science subjects pleased me. My positions in New Zealand were: Additional Mathematics—2nd, Magnetism and Electricity—3rd, Mathematics—6th, Mechanics—6th and Heat—6th. In French it was easier to reckon my order from the bottom; only ten people had worse marks, so at the top of the page I entered the position as 11\*. A few days later I was at the Technical College, waiting to be raised shoulder high. Of course all the teachers, who had played a role were very pleased. I was in the main corridor showing the scholarship list to Cyril Maloy and two or three other science teachers, when the French teacher, Mr Fulton, joined us. I explained that the numbers above each subject gave my position in that subject.

‘Eleventh in French?’ he exclaimed, ‘Never!’

‘Ah,’ I explained, ‘you have missed the asterisk.’

The Headmaster, Mr G J Park, previously a remote figure, had never been more friendly. I asked him if I could come back to school for a month before the University College term began in March, as I needed to study chemistry and make use of his laboratories. He agreed and furthermore, said that during that period I was to be Head Boy.

‘Does just one month in that position make sense?’ I ventured.

‘Of course—you have brought great distinction to the school,’ he replied. I should have asked him to translate the school motto once more, but I was awash with self-congratulation. It didn’t last long.

My father was mildly pleased. ‘It will help you to get a better job,’ he said.

‘I don’t need a job, I shall be at University,’ I answered.

‘So how will you pay your board? Your scholarship only covers fees and books and I cannot afford to support you any longer,’ was his surprising reply. Were we going round in circles? I reported this to my patron, Cyril Maloy, whose response was magnificent.

‘I will pay your board, Les,’ he said. I knew this offer would ‘blow my father out of the water’, and Cyril wrote to him, repeating his generous offer. Father’s response was not unexpected, ‘If anyone is going to support *my* son at university, it’s going to be *me!*’. However in the end, it didn’t turn out quite like that.

## Auckland University College

University life lived up to my expectations. I already knew most of the first-year work, so I had lots of spare time. The only challenge was Chemistry, a subject quite new to me. There was football, frequent college dances, parties and lots of attractive girls; a pity I was so shy. There were de-



My parents with Uncles Dave (seated) and Jack  
and Grandfather Woodhead.

bates about religion and politics and, best of all, the cinemas downtown in Queen Street were only ten minutes' walk away. Unfortunately, attending lectures was compulsory; either rolls were called by laboratory staff before the lecture started or a sheet of paper was circulated, on which students were required to write their names. Unsurprisingly, forgery was rife. More interesting were the additional names supplied. 'Mrs Simpson' was quite popular, although she was usually outranked by 'Stalin' or 'Jesus Christ'. Roll calling was equally fallible. Rudolf, who had passed his matric and was studying physics and mathematics in the classes I was beginning to skip, was always willing to throw his voice. He had other clients, and on one occasion he had to answer '*Present*' to three consecutive names on the roll, one of which was mine. I was told that his variation of pitch and timbre was masterly.

My atheism was fairly militant. I recall telling Harry Whale, another scholarship holder, that religion presented a serious obstacle to progress, or something to that effect. Harry was a brilliant science student and a member of the One Hunga Communist Party; he was more worldly and polished than I. He said that I should move beyond that first phase of enlightenment, and that the real enemy was capitalism. The depression

years from which the War was now rescuing us were a result of capitalistic greed; I should read some books on socialism. I took his advice and started with a booklet entitled the *Socialist Sixth of the World*, written by the Dean of Canterbury, who was known as the 'Red Dean'.

In 1940 Auckland University College had fewer than 1200 students, the majority of whom were really part-timers, especially in arts, commerce and law. The lectures for these subjects were scheduled towards the end of the working day from 5 p.m. until 9 p.m., whereas the laboratories and lectures for the sciences, engineering and architecture took place in the mornings and afternoons.

Wednesday afternoons were free for sport, but not on the campus site, which was tiny, just over four acres. Few students participated, and the older students were beginning to volunteer for the armed services and disappear, so I was soon promoted into the College First XV. We practised in the Domain, a large park close to the centre of Auckland. A college blue was awarded to those who in any one year played in more than three-quarters of the senior games. Mine was to prove very helpful eight years later. We played against local first-grade teams, and the climax of my sporting year was being included in a tour to Wellington to play against Victoria University College's team. We took the afternoon Express and thundered through the night at an average speed of 24 miles an hour reaching Wellington 17 hours later.

Ken Smithyman observed that 'the speed boasted by NZR was the same as the average speed of the Stockton-Darlington railway when George Stephenson got it going'. Lack of sleep, not to mention serious hangovers, gave the opposing team an unfair advantage.

Although there was no discernible class structure in New Zealand, it soon became clear to me that most of the students had come from homes more affluent than mine. But in the university environment social distinctions quickly dissolved, and differences of accent scarcely existed. The boys from King's College, a private secondary school given to employing masters from Oxbridge, soon lost their imported affectations. However brown faces were hard to find—I cannot recall seeing more than two or three Maoris in my time there. By 1997 there were nearly 2000 Maoris attending the University.

Nowadays torn clothing and trainers are correct undergraduate apparel, whereas 50 years ago the standard was polished shoes, pressed trousers, and jacket and tie. My clothing was a little shabby, so, wanting to make an impression at the Freshers' Ball, I spent most of my first scholarship cheque of £6/5/- (six pounds, five shillings) on a crimson jacket. I looked very smart indeed, but couldn't afford to take a girl to the junket, which was just as well. I entered the University Hall and was surprised to discover that most of the men were wearing dinner jackets, some even tails and a few were in acceptable dark suits. All eyes seemed to be on me; perhaps



I was a junior caretaker or an electrician checking on the sound system? I stayed in the shadows and went home early.

I had enrolled to study engineering; in fact I really wanted to be a mathematician, but an engineering teacher at the Tech had assured me that there were few job prospects for mathematicians. The first-year course consisted of basic sciences—Pure and Applied Mathematics, Physics and Chemistry. During the first term I attended most of the required classes, but when I realized that I was already familiar with the subject matter of the first three, my interest slackened, and I found more exciting things to do. I was allowed to attend some second-year classes in mathematics, but since these would have to be repeated the following year in order to sit the end-of-year examination with confidence, I didn't strain myself over the work. Some of the other scholarship holders probably reacted in the same way, but Freddie Orange, Ginger Millar and Harry Whale were more resolute. They had achieved high marks in their scholarship examinations, but continued to work hard or so it seemed. The knowledge I had acquired for the scholarship examination enabled me to pass each of the three end-of-term examinations, but with increasing difficulty. During the whole of my first university year, my academic standing slowly ebbed. Of course, I had excuses: my personal life was becoming more and more unhappy, and I had given up Josephine for a vivacious redhead and had then made the mistake of introducing the latter to a charismatic friend. I had also discovered a time-consuming interest in music.

## Music and Billiards

Early in 1940 Granny Tew, my last surviving grandparent, came to live with us. She was a good approximation to a sphere, not much over five feet in height and weighing at least 18 stone. She was kind to me and to please my mother, I even managed to kiss her sometimes. She had a solid rocking chair, which was just as well, for I doubt if she could have struggled free of an arm chair. The rocking chair technique gave me some amusement. To leave the chair she would rock back and forth, increasing the amplitude until on the last forward swing, her short, sturdy legs just touched the ground. At that instant, pressing down with her hands, she would straighten her arms and launch herself forward. Just occasionally a second attempt was required, but the reverse process of sitting down was more certain. She would back on to the chair, seize the arms and simply raise her feet as she fell backwards. Completion occurred when the resulting oscillations had decayed to zero.

Granny had two possessions that interested me, a Sunbeam motor car, with clip-on, canvas side-curtains to deflect the rain, and a piano. She had never driven the car, but couldn't part with it as it had belonged to

Grandad Tew. It stood outside 24 Royal Terrace, inviting attention. I got it started on one occasion, but stalled the engine before moving off, which was fortunate as I had never driven before. The piano stood in the front hall and when no one was about, I would raise the lid and try to pick out recent tunes like 'An Apple for the Teacher', 'Roll Out the Barrel', 'Any Umbrellas' and so on. A piano teacher lived four doors away, so I decided to learn the instrument. Granny didn't mind, and in fact said I could have her piano when she died. I should have asked for that bequest in writing. Lessons to start soon were arranged with the teacher; I would be able to afford one a fortnight. Sadly Granny passed on before lessons began.

After a decent interval, I asked Mother about the piano; 'Could I have it, as Granny had said?'

'I've only got your word for that, nothing was said to me. The piano is cluttering up the hall and anyway, it has to be sold to help with the funeral expenses,' was her reply.

My father had three hobbies, photography—especially when he was younger—woodwork and billiards. He had two wood-turning lathes and set up a workshop in the garage attached to our house as we had no car. He made his own billiard cues, inlaid with native hardwoods and complete with ivory butts. When the weather was too bad for fishing, he used to go to a billiard saloon about a mile from the house, on Dominion Road just before it joined Eden Terrace. When he heard that the owner wanted to sell, he decided that it was time to bring his hobby and his business 'under one roof' so to speak. He sold the boat, bought the saloon and managed it himself. To reduce the time taken to travel to and fro, he also bought a small two-stroke motorbike. The hours were long, as he usually opened at 10 a.m. and closed at 11 p.m. He paid for some assistance, which allowed him to be absent during a few of the slack, daytime hours. Lunch and dinner were supplied to him on a tray from a nearby cheap restaurant, but he loved the life.

After a little while, still concerned that he had a non-paying lodger, he proposed that I should relieve him of some of the work in the billiard room. He offered me 30/- a week, which I could then return to him to cover my board. I managed to bargain the board money down to 25/- and we had a deal; in effect he gave me 5/- a week in return for cleaning and preparing the billiard room each weekday morning and for managing the saloon alone each Wednesday night from 6 p.m. Wednesday night was the least busy evening. I used to ride my bike to university, calling into the billiard room at about 8 a.m. on the way. There were four tables, and my tasks were to clean the fireplace, sweep the saloon, empty and wash the spittoons, wash up 30 or 40 cups and saucers (I usually changed the water for this), uncover the tables and brush their surfaces down the table away from the 'D', until the nap was smooth.

Curious how spitting in public has slumped as an art form. Spittoons appear to have disappeared with the family po (i.e. chamber pot). When I was a boy the sight of men expectorating in public was quite common. Trams used to carry notices stating that the fine for spitting while aboard was £5 or so. The tradition is continued today on soccer and rugby fields and I have even seen golfers at it.

Wednesday night was more fun. The restaurant dinner devolved on me and I would practice billiards on empty tables until they were required by the customers. I began to play matches with the clientele who lacked partners and steadily improved my skill. At about 7.30 p.m. the room would be full and the pool games would begin. There were two forms of pool, one involving six pins standing on assigned spots and the other a set of 15 numbered balls, initially assembled in a snooker triangle. In the latter game my task was to shake 15 numbered alleys, or wooden marbles, about in a leather bottle and then throw one to each participant standing around the table. The numbers would not be disclosed until the end of the game. To enter the contest the players had to pay 'the house', i.e. me, a shilling and put an agreed sum into a pool. Their task was to pot the ball carrying the same number as on their alley, and they could do this by potting any balls in sequence, stopping and giving way to the next player only when a ball failed to go down. When a player potted his own ball, he won the pool; if his ball was potted by someone else, he was out of the game, but could buy his way back into it.

Other forms of gambling were also normal in billiard rooms. No one under 18 years of age was legally allowed into a billiard saloon, so when one Wednesday night a policeman appeared, I wondered what was up. He approached and spoke to a youth who was certainly older than me. They came towards me.

'Who is the manager?' he asked in a loud voice. I admitted my role. 'Do you know how old this *boy* is?' he said, in a very official voice.

'Eighteen, I believe,' I replied.

'He is 17 and under age!' After cautioning me, he marched the boy out and sent him off home. I learned later that it was at his mother's instigation that the youth had been rescued from our gambling den.

During each university vacation I would find a full-time labouring job to help my finances, and for three or four weeks I could usually earn up to £4 or £5 a week. During my university days, soon set to end, I found work in a fertilizer factory, in an abattoir and on several building sites. The abattoir job was the most unpleasant, but paid the most money. I was on the 'gut' floor where the sheep or pigs, hanging on hooks, were cut open and cleaned. The guts were dropped into a channel behind the slaughtermen, and my job was to push the offal along the channel, using a wooden pole fitted with a flat board shaped to fit into the groove.

Another job I shall not forget was working as a labourer, removing the scaffolding from the inside of a large concrete reservoir. It was some 24 feet deep, with a small manhole about three and a half feet square through which we had to manhandle the great number of metal pipes and couplings of the structure required to support the concrete roof during its drying-out period. The interior was gloomy and inadequately floodlit, and also stank of stale urine. My job was to climb up into the network of pipes, to walk along them about 12 feet above the concrete floor and then to undo the joints that held the pipes into a rigid structure. The order in which these were removed was important; I was directed by the foreman from the ground. One day he must have made a mistake, for when I unshackled one particular joint, a large block of the scaffolding started to move, the joints buckled and the scissoring pipes then sheared them through. I didn't think about such details at the time; I was riding the collapsing, accelerating framework down to the concrete floor below. I was lucky—I could have easily lost a limb in the mangle of twisted pipes. I hit the floor very hard and had to be helped through the hatch into the sunshine and fresh air. The foreman gave me the rest of the day off.

I used the money from the abattoir job to buy a second-hand B flat clarinet, which I had been bent upon for some weeks. I think it cost £20. Why I chose a clarinet I have no idea. Neither of my parents had more than a superficial interest in music. I wanted to learn *some* instrument and perhaps I was attracted by the mechanical beauty of clarinets. More likely it was the first instrument I saw that I could afford. This was the period when the great clarinettists Artie Shaw and Benny Goodman were at their zenith. I enjoyed their music and indeed still do. The instrument was a little unusual, being a full Boehm able to reach low E flat. I took it to pieces and replaced some of the ill-fitting pads, after which it didn't respond to my blowing. I found a teacher through an advertisement in the Auckland Star, who solved my problems and I was soon practising scales, developing my embouchure and learning simple pieces of music. Apart from sometimes being the worse for alcohol, my tutor suited me well and we became friends.

I met Neville Maxwell at one of the scout dances. He was a tall, charismatic man, about my age, and particularly impressed me, because he could play both the saxophone and the accordion—a natural musician. Owen Housby, whom I had met at university, was an able pianist, and as we all lived within half a mile of each other, we were able to gather for musical evenings. We met in Owen's house in Parish Road, Sandringham, and another young man, whose name evades me, added drums to the group.

It was Owen who outranked me with the redhead I mentioned earlier. Her name was Laurie Tindle, and, before switching to Owen, she had given me a large, unmarked studio portrait of herself that I greatly admired. She later requested that I return it to her, and deducing that Owen was

going to be the beneficiary, I decided to try to block the transfer by writing 'To Les with love' across the bottom of the photo. But in the end I lost both the portrait and Laurie. Later she became Mrs Housby and raised a family—I have visited them many times over the 50 years that have melted away since those happy days.

Neville was popular with the girls. We often made up a foursome and took our girl friends to dances in different parts of Auckland. I remember one trip to Ye Olde Pirate Shippe at Milford, a long bus ride north of Auckland. When the conductor came to collect the fare, Neville brushed my money aside with the remark that I could pay for the *return* journey. This seemed reasonable until I discovered that a taxi was unavoidable, the buses having stopped running by the time the dance had finished. He joined the Royal New Zealand Air Force as a trainee pilot early in 1941, and just before going overseas to Britain, he became engaged to Christine, a stranger to our group whom we did not particularly welcome. At the engagement party he looked so fine in his Pilot Officer's uniform, with his flying badge—his wings—on his jacket, displaying his new status. I was proud and envious at the same time. I made a speech, a mixture of congratulations and farewell, which fell short of what I really felt. He was a dear friend; within a year he was dead.

## Leaving Home

At the end of 1940 I sat the University of New Zealand's annual examination in mathematics, applied mathematics, physics and chemistry. Whether or not I would be admitted into the first professional year of the engineering degree would depend on the results. I had merely adequate passes in the first three subjects, but failed chemistry by just three marks. The phrase 'beautiful white crystals of urea' used by the enthusiastic lecturer in organic chemistry has been engraved on my mind ever since. There was a question on urea—a constituent of urine—and had I been able to answer it, I would have passed. But all I could recall was this one phrase, not enough on which to spin an answer. As I explained to my friends later, I was better at passing urea than at passing the exam. I was allowed to enter the engineering course, but had to repeat chemistry.

Three members of the University teaching staff, all mathematicians, remain in memory, the most remarkable of whom was Professor Henry Forder. He was a polymath, well read in mathematics, philosophy, relativity and quantum mechanics, and also a little eccentric. His geometry lectures were fascinating; he liked to draw tetrahedra, spheres and other solid bodies in the air with his hands, and having thus positioned an invisible figure before him, he would walk carefully around it to add more features on our side. It was like Harvey the rabbit. His ironic wit in dealing

with inattentive students was not to be missed. The senior lecturer was Keith Bullen, a distinguished seismologist with a deaf aid. His lectures on differential equations were precise, beautifully illustrated with examples and rather boring. He was to enter my life again thirteen years later, with unhappy consequences. The lecturer was Cecil Segedin, who was a shy man, and would look out of the window very frequently as if he wanted to escape from us all. His lectures in applied mathematics were excellent, and he gave particular attention to providing physical derivations for every equation. Some years later his style was to have a big influence on my approach to applied mathematics.

Professor Burbidge was Head of the Physics Department. He was a good and earnest lecturer, but because of increasing deafness, he was not always aware of competing developments in his lecture theatre. This was in the old Choral Hall, which at that time housed both Physics and Chemistry. The seating was steeply tiered with two stepped gangways running down towards the rostrum. I used to sit at the back, but not on the end of a row if I could avoid it, since the problem with the end position was that one was likely to end up sprawling in the gangway if not careful. The three or four men next to one were apt to move away and close up, shoulder to shoulder, and then move as one unit towards one, whilst one's attention was elsewhere. It was rather like three billiard balls simultaneously striking a single ball. The laws of momentum would suddenly place one in the gangway, with one's 'innocent' tormentors looking as puzzled as Burbidge always was. One day I found an old cannon ball and smuggled it into Burbidge's lecture. At a quiet moment when he was facing the blackboard, I gave it a gentle start down the gangway and gravity did the rest. At each step it made a pleasing thump, but Burbidge couldn't see it. It advanced inexorably right to the base of the rostrum with the cheering increasing at each thud.

The Professor of Engineering was Thomas Leech. He had come to the Chair from Sydney in 1939, replacing S E Lamb, who had been Head of the Engineering School for decades. Leech was a new broom, stirring up a lot of dust, but he soon departed to undertake research for the war effort. I had only just got to know him before he disappeared. Emeritus Professor Lamb returned to take over in Leech's absence, and was back home in his old office in the large tin shed that professed to be the Engineering Department. I once visited him in his office, early in 1941, and was surprised by how much at home he seemed; he was wearing carpet slippers.

The annual capping ceremony was preceded by a carnival procession with dozens of lorries and other vehicles moving in a long chain through the centre of the city. Each lorry was turned into a 'float' manned by a team in fancy dress and decorated to illustrate a theme of current interest, usually political. One example I shall always remember alluded to the powerful German pocket battleship, the *Graf Spee*, which not long before had been trapped by three cruisers off Montevideo. Its captain scuttled the ship

rather than have it captured. One of the cruisers, the *Achilles*, belonged to the NZ Navy; a local beer called 'draught speight' provided the link. The float claimed it was a 'pocket battleship' named the *Draught Speight* and that it was self-scuttling on being launched. As many of the lorries were provided by local brewery companies, barrels of beer were discreetly concealed under awnings and provided a continuing source of encouragement during the two or three hours of the slow drive around town. We carried collecting boxes and gathered money for crippled children and similar charities; the drunkenness was all in a good cause.

The capping ceremony was held in the Town Hall and usually generated good-natured ribaldry. There was a balcony behind the platform on which the Chancellor, deans and other dignitaries dealt with the serious matter of conferring degrees. Once when the Chairman of the Professorial Board, Professor Rutherford, was delivering a solemn oration on the importance of examinations, a duck was launched from the balcony rail. It fluttered down and took up a position close to the Chairman and facing the audience, quacked as if in agreement with his observations. Rutherford reacted badly to the competition, tore up his notes and angrily flung himself back into his seat. Another time a greased pig was injected into the Hall and interrupted proceedings for a enjoyably long period.

After the first term examinations in 1941, Professor Worley, the Professor of Chemistry, asked me to make an appointment to see him. He had my records before him and remarked on the dismal reading they made.

'This term you have a scholarship,' he said. 'Next term it is very likely, that unless there is a remarkable improvement, you will not.' He also remarked on my responsibility of presently being the only scholarship holder from the Tech. 'Don't let them down,' he said. I apologized for my poor showing and backed out.

The home front was equally depressing. My father was a gregarious man, full of fishing stories and always willing to play billiards with his customers when they had no partner; this made sense, since he usually won. When he had previously managed the billiard room on Wednesday nights, his presence attracted some of the customers; however with me now in charge, the numbers gradually fell to about half. So I had smaller and smaller takings to give him after Wednesday evenings. He became suspicious, and thought that I was helping myself to the till. There was no obvious way I could prove him wrong; the theory about his greater charisma flattered him until he decided it was a clever blind. One Wednesday night, a few days after my discouraging interview with Worley, we had a fierce quarrel about money. I decided to play what I thought would be a trump card. I went to my room, put on my jacket and coat, and returned to the sitting-room.

'I am going to leave home!' I announced dramatically. I stood waiting for his climb-down.

‘Don’t slam the door after you,’ he said. I had no choice but to leave.

I walked four miles down to the railway yards, entered one of the carriages and tried to sleep on the seats. This was difficult as I was anxious not to wake up and find myself on board a moving train. The next day I found a solution to the accommodation problem—Neville Maxwell was in England, so his family would have a spare room. A weekly rent of £2 for full board was agreed. I went back home, knowing that my father would be absent in his billiard room. Mother was tearful, but helped me pack and move out.

To this point I find that I have mentioned my father 79 times and my mother 22 times, numbers that do not do justice to the relationships I had with them. Unlike Father, there was no cruelty in my mother. She did her best, but a frequent response was ‘I can’t be bothered!’. She was not lazy, and in fact worked hard all her life, running the house and augmenting my father’s income by her dressmaking. She left Father to deal with me, which was a pity. Whenever I was naughty and deserved some form of punishment, she would say, ‘Wait till your father gets home!’. This usually meant a wait of several days until he returned from his fishing trip. My anxiety would mount; his homecoming was feared. At last she would report my misdeeds to him and he would feel obliged to punish me in cold blood. ‘Bring me my strap!’ were the dreaded words. In 1941 Mother had other demands on her time. Two years earlier, when I was 16 and my sister Beverley was two, a second brother was born; they named him Alex. He had little effect on my life, but sadly I had a large, indirect impact on his. Beverley was loved, Alex was barely tolerated. His childhood wilted under Father’s influence and later he lived a sad, embittered life.

My next task was to find a job, which was not difficult. During the previous long vacation I had been employed at the Public Works as an assistant surveyor in the Devonport Naval Base. I knew that they were often short of chainmen, so I offered my services. The wage was £4/10/- a week, a fortune in my circumstances. It remained only to visit the University Administration to resign my scholarship. That done, I decided to volunteer for the Air Force.

## **Joining the Air Force**

There was a recruiting office for volunteers to the Armed Services in Queen’s Street. I collected the appropriate form for aircrew in the Royal New Zealand Air Force and found an immediate problem. For persons under 21, the written consent of parents was required, which I knew there was no chance of securing. I considered forgery, but instead decided on honesty. On a separate piece of paper, I gave an account of the estrangement between my father and myself, and I said I was now supporting myself and



considered myself to be an independent adult. I still do not know why this ploy worked. I was invited to undertake the necessary preliminary training prior to entering the aircrew stream, which consisted of attending evening classes for lectures in navigation and Morse Code, in which a modest speed of eight words per minute was required. And there was also a medical examination to pass. I was fit and healthy, but my eyes were beginning to develop astigmatism, which I put down to reading and copying pages and pages of sheet music in poor lighting conditions. The lines of the staff had worn 'grooves' across my eyeballs, I imagined. I went to an optician who naturally recommended reading glasses. By resting my eyes from reading for a week before the examination, I was able to pass the test. I didn't mention my spectacles.

My private work at the Naval Base had been arranged by the University Engineering Department. The Bachelor of Engineering degree included a requirement that students undertake 18 months' practical training in approved engineering works, and which could be accumulated by working during university vacations. My role had been as an assistant to the surveyor to help him with calculations, drawing charts to scale and sometimes taking measurements with the theodolite. The particular surveyor to whom I was apprenticed commanded considerable respect for the reliability of his plans and measurements. However he had one problem; about every two months he would drink himself 'blind' and be away from work for a week. This fault was understood and accepted by the Department, and indeed suited me since I would temporarily become 'the surveyor'. Then I would have my own chainman at the other end of the steel tape used to measure distances. His job was to hold the plumb-bob steady over a tack in a wooden peg and to read the distance on the stretched tape against the attached plumb-line. Another was to hold the surveyor's staff (for measuring height) at given distances from the theodolite, and to move it slowly backwards and forwards so that the minimum length could be read through the theodolite telescope. This gave the height of the ground at that point. It was little more than a labouring job, but easier since there was no digging.

When I returned to the Public Works Department, it was in the modest role of a chainman; no longer sometimes the surveyor in command, just a labourer to be ordered about. It was a pleasant change from the stress of my blighted university life, and I expected it only to last for a few months. I used to enjoy coming 'home' to the Maxwell house. Along with other employees from the Naval Base, I would cross Auckland Harbour on the Devonport Ferry, proceed to one of the hotels in Custom Street and drink two or three glasses of beer. Then I would catch the tram to Sandringham, sometimes a little merry. As far as I can remember, at that time the term 'pub' was not commonly used in New Zealand. One went to a hotel bar; these were divided into 'private' for those willing to spend an extra penny or so for their drinks and 'public' for those who were not. The swearing

was louder in the public bars. This was not the first time I had been in a bar—that had happened when I was befriended by a tough young labourer working on the reservoir job. One day after work, he suggested that we went into a bar and drank some beer. I said, ‘But I am under age at 17.’

He replied, ‘So am I at 16.’ He looked older. He bought the first round, then it was my turn. The barman challenged me, and I claimed to be 21; I doubt if I was believed, but he served me. Appearances certainly count.

I did not entirely give up on my university studies. While I had dropped out of the course for an engineering degree, besides first-year chemistry, I was also permitted to offer the second-year subjects of pure and applied mathematics towards a Bachelor of Science degree. I studied by myself after work, occasionally visiting the University for help from Cecil Segedin. I sat these subjects in December and learnt in January, 1942 that I had passed them with marks to spare.

My father did make an effort to mend our relationship. He found out where I was living and came round to see me. He begged me to return home and resume my university course. I replied that I would never again be a dependent of his and that in any case the scholarship had been resigned. He was close to tears. I said nothing about the Air Force.

I continued with my clarinet playing. I recall one late evening when the Maxwells were away, playing the instrument in the ‘still of the night’, very likely playing the popular tune with that name. Suddenly I heard a loud clatter on the roof. I continued playing, then another stone hit the roof. Suddenly I understood; some neighbours wanted to go to sleep!

Towards the end of the year I told my tutor that I was going to join the Air Force.

‘In what job?’ he asked.

‘Oh, I am going to be a pilot,’ I replied.

‘You could have done better than that,’ he claimed. ‘Your clarinet playing is not that bad, and if you’d spoken to me, I could have arranged for you to get into the Air Force Band.’ I thanked him for his consideration, relieved that his opportunity to ‘help’ had passed.

I was due to report to the RNZAF station at Levin on 21st December, 1941, a fortnight after my 19th birthday. I packed my bag, following the instructions sent to me by the Air Force and said goodbye to the Maxwell family. I had no girlfriend to see me off and had lost touch with my university friends. In any case many of them had already joined one or other of the Armed Services and had gone overseas. Owen had joined the Army and would later serve in Italy. Rudolf was still studying at the university and, as he explained, there was no way *he* would be allowed to enlist. His father, Gustav, was interned on Somes Island near Wellington, as being a possible Nazi spy. Unfortunately during the thirties Gustav had maintained links with the Fatherland, persuaded by Hitler’s restoration of Germany’s international status. According to Rudolf, the old man had been unaware of the

malignant side of Nazism and had been duped by the propaganda he had received before August, 1939, into speaking well of Hitler's Germany. He had also unwisely secured the agency for Telefunken radios just before the War. That this man, loyal to his adopted country, could have presented a threat to security seemed quite ridiculous.

Rudolf's political views were very different from his father's. Like me, he believed in socialism. New Zealand, along with most other countries, had passed through a deep man-made economic depression, during which unemployment was high and many people starved. A new system of manufacturing and distributing goods was evidently required. It was very natural for idealistic young people to seek a new social structure, one in which the failed profit motive would have a much reduced role. Only the communists, however, believed it could be completely eliminated.

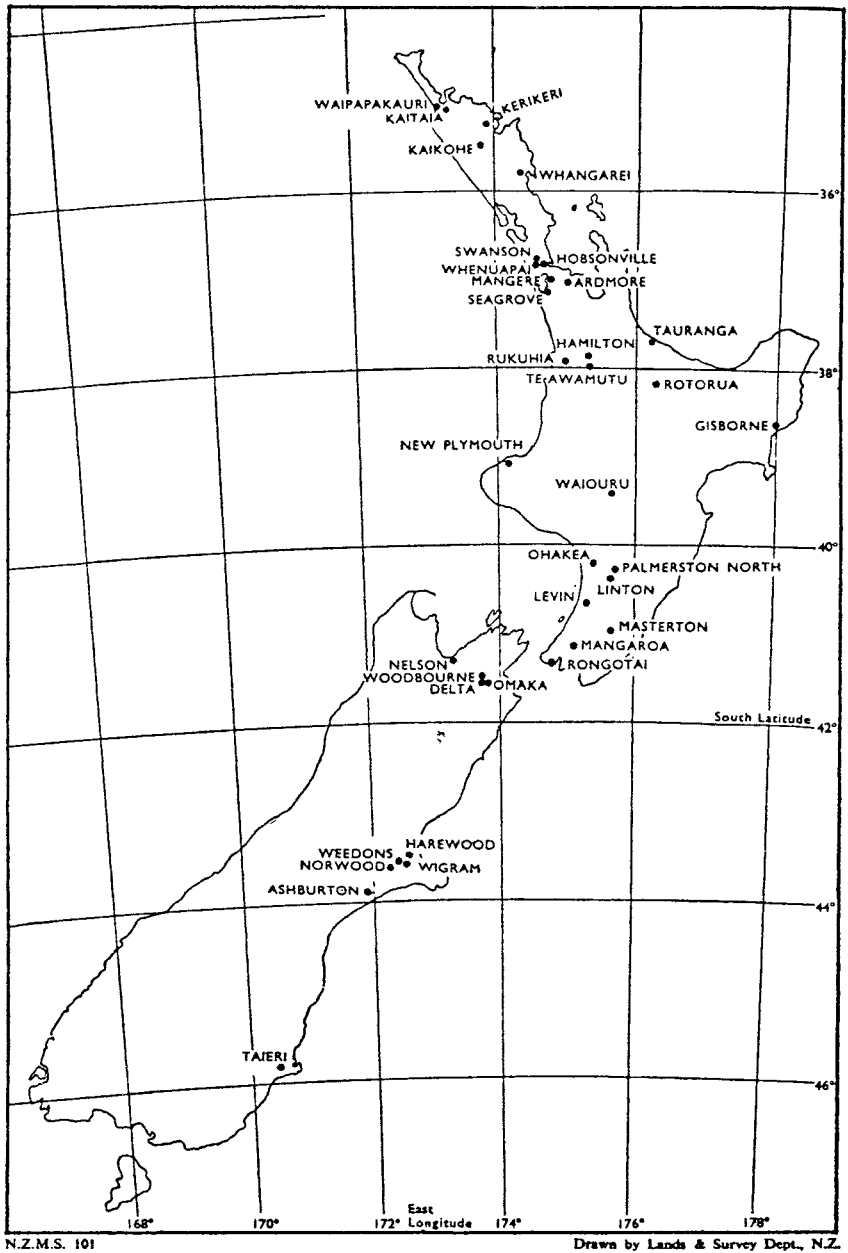
The Douglas Social Credit movement preached that it was not capitalism itself which was at fault, but that it was the banking system that needed to be reformed. The system failed to distribute sufficient purchasing power to the workers who made the goods, a shortfall that should be eliminated by continuously distributing 'social credit'. My father believed that Major Douglas, with his engineering qualifications, understood the faults of the system, while orthodox economists did not. I had studied the famous ' $A + B$ ' theorem devised by social creditors to justify their inflationary policy, decided that it was nonsense and had avoided debating it with my father.

Gustav Belin's internment with other potential 'enemies of the state' meant that Rudolf was now the sole breadwinner for his mother, sister and younger brother; he still had his demanding milk-round. To manage combining these responsibilities with the pursuit of a degree in physics showed great determination. Rudolf was an exceptional man and my best friend; he agreed to see me off on the three o'clock Wellington express on 20th December.

We met downtown for lunch and then proceeded to a bar in Custom Street, close to where the trams used to depart for the railway station about a mile away. As this was a special occasion, after a few beers we decided to try something stronger. I had recently been introduced to pink gins, expensive at eight pence or so a glass, but money didn't seem to matter much that day. It was sad for Rudolf to see me go, but easier for me, since I was escaping my failures and also embarking on a great adventure. We talked a lot about our time together in the Tech as we drank steadily into the early afternoon. Then a strange thing happened, something I had never seen before nor since. A group of businessmen were also relaxing the afternoon away, a few feet away from us. Suddenly one of them turned his head towards me and twisted his face into a hideous grimace. He held this fixed in my direction for a couple of seconds, then relaxed it and turned back to his comrades as if nothing had happened. I thought he was

making a comment on my increasingly raucous behaviour. I watched him out of the corner of my eye, and about five minutes later he repeated his frightening behaviour. I thought it was time to challenge him—perhaps it was a conspiracy and they were all involved. My judgement was becoming impaired with each pink gin, but I gave the man another chance. He did it again, but this time his gaze missed me by a few degrees. I was clearly not his problem. Much later I wondered whether or not I had seen an extreme example of St Vitus' Dance.

Rudolf looked at his watch. 'It's ten to three,' he said, 'You are going to miss the train!'. I sobered up quickly. We ran to the railway tram, but Rudolf, unused to strong drink, decided to remain on 'dry' land. He waved me goodbye and staggered away to be sick in Albert Park. He later told me that he waited several hours before attempting his journey home to Milford on the North Shore. I reached the station with two minutes to spare, and fortunately I did not have to purchase a ticket since the Air Force had provided that. The run to the platform with my suitcase banging against my leg was a torment. If I missed the train, my Air Force career would start where my university career had finished, in disgrace. But the express had a long way to go and plenty of time to do it in. It was delayed just long enough to see me aboard—I found a seat and fell asleep.



Map 3: Main RNZAF wartime establishments.

## Chapter 3

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### Learning to Fly

#### Ground Training School

Levin is a small town about 50 miles north of Wellington and some six miles from the East Coast. The express arrived there about five in the morning, thus leaving two hours for the final ‘dash’ to Wellington. I had recovered from my stupor in time to collect sandwiches and NZR tea at one or two earlier stops, probably at Te Kuiti and Taumarunui. My memory is unclear about the stops, but I do remember what NZ railway tea was like. It was served at most of the stops on the Auckland to Wellington line. The thick, clumsy cups resembled miniature pos; they were filled with a warm amber liquid, like tea in appearance but not taste. The train would wait for about ten minutes while its passengers rushed to the tea rooms to collect their mugs of ‘tea’, already poured and waiting. Doorstep ham sandwiches would also be collected on the run and then back to the train, which would be puffing and snorting in anticipation of roaring on into the darkness. I expect things are very different now.

A group of young men of my age left the train with me. We were rounded up by corporals and driven in trucks to the nearby ground training school (GTS) that was to be our home for the next six weeks. On arriving at the GTS, we were met by a flight sergeant, who explained in very simple, firm language how our day was to be filled. We were first allocated our huts, which were quite small and arranged in several orderly rows, each accommodating two airmen. Next we attended the equipment store to receive our uniforms, boots, underwear and other useful items. The corporals tried to get the sizes right, but didn’t make a great issue of it. We were given numbers to add to our names; I was allocated NZ 417141. Our rank was ‘AC2’—aircraftmen, second class, no less.

We changed into our uniforms, handed in our civvies to be returned to our homes and went to the mess for lunch. After lunch we were given our 'meat tickets'. These were flat discs about an inch and a half in diameter, made of a tough, polymeric material, indestructible, especially by flames. On them we had to use a hammer and punch to impress our service numbers, blood groups and religions. They were to be hung around our necks, ready for emergencies, such as transfusions, last rites and corpse identification.

Stating my religion gave me some concern, and I decided it would be prudent not to be an atheist. In those days to many people atheists were not merely godless, but also without any moral code. How could an *atheist* possibly believe in the Ten Commandments? He was immoral by definition! My mother had been a Presbyterian, so I began trying to stamp my disc with this choice. Unfortunately the name was too long to fit into the space I had allowed for it, so I decided to change to Methodist, requiring me to start again. I went back to the stores to get another meat ticket.

I cannot recall the name of my hut mate. Early each morning we would be awoken by a loud siren and then re-awoken by a corporal using foul language with base implications. After breakfast, which always included porridge, bacon and eggs, there would be an inspection of our huts. The sheets and blankets had to be folded in a particular manner, correct to within an inch, one's kit had to be laid out with mathematical precision and the hut had to be swept clean. The inquisitors enjoyed finding the smallest irregularity and then handing out a disproportionate punishment for it. The brass buttons on our jackets and great coats added considerably to our labours; we were issued with button sticks, which we could slide under the buttons to protect the fabric of the uniform while brushing and polishing them. This futile task was necessary every day.

We also spent some time drilling, carrying rifles, stamping our feet on the tarmac and trying to avoid attracting the drill sergeant's attention. Our new boots needed to be run in; route marches were apparently invented for this purpose. We were required to move at four miles an hour, including a five minute break for resting and 'easing springs'. The remainder of each day would be filled with lectures on navigation, principles of flight, pyrotechnics, machine gun dismantling and reassembly, Morse code practice and how to treat officers with proper respect. There may have been other topics, but the details have faded with time. With my university background the lectures gave me no problems.

On the fourth day there was a new experience. It was Christmas and by tradition the officers served dinner to the other ranks. Members of the Women's Auxiliary Air Force (WAAF's) joined us and added a civilized tone to the occasion, at least at the beginning. Later with the beer flowing freely, a few of them proved to be as vulnerable as some of the men had hoped. I overshot the occasion and fell asleep. When I felt better and

started to take an interest in my whereabouts, I found myself in a flat-topped lorry with a number of men and women on the way to the coast for a swim. On the lorry were two officers, dressed in summer drill uniforms, with thin, pilot-officer, unweathered braid declaring recent promotions. I was more impressed by their flying badges or wings, indicating that they were pilots. I tried to engage them in conversation, but they had become rank conscious or perhaps I had forgotten to say *Sir* sufficiently often. One day, I thought, I too might achieve such distinction; but that was at least six months away.

I had brought my clarinet with me, but the few times that I played it did nothing to improve my standing in the hut lines; my teacher had apparently overestimated my ability to entertain. However, there was one sympathetic AC2, named Frank Keefe. He was a skillful pianist and usually took command of the piano standing in our recreation room, 'Rustle of Spring' being his signature tune. The impressive opening bars would collect him an expectant audience, but after about two or three minutes he would fade and switch to a less demanding piece. He tried to persuade me to join him in duets, but the 'Rustle of Spring' warned of a skill beyond my reach so I declined.

Three years later Frank was shot down over Rabaul and parachuted into Simpson Harbour. He spent all day attempting to swim out of the harbour to a point out of range of the Japanese shore batteries, where he could have been safely rescued by a Catalina flying boat. While he swam for his life, RNZAF Corsairs kept up air cover to deter Japanese launches from reaching him. Finally exhausted, he was washed up on a beach, where it was rumoured that a shore patrol summarily beheaded him.

At the end of the ground training course we had our examinations and were promoted to the rank of leading aircraftmen (LAC). We were given the chance to nominate which one of four elementary flying training schools (EFTS) we wished to be assigned to for the next stage of our training. I chose the one furthest away from Auckland, No 1 EFTS at Taieri, which is in a valley about ten miles inland from Dunedin. Some of the friends I had made at Levin and who had lived in Auckland also chose to escape from their relatives.

We were given rail and boat tickets and set off on the long journey to the southern part of the South Island. It was my first trip away from the North Island—the 'mainland' as some of us Northerners feigned to call it. The overnight boat trip from Wellington to Lyttelton was an exciting adventure for those not prone to sea sickness. Many airmen had taken the precaution of carrying bottles of beer aboard the vessel, but for some the beer did not stay very long out of the bottles before it went overboard in a haze of vomit. However my childhood had rendered me immune from seasickness. The next day we had the long train journey on another so-called express down to Dunedin.



## Elementary Flying Training

We were accommodated in barracks at Taieri, a step up from the huts of Levin. After a day or two, we received our flying equipment: helmets, goggles, wool-lined, calf-length boots, fleece-lined flying suits and gloves. It would be cold several thousand feet up, sitting in an open, windy cockpit, travelling at 90 miles an hour or more. We were assigned to instructors; mine was Pilot Officer Tom Newland, a tall, irascible man, only a little older than myself. He had good reason to be annoyed with his lot as an instructor, since he had been expecting to travel to England to fly on operations, but had only got as far as being on a vessel moving up the East Coast, north of Auckland. A German submarine had intercepted the boat and the names of all those in uniform had been taken. For these men to be subsequently captured in Europe or any other arena of war would have meant death. The boat was forced to return to Auckland and those who had been *en route* to fight in Europe were confined to New Zealand for the rest of the War.

The aircraft used for elementary training was the DH82, the letters standing for 'de Havilland', but its familiar name was *Tiger Moth*. It was a small, under-powered biplane with a fixed undercarriage, which gave it poor aerodynamic efficiency, but made it very stable. The engine was a 139 h.p. Gypsy Major, giving a cruising speed of 90 m.p.h. and a maximum speed (in level flight) of 108 m.p.h., and there were two cockpits. The instructor sat in the front one and communicated to the pupil behind him through a speaking tube. Acoustic ear pieces were fitted into the helmets. The rudder and wing controls were duplicated and linked together. When



LCW centre front row.



Drawing of a Tiger Moth.

the Tiger was used for solo flying, the front cockpit was left empty with its control column removed and its safety harness secured. Apart from a concrete apron in front of the hangars, the airfield was entirely grass; there was no restriction on where one landed or took off, provided of course that these paths were into the wind, the wind direction being indicated by white wind-socks fluttering here and there on the boundary.

On the morning of 9th February, 1942, I reported to P/O Newland at the Flight Office. My first task was to collect a parachute and convince him that I understood how to strap it on and how to operate it should I need to jump. For the rest of my Air Force career, before every flight I would be issued with a parachute and after every flight—assuming that I had not made use of it—my first action was to return it to the Parachute Section. Just before climbing into the plane, I strapped on the parachute, the tightly packed canopy of which fitted neatly into the bucket-shaped cockpit seat to play the role of a rather firm cushion. Parachutes added a feeling of security, although the probability that it would be necessary to jump was very small. The habit of never flying without a parachute was so entrenched that when after the War I made my first civilian flight and was *not* given a parachute, I wondered for a few moments whether a mistake had been made.

My first dual flight lasted 20 minutes and was called ‘air experience’; I had never been in any aircraft before that exciting day. How exhilarating that first flight was in the beautiful Taieri Valley, with its checkerboard of green fields dotted with animals, occasional farmhouses, clumps of trees, mountains on either side and a glistening river. Perhaps it was going to be an enjoyable war after all. I am able to be very precise about this part of my training, since I still have my pilot’s flying log-book, in which is recorded every flight I made, right up to my last as a pilot on 13th December, 1958.

After another two hours’ flying during which I went through exercises involving straight and level flight, climbing and gliding, medium turns and stalling, we started taking off into the wind. This was followed by powered approach and landing, an exercise would be repeated many times and then combined with taking off into what was colloquially called ‘circuits and bumps’. This was a rectangular circuit of the airfield, with a downwind leg at 1000 feet, and the final approach to what one hoped would be a three point landing—where the two wheels and tail skid touched the ground simultaneously—was the most demanding. The engine power, now having been reduced, had to be continuously adjusted so as to maintain the correct angle of descent in order to bring the aircraft over the boundary fence at 20 or 30 feet. After levelling off and floating a foot or two above the ground, the throttle would be closed and at exactly the right moment the control column pulled back hard so as to stall the plane onto the grass. All this training was in preparation for the great event known as the first solo, but not everybody on the course would achieve this goal.

Most pupils required between eight and ten hours' experience with an instructor before being allowed to go solo. When it seemed that a pupil was nearly ready for this feat, his instructor then had to give him experience at spinning the aircraft and, more importantly, at recovering from the spin. The first spin, which was executed by the instructor, was an exhilarating experience. The plane would be nose-down at such an angle in the spin that the pattern of roads and fields a few thousand feet below would be seen rotating as if attached to an enormous gramophone record viewed from above. In the early days of flying the phenomenon of spinning was not understood and many pilots spun down to their deaths, instinctively holding the control column back hard in a desperate effort to raise the nose of the aircraft. This would merely perpetuate the stalled condition and hold the aircraft in the spin. The correct method of recovery from a spin was drilled into us: 'Apply full opposite rudder, *then* move the control column forward until the spinning stops. Centralize the rudder and *ease* the aeroplane out of the dive.'

Tom Newland was not senior enough to send me solo until I had first been checked by the Flight Commander. After five and three quarter hours of instruction, he judged me to be ready for F/Lt Greenslade's test. I passed this and on 19th February after a check flight, the moment of truth arrived at last. Tom taxied to the downwind boundary, removed the front control column and climbed out.

'Away you go, once round and don't break the bloody thing!' he said. I taxied out, went through the short cockpit take-off drill, turned into the wind and opened the throttle. It was quite mechanical, and I had no fear. The only difference I noticed was that the aircraft climbed more rapidly. Ten minutes later I was landing; this was not perfect, but satisfactory. It is said that a 'good' landing is 'one you can walk away from'. I taxied back to Tom, who had watched as I flew around the circuit.

Congratulations, and it was over. After my solo, my total flying hours added up to exactly eight. Some students on the course were growing anxious as their dual hours mounted to 10, 12 or more without their being sent solo, and a few were never sent. I heard of one man who took 14 hours to reach his solo, but who later had a brilliant career as a pilot.

During the following week dual and solo flights were alternated and the exercises became more advanced. They included stalling, spinning, side-slipping, steep turns, climbing turns, gliding and forced landings, the latter providing an interesting challenge, requiring some skill. In the event of engine failure, the technique was to locate a suitable field on which to make a landing, then to glide to its downwind side and, staying downwind, to lose height by flying a figure of eight course, leaving enough distance for the final straight glide into the landing.

One day Tom Newland and I were flying at about 5000 feet with me in control when the engine cut out. The propeller kept spinning, but there

was no power at all. Tom remained silent; I asked him what we should do—he replied that it was my problem to solve. Then I noticed that he had created the problem himself by surreptitiously sliding the petrol cock to the off position. The simplest solution would have been to slide it back again and say nothing, but I knew he had more in mind than that. He evidently wanted me to make a forced landing, so I searched below for a satisfactory field on which to land—one within easy gliding distance. I had some trouble locating a suitable field, but at last I thought I saw one. I glided downwind of it and lost height in the approved fashion by making figure of eight turns just short of the downwind boundary. As we approached the field, I could see that I had made a bad choice. I had mistaken an agricultural field for a grass field, the surface of which would be both soft and rough. To land on it would have put us upside down in a few yards; Tom remained silent and I felt that I had no choice but to obey his perceived instructions to make a forced landing. I had reached the stage of ‘holding off’, which just precedes touchdown—another moment and we should certainly have been hospital cases. Then with a roar of rage, Tom seized the controls, opened the throttle and we staggered up to a safe height. He had of course turned the petrol on during the approach. What followed was terrifying. He was in such a temper that instead of simply reprimanding me, he climbed to about 1000 feet above another nearby field—grass this time and with a convenient wind sock on its boundary—and dived straight at it as if to crash on to it.

‘Now can you see the bloody forced landing field?’ he shouted. I could see nothing else! He repeated this two or three times, making sure that I should never ever forget the field. He calmed down, flew back to the airfield in silence and landed. I had been unaware of the existence of a *specific* grass field on which forced landings were practised, believing that finding a suitable field was the essence of the test.

## Flying Experience

At weekends we were free to sample Dunedin’s pulsating night life in a few hotels and dance halls. In NZ at that time the law required bars to close at 6 p.m., which resulted in a phenomenon known as the ‘six o’clock swill’. However, if one had a room booked in an hotel, six o’clock closing did not apply, and even without a normal booking, some obliging proprietors were kind enough to issue customers with a room number just before ejection at six o’clock. This allowed them to return after 6.30 p.m. or so to continue drinking without risk to the proprietor’s license. Later—often much later—it would merely remain to decide not to stay the night after all! A favourite haunt of the group of airmen and WAAF’s with whom I fraternized was the City Hotel, where we would gather for drinks prior to going off to a public

dance hall. Sometimes we would have partners to take to the dance, at other times we would rely on picking someone up in the hall.

One Saturday before we set off from Taieri to Dunedin, I complained that I did not have a partner to take to that evening's dance. An airman whose name I would prefer not to remember said he knew lots of girls in Dunedin and, if I wished, he would give one a ring and arrange for her to meet me in the City Hotel for the pre-dance drinks. I thanked him for his kindness. I had something to attend to before getting to the City bar, so when I arrived, I could see our party already well established, losing their inhibitions. Before I could advance to join this procedure, one of them, Terry Aiken, intercepted me, drawing me behind a pillar out of sight of the others.

'Disappear quickly!' he said. 'Your blind date is here and we have been filling her with booze and telling her that you are sick and will not be coming.'

'Why?' I asked.

'She is a rather repulsive prostitute,' he said, 'and you would not want to be seen with her. We shall send her off shortly.' I thanked Terry and went directly to the dance. That was the only blind date I ever had, or rather, never had.

I later found an attractive medical-section WAAF whose name was Nancy, and escorted her regularly to dances. She was sweet and gentle and I could easily have fallen in love with her, but her husband was away fighting in Europe, so I resisted her encouragement beyond some petting. Perhaps I was too prudish. During the weekends she stayed with her mother and father in a beautiful house on a hill in Macandrew Bay. Ray Danzey, a friend of mine on the course, and I were invited to stay in this mansion when free from flying at the weekends. The family owned a sailing dinghy and Nancy would let us take it out into the Otago Harbour; we discovered that drinking and sailing do go together, provided the crew are good swimmers.

Another course member, whose first name was Ernie, was a rather wild character. He usually collapsed early at any party, his tolerance of alcohol being diminished by his small stature. His good-natured, feckless gaiety made him popular at parties, although his behaviour sometimes gave his friends some concern. I recall a party that some of us had on St Kilda beach, a beautiful surf strand just south of Dunedin City. The waves were quite high, breaking into white foam some distance from the shore. We mixed waves and beer for an hour or two and then decided to leave. Where was Ernie? He was still in the water. We found him diving repeatedly into the surf, distraught and almost in tears.

'What is the matter?' we called from the shore.

'Please help me!' he begged. 'I have lost my false teeth somewhere around here and cannot find them.' Of course his chances of finding them

in the boiling surf were infinitesimal, but we suppressed our amusement and helped him for a token five minutes before persuading him that his teeth had gone forever and that he would have to live on bread and milk for a few days.

Perhaps the most exciting exercise in a Tiger Moth was the one termed restarting the engine in flight. This was always an exercise with instructor only, because of the possibility that the engine would not in fact restart! The plane would be taken to about 7000 feet, the petrol turned off and the plane held close to stalling until the propeller stopped turning. With the petrol back on, the hard part was to get the propeller rotating again. This required diving the plane almost to its maximum allowed speed of 160 m.p.h., when the aerodynamic forces would apply sufficient torque to the propeller to start it turning—but not always. Sometimes a second dive was required; there was not usually enough altitude for a third attempt, so the exercise was always carried out in the neighbourhood of a forced landing field.

As the course advanced into the second month, aerobatics were added to the training programme. These were the loop, stall-turn, half-roll, slow-roll and half roll off top of loop. I particularly enjoyed aerobatics and I remember the first time I flew upside down. Tom asked me to check that my harness was tight; I thought it was tight enough, but when he rolled the plane on to its back with the ground now a few thousand feet above my head, I seemed to go into 'free fall' until the straps across my shoulders stopped me. I suppose I fell no more than an inch before this happened; it seemed a good deal further. After that I always tightened my harness firmly.

The most difficult of the aerobatics, but the one I liked most, was the roll off the top. To execute this one had to dive until a speed of 130 m.p.h. was attained, the typical cruising speed of a Tiger being about 85–90 m.p.h. Then a loop—or rather half a loop—was executed and as the nose of the aircraft descended towards the horizon in the upside-down position, the loop was checked and a half roll performed to bring the aircraft out of the manoeuvre, after which one was flying in a direction opposite from that at the beginning.

Towards the end of the course, we were required to make a dozen or more landings at night using a flare path to guide us during take-off and landing. Solo night flying was not allowed at this stage. Instrument flying was a dual exercise I did not much enjoy. The Tiger had only four instruments—indicators giving the airspeed, altitude, banking angle and rate of climb or descent. A hood was placed over the pupil's cockpit, preventing him from seeing anything outside. He then had to fly according to instructions—turns on to given compass directions, climbing and gliding to specified altitudes, and so on. The most demanding was taking off under the hood. Fortunately the altimeters were not accurate enough for blind landings to

be on the programme! A landing exercise that I particularly liked was termed a precautionary landing. For this it was necessary to make as short a landing run as possible, slipping low over the airfield boundary at a speed a little above stalling and then touching down immediately.

There is one flight I shall never forget; it proved to be the longest trip I ever made in a Tiger Moth, 1 hour and 55 minutes. March 3rd, 1942 was a very overcast day with the cloud down to about 1500 feet when I took off for 40 minutes solo practice. I was warned that I should watch out for recall flares, as the weather was so poor. The airfield was in a wide valley, about three miles across, and on the side nearest to the coast there was a range of hills with some peaks up to 1000 feet or so, while on the inland side there were mountains at least twice as high. I decided to fly out to the coast, some eight miles away. The cloud was well clear of the hills, so I could see no danger in this excursion, although admittedly my chances of seeing a recall flare launched from the airfield would have been negligible. However I cannot recall giving this aspect much consideration.

About ten minutes later, flying just under the base of the cloud, I decided to return to the airfield, but the cloud was now sitting on the hills and forced me to climb up into cloud to clear them. My plan was to fly in the cloud for two or three minutes and then to descend below it and return to base. But then I remembered the mountains on the other side of the valley, mountains that I could certainly reach in five minutes' flying. I could have risked it and continued with my plan, but unfortunately I failed to look at my watch when entering the cloud, and suddenly became unsure of just where I was relative to these mountains, so I turned back towards the coast. Perhaps I could land on a beach?

I flew back to the coast at about 1500 feet in thick cloud. When I judged that I had reached the sea, I started to descend. At 500 feet or so the cloud started to thin out and I suddenly caught sight of a wireless mast *above* me, then some houses flashed into sight just below. I pulled the control column back, opened the throttle and climbed back into the cloud up to 1500 feet. It had been a very close shave; I had misjudged the distance to the sea and had been descending onto the coastal foothills. I had a struggle to keep calm. Now I would run no risks, so I continued flying in the clouds towards the east for ten minutes until I was quite certain that I was over the ocean.

The descent was nerve racking. My altimeter showed 500 feet, 400 feet, 300 feet... and still no break in the cloud. At last I reached the cloud base at about 200 feet. It was raining and no land could be seen. I later reckoned that I must have been about 15 miles out to sea. I reversed course and flew due west. I knew there was no way I could miss New Zealand on this heading! But I remained insecure until at last the coast appeared. Then a new problem arose—I could not recognise where I was and I had no maps

with me. Was Dunedin to the north or the south? Where had I intersected the coast line? I chose north.

The coastline of the South Island lies about 30 degrees east of north, so my westerly flight had displaced me south of Dunedin. I had luckily made the right choice. When I reached Dunedin, still flying at about 200 feet, I turned inland and flew over the city towards the Taieri Valley. There were about ten miles to go, but between me and the airfield were cloud-covered hills some 500 feet high. I knew I had very little petrol left, and had to risk some more cloud flying, but now a long valley extended along my flight path. I climbed enough to clear the hills and a few minutes later began my descent. Dropping below the cloud base, I was relieved to see the airfield ahead. I made the briefest of approaches, landed and taxied in towards the hangars to find a posse of senior officers waiting for me.

The Chief Flying Instructor wanted to know why I had landed at least an hour after every other pilot had returned in response to the flares that no one could have missed.

‘I got lost,’ I replied.

‘Did you fly outside the valley?’ he asked.

‘Only after I was lost,’ I lied. I gave an account of my adventure which in modern parlance was ‘economical with the truth’. I didn’t mention the wireless mast. The officers asked me to leave while they discussed what should be done. Shortly afterwards they called me back, gave me a caution, but also congratulated me on keeping my nerve and getting back to base.

The ground staff man who checked the Tiger after my landing, told me that the dip stick showed there was no petrol in the tank, hence the engine could not have run for more than another minute or two.

At the end of March, I had my final test and was given ‘above average’ for my flying skills. I had now accumulated 31 hours of dual flying and 32 hours of solo flying.

We left Taieri for a week’s leave before moving on to more advanced training. Some members of the course were due to depart for further training in Canada; I envied them. My unexciting destination was No 2 FTS at Woodbourne, about five miles from the town of Blenheim in the north of the South Island.

## **Flying Harvards**

The station at Woodbourne had a more permanent look about it than Taieri; I think it was used by the pre-war, regular Air Force. We were paired in small but comfortable rooms, and I had the good fortune of having Puki Hulton as my room mate. He was a Maori with an attractive personality and a good singing voice, and was therefore much in demand at parties,



with me being included by association. He had that slightly reckless, good-natured, generous personality of the Polynesian race. It is sad that I have no photographs either of him or of the other course members; I can recall very few of their names and I do not know how many of them survived the War. Certainly many of those who went to Europe as pilots never returned; Puki was one of those who was lost.

I shall always remember a drunken escapade on the ferry between Picton and Wellington. After several beers, Puki decided to demonstrate his skill at walking on narrow ledges, so he climbed up on to the deck rail which ran round the stern of the boat. The drop was 30 or so feet into the turbulent water created by the ship's propellers, and as Puki balanced his way along the narrow rail, we stood back and applauded his bravado. Then suddenly he slipped and started to fall outside the rail towards the sea. He reached out desperately, just caught the rail and hung on by his finger tips. We ran forward and hauled a very pale Maori back on board.

The advanced trainer that we flew at Woodbourne was the Harvard II. This was a low-wing, single-engine monoplane with a retractable undercarriage and a variable pitch propeller, with machine guns fixed in each wing. Whereas the Tiger stalled at about 43 m.p.h., the Harvard stalled at 70 m.p.h. It climbed at 115 m.p.h. and it had a level cruising speed in the range 140–170 m.p.h. Another big advance was that it had a canopy that could be closed; no longer were we to be buffeted and chilled by the airstream. On 7th April, I had my first Harvard flight with my instructor, Flying Officer Johnson. Johnny was a calm, taciturn man, who had seen active service in Singapore and whom I greatly respected. After three hours experience, I was sent solo. I then went through all the exercises that I had practised on Tiger Moths, but at a greater rate. The most interesting was a solo flight across Cook Strait to the North Island. I landed at Levin for lunch. It seemed an age ago that I was there, collecting my uniform, going on route marches and listening to the 'Rustle of Spring'. I saw some new recruits; how green they looked! After refuelling, I flew back home to Woodbourne.

I cannot remember the name of the attractive WAAF I started to escort to dances in Blenheim. She had refinement, good taste and a perfect figure, but one other merit that interested me was that she worked in the medical section of the station, which meant that she had access to the charts used to test eyesight. About every six months pilots were required to pass a strict medical test. My only anxiety was the eyesight test; I could barely read the second line from the bottom of the usual charts, which would put me near the borderline for flying. My dear WAAF was very helpful by providing me with the last three lines of each chart in the eye-testing section. I memorized them, such that seeing the very large letter at the top of the chart was sufficient for me to be able to re-

peat, forwards or backwards, every line indicated by the medical orderly. I had to be careful though not to close my eyes in concentration during a test!

I recall an episode when I was bringing my WAAF, whom I shall call Zoë, back to the station from a dance in Blenheim. It was one of the few times when circumstances seemed to favour a seduction attempt. Just short of the station gates there was a farmer's paddock with an inviting haystack a safe distance from the road. I suggested to her than she might like to have a 'rest' with me in the hay. She was willing, so I found a broken corner of the stack and arranged a bed of hay. We lay down and I began a cautious exploration, beginning with kisses and advancing through what I imagined was standard procedure, one button at a time. A certain amount of rolling around in the hay in between buttons gave me confidence that I was going along the right lines, since I was actually totally inexperienced at making love. Then something happened that destroyed the plan completely. I felt a patch of damp on my backside. I used my hand and then my nose to investigate, and found that I had rolled through a soft pat of cow manure. My uniform was stiff with it! I had no choice but to imply that it was getting late and that we should perhaps report back to the station. I couldn't face revealing my state to Zoë. When I got back to my barracks, I washed my trousers and cursed that careless cow.

Solo night-flying was a new experience on the Harvards. We would land either guided by a flare-path, or using a landing light to determine height above the ground. Another exercise, included under the general heading of 'instrument flying', was styled 'recovery from awkward positions'; my experience of being lost in cloud at Taieri stood me in good stead here! After eight weeks' training, the Chief Flying Officer, Squadron Leader Campbell, gave me a test and I was pleased to get above average ratings both as a pilot and as a pilot-navigator. Following a straightforward written examination on 15th June, 1942 I was deemed to be qualified to wear the coveted flying badge known as 'wings'. I still have it, on a faded uniform lying in a trunk in my attic. The course then moved to the Advanced Training School, also located at Woodbourne.

In the ATS a number of new exercises were introduced. These included formation flying, instrument take-offs, cross country navigation, firing the wing guns at ground targets and, most exciting, firing at a drogue being towed 50 or 60 yards behind a Vickers Vincent aircraft. This was a large, lumbering, pre-war biplane, capable of a top speed of only 143 m.p.h. (see p 83). Unbelievably, these planes were used as night bombers in the defence of Singapore and if, as sometimes happened, they were caught at dawn returning to base, they were easy targets for the Japanese fighter planes known as Zeros. The boring task of towing target drogues, which resembled large wind socks, up and down in the firing range, at an altitude of 5000

feet or so, was undertaken by pilots who were thought unfit for more heroic tasks, or whose behaviour warranted some form of punishment. As I was to discover a year later, there was no form of aviator life lower than that of a drogue pilot. A single drogue would be attacked by four Harvards in sequence, each having bullets marked with a different colour. After this the drogue would be returned to the airfield and dropped for the armourers to count its bullet holes. Thus each pilot received a score giving some measure of his accuracy in attacking the drogue.

I finally qualified as a service pilot on Harvard aircraft on 2nd September, 1942 and was commissioned as a Pilot Officer (temp) three days later. About a quarter of our course—27A—was commissioned; the rest became Sergeant-Pilots. I found this rather strange and unnecessary discrepancy in rank somewhat embarrassing, especially for those few days when our lives continued to overlap. A few of us would now immediately attend the Officers' Mess for meals, while our friends of the past eight months would go off to the Sergeants' Mess. No such division of new pilots occurred in the USAAF. Our flying badges and insignia of rank were sown on our old LAC uniforms by patriotic young women from Blenheim town; tailored officers' uniforms would take some weeks to acquire. We were given £25 to cover this expense and a list of approved tailors in the major New Zealand cities.

Almost all the members of course 27A were assigned to travel overseas on the great adventure of heroic flying over England and France. My friend Ray Danzey went off and later earned a DFC (Distinguished Flying Cross) in the European theatre of war. Some weeks previously we had been asked to fill in a form setting out the type of war service we would prefer, with the warning that our wishes might not be fulfilled. I decided on flying boats, but found the line 'Give reasons for your choice' difficult to complete. It was evidently not enough to say I fancied the idea of piloting a flying boat, so I tried, *'I've always enjoyed fishing'*. This feeble joke made no impression. To my dismay, I was assigned to be trained as an instructor on Tiger Moths and hence to stay in New Zealand. I couldn't imagine anyone on our course less suitable.

I tried very hard to escape my fate, and wrote a craven letter to the air officer in charge of postings or some such dignitary, at an office in Wellington. I pointed out that at my age (19 years), I was too immature for the responsible task of being an instructor. I was unmarried and if I were killed in the European theatre of operations, no one would miss me. On the other hand, I wrote, there was a member of our course, a much older man (he was 23), with a wife and two children, who would make an admirable instructor and who would prefer to remain in New Zealand. Unfortunately this man had not been commissioned, so the proposed interchange probably had little chance. I decided to continue struggling with the authorities in Wellington to try and be transferred to active service. This would take me 15 months to achieve and even then by a very curious route.

## The Flying Instructor's Course

My friend Jack Parsons had also been commissioned and posted to instructor duties. We were travelling to Auckland on leave, still wearing our rough airman uniforms with thin, almost invisible blue braid circling our sleeves, marking our newly acquired status. We stayed in Wellington for two days, before catching the Auckland Express. Not having much money to throw around, we decided to spend the night at the local YMCA. I had my £25 uniform money in the top pocket of my jacket, a large sum (worth about \$2000 of today's debased NZ currency), which I checked regularly to ensure that it was still on my person.

In the morning, before showering in the communal facilities, we hung our jackets and trousers on pegs near the showers. After breakfast, we set out to explore Wellington, and after a few yards down the road, I checked my top pocket. Disaster! The money had gone. We quickly returned to the YMCA, searched our beds, looked in the shower room and the breakfast room, but without success. I had clearly been robbed, which made me very depressed. Jack suggested going to a hotel bar to cheer up.

About a 100 yards or so down the road, Jack exclaimed 'What is this money doing in my jacket pocket?' and produced exactly £25. We exchanged jackets and continued to the hotel bar, but this time to celebrate.

We had arranged to meet some other members of our completed flying course at the Occidental Hotel that afternoon, but for some reason I can't recall, instead of waiting sensibly *inside* the hotel at the bar, Jack and I were lounging outside. We were chatting together, when we were suddenly interrupted by an irate army officer, who was a freshly minted second lieutenant, the same rank as us.

'Haven't you airmen been taught to salute officers?' he exclaimed.

'Not army officers like yourself,' replied Jack with a smile. I was not to be excluded from the sport.

'Particularly *junior* upstarts recently commissioned,' I added. He took the bait.

'Right, I shall report you both to your commanding officer for your insolence.' He produced a note book and pencil. 'What are your names and station addresses?'

'Are you really going to report us?' asked Jack slyly. But I thought the charade had gone on long enough.

'Stop annoying us and bugger off,' I said.

'I could arrest you,' the 'Army' ventured. 'Once again, give me your names', his pencil stood poised ready.

'OK,' said Jack, 'I am *Pilot Officer* Jack Parsons and this is *Pilot Officer* Leslie Woodhead.' The Army Officer looked carefully at our uniforms, changed colour and silently took my advice.

I had been made an 'officer', but there remained the 'and gentleman' quality to deal with. To this end, I had to spend two or three weeks at an Officers' Training School, where we received lectures on King's Regulations, covering such useful things as how to run a court martial, how to arrest a senior officer who had 'lost his marbles' and how to be duty officers. We were enjoined never to mention politics, religion or a woman's name in the mess. The art of giving and receiving visiting cards on arrival at a new posting was discussed and how to pass the port at the dining table received proper attention. Etiquette's niceties prevailed and the War seemed far away.

I arrived at the Central Flying School, Tauranga, in the second week of October. The airfield was on the coastal strip of land leading to Mount Maunganui, about two miles south-east of the Mount. During the next eight weeks with about 20 others I would be drilled in the art of teaching new recruits how to fly Tiger Moths. Apart from some flights in the twin-engined trainer known as an Oxford, for the foreseeable future, I would *only* be flying those draughty, clumsy little Tigers, a depressing prospect. I would have been even more miserable had I known that the next aircraft type to be entered in my log book would be a Vincent! Rather like my university career, I had reached a peak; it now only remained to slip downhill into disgrace.

The region around Tauranga is very beautiful. It is not unlike Mercury Bay, 60 miles to the north, but without its necklace of islands. The harbour is a large stretch of water—almost a lake—sheltered from the ocean by the strip of land on which our airfield was situated. Fifty years ago, much of the land around the harbour was covered by cultivated pine forests, running right down to the water's edge. Although not much above a thousand feet, the Mount rose from water level without competition, making an excellent landmark for the nearby landing field. To get into town from the station, without a long drive, one could take a ferry across the harbour water. At weekends we went to dances, parties and sporting events around Tauranga by this route. I started playing rugby for the Flying School.

Initially, my instructor was Flight Lieutenant Gain; however, after four lessons, he was replaced by Pilot Officer Bodle, who, I soon discovered, was certainly no gain. Bodle had a reputation for separating fellow officers from their money with the aid of his poker dice. At mess parties he would drink cautiously, watching others who were less calculating blur their judgement. At this stage the dice would be produced and bets laid. He seldom lost to his inebriated victims and caught me out twice.

The student-instructors were grouped into threes. My partners were Pilot Officer Ted Morley and Sergeant Pilot Russell Coulter. Two would fly together, alternating in the roles of 'the instructor', who would sit in the front cockpit of the DH82 and 'the pupil', who sat in the rear cockpit. Bodle would sometimes replace one of us and sitting in the cockpit appropriate

to his assumed role, either teach us or listen to us teaching him. We were issued with a small book that contained all the patter needed by an instructor—this was the precise form of words that we were supposed to use during any particular exercise. For example, if we were teaching the pupil how to make a forced landing, we were required to say something like:

When the engine ceases firing, first check that the fuel cock has not been accidentally switched off, then look below for a suitable landing field. Try to choose a field not being used for agricultural purposes. Look for indications of the wind direction, such as smoke from fires, or movement of trees. . .

and so on. The instructor would execute the actions described in the patter at roughly the same time as speaking about them. Of course when we *really* started instructing pupils, the precise form of the patter was forgotten; we knew the essential points to make and chose our own way of describing them, not excluding expletives for emphasis. When Russell and I were flying, we often parodied the patter, laughing throughout. Ted however had a more responsible attitude to the work. He was a short, heavily built man with cauliflower ears and had been a wrestler, perhaps a professional in the ring, but was quite a gentle, serious-minded person. He was in his late twenties, and married with a family. I was fond of Ted, but found my drinking friends amongst the younger, single and uninhibited pilots on the course, one of whom was Russell. We were not intentionally irresponsible, but we did run risks, especially as we grew more familiar with the flying characteristics of Tiger Moths. It is a wonder that Russell and I did not kill each other with our escapades. In the end it was Ted who died.

## Stunt Flying

The competition that developed between Russell and me could be described as frightening each other witless. The person in the front cockpit would be the 'instructor' and therefore in charge of the flight; he could therefore take over and pretend to be demonstrating to the other a particular manoeuvre, for example a slow roll. But the roll would somehow turn into a more dangerous aerobatic, like flying upside-down until the engine stopped firing due to lack of petrol. The carburettor on Tiger Moth engines could not operate under negative gravity and it would take a few seconds of flying the right way up to get the engine firing again. Of course we were always confident that we had the skill to recover from any awkward positions.

There was just one occasion when Russell responded to my 'silly flying' with a mixture of fear and anger. One day when I was in charge of the

flight and therefore sitting in the front cockpit, I said to Russell, 'Let's see how close to the water we can fly without touching the waves.' He agreed to the experiment, so I flew the plane down until I judged the wheels to be about two feet above the water. Very exciting. I had on a previous occasion, flying solo, once just clipped the top of a wave with my wheels and had easily recovered from the slight nose-down response, so I was not worried about flying so low. I expect that Russell had his hands lightly on the control column in his cockpit just in case I made a mistake. Ahead we could see the pine trees on Matakana Island rising straight up from the water's edge—they made an inviting target.

'I shall make two sharp, right-angled changes of direction to lift us to the level of the tops of the pine trees,' I said. This involved flying straight at the pines at sea level, hauling back the control column hard at the last possible moment and then almost immediately forcing the column hard forward to restore level flight. According to my theory this would place us just over the pine tops and flying inland. Of course all this low flying was entirely forbidden, but who would catch us? It was a good theory with just one flaw that didn't occur to me. When I forced the control column forwards, the carburettor was under negative gravity long enough for the engine to cut out. This left us gliding quietly down into a profusion of pines, with no power to escape. I saw a channel ahead where the treetops appeared to be lower than the average, so I veered towards it. Russell was as silent as the engine. The treetops were beginning to flash past each wing tip, now just a little higher than us. The engine *would* start again, but when? In just a few more seconds we would be crashing through the forest; survival would be a miracle. When at the last moment the motor coughed, sputtered a little and then started, we climbed steeply out of the shallow valley that had saved us. Russell took over abruptly; I was not going to argue with that. He was very aggressive and exploded with a range of epithets to describe my stupidity which I had no choice but to accept in silence. He flew us back to the airfield and landed.

There was one other, apparently less dangerous manoeuvre that I adopted for Russell's entertainment, but which did not impress him as much as I thought it should. While flying solo one day, I worked out the altitude lost during my favourite aerobatic, namely a roll off the top of a loop. From a straight and level position I discovered that in order to acquire the correct speed to begin the loop it was necessary to dive through an altitude loss of 600 feet. Then after the loop the half-roll would place the plane about 300 feet below the original height and now moving in the opposite direction. When I next flew with Russell, I took over the controls and descended to 600 feet over the sea.

'Russell,' I said, 'do you think we could execute a roll off the top from this height?'

‘No,’ he replied, ‘you will not get up enough speed.’ Of course I knew better than that, having done the experiment.

‘So why don’t I have a go at it?’ I said. The rules of our game required him to assent to this risky trial. He said nothing, so I put the Tiger into a dive, then just above the water I pulled the control column back to begin the loop, but was surprised to note that the airspeed was a little short of the 130 m.p.h. required for the manoeuvre. I pressed on however. At the top of the loop the sea was probably no more than 400 feet above our heads, and a half-roll was the only escape, but that was as I had planned it. In the roll I lost more than 300 feet, so we ended up flying about fifty feet above the water, instead of the 300 feet I had expected. Russell was not amused. At first I couldn’t understand what had gone wrong, but it occurred to me later that a Tiger Moth—which is a very light aircraft weighing under three-quarters of a ton—with *two* occupants would behave much less efficiently than with just one. I didn’t trouble Russell with this explanation.

That evening just before we went into dinner, the Commanding Officer said he had a serious matter to raise. He told us that a visiting Air Commodore had been relaxing in a fishing boat near the Mount and had seen some idiot performing aerobicic manoeuvres right down to sea level. The ‘Air Commode’, as we were wont to call such officers, had unfortunately not been close enough to take the number on the plane, but he had requested the CO to find the culprit and make an example of him.

The CO was generous and thought a warning would suffice, saying ‘Whoever did this, be warned that a repeat performance will be treated very seriously indeed.’ In fact it would not have been very difficult for him to determine who the ‘idiot’ was from the record of flights undertaken at the time in question.

One problem that instructors occasionally had to face with new pupils was ‘freezing on the controls’. The pupil would become overcome with fear, especially during stalling or spinning manoeuvres and would then hold the control column rigid in one position. The instructor would have to talk the pupil into relaxing and releasing his grip, but if this failed, he would have to try to take over the controls by force. I had this experience only once during my short career as an instructor; it occurred during a stalling exercise. The pupil refused to push the control column forward to bring the plane out of the stall, so I shouted through the speaking tube at the pupil to get on with it before I realized that he was frozen with fear. Then I tried to take over by force. In the end I forced the control column hard to one side and then suddenly changed my pressure to the opposite direction, which surprised the pupil into letting go. Fortunately, we had plenty of altitude. Afterwards I reported the incident and the pupil was grounded. It is a matter of speculation whether or not a similar thing happened to Ted Morley a few months later, but what is known is that he and his pupil



were in a spinning exercise from which they never recovered. It was quite likely a case of a pupil freezing on the controls.

Sometime during my posting in Tauranga my new uniforms were delivered, and it was pleasing to assume the proper appearance of an officer at last. The summer drill looked particularly smart with the thin blue braid of a Pilot Officer appearing on the shoulder bands. In place of the cloth wings sewn on the blue uniform, I now had a detachable metal replica of the flying badge fixed on the jacket. I was anxious to discover if it had an aphrodisiacal effect on the local girls, but drill could not be worn before a certain date in early summer. At last that date arrived and as the weather was pleasantly warm, I put my summer uniform on in the evening and went off to the mess. Everyone else had had the same idea. After dinner a drinking party developed in a small room with a piano. One of the course instructors played some popular music, although the words we sang would have scarcely been recognized by the librettist. The room was crammed full of officers dressed in freshly laundered drill. None of us noticed two or three sergeant pilots outside the building creep up to an open window, carrying a large stirrup pump normally used for extinguishing fires. The nozzle was aimed inwards at our bibulous party and suddenly vigorous pumping commenced. Pandemonium understates the outcome—we did not want our fresh uniforms to be spoilt, but there was no easy escape in such a crush. The door was torn off its hinges in the *mêlée*, and the culprits outside the room quickly disappeared. Most of us were soaked and our uniforms temporarily ruined.

Towards the end of my period of training as an instructor, several members of the course including me were each given the task of delivering a Tiger Moth to Rongotoi, an airfield about two hundred miles to the south, since these planes required a level of servicing not available in Tauranga. We were to fly together in a loose formation with one stop *en route* for refuelling, and at Rongotoi we were given replacement planes for the return journey. The flight to Rongotoi was uneventful, but on the return journey I was lucky to escape crashing. We flew across Lake Taupo very close to the water; I remember clipping a wave or two with my wheels. However, the near disaster occurred a few minutes later when we encountered the Waikato River, the principal river in the North Island. We met it meandering through an attractive, steep-sided valley ideal for a game of follow my leader. I was in second position, and we flew at a comfortable height of about 30 feet above the water. Suddenly I saw flashes of light from the bracing struts joining the leader's two wings, which then appeared to be flapping about independently. The pilot had no choice but to attempt a forced landing from a starting height of less than 50 feet. He was fortunate as a narrow field lay beside the edge of the river and he literally fluttered down into it. Considering his situation, this was an impressive and lucky piece of flying. I pulled up steeply and circled around the stricken plane;

for a few wild moments, I considered attempting to land in the same field, but then the pilot waved and he was evidently unhurt. Then I saw the problem. High voltage electric cables had been draped across the river at the point where the accident had occurred; these were now missing. I hadn't seen them previously, but when I reached their location, they had been removed a few moments earlier. Being second saved me.

At the subsequent investigation by the Chief Flying Instructor, I was able to explain that engine failure (at a considerable altitude of course!) had required the unlucky pilot to make a forced landing. Except for the strip of grass along the river, I had seen no obvious landing field for him. He had been *so* unlucky to encounter the electrical cables during his approach to the emergency landing field! I explained how I had circled around to ensure that the pilot was unhurt; if he had shown no signs of life, I had been going to attempt to land near him, to give him first aid. The CFI was generous in his praise!

On 30th November, 1942 I flew for 45 minutes with F/O Trevor Gallagher. We did precautionary and forced landings, steep turns and aerobatics; he was testing my flying skills. Six years later, while again flying a Tiger Moth, I was to put Trevor in an embarrassing position even though he was not in the plane. My final test with the CFI came three days later. I left Tauranga just before my 20th birthday with an above average assessment for flying proficiency. I was a good pilot, although perhaps a little reckless at times, but able to perform the most difficult aerobatics very accurately. I had now accumulated 356 flying hours, almost all in Tiger Moths. A week later I started my fateful career as an instructor at No 2 EFTS, Ashburton.

## Chapter 4

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# Flying about New Zealand

### Flying Instructor

Ashburton is a small town in the South Island and lies some 50 miles south of Christchurch, on the Ashburton River and about twelve miles from the coast. Thirty miles inland the foothills of the Southern Alps climb up from the Canterbury Plains and a further 40 miles takes one to mountains nearly 8000 feet above sea level. Winds crossing the Tasman Sea tend to drop their moisture on the western side of the Alps and then descend to the Canterbury Plains as hot *Föhn* winds.

The airfield was about six miles from the township, which had a population of several thousands. My first flight was a familiarization trip accompanied by one of the senior instructors, who showed me the low-flying area and forced-landing field, and made sure that I could recognize exactly where I was in relation to the airfield. Then I took off by myself to continue the process. I was attracted to the low-flying area, which was a region where instructors and their pupils were allowed to descend to 400 feet, but no lower, and to fly carefully, making gentle turns, watching the ground for wind effects on their flight path and so on—rather boring stuff. The terrain was remarkably flat, with checker-board fields and occasional clumps of poplar trees. I flew as close to the ground as I thought safe in order to get a sensation of speed. Unfortunately, I must have been about three feet too low. I was travelling at 80 m.p.h. or so, enjoying watching the ground flash by, when I noticed that my airspeed was dropping rapidly. I pulled away from the ground, up to a hundred feet and almost stalled. I had now opened full throttle and yet was only just able to maintain height at a speed not much above stalling. The aircraft seemed to move in a fitful fashion; I soon discovered the cause. Stretching away on both sides of the Tiger were telephone wires and jerks occurred as the bindings to the insulators snapped off in turn, along the row of telegraph poles. I had been flying at right angles to these wires and failed to notice them; now

they were caught on my undercarriage and festooned for 100 yards or so on either side of the plane. Soon I had liberated a complete section and was flying along, linked to the ground by several very long, trailing wires—this was not a good start to my career as an instructor! Had I tried to fly back to the airfield, the wires would almost certainly have short-circuited the local power supply.

I had no choice but to land straight ahead in the nearest grass field. My luck changed; there was a suitable paddock ahead, almost large enough for a forced landing. Not that this mattered because the wires made excellent arresters. I rolled to a halt, throttled right back and climbed out of the plane to inspect the damage. My catch was four copper wires, running back into the next paddock. I pulled them off the undercarriage, climbed back into the plane and taxied it forwards, clear of the wire, then got out again and started to roll up the wire. My plan was to bundle it up into a small coil and then find a suitable hiding place in a nearby boundary ditch. This would have presented the Post and Telegraph Department with an interesting mystery, but Fortune intervened again. A farmer appeared in the distance, walking towards me. I dropped the wire, hoping he had not seen it and walked quickly to meet him.

‘Hello,’ he said, ‘What is the matter?’

‘I had a little engine trouble,’ I lied, ‘and was compelled to land in your paddock. I hope you don’t mind.’

‘Not at all,’ he replied, ‘you pilots are doing a patriotic job and I am glad that my paddock has been useful.’

‘The engine is now running smoothly,’ I said, ‘so I shall taxi to the edge of the paddock and take off.’

‘Good luck,’ he said, and I had a feeling that I was going to need it. After my take-off he would certainly discover the wire and if in addition he happened to note the number of my plane I would be completely sunk.

Upon landing at the airfield, I asked one of the mechanics to check the undercarriage without explaining why. He did so and found no structural defects, but was surprised by four parallel scratches on the paintwork. I then took off again, with my first pupil, LAC McKenzie, giving him an hour’s instruction on some aspect of safe flying, but avoided the low-flying area. I flew with ten different pupils during my first week and the chance for further solo flights arose only twice. I was very circumspect, but about two weeks later, just when I was beginning to hope that the incident was history, Squadron Leader Firth gathered us before dinner, saying he had a serious matter to discuss. It appeared that he had received a curious bill from the Post and Telegraph Department for some £18 to cover the cost of replacing some telephone wires in our low-flying area. Only a low-flying aircraft could possibly have caused the damage they claimed, so the Air Force would have to cover the cost. The Squadron Leader wanted the culprit to own up and accept the bill, which caused a buzz of excitement.

Some pilots standing near me quietly speculated as to who was probably guilty; being very new to the station, I was ignored, but I did venture to ask them for the name of their candidate for the bill. A name was confidentially mentioned, but at that time I did not know the person. (I later learnt that this pilot was known to be in the habit of landing in farmers' fields in order to gather mushrooms.) The Chief Flying Instructor gave the guilty party a few more minutes to confess, but I felt sure that there would be more than the bill at stake, and decided to hold my tongue. The farmer had evidently also held his, since the time of day would have given the CFI a good clue to the perpetrator's identity.

I soon settled into the routine of being an instructor. We lived in little wooden huts set out in a pine forest, one person to a cabin. I was at last able to spread out my books on shelves, tidy up when it pleased me and write letters to friends and even to my parents. My relationship with my father considerably improved and he seemed pleased that I had become an officer and had not been sent overseas. I remained unhappy about missing out on the great adventure in Europe and hoped that if I made a good job of my instructing for a few months, my plea to be transferred to active service would be granted. That is not how it happened however.

On a typical day, flying would start at 6.30 a.m., which would enable us to finish before the hot wind strengthened in the afternoon. After breakfast we would walk the half mile or so to the flying field, meet our pupils and plan the day's flying. My log-book shows that each day I would make between two and eight flights—on average about five. Sometimes two of these would involve the same pupil, but usually each flight was with a different person. These flights would last about 35 minutes unless we were on a cross-country map-reading exercise, which would take much longer. When the wind became too strong, flying would be cancelled, and on such occasions the last instructor to land would sometimes put on a show for the ground staff. If the wind exceeded the Tiger Moth stalling speed of 43 m.p.h., as it often did, it was possible to hold a Tiger stationary above the airfield; the pilot could then juggle the controls so as to descend slowly along a vertical trajectory to the ground. But as the aircraft got closer to the ground, the wind speed would fall away and some forward motion just before landing would be necessary. Ground staff would run out and hold on to the wing tips to steady the plane as it was taxied into a hangar.

Remembering how my instructor, Tom Newland, used to seize the controls as soon as I showed any sign of making an error, especially when landing, I resolved to give my pupils more leeway—let them make and correct their own mistakes, I thought. I should take control *only* at the last moment to avoid an accident. I still think this was a good idea, but it does require good judgement and therefore a clear head early in the morning. I never flew with junior pupils on the early morning flights.

I found the 400 feet limit on low flying rather too restrictive, but I was careful about telephone and power wires. Looking for a new adventure one day, I noticed two tall poplars standing close together and wondered if I could fly between them. It was certainly not possible to do this flying a straight path—the trees were clearly less than a wing span apart—but if one banked steeply immediately before reaching the trees, one could pass between the trees in a steep turn. This I judged would be quite safe since the gap between the trees was wider than the distance between the top wing and the wheels. I tried the manoeuvre when flying solo; it was exhilarating. I thought that my pupils would have the same reaction to such an exciting experience.

My method of testing a pupil's spirit was first to fly past the trees with the question, 'Do you think we could fly between those poplars?'. I never received an affirmative answer and didn't expect one. My next move was to say 'I think it's possible so why don't we give it a try and see what happens?'. Some protested, but most remained silent, perhaps not believing their ears. I would fly directly at the trees, glancing at the pupil's face in the front cockpit mirror. Then through the gap we would spin, standing on a wing tip. I rationalized the exercise as being a test of my pupils' moral fibre, but with hindsight I must admit that the danger outweighed any insight I might have pretended to gain. It was foolish bravado, but I was only 20 years old and, as I had explained months before to the Air Officer in charge of postings, I was quite unsuited to being an instructor. The last time I flew through the poplar trees, I slightly misjudged the turn, caught a branch with my wheels and felt a strong tug on the control column. It was time to stop.

A few pupils would suffer airsickness in their first few flights in a Tiger. They would do their best to conquer this affliction and sometimes try to conceal it from their instructors, because repeated airsickness would mean the end of their flying careers. The ground staff were not partial to cleaning up vomit from the cockpits, so any poor pupil who had lost his breakfast was obliged to clean up his own mess. One of my pupils suffered badly and had to wash the side of the cockpit more than once. He begged me not to report it to the Flight Commander and said he could overcome it given a little time. I was very sorry for him and gave him time, but in the end he had to be grounded.

## **Accident Prone**

For recreation I started going to the Saturday dances at the Radiant Hall in Ashburton. Transport there was a problem, so I purchased my first motorbike, which was second-hand and cost me £20. The road leading to Ashburton was covered with loose metal, which is not an ideal surface

for a light motor cycle, especially at turns. I fell off a number of times; I suppose the drinks I used to have in the Mess before departing for the dance played some role, although that didn't occur to me at the time. One January night in the Radiant Hall I met an interesting girl, who seemed to share my interest in religious philosophy. More to the point, she was pretty, had an attractive figure and a vivacious manner—I was completely captivated. Her name was Gladys Elizabeth Bayley, but she answered to Betty. I had several dances with her and at the end of the evening she allowed me to escort her home. When we arrived, she discovered that she did not have her front-door key and, not wanting to wake her parents, she asked me to help her through a window and had to remove her stockings to avoid laddering them—all very exciting.

I saw Betty most nights over the next few days, met her parents and quickly made up my mind that I should like her to be my wife. So after ten days I asked her to marry me; she took a whole, boring week over the matter and then agreed. There was just one problem—I would not be 21 for another ten months, so my parents' permission was required for the marriage to take place. I immediately wrote to my father with the good news, but his reply was that he would certainly *not* agree to my marrying someone I had just met at a dance, that I should take much longer to find a suitable wife and that in any case I was far too young. He also remarked that a good way to judge whether or not a girl would make a good wife was to study her mother, because in 20 or 30 years' time the daughter would resemble her mother in both appearance and manner. I decided that this was a bogus argument for had I accepted it there would have been no marriage. I waited a few weeks and then wrote again, stating that if Father continued to withhold his consent, I would forge his signature. After another long letter full of dark warnings, he finally gave in, but marriage was still many months ahead. I had no money and would need to save up to buy an engagement ring, to pay for a honeymoon and so on. I thought that £60 would be enough. My salary as a Pilot Officer was £275 per annum, but I had enjoyed spending it in the Mess, so I had very little savings.

Petrol was strictly rationed and I never had quite enough to run back and forth to Ashburton every night. Airmen were occasionally caught smuggling petrol off the station in hot-water bottles concealed under their jackets, but this could lead to a court martial and in some cases prison. Petrol was freely used by the mechanics to clean the Tiger Moth engine down, this being done by placing a large shallow tray of petrol on the ground just beneath the engine and applying a brush dipped in the petrol to the parts that required cleaning. The petrol in the tray would soon become quite dirty of course.

One day I was watching an erk—Air Force slang for the lowest rank—clean an engine. He finished and was about to throw away the dirty petrol

in the tray. My motorbike was close by, so I innocently said, 'Don't throw all that petrol away. Would you please carefully fill my motorbike tank with the cleanest top layer of petrol?'

He replied 'You don't want to put this dirty petrol into your bike; have some clean stuff.' With that he threw the dirty petrol away, ran some clean petrol into the tray and moved towards my bike.

'No,' I said, perhaps too weakly, 'that is clean petrol and it is an offence to take it.'

The erk seemed determined to help me. He quickly washed his hands in the tray and said 'Now it is dirty and I am about to throw it away. Instead of doing that and wasting it, I will put it into your tank.' Before I could muster an argument to stop him, he poured the 'dirty' petrol into my tank. I looked around to see if anyone had noticed this felony. I wisely decided not to report the matter, although I felt uneasy about it for a minute or two. I avoided watching the mechanics too closely after that.

About this time I began to consider the problem of supporting a wife after the War. I would need to complete a university degree. I had five units towards a B.Sc. degree, namely Pure Mathematics I & II, Applied Mathematics I, Chemistry I and Physics I, the symbols 'I' and 'II' denoting the year. Three more units were required, but the only subjects available which didn't require laboratory attendance, were Pure Mathematics III and Applied Mathematics III. I therefore decided to become an extramural student and study these subjects, leaving completion until after the War. I stopped being so reckless, cut down on my drinking and generally improved my attitude to work. I wrote to Auckland University College for advice about books; Cecil Segedin was very helpful, so I set about studying by myself just as in the Tech College days four years previously. We decided to get married in August, giving me time to save the required money, and I also had to ask the Commanding Officer for permission to marry.

All proceeded smoothly until P/O Louis Fox hit a haystack in March. He was chasing a hare, concentrating so much on getting it with a wheel that he failed to see the stack. The impact spread the hay, but enough remained covering the Tiger so that its wings appeared to be projecting out of the stack—it was an amusing sight from the air. Louis was particularly anxious about the petrol gushing out of the tank into the hay and removed himself from the potential bomb very quickly, but fortunately there was no fire. The Commanding Officer was very annoyed; there had been several minor accidents on his station in recent months. Fox's was the last straw. He warned us that he had been advised from Headquarters in Wellington that after Fox the next perpetrator of a stupid accident was to be treated with the utmost severity. Naturally it turned out to be me.

My career as an instructor on Tiger Moths finished on 6th May, 1943. The accident occurred three days earlier. On the evening of 2nd May there was a party in the Mess, and, since I did not want to appear unsociable,





Pilot Officer.



Wedding day, 1943.

I joined in, perhaps with more enthusiasm than was strictly necessary. I was still unwell the following morning, but the flying had to go on. I chose my most reliable pupils for the earliest flights. LAC Rait was one of my senior pupils with 53 flying hours to his credit, so had made many landings, both solo and dual. I felt safe with him and decided that a cross-country exercise with its straight and level courses would suit my condition best.

After three quarters of an hour of peaceful flying, I stirred myself and asked Rait to take me back to the airfield. I woke up again just before he landed. To my astonishment he was about 20 feet too high and about to stall, as if touching down. I shouted through the speaking tube for him to open the throttle and make another approach; I should have taken over immediately. He did not react fast enough, so I grabbed control and opened the throttle. It was too late. We hit the ground very hard. I still had hope for a successful landing when out of the corner of my eye, I saw a wheel moving off on a separate trajectory. The bare axle dug into the ground causing us to spin around, the remaining undercarriage buckled and finally the aircraft pitched forward, smashing the propeller. Then silence. We were not seriously hurt. Getting out was a little awkward, with the plane at such an unusual angle.

We walked back to the flight hut with our parachutes over our shoulders. A crowd had gathered; the Chief Flying Instructor was there, grim-faced and beckoning. We told our story. Rait was immediately grounded, and I

thought he deserved it. Three days later the same happened to me. I was told that my case was being considered by the Air Officers in Wellington. I remained in limbo for three weeks, then at last the CO called me into his office. He said my punishment was more severe than perhaps deserved, but an example had to be made. I was to have my flying log-book endorsed, a black mark for pilots, and I was to be transferred to Woodbourne to join the drogue-towing flight. This was the nadir of my flying duties—I suppose it could have been worse.

## Drogue Towing

The move back to Woodbourne, where I had learnt to fly Harvards a year before, was depressing in two ways. First I would be separated from Betty for the three months until our marriage and secondly, drogue towing was a boring, low-grade activity given to those pilots who were judged unsuitable for anything else. It was a severe blow which I thought I did not entirely deserve. I was determined to escape from this task as soon as possible.

Drogues resembled the white wind-socks one sees flying on the boundaries of airfields used by light aircraft. They were tubes of cloth, about 25 feet long and about three feet in diameter held into shape by rings of wire. They were used to give pilots experience at making machine-gun attacks on moving aerial targets and hence they were towed on a steel wire, a safe distance behind an aircraft flying at a height of about 5000 feet. At Woodbourne the trainee fighter pilots flew Harvards with machine-guns mounted in the wings, while the drogue was towed behind a large, single-engined biplane called a Vincent. This Vickers aircraft was a general purpose version of an almost identical plane known as a *Wildebeest* which was designed to be used as a torpedo-bomber. The Vincent was built in the 1930s for tropical service in the Middle East and, as mentioned earlier, it was also used as a night-bomber against the Japanese during the defence of Singapore. With this aircraft being symbolic of the British state of preparation against attack, the fall of that city is scarcely surprising.

The Vincents used by the Drogue Flight were painted yellow and, because their fuselages sagged slightly, they were nicknamed 'flying bananas'. They had 13 foot wooden propellers which ticked over so slowly during an approach to landing that the blades were separately visible; there was none of the usual blurring. The airscrew was driven by a 640 h.p. Bristol Pegasus radial, air-cooled engine; the cruising speed was 121 m.p.h. and the maximum speed only 21 m.p.h. greater. The undercarriage was fixed with a streamlined housing (spats) covering each wheel. Another interesting feature was that before landing one had to pump up the wheel-brake pressure to a prescribed mark. Thus the machine was landed with the brakes

already applied; a mistake here meant that on touching down the plane could tip onto its nose! The cockpit was about 12 feet above the ground, so getting into the plane was like climbing up a short cliff-face with several footholds to assist. Behind the pilot's cockpit were a few feet of enclosed fuselage followed by a long open cockpit in which half a rugby team could have stood and no doubt did occasionally.



Vickers Vincent: used as a patrol bomber until the end of 1943.

They were later used to tow drogue targets.

To allow the drogue wire to hang well clear of the tail-plane and rudder, it was attached to a winch that projected two or three feet out to one side of the fuselage. This was hand operated by an aircraftsman standing in the rear cockpit. When the firing range was reached, the drogue operator attached the drogue to its wire, which was then paid out, allowing the drogue to float back from the plane rather like a kite. As it moved away, its wire ran through a pulley at the end of the winch and when it was about 60 yards away a brake was applied, holding it in a position fixed relative to the Vincent. After the student pilots had completed their attacks on the drogue, usually about two hours later, the operator winched it in and detached it from its wire. When we returned to the airfield, I would fly low, enabling him to drop it overboard to be collected by the Armaments Section. Typically each drogue would be attacked by four pilots in turn, each completing a number of quarter attacks before returning to the station. For safety, only one pupil was allowed on the firing range at a given time. To seek permission to begin their attacks the pupils would fly their Harvards close to the Vincent and attract attention by waving their wings. A green flare fired from a Very pistol by the Vincent pilot was the signal to proceed; red flares were a warning to keep away.

Returning to my first solo flight in a Vincent, it is not easy to forget, since I nearly killed myself. On 4th June I was given a conversion flight by F/Lt Edwards; I was merely a passenger as the Vincent's cockpits did not allow dual instruction. I was in the rear cockpit where the drogue operator usually sat and a speaking tube allowed Edwards to describe what he was doing. Afterwards I was sent off solo to become familiar with the Vincent's various idiosyncratic features, but was given no specific instructions about what exercises to perform.

First I made two landings on the small field normally used by the Harvard pilots for forced landing practice. This field was really a little too small for the big, lumbering Vincent, so to avoid hitting the opposite fence I had to apply rather more brake than was comfortable. But my first landing was good; I skimmed close over the boundary, having pumped up more than the specified brake pressure for normal landing. The landing run neatly fitted into the field—no space wasted at either end! My second landing was a near disaster. I was a little too high over the approach boundary, so touched down too far into the field. Perhaps I should have opened up the throttle and tried to go round again. Anyway I forced the brake pedals hard forward, adding considerably to the preset braking force. The tail lifted up, so I quickly released the brakes and then had to apply them again. It was a balancing act—the maximum braking I could apply, without nosing over. Towards the end of the landing run one of the brakes partially seized up and I performed a 'ground loop'. Fortunately the wing tip just brushed the grass and no damage was done; also it saved me from hitting the fence. After this, I began to think that the forced landing field was not really suitable for the Vincent, a speculation I covertly confirmed that evening in the Mess. I gave up landing practice at that stage and turned my attention to more interesting exercises.

In some ways the Vincent was like an enormous Tiger Moth. I thought that it might behave similarly in aerobatic manoeuvres, so I climbed to about 7000 feet to test this idea. Loops were no trouble—the plane performed beautifully despite its size. Then I tried it in a slow roll. There was no problem getting it on to its side, but it was very slow to reach the half-roll, upside-down position. When it did, even though I had the control column hard over the rolling motion almost stopped, leaving me flying upside down and losing height rapidly. I looked up at the hills below, which were getting closer by the second. It struck me that I was stuck upside-down with no escape. It didn't occur to me that as far as recovery was concerned, continuing the roll would be any different from reversing it since aeroplanes were supposed to be symmetrical about their centre planes. But when there was less than 2000 feet to fall, I realized that my only chance of survival was to try to reverse the half-roll, so as to come out of it the way I had gone into it. This worked and only just quickly enough—I had about 500 feet clearance over the hills by the time the Vincent had recov-

ered its normal flying attitude. When I had recovered my wits, I took time to examine the few cockpit instruments there were. I was surprised to find a prominent notice that I had not read before. Attached to the panel was a metal strip with a warning in red letters:

**Under no circumstances are aerobatics to be performed in this aircraft!**

Edwards should have told me. Later I realized that the Vincent I had tried to roll was not at all symmetrical about its centre plane. The mounting for the drogue winch was the problem, since it projected out from the fuselage sufficiently to disturb the air flow and upset the aerodynamic response of the aircraft.

Drogue towing consisted of flying on a straight and level path, up and down a few miles of the same stretch of the firing range at about 5000 feet. It was boring work and the only excitement came when an occasional over-enthusiastic Harvard pilot would press his quarter attack too long before breaking away. To keep the drogue in his sights, a pupil would have to make a slow turn towards the Vincent, but if this were continued too long, the quarter attack would become a stern attack. Then I would see tracer bullets flash under my wings and, but for the action of gravity, the Vincent would be in the line of fire! This would make me quite angry, so I would seize the Very pistol, load it with a red flare and fire at the Harvard as it passed me.

It was about this time—June, 1943—that I began to wonder why I had not been promoted to the rank of Flying Officer. The normal expectation for aircrew was that the first promotion occurred six months after being commissioned and I had now been a Pilot Officer for nine months. Wing Commander Tancred was the Commanding Officer at Woodbourne; I wondered if I should approach him to ask if I had been overlooked. But I hesitated to do this as he was not a sympathetic person. He made his style very clear one winter's day when I was sitting in the Mess near an open fire, reading a book on mathematics. I had completed my dreary stint of drogue towing for the day and was pursuing my extramural studies. When I went into the Mess at about eleven o'clock, no one else was about and I became quite absorbed in my reading, although I was aware that other officers were gradually accumulating before lunch.

Suddenly I heard Tancred's angry voice: 'Who is this *junior* officer rudely hogging the fire?' he shouted. 'Get out of that chair!' I moved quickly, protesting weakly that I had not seen my shivering superiors approach the fireplace. After that, whenever this boorish CO entered the Mess, I would always conspicuously position myself the maximum distance from the fireplaces, the correct location for the most junior officer, I would explain in a loud voice. I rose to be one of the most senior *Pilot Officers* in the RNZAF, and when I was finally advanced to the rank of

Flying Officer, it was back dated to one year from my first commission, so six months' loss of seniority had been added to my punishment without mention.

The business of the fireplace was trivial compared with an offence committed against my room-mate, Flying Officer Dark. Late one evening there was a drunken party in the Mess with the CO presiding over his acolytes. At his bidding, a gang of these fawning inebriates went to the barracks to rouse up officers from their beds, who, under threat of having their pyjamas removed and receiving an enema from a stirrup pump, were forced to join the CO's merry party. That day I was in some pain, still recovering from having had my nose broken in a rugby game that afternoon, so I managed to persuade the marauders to leave me alone. Had I been well, there would have been blood on the floor. Dark was not so fortunate, being dragged before the CO and physically abused. He was so incensed by this, that the next day he demanded that the CO immediately arrange for his transfer to another station. This was instantly granted; I considered doing the same, but as I was already on a punishment course towing drogues, there was nowhere else I could go and still remain flying.

One day at the end of a drogue-towing flight just before the operator winched in the drogue, I celebrated my imminent release from boredom by going into a steeper turn than normal. To my dismay I found that I couldn't resume straight flight as the controls seemed to be locked. As we started to spiral down, I called to the drogue operator who replied that he was unable to remain on his feet but fortunately he was wearing a safety harness. I asked him to look at the control surfaces—the elevators and the rudder. He struggled to stand up in the aircraft, which was now beginning to spin quite rapidly. He said that the drogue-towing wire had slipped into the gap between the fixed tail plane and the elevator and was stopping its movement. By some fluke my steep turn had allowed this to happen. I asked the operator to cut the wire cable, but he then had to struggle to reach the wire cutters which were not immediately to hand. Just when I was wondering whether or not we should bail out, he managed to cut the wire. It slipped away and I recovered normal flight.

## **Domestic Life**

Betty and I were married on 21st August in Ashburton, inviting many old friends from No 2 EFTS, where I had been an instructor. One of these was my Best Man, F/O Jack Godsif. I knew there was some risk involved with this choice, since when off duty Jack had developed the habit of drinking for as long as he could remain standing. We had enjoyed many jolly evenings in the Mess before Rait terminated my instructing career. Sadly, Jack fulfilled my expectations—at the reception, held in a local dance hall, he climbed on

to the stage and made a short and fortunately incoherent speech, peppered with expletives. He was bloody pleased for us! He soon collapsed on the floor and was removed out into the fresh night air. About two hours later he reappeared in a contrite mood and made a humble apology from the same stage; since he had flown in Singapore during the dreadful days of the Japanese invasion, it was easy to forgive him.

We spent a short honeymoon in Auckland, but I am chagrined to admit that due to lack of money we stayed with my parents, who were now reconciled to my marriage. But it was not altogether comfortable and alcoholic beverages had to be consumed covertly in our bedroom. There was also a prudish streak in my father which required more care than I had become accustomed to. We took Mother to the Zoo on one occasion and I made the error of attracting her attention to two monkeys skilfully copulating on a swing. This was reported to the old man who feigned great offence. Still Betty had not seen Auckland before then, so there was some merit in the choice.

Betty and I set up our first home in a flat in Blenheim. I still had my motorbike, so I would drive out each morning to the Station to undertake my flying and other duties. No more drinks in the Mess before dinner—well very few—for I had to drive home to have dinner with my wife. After some trial and error, she became proficient in her housekeeping role and slipped comfortably into the modest social life of the station. She was a loving wife, supplying the affection which had been absent from my childhood. It was a happy interlude, but soon to finish.

My socialism had instilled strong egalitarian principles in me. I disliked the notions of rank and privilege. I particularly objected to the way in which some people gravitated towards higher ranks, seeking patronage—crawling was a polite name for this. I tended to avoid officers of higher rank but with hindsight I know I carried this too far. I could not accept the idea of being beholden to anyone; I would be my own man, even if it killed me. I discovered that on social occasions wives are much more conscious of their husband's rank than the husbands themselves. I recall approaching a Flight Lieutenant and his wife at a dance. As I knew him well, I addressed him by his first name.

'Who is this person?' she puffed, disdainfully, 'Send him away.' To save my friend further embarrassment, I retreated without comment. It was my first practical experience of a class system, but trivial compared to what lay ahead.

At about this time I became rather concerned by the shoddy treatment handed out to conscientious objectors in New Zealand. These were men who objected to serving in the Armed Services for religious or philosophical reasons. On being conscripted, they would give their reasons to a board for being excused from service. Some were successful, but the great majority (about 80%) were disbelieved and sent to prison. In England at this time

only about 20% of objectors were treated so severely—at least this was the claim in the booklet I had received from the Rationalist Association in Auckland, a proselytizing, atheist organisation which I had joined while at university. The booklet gave details of many harsh judgements made by the board. The Society asked me to help the cause of the conscientious objectors by selling copies of their booklet to people on my RNZAF Station. Perhaps I was rather naive, but I was then under the illusion that even members of the Armed Services should be concerned about unfair treatment of objectors, but almost the first man I approached disabused me of this view. He was a Flight Sergeant, very brisk and formal. I started to explain the plight of the objectors to him and showed him the booklet. ‘Would you like to buy it? Price, one shilling.’ His response surprised me.

‘No thank you, *Sir*,’ he shouted, ‘Goodbye, *Sir!*’. He gave me the most formally correct salute I had ever received, stamped his feet as if at a court martial and marched off, clearly in a very bad temper. I gave up at this stage and took a financial loss on the booklets.

My studies for the end-of-year university examination were proceeding well despite the novelty of my domestic life. Since my eyes were being strained somewhat, I took to wearing glasses when reading between my flying duties. At first I made sure that I was not seen doing this, but after a while I became careless. One day I emerged from the Drogue Flight offices, still wearing glasses and happened to run into a Flight Commander. He expressed surprise and concern about the state of my eyesight and asked me to report to the Medical Section immediately. I told him that my eyes were perfectly sound, but for close reading spectacles were helpful although not essential. I did have a medical soon after this, but as my memory remained better than my eyesight, I had no problem.

I was acquiring an increasing and probably excessive respect for what I called ‘logical arguments’; propositions had to be justified by reason when possible and faith was an indulgence required only by weaker intellects. I believed along with Karl Marx that religion was ‘the opiate of the people’. Except for his unconvincing chapter on dialectical materialism, I was much impressed by John Strachey’s book *The Theory and Practice of Socialism*. Strachey became a cabinet minister in the post-war Labour Government, but the Cold War had not yet begun. I built up a small library of left-wing books that were anti-religion and anti-capitalism. I became interested in the philosophy of communism and grew convinced that the ‘lying’ capitalist press were deliberately distorting the facts about the USSR—the reader should remember the times. A long failure of the free market had given way to a world war and it was also pleasing that the Soviets had joined the Allies against Hitler—not that Stalin had much choice in the matter.

When I decided not to continue under the false religious colours of Methodism, I found that the rules for changing religion had been set out



in King's Regulations. It was necessary to consult the two chaplains of the religions involved and to obtain their written permission for the change. This was then to be presented to the Station CO, who would decide on the matter. In my case there was a problem; a chaplain could be found to represent Methodism but obviously not one to represent atheism.

'How can we contact the devil?' as one of my friends put it. When I approached the one chaplain concerned, he asked me if I had read any of the many books supporting religious faith. I mentioned the Bible, but he said that the word of God required interpretations usually too subtle for laymen. So he lumbered me with six substantial books written by scholarly clerics, which set out to explain the Christian religion. He advised me to come again when I had read these works and discuss any points I could not understand or even disagreed with. Until I had done this, he would not consider releasing me from my religious obligations.

During the next month I read the books and made notes of what I considered to be the various jumps in logical reasoning, the hidden assumptions, special pleadings and so on. Some of the authors adopted child-like reasoning, falling back on faith when stuck, others had sophisticated, philosophical arguments that were usually tautological, being based on initial assumptions that to be valid required the truth of the conclusions. I had read the standard works of atheists or agnostics like Thomas Paine, Anatole France, Charles Bradlaugh, Llewelyn Powys and Joseph McCabe, reprinted in the *Thinker's Library*, so was able to contrast the style of reasoning adopted on each side of the theological argument. I returned to the chaplain with my notes and an armful of books. After half an hour of argument, I could see that his religion was basically a matter of faith; logical reasoning was merely a thin pie crust covering a soufflé of optimism and dogma. I said that since I had read his religious books which I now returned, he should read some of my rationalist books. I offered them to him.

He took a cursory look and said 'No thank you'. I said that he had a closed mind: he looked to heaven, held his tongue and signed the paper giving me permission for a change of religion, then showed me to the door. The CO had no interest in the matter and freed me from Methodism without comment.

When Kendrick Smithyman read an early draft of this book, he commented:

When you wanted to change from a 'religion' to 'atheism,' you realize the problem created? The matter of 'loss of faith' is only incidental, and the red tape issues were shoved off on to the chaplains in the hope that if they bumbled along enough, the problem would go away. Something like this. As an atheist you can be

called on to Church Parade (because it is a parade), but you can't be forced to attend a service, nor can you be dismissed (until the services which constitute the parade are dismissed). You can be put on e.g. cookhouse duties and thereby excused Parade, but if every time people go to church you are sent to the cookhouse, you can scream *Victimization*; and if you are simply left on the parade ground when the various religious groups march off to their services and have to stay there until they are eventually dismissed, you may again scream *Victimization*—the one thing that got the Air Force upper echelons into a real flap. Moreover, the NCO in charge of parade has to remain on parade with you, and to be there to dismiss you. But most worrying was not that you might be Excused Parade without being assigned duties except at risk to the assigner—you had legally been excused to do nothing, which would be very bad for morale, especially for those who were being compelled to go through a compulsory exercise of conscience (the phrasing is from the chaplain at Whenuapai, who refused to take church parades). But worse—once you were, say, changed from a religion to 'atheist', you could not be required to swear an oath of loyalty of the kind which impressed the mighty. Was, say, a declaration of loyalty analogous to a declaration made in a civil or criminal court? Swearing carries sanctions as a Bible oath, which no way pertain to declaring, and we were sworn on the Bible (or should have been) when attested. You see what a security risk suddenly emerged?

When in early November I had to sit my university examinations in Pure and Applied Mathematics, the Air Force granted me leave for the purpose and I travelled to Auckland for a brief return to the life I had given up two years before. I had worked conscientiously through the recommended books and had no trouble with the papers. The results were published two months later; I had good passes in both subjects despite not having attended any lectures. In order to qualify for a B.Sc. degree, I needed just one more unit, to make a total of eight. But this was not required of me, since servicemen, I learnt some months later, were being allowed to take their degrees with fewer than the complete number of units, each case being considered on its own merits. I was invited to apply for a B.Sc. immediately. The University of New Zealand adopted a generous attitude to servicemen, for which I remain grateful.

In December the CO distributed a notice requesting all those pilots who wished to be trained for active service in the Pacific Area to notify him immediately. I feared that as drogue pilot I would be denied the chance, but I applied anyway. I had no particular feelings of guilt over leaving Betty; married pilots were being killed every day in Europe. I assumed

that of the 30 or more pilots at Woodbourne, most would have opted for active service and that there would have been strong competition for the overseas postings. Thus I was very pleased to learn that I was to be trained as a fighter pilot, commencing in January—my drogue towing days were nearly over. Much later I was surprised to learn from Bernie Hoskin who was at Woodbourne at the same time as myself, that W/C Tancred had told him that only *three* pilots had volunteered for active service: myself, Bernie and one other.

At this stage there was no prospect of my going to Britain; the Pacific War was an obvious priority for New Zealand. The American Navy and Air Force provided a shield for Australasia against the Japanese and, with the help of Australian and New Zealand Forces, were steadily capturing the islands to the north, which had been overrun by the Japanese two years earlier. The RNZAF had been equipped with American aircraft and was sending Fighter Wings to the Solomon Islands to operate under US command.

## Becoming a Fighter Pilot

After a short refresher course on Harvards, followed by two weeks leave, I arrived at No 2 FOTU, Ohakea on 25th January, 1944. The station was located near the Rangitikei River, some 20 miles from Palmerston North in the North Island. The town nearest to the airfield lies on the other side of the river and is called Bulls; this is where Betty and I found accommodation in a small hotel. The Air Force provided regular transport to the Station, across the long bridge spanning the river.

According to my flying log-book, my first flight from Ohakea was a check dual in a Harvard with F/Lt Douglas St George, who had been a flight commander at Ashburton during my six months there as an instructor. He knew about my university aspirations and once at Ashburton he teased me about book learning, implying that it was no match for experience. Many years later, when he had risen to the highest rank in the RNZAF, I sent him my congratulations from Oxford and reminded him of the pragmatic philosophy he had held 30 years before. I was pleased that his reply rejected such a restricted view—his teasing was more a challenge than a statement of principle he maintained, perhaps with a little hindsight. Even flying an aeroplane can be learnt from a book, for in a sense this is what happens when one prepares to go solo in a fighter aircraft, which has only one seat. No dual instruction is possible, but the first time one opens the throttle for take-off is very exciting, with the uncertainty about how the aircraft will respond to the controls, how much rudder will be needed to keep its



Kittyhawks of No 14 Fighter Squadron over NZ.

take-off path straight and how quickly it will climb. No amount of reading manuals can fully convey the sensations experienced.

The Kittyhawk, also known as a P40, was a single-seat fighter and fighter-bomber manufactured by the Curtiss-Wright Corporation. This low-wing monoplane was widely used by the Americans in the Pacific and by the British in North Africa. Our version was powered by a liquid-cooled Allison engine capable of developing 1350 h.p. that drove a three-bladed, electrically controlled airscrew. The pitch of the propeller was variable, the finest being used for take-off and landing; otherwise it was adjusted so as to keep the airscrew rotating at about 2600 r.p.m. The normal cruising speed was 180 knots (207 m.p.h.) and the maximum speed in level flight at 11 000 feet was 328 knots (377 m.p.h.). There were three, self-sealing fuel tanks, two in the wings and one in the fuselage, and an auxiliary, disposable fuel tank could also be carried under the fuselage.

My first solo in a Kittyhawk was on 26th January, 1944. Half a century later, it is hard to recall feelings other than my excitement that I was at last flying a combat aircraft. The climbing speed was impressive, but the cockpit felt cramped and the tail trim on the left was slightly awkward to turn. The impression of speed, although very slow by today's fighter standards, was exhilarating.

The conversion course to Kittyhawks lasted five weeks and involved 41 hours of flying. The sort of exercises that I and others on the same course were required to perform included formation flying in pairs and in fours. In pairs, the usual formation placed the two aircraft line abreast, less than a wing span apart with the pair leader slightly in front, while fours consisted of two pairs and were termed a section. The section pairs usually flew on parallel courses, typically 200 yards apart and abreast of each other.

For identification, the four aircraft were numbered one to four, one being the section leader, number two his wing-man, number three led the other pair and number four was number three's wing-man. Numbers two and four would be stationed on the outside of the formation and sometimes the pairs would close up, bringing the four aircraft within a wing span of each other and sometimes much closer. Unless one was the section leader, it took a lot of concentration to hold station in the formation accurately, especially in the closed-up configuration.

Weaving was defensive formation flying, in which the pairs started well apart. Numbers one and three turned towards each other, with their wing-men keeping close and the pairs would then cross over at an angle of about 90 degrees and start to turn back, first recovering parallel flight and then turning towards each other again to cross over as before. In this manoeuvre numbers two and four had to slip underneath their respective leaders in order to stay in their stations outside the formation. There were two objectives. First, if an enemy aircraft were to attack either pair and end up on their tails, the other pair would soon be in position to attack the enemy, or to chase him off. The other advantage of weaving was that, because the cruising speed of fighter aircraft was somewhat higher than that of bombers, this pattern of flying reduced the speed of the fighter formation relative to the ground, thus enabling fighters flying several thousand feet above a bomber formation to provide top cover for the bombers and yet remain in the same position relative to them.

Another important exercise was termed an oxygen climb. Above about 15 000 feet the atmospheric pressure is sufficiently reduced to require pilots to wear their oxygen masks. One could fly without oxygen for some minutes at this altitude without noticing any change, but after a while the lack of oxygen starts to produce effects on the pilot similar to an intake of alcohol. Confidence increases and the danger of fainting through oxygen lack may not be appreciated. We were advised to look at our finger nails, since these would turn blue when the lack of oxygen was becoming serious. In the oxygen climb, we were required to put on masks at about 10 000 feet and to continue climbing as far as possible above 30 000 feet for the experience, both of using the oxygen equipment and discovering how altitude changes the flying characteristics of the P40.

An exercise that proved to be particularly relevant to my active service flying in the Pacific, was a cross-country flight lasting 2 hours and 40 minutes, a long time for a fighter plane to be airborne. It was achieved with the aid of a 'belly tank', hanging under the fuselage, between the landing wheels, which carried the additional petrol required for long flights.

By the end of February my training was completed—I had now flown a total of 120 hours dual and 753 hours solo, very little of which was relevant to active combat. I had a week's leave, after which I was to join No 16 Fighter Squadron and fly north to Guadalcanal in the Solomon Islands.

## Leaving New Zealand

Marriage made me more responsible, in some respects at least. Betty was soon pregnant, hence reckless flying was in my youthful past with two now dependent on me. I made no conscious change but found less reason for taking risks. It was one thing to fool about in a Tiger Moth but a very different thing to do the same in a Kittyhawk. We decided that during my service overseas Betty should live in Auckland, I believing that my parents would care for her during her pregnancy; but this was not to be. For a reason I never discovered, when Betty appeared at my parents' home in Auckland a few days before I joined her on my final leave, Mother said that Betty was not welcome at this time and would have to go elsewhere. Her explanation was that one of my aunties was coming to stay with her and therefore there was no room, but then just as Betty was leaving the house, Mother offered to let her sleep on the sofa as a last resort. This was not accepted and this shabby treatment of my wife at a stressful time led to several years of estrangement between my parents and me. Rudolf came to the rescue, arranging for her to live with his family in Milford on Auckland's North Shore.

During my week's leave in Auckland, I visited Auckland University College to enrol as an extramural student. I was allowed to undertake studies for a Masters degree in Mathematics, although my B.Sc. had not yet been awarded. At that time an M.Sc. in Mathematics did not involve a supervised dissertation and so could be pursued without my attending the University. The syllabus contained both pure and applied mathematics and was examined in six three-hour papers.

I did not expect to do particularly well in my M.Sc. examination; first-class honours while on active service in the Tropics seemed an unlikely outcome. Second- or even third-class honours would be creditable. If I were to achieve my ambition of obtaining a good teaching post in a secondary school after the War, I reasoned that a university degree in the Arts would be helpful. Three degrees were better than two, I believed. My excursions into theology, undertaken to strengthen my opposition to formal religion, had given me an interest in philosophy, so I decided to start a B.A. degree with a view to majoring in this subject after the War. I called on Professor Anderson, the Professor of Philosophy at AUC, who was encouraging. The course 'Philosophy I' seemed very appropriate, being comprised of two topics of interest to me, namely Logic and Ethics. How two such disparate subjects became coupled into one unit I cannot imagine. But Logic suited my mathematical outlook and, as I earnestly explained to the Professor, Ethics would help me to be a better parent when my expected child arrived! If this naive view of the relation between knowledge and behaviour amused him, he kept a straight face and did not reveal it.

My big adventure started on 7th March, 1944. The members of No 16 Fighter Squadron were required to fly their P40s from Whenuapai, an airfield near Auckland, to Guadalcanal, which is about 2000 miles Nor'-nor'-west of Auckland. Five flights were required: Whenuapai—Waipapakauri (Northland, NZ)—Norfolk Island—Tontouta (New Caledonia)—Espiritu Santos—Guadalcanal (Honiara Island in the Solomon Group) (see map on p 99). The flying time was 13 hours and 20 minutes and was spread out over five days; belly-tanks were fitted to the aircraft to extend their range to over a thousand miles. Since this was before the days of the jet engine and numerous international airlines, to us it seemed to be a very rapid transit into the Tropics. It did not occur to me that flying a single-engined aircraft over hundreds of miles of empty ocean was at all dangerous; fortunately I had complete trust in the Allison engine and no experience of how rapidly the weather could change in the Tropics.

Norfolk Island was the first foreign country which I had ever visited, so I found it very interesting. From the air it looked enchanting, a roughly circular island about ten miles across, edged with steep cliffs and set in a blue ocean. Although closer to New Zealand, it was under Australian administration and had been so since the previous century, when it had been used as an annexe to the prisons in Sydney. It also had connections with the *Bounty* mutineers, some of whose descendants had moved there from Pitcairn some time after its prison role had ended. I remember the groves of orange trees, the soft balmy air and the attractive, dark-skinned people walking about in the evenings. It appeared to be a paradise, isolated from the troubles of the world.

The next day, after another long flight we arrived at a genuinely foreign country, New Caledonia, which, although a French territory, was largely occupied by American troops. We were given leave to travel south to visit the capital city, Nouméa. We walked about, looked in the shops and some of us tried out our New Zealand version of the French language. At one stage I noticed a long line of men, all members of various armed services and most of them Americans, queued up outside an apartment building.

'What are you queuing for?' I asked a New Zealander in the line. My question surprised him.

'That is a brothel,' he answered, 'but I'm not here for sex. When I get near the entrance, I shall sell my place in the queue to an American for \$20 or \$30.' Free enterprise takes many forms!

We decided to go to an Officers' Club which was guarded by American soldiers, but we were made welcome. There was one difficulty; one member of our party was a sergeant pilot and not eligible to enter this club, but we were not prepared to leave him outside. F/O Pat Bull found the solution. He removed one of his shoulder badges of rank from his jacket—this was on an easily removed loop—and gave it to the sergeant who slipped it on in place of his own badge. We had noted on which side of the entrance the

guards were standing and ensured that the officers' badges were worn on the side visible to them. We then entered as a group, returning the guards' salute with appreciation. I had not tasted insipid American beer until then, and while I enjoyed quenching my thirst in the hot, humid climate, the taste of real beer was missed.

Our next stop was Espiritu Santos which lay 500 miles due north at 15 degrees south latitude. We had no opportunity to explore the island, but relaxed on a dazzling white beach, swimming naked in the warm tropical sea. The final leg of our flight took us to Guadalcanal where we joined No 16 Fighter Squadron. The Japanese forces had occupied the Solomon Islands and had been either removed or outflanked by the Americans more than a year before. Guadalcanal had been the location of a famous battle between the American Marines and the occupying Japanese Army; it now served as a base for the Allied Forces. We remained here for two weeks, flying most days, practising formation flying, bombing and strafing.

During this period I made friends with most of the 28 members of the Squadron, which consisted of 12 commissioned pilots, three flight sergeants and 13 sergeant-pilots. Rank made little difference while on active service. The Commanding Officer was S/L A G Sievers, whom I found to be an engaging, gregarious man—a good leader who could be stern at times. The Flight Commanders were F/Lt Merv Jones and F/Lt Alan Mitchell, who were both pleasant, good-natured men. Merv was the better disciplined and took over command of the Squadron on its next tour of duty, while Alan was more fun at parties; he had a reputation for bucking authority and later got himself into severe trouble on a night flying prank back in Auckland. While flying low parallel to a busy road for amusement, he had switched on his powerful landing light and dazzled drivers coming in the opposite direction!

Among the Flying Officers were Keith Starnes, Pat Bull, Freddie Tucker and myself. Freddie was a well built man, against whom I had played rugby some years before when he was in the Mount Albert Grammar School First XV and I was in the Technical College First XV. He was an dominant, intelligent man with whom I frequently argued. Pat Bull was a quiet, humorous farmer's son, who used to tell us tales about shooting wild pigs in the King Country, a mountainous region of the North Island south of Lake Taupo. Keith was a fine, reserved man whom I shall return to later. There were two Pilot Officers—Ernie Laurie and Bill Newfield; I once overheard the latter telling an American that his name was *Pilot Officer* Newfield—a small conceit which gave me some amusement. Some months later Newfield was forced to land his Kittyhawk in the middle of the Firth of Thames, a large shallow bay near Auckland, and the newspaper photograph of him standing on the tail unit of his just submerged plane with no land in sight was comic and somehow appropriate.



Like me, Ernie Laurie had been to Seddon Memorial Technical College, so sometimes we talked about that establishment and its teachers. Amongst the other Squadron members the one I found most interesting was Peter Freyberg, who was a studious man with a knowledge of religion and philosophy, subjects that we sometimes debated in the evenings over our drinks. Many years later Peter became a professor of philosophy at the University of Waikato.

The use of fighter aircraft for bombing may seem strange, but because of Allied successes in December and January in destroying many Japanese aircraft in the air and on the ground, RNZAF fighters were not now required for air-to-air combat. The last meeting in aerial combat between New Zealanders and the Japanese occurred on 19th February, 1944, five weeks before my first operational flight. No doubt the Japanese fighters were still occasionally airborne, but not in adequate enough numbers to engage in combat. We had to keep a good lookout and there were times when I imagined that I saw enemy planes on the distant horizon. The main use of fighter aircraft after this date was to bomb the Japanese airstrips so as to prevent, or at least impede, their use by such aircraft as remained available to the enemy. There was a competition between the rate at which the Japanese could repair the strips—usually at night—and the rate at which the Allies could destroy them again by bombing. Strafing ground targets was another way of harassing the enemy, still remaining trapped in the Solomons and the many islands of the Bismarck Archipelago. Our stay in Guadalcanal had acclimatized us to flying in tropical conditions, and now we were ready to join the shooting war which for us was only two hours' flying to the north-west.

# Chapter 5

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## On Active Service

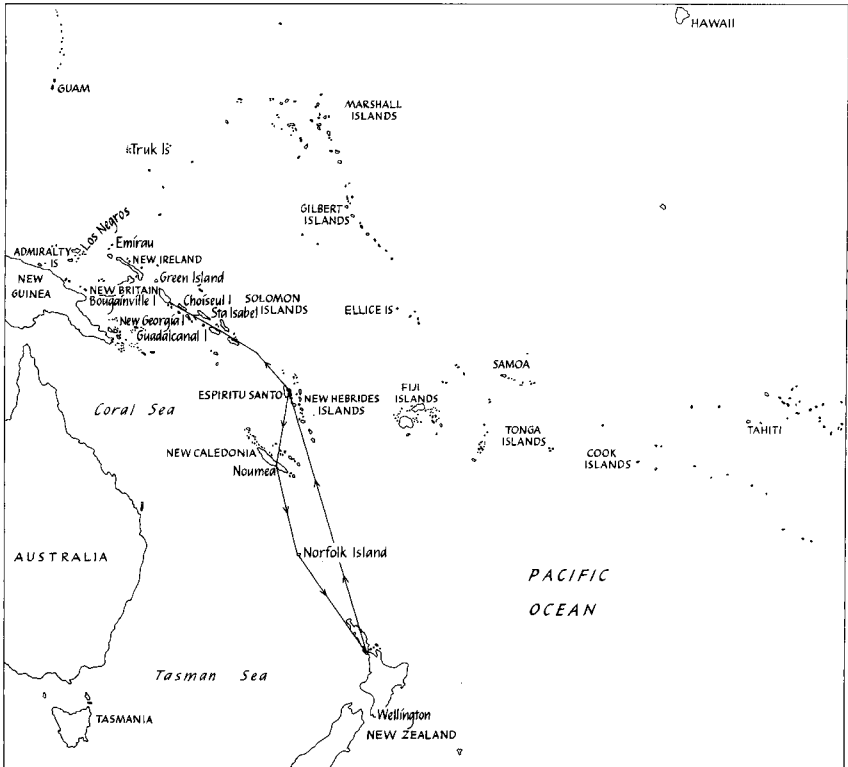
### Bougainville Island

On 26th March, 1944 we flew 400 miles to an American base on the south-west side of Bougainville, the largest island in the Solomon Group (see page 105). There were three airstrips—‘Torokina’ was 100 yards from the coast and named after a nearby cape, while ‘Piva 1’ and ‘Piva 2’ were about two miles inland. The Americans had wrestled a short, three mile wide coastal strip of land from the Japanese the previous November. Our camp was a comfortable distance from the perimeter, which was defended by American soldiers. This was to be ‘home’ for the next seven weeks. The rest of the island was occupied by the Japanese, who had been cut off by the American Forces and who now survived as best as they could, growing vegetables and catching fish. Torokina was only six degrees south of the equator, so it was hot and humid. It was a mostly a flat, jungle-covered belt, which would become rather swampy during the wet weather.

Bougainville Island is about 140 miles long and 40 miles wide, and when I saw it over 50 years ago it was covered by a dense tropical forest. Along its centre runs a mountain range 4000 to 5000 feet high, where in the afternoons towering cumulus clouds would usually develop, covering the mountains and sometimes enveloping the coastal lowlands. Heavy tropical showers would regularly occur in the late afternoons. These at least provided a welcome relief from the heavy, humid atmosphere, which would become more oppressive from midday onwards; early mornings would be relatively cool and pleasant. Because of the weather most of the flying sorties were scheduled to start just after dawn.

The Japanese had some heavy guns at various positions in the foothills of the central mountains and at dawn they would frequently shell Torokina airstrip but with little success. However this made take-offs more exciting than usual—one didn’t want to loiter too long! The biggest danger came from the airstrip itself, which offered only two possible directions for take-

off and landing. If there was a strong crosswind there was a chance of an accident, especially on landing, for in order to fly parallel to the strip the aircraft has to be heading at a small angle to it. Then the wheels are not exactly aligned with the relative motion over the ground and touching down would tend to topple the aircraft. Just before the wheels contact the surface it is necessary to kick on the downwind rudder to turn the aircraft parallel to the landing strip, but not all pilots were sufficiently experienced to do this, so there were frequent accidents.



Map 4: Southwest Pacific—the operational area of the RNZAF.

Accommodation was provided for the officers in a row of tents erected on a high hill, where cooling breezes made living more comfortable. Two men were allocated to each tent unless their seniority allowed them solo occupation. We slept on camp stretchers with bedding consisting of sheets, a pillow and one blanket. Mosquito netting was suspended from the tent structure and hung down over our beds, and on retiring it was important to tuck the netting very carefully underneath the bottom sheet all the way round the bed. The smallest gap would mean a restless night as one would

lie there listening to the mosquitoes buzz near one's head, wondering if the unpleasant creatures were outside or *inside* the netting.

The Officers' Mess was nearby and a typical breakfast for those times would be porridge, eggs and fruit, the eggs always being scrambled since they were reconstituted from egg powder. We also had to consume an array of pills—atabrine to suppress malaria, salt to compensate for losses through perspiration and other vitamin tablets. For other meals the commonest form of meat was Spam, which could be disguised by imaginative cooks in a variety of ways, although the taste remained constant. Lime juice was always available and reputed to have a calming effect on sexual desire, so some avoided it. I gave it up after discovering another use it had. One day I went to the kitchen, seeking a cold drink out of normal hours. I remarked to the cook who served me how clean and white his concrete floors were, and he showed me how this was achieved. The powder to which water was added to make the lime juice we drank at table was the secret; at double strength it made an excellent cleaning agent, stripping the floors of dirt and grease very quickly.

The latrines, usually termed the 'heads', were like large, fly-proof safes. A wooden structure capable of sitting eight or more 'customers' in a back-to-back arrangement was installed over a deep hole and the whole lot enclosed in wire gauze fixed to a wooden frame. The heads were usually placed on high ground to allow the passage of a continuous flow of fresh air, and the occupants could be seen sitting back-to-back, reading or struggling with their motions, from quite some distance away. Communal lavatories soon become a normal way of life, although thoughts of spiders and snakes tended to spoil their appreciation. Senior officers had their own private head of course.

My first operational sortie occurred on 28th March, 1944, and required two flights, the first of which took us to Green Island, an atoll to the north of Bougainville and some 140 miles from Torokina (see map on p 109). Six weeks earlier American Marines and New Zealand troops had landed on this flat, coral island and constructed an airstrip on it and we now needed to land there in order to refuel for the next stage of our journey.

Our mission was to bomb a place called 'Rataval' on New Ireland and then to return directly to Torokina. At Green Island each Kittyhawk was loaded with a one thousand pound bomb. We used the fighters as dive-bombers, aiming at the target in a long dive from several thousand feet and releasing our bombs at a height of a thousand feet or so. After delivering my bomb, I pulled up into a steep climb in an effort to avoid being hit by flak from anti-aircraft batteries near the target and I then watched other squadron members going through the same manoeuvre, seeing black puffs following them closely as they climbed up to safety. I expect I also had my share from the Japanese batteries, but, since it wasn't possible to see the bursts behind me, I was not too concerned.

With all bombs away, we returned in open formation to base. The round trip from Green Island to the target and then back to Torokina took two and half hours. I cannot remember if on that first occasion my bomb was seen to hit the target or not. The success rate was not very high. After landing our first duty was to report to the Intelligence Officer to give him an account of what we had seen and experienced.

My next two operational flights are entered in my flying log-book as a dawn patrol and a dusk patrol, which involved flying in the neighbourhood of Torokina, keeping a watch for submarines when over the sea and looking out for signs of Japanese troops when flying over the hills a few miles in from the coast. The next flight is described as 'T U Cover', which was the boring task of protecting a shipping convoy that was proceeding slowly along the Bougainville Coast. Two and a half hours of flying up and down, sitting in a hot cockpit several thousand feet above a fleet of slowly moving ships was certainly the worst of the operational duties one could be assigned.

On 2nd April, 1944 I had my first mission to the strongest enemy base in the south-west Pacific, which was to dive-bomb targets in Rabaul City at the end of New Britain Island. It was well protected by ack-ack machine-guns, so the dive down was always exciting. We stayed high above danger until our turn arrived and then turned down to our target and dived at speed—the faster the better so that we were not easy targets. Upon releasing our bombs we pulled up into a steep turn to escape to safety. I was to be 23 times over this dangerous city before the end of my flying duties; several New Zealand pilots were shot down and killed in its vicinity.

On one of my early Rabaul missions I made a careless mistake that almost terminated my career. In my rush to get into my plane at Torokina, I forgot to collect my oxygen mask. I was flying Number 2 to the CO, Alan Sievers, and to avoid incurring his wrath by a delay to get my mask, I decided to ignore the omission and proceed without it. I was encouraged by the fact that at the briefing our maximum height was to be no more than 15 000 feet and that not for long—I knew that I could manage this height without oxygen for perhaps half an hour. Normally one was expected to use oxygen above 12–13 thousand feet. However, I had not counted on Alan deciding to fly *over* some towering cumulus clouds on the way to Rabaul. My anxiety increased as he climbed up to 16 000 feet and then still higher. I kept looking at my finger nails, which were turning decidedly blue. At 17 000 feet I thought that the game was up and that I would have to admit my carelessness and dive away to a safe height. But my confidence soon returned and, although I felt a little dizzy, I felt happy with the situation. My formation flying became erratic and Alan kept ordering me to keep up with him. Then, thank goodness, he began the long descent towards the target, down and down between the black clouds and I soon recovered. I remained quiet about this.

Many of us were prone to attacks of heat rash. Flying gave some relief from the itching, especially if we could climb high into the colder air. We usually wore only cotton underpants under our tropical-weight flying suits. Sitting and sweating for long hours on a hard parachute often caused a rash on one's bottom. Rubbing the skin with methylated spirits was the recommended method of toughening it.

A regular tour of duty was planned to last for six weeks. A typical day involved about three and a half hours flying in the morning, usually on a bombing mission, and then relaxation during the afternoons. Most pilots slept part of the afternoon; the flying made one tired and the humid heat was very soporific. I found it difficult to keep awake after lunch, but I had my university studies to pursue, so with some effort I forced myself to begin studying and after about half an hour or so, my interest in the work became sufficient to overcome the drowsiness. I generally managed two or three hours study each day in this fashion except when the occasional afternoon mission was required. One irritating problem was that perspiration made one's arms damp so that notepaper would stick to them. The usual afternoon weather of breezes and heavy showers was eagerly awaited.

Before dinner we generally gathered for drinks in the Commanding Officer's tent—Alan Sievers had a cabinet in which our own bottles of spirits were stored. We scratched our names on the labels and made sure that we poured drinks from our own bottles, unless of course, invited to use someone else's. After dinner on special evenings Sievers would invite us to join him in his tent for a party. A shortage of suitable glasses posed a problem, so we often had to use the large enamel mugs that we had been issued for drinking tea and water. The CO had an oil lamp in his tent, but it was inadequate to enable us to estimate the depth of the whisky or gin poured into the mugs. I tended to be slightly more generous than necessary, which meant that each single drink was equivalent to several normal measures. I learnt my lesson on one wild evening after which I found the taste of whisky quite repulsive for many months.

On the evening of my disgrace I became more and more confident and noisy. Standing became increasingly difficult, although I was not alone in this state. One of the last things I later remembered was one of the party discovering a large snake outside the tent and deciding to throw it in amongst us, which caused a furore until someone killed it with his sheath knife. The next day I was informed that about an hour after that I had been taken to my bed and deposited there, unconscious. However, before this it appears that I had spent some time telling Sievers in a very loud voice how *I* would run the Squadron were I its CO.

When I awoke next day, I wished I hadn't. During the night I had been more than just ill, and had rolled about, pulling the mosquito netting down and around me into a ghastly shroud. The airman who tidied our tent each morning, came in, looked at me and immediately disappeared. No one was

about. I staggered down to the showers. It was late in the morning, but I was still inebriated and then remembered that I had been due to fly a sortie. I was in trouble!

Sievers was very forgiving when I saw him later that morning. When I said that I would undertake an extra mission the next day, he replied that I would certainly *not* be flying the next day. He grounded me for two days to enable me to recover from the severe alcoholic poisoning I had suffered. I had eaten no breakfast, so that by lunch-time, although still with a severe hangover, I was quite hungry. I enjoyed eating lunch, but that is as far as it went, so I was even hungrier at dinner-time. I took the precaution of visiting the Medical Officer, who said I was suffering from an acidic stomach and gave me an alkaline liquid to drink so that I could eat a meal. Others told me about the impertinent ‘advice’ I had given the CO, but he never commented on it.



A swimming pool on Bougainville Island.

I don't want to give the impression that the disgraceful behaviour I have just described was typical of an evening after flying. Usually we just had one or two beers and spent our time talking about our interests, families or beliefs. Sometimes there would be visiting comedians accompanied by female singers to distract us; Bob Hope came once and remarked of his trip across the Pacific that he had ‘never passed so much water in his life’.

One day my friend Ernie Laurie decided to visit an American Fighter Squadron, based close to us, which flew Corsairs at that time—our own

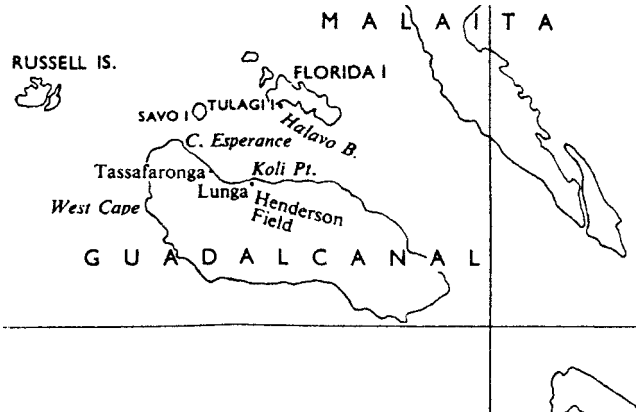
experience with these aircraft was yet to come. Laurie was a reckless young man and thought he would steal a march on the rest of the Squadron by being the first to fly a Corsair. He persuaded the Commanding Officer of the American Squadron to let him try a circuit and landing. Of course he should have asked S/L Sievers permission to do this and, had he done so, there is no doubt that it would have been refused. It appears that with the minimum of ground instruction, Laurie was permitted to take off. On landing he badly misjudged the approach, overshot the strip and splashed into a shallow lagoon; he suffered a severe head injury and died. His body was recovered and two or three days later the Squadron attended his funeral in a hilltop cemetery. We stood in formal ranks in the blazing sun and listened to a chaplain's prayers for him, before his shrouded corpse was wheeled by on a cart to his grave. There was no coffin and the head wrapping was stained with blood. I felt faint in the oppressive heat, finding it difficult not to weep. The image of poor Laurie being taken to his final resting place has remained an indelible memory.

## Operations

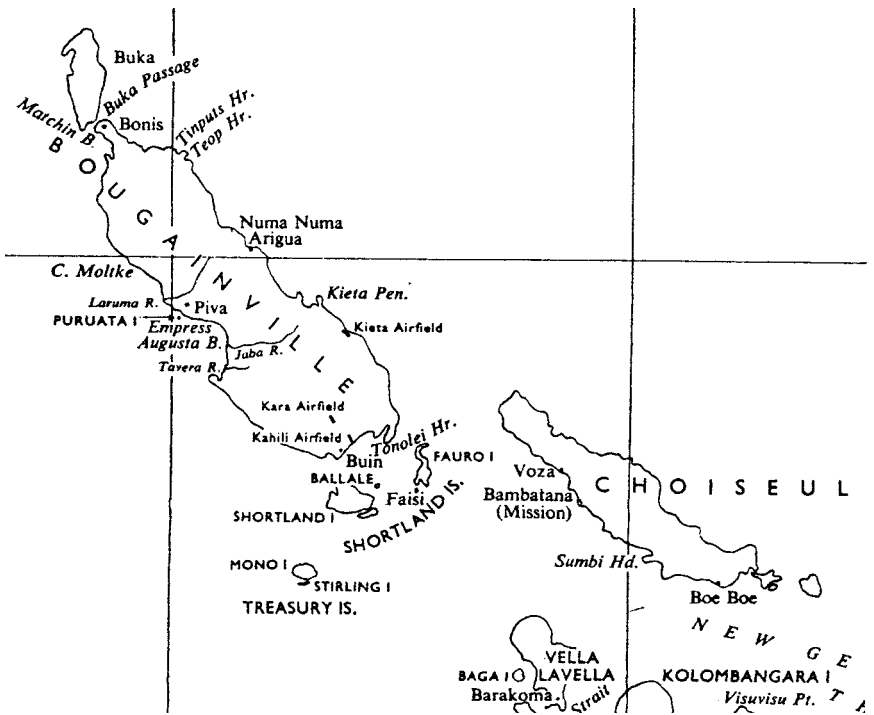
I should mention here the heavy jungle packs that we carried strapped to our backs when flying on a mission. These contained a variety of items to help a pilot to survive, should he be forced down into the jungle or the sea. Included were a machete for hacking through the jungle, a knife, a syringe containing morphine, various other medications, a fishing line, a torch, a whistle, shark-repellent dye and some waterproof matches. The rubber dingy pack was strapped further down and formed the cushion on which we sat. We were also issued with a water bottle and a 38 calibre revolver with holster. We had official practice at using this weapon on a firing range and informal practice—aiming at bottles—in the jungle, the theory being that if we crashed into the jungle in a region occupied by the Japanese, we should be able to defend ourselves against capture, but this seemed like a forlorn hope to me. Surviving a *crash* into a thick forest was itself rather improbable, let alone beating off an attack by a ground patrol. However, the weapon gave us some sense of security, except when—as happened twice in my experience—a pilot got so drunk as to start shooting at light bulbs and other inviting targets.

We were briefed on how to behave if we were captured by the Japanese and enjoined to treat the advice as strictly secret. We were told that we should *not* adhere to the Geneva convention for prisoners and volunteer only our rank, name and number. In order to stay alive it was better to talk freely, but only about matters of no military significance, for example about how we had been educated in NZ, about our families, what we did during holidays, etc, etc. This might then encourage the Japanese





Map 5: Guadalcanal Island.



Map 6: Bougainville and neighbouring islands.

soldiers to send us away from the front lines to be interrogated further by more civilized samurai, who were not so prone to decapitating their prisoners.

The bombing missions that I carried out over the following six weeks often had airstrips or buildings in Rabaul as the principal targets. At that time, the Americans had not troubled to capture New Britain but simply bypassed it, pressing further north through the chain of Pacific islands. Some of these islands were captured from the Japanese for use as bases, whilst others were passed by like New Britain. Of course the real target was Japan itself; 'mopping up' the stranded Japanese Forces could be dealt with later or assigned to the Australian and New Zealand Forces.

There was some criticism of the fact that America did not share the front line of the War against the Japanese with its Pacific Allies, but the enemy on New Britain was a long way from defeat. At the time when I was dropping bombs on Rabaul, they were capable of getting their fighters occasionally airborne and certainly able to shoot down planes with their ground batteries, which they managed often enough to make us cautious when flying over their territory. The routine of flying first to Green Island and being refuelled and armed with a bomb before proceeding on to Rabaul to drop it was repeated many times. The flight to Green Island took about an hour and the bombing flight just over another two hours, so that, together with the refuelling stop, the operation would usually occupy the whole morning.

One particular episode, which could have become a nightmare, is worth relating. I was asked to patrol alone several miles inland from the Torokina perimeter to try to discover the location of some heavy guns that the Japanese were intermittently using to shell our base, but there was little expectation that I would be successful due to the thickness of the concealing jungle. I flew inland well past the perimeter, keeping quite low just above the trees, searching for any sign of the enemy. As I flew up and down, first in one valley then in the next, I lost sight of the coastline. Then quite suddenly, coming over a ridge, I spotted a number of soldiers, some tents and vehicles under the trees. I flew even lower in order to avoid possible anti-aircraft fire and turned to make a strafing run back across the camp. I turned on my gunsights, armed my machine-guns and held my finger ready on the trigger at the end of the control column. Very fortunately I hesitated, puzzled by the openness of the camp. As I flew back over the soldiers, I could see them waving to me and as I pulled up to a thousand feet or so, I was shocked to see the coastline much closer than I had expected. Of course many pilots have fallen into the trap of mistaking friends for foes. I remained silent about my near disaster.

Sometimes Green Island, which was less than eight miles across, was very difficult to find. After taking off from Torokina, low cloud could



Green Island, a base for RNZAF fighter and bomber squadrons.

often form rapidly enough to completely obscure the atoll, making landing hazardous, in which case the mission would be aborted and we would be recalled back to base. If cloud also descended over the airstrip at Torokina, we would have a struggle to return safely. Several pilots lost their lives in this trap.

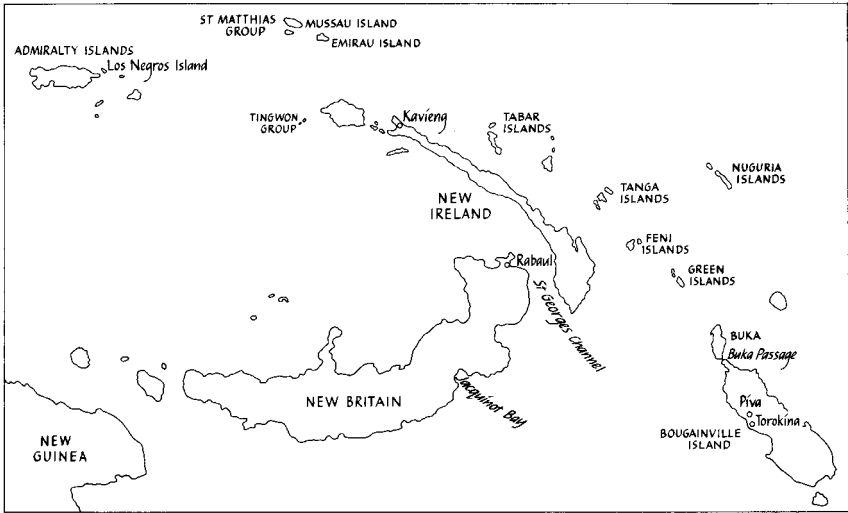
My most exciting flight occurred from Green Island, although cloud was not the problem. I was flying as No 2 to the Squadron Leader when we took off one day to fly to Rabaul. Something went wrong with the electrical system on my plane, so that just after take off I found that Alan Siever's voice was very faint over the radio transmission. I was still trying to catch him up to assume my correct station for formation flying and he was apparently complaining about my slowness in doing that. I replied that I was doing my best on nearly full throttle but I doubt if he heard me. I couldn't understand why my Kittyhawk was not easily overtaking his plane, but when I finally managed to fly alongside, he pointed to the ear pieces in his helmet, indicating that he could not hear me. Despite having the throttle wide open, I was slowly falling back. I looked at the instrument panel and got a shock. The propeller was still running at fine pitch as if for take-off and the engine temperature was beyond its maximum value for safe operation. The pitch of the propeller was controlled electrically, hence I evidently had a serious electrical fault and would have to return to

Green Island. I waved goodbye to the Squadron Leader, hoping he would understand my predicament. He continued to lead the Squadron on the bombing raid, while I turned back to the island alone.

By this time I was well over the sea, about 15 miles from the landing strip and at a height of about 10 000 feet. The engine was close to failing completely, so I throttled back and made my descent in what could be described as a power-assisted glide. The distance was too far to glide all the way, so it was fortunate that the hot engine was still delivering some power to the propellers. Of course I could have ditched close to the shore, but that would have been a last resort. I had three problems—firstly the undercarriage and flaps were normally operated electrically, so now they would have to be pumped down by an emergency hand pump, which would be a relatively slow business; secondly, I had to make a landing approach on to a very busy runway without being able to warn the officers in the control tower of my situation; thirdly, if I misjudged the approach, there would not be enough engine power for a second attempt. I must not lower the wheels *too* soon for that would have greatly increased my angle of descent and put the airstrip out of reach.

When I judged that I could reach the runway with my undercarriage down and no engine power, I throttled right back and started pumping; it seemed to take an age. The wheels finally clicked into their locked-down position when I was only 300 yards or so from the end of the runway and still far too high. I started urgently to pump down the flaps. Then the control tower showed signs of anxiety by firing a red flare at me. This meant ‘Open throttle and go round again’ or more likely ‘What the hell are you doing landing without permission!’. When I flashed past the tower, which was midway along the strip, I was about ten feet from the ground and still pumping down the flaps.

I could not wait to land normally by stalling onto the strip so I pushed the control column forward and flew onto it. Then I gingerly applied the brakes, trying to get maximum braking, short of nosing over. At the end of the runway ahead of me there was a dense grove of palm trees that would certainly solve the braking problem! I reached the end of the coral strip at a speed of about 60 miles an hour, where the strip gave way to a relatively narrow service road, at an angle of about 45 degrees. I took the turn, the outer wheel lifting momentarily from the ground. Airmen were working on planes parked just off the service road and out of the corner of my eye I saw them scattering out of my path. I shot along the road, narrowly avoiding the parked aircraft and finally managed to stop just short of some palms. A fire-engine and ambulance soon appeared as I sat still for a minute or two, recovering my composure. Then I left the Kittyhawk to the attention of the RNZAF ground crew and went off to report to the officer in charge of the control tower.



Map 7: The main islands the RNZAF operated over in 1944-45.

After lunch I returned to the service road to see if the ground staff had been able to solve the mystery of the failed electrical system. They had and furthermore they said that the aircraft was now ready for me to fly back to Torokina. I was not so sure.

‘But surely the engine needs a complete overhaul after running for so long at well above its normal operating temperature?’ I ventured.

‘It is running perfectly now,’ I was assured. So still uncertain I took off and flew back to base where I gave the Intelligence Officer an account of the incident.

My friend Bernie Hoskin had had a much more exciting adventure two months earlier. He was in No 18 Fighter Squadron, which was providing top cover for a squadron of American dive-bombers. Close to Rabaul where enemy fighters were expected to appear, it was expedient for the Squadron to drop their long-range belly tanks, but Bernie had great difficulty in releasing his. He had to ‘skid’ his Kittyhawk quite violently to dislodge the tank, and this damaged the petrol-carrying pipes so much that he soon lost all of his petrol save that in his reserve tank. However this was not enough to enable him to return to safety and he had to bail out about 40 miles short of Green Island. The canopy refused to be jettisoned and his Mae West, parachute, rubber dingy pack, jungle pack, water bottle and revolver encumbered him so much that it was very difficult to squeeze out past the stuck canopy to dive overboard. A little later when in the water his parachute with its maze of shroud lines fell on top of him and trapped him like a giant jellyfish, forcing him to dive down and swim underwater

to escape from it. An American rescue boat reached him two hours later and took him to Green Island.

In the evenings we had a number of possible entertainments, with open-air cinemas operated by the Americans, occasional visiting parties of actors and singers from the USA, the usual drinking parties and sometimes serious discussions on politics and philosophy. I did not hesitate to press my views on religion on those who would listen and we had many an argument often heightened by alcoholic enthusiasm. One evening the CO asked me over to talk to him. He said that he had heard of my atheistic views and that I was to stop trying to convert members of the Squadron to my point of view. He was a Roman Catholic, but I don't think that he was deeply religious—anyway, he was virtually giving me an order to stop talking about religion. His reasoning was that some of the pilots I was upsetting with my ideas would not survive this tour of duty; they were near the ends of their lives and it was not the time to disturb their religious faiths. I accepted his argument and remained silent on the topic after that. In fact, from then on my proselytizing days were over.

I learnt to drive a jeep while on active service since it was simply a matter of stepping into one, experimenting with the gears and then driving off. I then graduated to the 'flat-tops' that were used to transport pilots between the barracks and the airstrip. These were lorries with bench seats along each side capable of seating a dozen or more men. One of the pilots would commandeer the driver's seat and the rest of the flight would sit in the back. I remember the first time I managed to win the driver's seat; I hadn't mastered the double-declutching required by the gear boxes of those days—we were climbing up a hill and I attempted to change gears. I took so long that the flat-top began to move backwards down a narrow high-cambered road, so I applied the brake. There was some good natured comment from my passengers.

'How long have you been driving?' one of them asked.

He did not expect my reply. 'This is my first time,' I exaggerated slightly.

'Hell, get out of that seat before you kill us all!' he shouted.

Mail came from New Zealand once or twice a week with usually two or three long letters from Betty, giving the progress of her pregnancy and relating stories about her employment. She had found a job as a secretary in the office of the Rationalist Association and would describe some of the eccentrics who occasionally came into her office. It appears that militant atheism attracts its share of strange people, not unlike some of the fanatical forms of the Christian religion.

As an officer I had to censor letters written by airmen to their wives or sweethearts, being required to obliterate references to places, squadron movements, equipment and so on—anything that in our judgement would have been helpful to the enemy. It was not a job I enjoyed and, given the

state of the Pacific War at that time, it was in my view a complete waste of time. One airman requested his wife to spend some time looking at the floor before he got home, since, when that happened, she would not be seeing it for some time!

## A Second Tour of Duty

At the end of the six weeks' tour I flew a Kittyhawk back to Auckland, reversing the sequence of flights I have described earlier. I had now accumulated 71 hours flying on operations against the Japanese and was due for three weeks' leave, which I spent with my wife in Rudolf's family house at Milford. Her pregnancy was proceeding normally and in three months' time I could expect to be a father. Unfortunately it seemed that when this was due to happen, I would be overseas on my second tour of duty with No 16 Fighter Squadron.

The expected addition to my family prompted me into an action that I considered very sensible at the time but which in recent years I have come to regret. I remembered the bullying I had suffered as a small schoolboy, exacerbated by my name 'Woodhead', which had lent itself to cruel jibes. I had learnt to fight back, but why should my offspring have to start life with such a handicap? There were enough natural hazards in this world without the addition of artificial ones, so the name had to go. But had I not been estranged from my parents at the time, I doubt if it would have occurred to me to make a change let alone carry it through. But I now considered myself entirely free of filial loyalty—there was no way I believed that there could be any further contact between my parents and myself. I was now thinking of the next generation. I decided that the simplest change was to 'cut off my head', but since 'Wood' sounded incomplete, I settled for 'Woods'. Kendrick Smithyman happened to be at Ardmore, so I asked his advice on a suitable lawyer to draw up the deed poll. He recommended Dr Martyn Finlay (who later became a Labour party MP), so on 28th June, 1944 we went to see Martyn in his Auckland office where the deed was done with Kendrick as the witness. The fee was half a crown for which Martyn offered to toss, double or quits—I won. We then proceeded to the private bar of the Occidental to seal the crime. When Father heard about this much later, he was very hurt, considering that I had done it to punish him; there may have been an element of truth in this.

During my leave, I made several visits to Auckland University College, working in the library, reading books on advanced mathematics and philosophy for the examinations I expected to take at the end of the year. There was some uncertainty since the Air Force would have to agree with the timing of my stay in Auckland to sit the examinations. I did not realize then that I could have requested for these to be held wherever I happened to be overseas.

When I rejoined the Squadron, Mervyn Jones had become the Squadron Leader and Keith Starnes one of the flight commanders. Mervyn proved to be as good a commander as his predecessor, although perhaps less formal, but just as tolerant of my foibles. The principal of these was my growing interest in reading and studying. With the end of the War faintly looming—Europe had just been invaded and the Germans were retreating on two fronts, I was beginning to think of my civilian future, but I was also genuinely interested in the subjects I was studying.

After three weeks training in New Zealand, we were transported to Espiritu Santos to become familiar with a new American fighter known as a 'Corsair' or an 'F4U'. The Corsair was a first-class Navy fighter plane, originally designed to be used from aircraft carriers. It was powered by a radial liquid-cooled engine, capable of delivering 2000 h.p. to a four-bladed airscrew over 13 feet in diameter. This gave it a cruising speed of 182 m.p.h. and a maximum speed at about 20 000 feet of 417 m.p.h.; in fact, it was the first American aircraft capable of exceeding 400 m.p.h. With water injection at full throttle the engine delivered 2250 h.p. It had gull-shaped wings that could be folded to allow the plane to be stored conveniently below deck. Since the RNZAF Corsairs were to fly only from airfields, the wing-folding controls were securely wired off and the landing wheels could be lowered independently of the tail wheel, a choice known as the 'dive brake' mode. In this configuration the plane could be dived towards a ground target at a nearly constant speed, rather less than the maximum that would otherwise be obtained. This gave the pilot



Corsairs over the Guadalcanal coast.



a steady platform from which to launch bombs, but on the other hand it would become an easier target for ground batteries to hit. The model of the F4U we flew had six machine-guns firing half-inch diameter bullets.

I had my first solo in a Corsair on 20th July and was impressed with the performance and comfort of this powerful aircraft. While the Kittyhawk had a cramped cockpit, in the Corsair there was ample space under the canopy. It could climb at about 3000 feet a minute and was noticeably faster than the Kittyhawk. After a few hours' flying experience at Espiritu Santos, the Squadron was transported up to Guadalcanal for two weeks training on F4Us, prior to returning to active service at Torokina. This included night flying from an airstrip at Guadalcanal called Henderson Field.

I experienced an accident while night flying, although I had not even left the ground. Close to the airstrip at Henderson Field were a number of shallow ditches, perhaps eight feet deep and with banks that sloped gently downwards. At night these hazards and the safe taxiing routes were distinguished by lights of various colours, and of course pilots were supposed to be familiar with the convention adopted. Because I had flown from the airstrip many times during the daytime, I was confident that I knew exactly where the ditches lay relative to the path I had to take to reach the take-off point at the end of the strip, but in fact I got lost in the dark. I was taxiing slowly along confused by the ground lights when suddenly I felt the plane lurch to one side so I immediately applied the brakes. The plane was now at a dangerous angle and I realized that I was poised on the edge of a ditch. Another foot or so and I would have toppled in, doing considerable damage to the Corsair let alone my standing with the Commanding Officer. The brakes were applied through pedals fixed to the rudder controls and I had to press hard against them with both feet—any relaxation and the plane would move forward down the ditch and my carelessness would be revealed. I was in this frozen state for some minutes, hoping for someone to come by and rescue me; my legs were getting tired, but no one came. Why wasn't I missed on the circuit? Surely they would be looking for me by now? I had decided to switch off the engine, which was still ticking over, release the brakes and accept the consequences when I heard the welcome voice of an airman.

'Hold on another minute or two,' he shouted, 'and I will bring a tractor to pull you out.' When this rescue had been completed, I thanked him and he made me even more grateful by saying that there was no need for him to report the matter.

After two weeks at Guadalcanal, practising night flying, fours formation and bombing, No 16 Fighter Squadron was moved up to Torokina to commence another six week tour of operational flying. For me this was almost like returning home, although we were now billeted in a different camp

from that of my first tour. While the Squadron had their tents in a group, we were part of an American command and therefore ate our meals with American officers, used American currency in their canteens and learnt to enjoy Coca Cola and peanut butter sandwiches. I was rather surprised to see how brusquely the Americans treated their black countrymen who served us at table in the mess. The black waiters were often cursed for being slow and it seemed to me that as a result they moved even more slowly. I always treated them with respect and imagined that I received preferential service as a result, although this was not my objective.

My tent was quite large; I shared it with Keith Starnes, Freddie Tucker and Dave Maclean. It had no table so I volunteered to find one. I went scrounging around the camp, but could find only timber planks. An airman found me some tools and nails, so I spent the afternoon making a large trestle-table, with built-in benches for seats. It was a very solid, over-designed structure that two of us could scarcely manage to carry into the tent. Covered with a blanket, it made an excellent base for most of our activities—writing letters, playing cards, my university studies, serving drinks and so on. I was very proud of this piece of rude carpentry. It lacked some ornaments to add style or act as paper weights when the afternoon breeze stirred. The other occupants found attractive smooth stones for this purpose, but I did rather better. In the jungle not far from our camp I found a skull, which I believed to be that of a Japanese soldier. It was fairly clean, the insects having had many months to tidy it up, so I washed it and when the others were absent, placed it in pride of place on the centre of the table. They did not object, so it became our mascot, a macabre reminder of why we were risking our lives on the Island.

Bottles of spirits could be purchased by officers at the rate of one or two a month at a cost of less than \$2 each. It was forbidden to sell them, but American servicemen would pay up to \$25 or more for a bottle as they had good wages and few opportunities to spend. Unfortunately they were sometimes sold a more lethal form of alcohol by a cartel of enterprising New Zealand airmen. To explain this I need to describe first a feature of the F4U engine. In order to reduce the maximum cylinder pressure when operating the engine at full throttle—as one might have to do in an emergency—water would be injected into the engine. This would only happen when the throttle was opened past a gate near the end of its travel, but at high altitude the water was likely to freeze. To overcome this ethyl alcohol was therefore mixed with the water, which meant that the stores were required to hold substantial quantities of this liquid, kept in 44 gallon drums. One stolen drum diluted with water would be sufficient to make at least 500 bottles of highly sellable, bogus ‘gin’. I never saw the finished product, but was told that the syndicate involved even manufactured very professional looking labels to glue onto the bottles. Whether or not any of these purveyors of hooch were ever caught I do not know.

## Section Leader

Since I was now an experienced fighter pilot, S/L Jones gave me a section of four planes to lead. The sections were distinguished by colours; we were Yellow Section, not a choice of colour I would have made myself. Over the R/T I was referred to as 'Yellow 1'. My sub-section leader, Flight Sergeant Ken Rogers, was 'Yellow 3'. He was a mixture of unctuous charm and ill-concealed aggression. He didn't like me. He had a 'chip' on his shoulder, probably because he was angry at not being a commissioned pilot. It was an unsatisfactory system and not my fault, as I explained to him somewhat unnecessarily. But he still spent a lot of energy goading me.

On 13th August Yellow Section were on 'scramble alert', which meant that we were sitting in our flying suits in the flight offices, ready for action should we be called. Our aircraft were nearby and their engines could be started at a moment's notice. Usually nothing happened, but on this day we were scrambled; a submarine had been detected off Cape Esperance, which was a point on Bougainville Island, just south of Torokina. We ran to our Corsairs, our engines were started and we taxied out in some excitement. We were not the only aircraft hunting for the invader; some Americans had been alerted and other aircraft, including a flying boat already airborne, had also been directed to search the Cape Esperance area.

A few minutes later we were over the search area and no other aircraft were visible. We flew at about 2000 feet in a loose formation up and down, studying the sea. I had never seen a submarine before, so was not quite sure what appearance it would have. But if it were near the surface, I expected to see a long, streamlined grey cylinder, moving rapidly enough to leave a wake. Yellow 3 spotted it first.

'I think I can see it!' he called over the R/T. Then I saw what he meant—a blue torpedo-shaped object, moving slowly towards the distant shore.

'Yellow Section, prepare to attack the submarine,' I ordered. 'Line astern, then follow me down.' It was a stirring moment. I armed my machine-guns, turned on my gun-sights and flew on a course to take me parallel to the motion of the submarine. I started my dive and held the enemy vessel in my sights, finger ready over the trigger at the top of the control column. Success would surely mean the award of a DFC (Distinguished Flying Cross) and I was about to justify this decoration when the object in my sights made a surprisingly flexible turn and spouted a jet of water. The darn thing had transformed itself into a whale! What a disappointment, but I was glad that I hadn't pressed the trigger.

I wisely avoided mentioning the word *whale* on the R/T. The first announcement had been heard by several other aircraft operating on the same R/T frequency and I could hear echoes of my premature triumph during the ten minutes it took us to return quietly to Torokina. Excited American

voices kept the R/T busy: 'Just where is the submarine?' 'The submarine has been sighted and is being attacked!' 'Has it been sunk?' 'I believe so... ', and so on. I didn't want to disappoint them, or to appear foolish. Perhaps there *was* a submarine off Cape Esperance, so let them get on with finding it, I thought. I remained silent. It was possible that the whale had been the cause of the blip on the radar screens that had generated the scramble. Yellow 3 insisted on telling the Intelligence Officer that I had tried to 'sink a whale'.

There was one other scramble alert for my section, but we found nothing. Much of our operational flying on this tour involved finding and strafing Japanese on our 'own' island. Torokina extended over only a few of the 300 miles or so of Bougainville's coast. Despite being cut off from supplies, the enemy were able to survive in concealed camps just in from the coast by fishing and gardening. A 'Bougainville Patrol' required us to fly low around the coast, looking for signs of habitation. When we saw Japanese working in their gardens, we would circle around and dive down, strafing them or more likely the jungle into which they quickly disappeared. I suppose we killed a few, but our main role was to unsettle them to keep them 'neutralized'. This was not a form of warfare that appealed to me. It is true that there were some anti-aircraft guns here and there and that some pilots were shot down, but if I were fired at, my plane was never hit. One member of the Squadron took macabre enjoyment in describing how he had come across 20 or 30 Japanese swimming off a point. They were unable to escape across the coral reef quickly enough and were strafed in the water with our hero circling round and round, making repeated strafing runs until the sea was red with their blood and all the swimmers were still.

It was unusual for the Japanese to shell Torokina at night, but I once experienced this frightening event. The shells started coming over at about nine o'clock, whistling past us before we heard them exploding nearby. We scrambled into our foxholes and spent an uncomfortable hour or two waiting for the attack to stop. It is not the shells that can be *heard* that matter—they have already passed the listener—but the thought that there *could* be a shell speeding silently towards your foxhole. This small experience of being shelled made me appreciate how terrible it must have been for the soldiers in the trenches in the First World War.

One operation that I shall never forget involved a coordinated effort between our squadron and a squadron of American bombers. The plan was to bomb a coastal region of New Britain known as Wide Bay, lying to the south of Rabaul. We were to make a low level attack 30 minutes after the Americans had dropped their larger bombs from 15 000 to 20 000 feet. On the day there was a lot of cloud cover, which included stratus at about 8000 feet. We were crossing the Bay on time and moving towards our targets, flying below the cloud, when suddenly we were surprised to see bombs exploding on the water surface below us. Then we saw that they

were falling through the clouds dangerously close to us. The Americans were late and had assumed from their navigational reckoning that they were over their targets, which were invisible to them, so they were happily releasing their bombs regardless of the time and of our presence below. As far as I could see, not a single American bomb fell on the land—ours did.

One member of our Squadron started experiencing engine trouble shortly after taking off on a mission. This happened several times in succession, yet the ground staff were unable to find anything wrong with his engine. He was eventually grounded and returned to NZ with 'LMF' (lack of moral fibre) stamped on his papers, which was a cruel description for a breakdown in morale. Except for this man, I never met any NZ pilot who appeared to show any concern for the dangers of operational flying. One was somehow confident, perhaps overconfident, that while others might be killed, oneself would not. Logic had nothing to do with it; all that seemed to matter was one's own skill as a pilot.

I have not yet mentioned the several pilots in my Squadron who died, either through being shot down or more likely through accidents. When this happened, I would feel a strange mixture of sadness and relief that it hadn't happened to me. After a death we did not go into mourning—if anything, the evening party after dinner would be even more boisterous than normal. Our true feelings were left unspoken and the only counselling available came out of a bottle.

I remember one friend whose F4U's undercarriage had been damaged by enemy bullets. When he touched down, his Corsair flipped over on to its back and skidded to a stop along the coral landing strip. He was still alive, but had made one instinctively natural mistake during the crash. His canopy was open—the correct position for landing—and as the plane tumbled, to steady himself he put his hand up beyond the top edge of the instrument panel with his fingers just outside the fuselage surface. His wrist was thus in the position that the front edge of the sliding canopy occupied when closed, so that when the Corsair suddenly decelerated, the canopy's inertia carried it forward into its closed position with sufficient force to slice off his hand. I visited him in hospital a few days later; an operation had tidied up the stump of his forearm, which was now immersed in a bucket of ice, but he was more cheerful than I expected. There was an American negro in the next bed, he explained, who was in a much worse state. This man had become paralytic by drinking an alcohol-based cleaning fluid. He had been lying on a road when he was run over by a truck and had his pelvis smashed. I felt a little guilty at the relief I felt leaving my friend, but at least his war was over.

The only time that I saw any use being made of the jungle survival packs that we wore when flying on operations occurred on an airstrip when I was on scramble alert. I heard a rifle shot and an agonized shout, and ran out to find an airman lying on the ground with his hand a bloody mess. Other

pilots then arrived and I left to get medical help. The ambulance took a long time to arrive. The airman's pain was very intense, so I suggested that we should open a survival pack and use its morphine syringe to relieve his distress. The first of us to reach a pack and return with the morphine injected the airman who shortly afterward seemed calmer. I later learnt that the man, who had been on guard duty with a rifle, had climbed up on to a wheel of a large aircraft to see something more clearly in the distance. To assist his return to the ground he had used his rifle as a staff, holding his hand over the end of the barrel. Bumping the rifle butt on the ground was trying fate beyond reason.

Keith Starnes was a charming, slightly reserved man, rather different in temperament from me. He drank very little and seldom got embroiled in arguments, but he had a wry humour that appealed to me and I admired him. Dave McLean and Dave Ellison were two of the pilots in his flight. On 18th September Keith and I each took off for Green Island with our sections of four planes. We were on our usual mission, namely to collect bombs, refuel and bomb Rabaul. The weather was poor and after we landed on the atoll, it got worse, so the sortie to Rabaul was cancelled and we were ordered to return to Torokina. Keith's section took off first; we followed a few minutes later, flying under thick cloud with flashes of lightning here and there; the rain squalls became more and more frequent. The journey normally took about an hour. When we were about 15 minutes away from Torokina, flying parallel to the Bougainville coast, we were forced to fly closer and closer to the sea to keep below the cloud. It was raining over the land with very poor visibility, when I received an R/T message ordering me to return to Green Island. We turned round and flew back into clearer skies, but Keith was not so fortunate. Not long before we were turned around, I thought I heard him complaining to base that he was flying into rain, with very little visibility. Only one member of his section survived. Keith and the two Davids hit the water and were lost. I was so upset by this tragedy that I recorded their deaths in my flying log-book—although several other friends died, I made no similar entries. I expect Keith's death was so much more unexpected than most of the others as he was such a careful and able pilot. I occasionally still think of him over half a century later.

## On Leave

Sometime early in September I received an exciting letter from Betty—on the first of the month she had given birth to a daughter and both were well. For this event she had returned to her home town of Ashburton for her mother's help. We had already decided on the name we would give to the baby were it a girl; she was to be registered as *Coral Anne Woods*. The

name Coral appealed to me perhaps because of the coral reefs and islands that I flew over most days. Also the landing strips were usually made of crushed coral. Some strips were covered with a heavy metal lattice, known as Marsden matting, which prompted one of my congratulating friends to suggest that had the baby been a boy we would have named him 'Marsden'! When I mentioned the baby's weight as being eight and a half pounds, another friend, with an interest in fishing, said 'Well, you got your bait back then!'.

The Squadron returned to New Zealand on 22nd September, this journey being especially exciting for me since I now had a daughter to see and love. Betty and our baby were still in Ashburton, so on arriving in Auckland I was impatient to set off for the South Island, but first I had to have a routine medical check—all pilots had these every six months or so.

It seemed to me that it was only a matter of time before the Pacific War would be won, another year at the most, and with my new family to take care of, I began to think it wouldn't be too irresponsible of me to try to delay going on another active service tour in the Islands. Three tours of duty were considered to be the norm and I was only one short. In any case I had applied for permission to remain in Auckland for an extra month to sit my M.Sc. examinations in November, so perhaps I need not go overseas again? I've always been good at rationalizing my hopes and desires. Then an honourable method of avoiding a third tour was presented to me. I was due for a medical check-up, so all I had to do was to take the eyesight test honestly and not to use memory as a crutch as I had always done in the past. My eyesight was not really bad, but the studying I had done in the Islands had certainly affected it. The case seemed logical as well as ethical.

The medical corporal conducting the eyesight examination was eager to talk to me about the war in the Pacific and told me he wished he could have been a fighter pilot. He hung the eyesight chart on the end wall of a corridor and told me where to stand. As I expected, I failed easily with the bottom line since the letters were really blurred. I managed two or three letters on the next line, but it was a poor showing. I had clearly failed. The corporal was as disappointed as I appeared to be. He asked me if I had been doing a lot of reading lately, so I told him about my university studies.

He thought for a moment and then said, 'You should really fail the eyesight test, but I have to admit that the lighting in this corridor is not as good as it should be and also your studies will have temporarily affected your sight. So I am going to stretch a point and pass you.' He beamed with pleasure at being so helpful. I mumbled my thanks and said I was looking forward to another tour of operational flying.

Leave was granted and I took the Air Force transport down to Christchurch. The RNZAF provided transport for servicemen by using bombers modified to seat passengers along each side of the fuselage; we sat on our

parachutes facing each other. From Christchurch I travelled by train to Ashburton with mounting excitement. It was marvellous to hold my new daughter in my arms and the three weeks that followed were very happy. My father-in-law, Jim Bayley, was a straightforward, kind and gentle man, devoted to his garden and with a talent for making parsnip wine; I quickly developed one for drinking it. My mother-in-law was more of a challenge, being inflated with knowledge about rearing children despite having managed it only once 25 years before. Her advice dominated the situation and I had no choice but to accept her interference; my time would come, however.

I had written to the Officer in charge of postings at the RNZAF headquarters in Wellington about my November examination and was given an appointment to see him at the end of my leave. When I met him, he said that I could transfer from No 16 Fighter Squadron to No 17 Fighter Squadron, which would delay my third tour long enough for me to take my university examinations in Auckland. But he then added something that both pleased and unsettled me. This was that I had been due to be made a Flight Commander in No 16 Fighter Squadron with consequent promotion to Flight Lieutenant. He invited me to consider this offer, which was still open. I was very tempted to forget the M.Sc. and take the responsibility and promotion, but eventual progress in civilian life, although less exciting, was more important. I decided to transfer to No 17 Fighter Squadron and remain a Flying Officer, a decision that quite possibly saved my life as I shall explain shortly.

The Air Force gave me a month of special exam leave after which I had two weeks loitering around in the aircrew pool at Hobsonville before joining No 17 Fighter Squadron on 26th November. This then involved training at Ardmore, a well established base built by the Americans earlier in the War but never used by them. The RNZAF had acquired it for training the last of the P40 squadrons and then the F4U squadrons.

I was not pleased with my performance in the examinations, but, considering that I had attended no lectures and that the degree really required full-time study, I would have happily settled for a pass. The results were not available for some months; I passed Philosophy I and in the M.Sc. I was initially awarded the satisfactory grade of third-class honours, but, through Mr Segedin's intervention and the generous attitude adopted to servicemen, this was raised to second-class honours. With this result I could evidently not expect to have a career as a professional mathematician, but at least I now had adequate qualifications for a teaching post in mathematics.

A pleasant event at this time was being invited by Rudolf to be the Best Man at his wedding to a lively redhead named Pat, whom he had met at a dance and a romance then flourished. She was only 17 and there was something of a tussle with her parents over Rudolf's marriage proposal, but as he was a man of outstanding ability and character, I suppose in the end



this became clear to Pat's parents. Rudolf's father was still being detained on Somes Island as an 'enemy alien' and here was I in the King's uniform proposing a toast at Rudolf's marriage.

For my B.A. degree programme, I decided to study Philosophy II, Economics I and Political Science I, subjects which reflected my interests in politics and religion. This occupied much of my spare time during my third tour of duty in the Pacific. The possibility that there might be a chance of my returning to the engineering studies I had started four years previously never occurred to me. With a second class M.Sc. and a modest B.A., I should have no trouble getting a job in a good secondary school I thought. I would have liked to have aimed higher, but I could see no avenue ahead, and anyway it seemed that the War still had at least another year to run. Germany was continuing to hold out against the Allies, although its ultimate defeat now seemed inevitable. I received much of my news about the progress of the War from the NZ Communist weekly newspaper, *The People's Voice*. The slowness of the Allies' advance through France and the Low Countries meant that the brave Soviet forces would be further weakened by the Nazis, which naturally suited the 'wicked' capitalist countries. Incidentally, it should be remembered that at that time the Soviets were Allies of the western countries, so the 'red' newspaper that came regularly with my mail excited no comment.

## Green Island

The Commanding Officer of No 17 Fighter Squadron, S/L Boyd Le Pine, was very different from the two experienced COs that I had served under in No 16 Squadron. He belonged to the pre-war or permanent Air Force and had come straight from an administrative post in Wellington. He lacked experience as a fighter pilot on operations, but now near the end of the War he was about to remedy this, a wise move for a successful post-war career in the Air Force. This shortcoming was partially compensated for by his having two good Flight Commanders, F/Lt Roy Mansill and F/Lt Tony Pierard; Roy was the only one I liked, which was fortunate since I was in his flight. He had the double advantage of being confident and not conceited, while Tony's cockiness was bolstered by his having been 'mentioned in despatches'. Boyd may have found my university background, which I did not conceal, something of a challenge, or he might have found my operational flying experience irritating. Whatever it was, he was cool and officious towards me and I avoided off-duty contact with any of them. It was not going to be a happy tour.

We arrived at Guadalcanal on New Year's Day, 1945 and commenced our two weeks of acclimatization training. On one occasion my section followed Pierard's on to the bombing range, but, instead of returning to

base with the rest of his section, Pierard waited to keep a watch on my performance. Without any discussion either with me or my flight commander, he reported directly to Le Pine that my bombs had fallen wide of their target. I had no way of disputing this, although it surprised me. It was quite hard for a pilot to see where his own bombs fell since at the moment of release he had to turn away sharply to avoid flak. Other members of my section had thought that my bombing was reasonably accurate. Of course one could always do better. Le Pine ordered me to report to him and asserted that I was not performing my duties satisfactorily. He mentioned the bombing and added that I had also been discourteous to him by ignoring a standing invitation to drinks before dinner. It seemed to him that I preferred the company of the sergeant pilots in the Squadron to that of the senior officers—he was not wrong on this point. I controlled my temper and responded only to direct questions since I thought that he was trying to goad me into a serious indiscretion. I managed to calm him with more than the requisite number of ‘Sirs’ and my final sarcastic salute came straight out of the manual.

What might have happened if I had become a flight commander in No 16 Squadron? I would certainly have been happier unless I had been caught up in what became the biggest disaster to hit the NZ fighter squadrons.

I have earlier mentioned Frank Keefe and his fate in Simpson Harbour. This happened on 15th January, the day when Le Pine was trying my patience. Frank, who was in No 14 Fighter Squadron, was hit by ack-ack while bombing a target near Rabaul, but unfortunately, being over Simpson Harbour, he ended up in the water in the centre of a Japanese stronghold. While he was struggling to swim out to a safe position for the rescue flying boat, he was being machine-gunned from the shore and but for the presence of Corsairs of Nos 14 and 16 Fighter Squadrons, a Japanese boat would have quickly reached him. The planes protected him all day long, returning to Green Island in turn to refuel. After nine hours of this effort to rescue Frank, it appeared that he became too exhausted to continue the struggle. The nature of his death at the hands of the Japanese is uncertain, but the official post-war investigation accepted the Japanese account that he died of a festering wound.

On the final return to Green Island there were 15 Corsairs from the two squadrons; it was dark and to compound the danger they ran into a tropical front with heavy rain and intense lightning. The cloud base was not much above sea level, so finding Green Island, let alone getting the planes down onto the strip, was not going to be easy. Two flights of four, the leading one from No 14 Squadron and the other from No 16 Squadron, took a route down into the murk that was perilously close to the water. It appears that during a turn Nos 1 and 2 of the leading flight collided and hit the water, while No 3 may have been looking back to see what had happened when he flipped over and crashed. Only

No 4 of the leading flight survived. The leader of the flight from No 16 Squadron and his No 2 also hit the sea. Of the other seven planes two more were lost: one from No 16 Squadron flew into trees on the island, while a member of No 14 Squadron disappeared in heavy rain while on the landing circuit. Seven brave pilots were lost trying to save the life of one.

The American 'PX' stores contained a remarkable range of items, many of which were rationed to civilians: clothing of all kinds, blankets, splendid towels, fast food, soft drinks, silver chains for identification tabs, cigarettes by the carton, books, writing materials and so on. These were the fore-runners of the modern supermarket. Whenever I was near one of these fascinating cornucopia, I was always tempted to spend some dollars, finding white towels particularly attractive. On each return to New Zealand, my kit would be stuffed with PX treasures such as towels and cigarettes for friends.

On one occasion I was asked by an airman on Guadalcanal to purchase some silver chains from the PX Store on Green Island. They would cost me just a few cents each he said, but he would give me \$2.50 each for them, as he needed them for his 'Perspex ornament' trade. Some airmen came into the RNZAF with craftsman skills, while many others learnt skills in the Force. During their spare time some would turn these talents into money by manufacturing artifacts, an activity known as 'making foreigners'. These were usually sold to the overpaid Americans. A favourite object was a polished, heart-shaped brooch made from Perspex and inscribed with the word *MOTHER* in silver, and the requested chains were required to turn the brooches into pendants. When I got to the store on Green Island, I asked for 50 chains, but was told that there was a limit of ten chains per officer. There were several of us in the party, so I separately asked each of my friends to purchase ten chains, telling them I would even pay twice what it cost them. It was a profitable outing all in all.

About the middle of January, the Squadron moved from Torokina to a camp on Green Island. The Americans had vacated this atoll to move their operations closer to Japan and it had been turned over to the New Zealand Forces. Our task now was to ensure that the Japanese, who were still in strength at Rabaul, remained trapped on the ground. Most of the sorties were described as Rabaul patrols, but this included both bombing their take-off strips and machine-gunning any transport moving around or outside the city. We also attacked specified buildings and any troops careless enough to venture out into the open in daylight hours. These offensives were not without danger since the Japanese anti-aircraft batteries were still active and occasionally managed to shoot down a Corsair. Some of the trucks were also decoys and carried anti-aircraft guns, so we were warned to be careful and not to attack them unless confident that they were genuine transport vehicles.

I recall on one occasion when I was off duty being dismayed to learn that one of our Squadron had been shot down. The inexperienced CO had led a flight on a Rabaul patrol and foolishly decided to attack some trucks, which then fired back. The information about our loss had been transmitted by radio from a pilot still over Rabaul, but we did not know at this stage exactly *who* had been shot down. A little later we discovered that it was either the CO or his No 2, who was a popular member of the Squadron. Some of those to whom I mentioned the uncertainty said that given that one or the other had 'bought it', they hoped that it was not No 2. Sadly, alas it was.

The light-weight flying suits issued to us had to be washed frequently, as often on landing we would be saturated with perspiration and, if left unwashed, the suits would soon become objectionable to anyone within an arm's length. Mine had served two tours, had been washed dozens of times and looked ready to fall apart. Had I fallen into the jungle, it would have been quickly torn to shreds by the undergrowth, so I went to the stores with it and asked for a replacement. The airman serving behind the counter replied that only the Equipment Officer could authorize this change. When he was called, this officer examined my suit and then disagreed that it needed replacing. It was still quite tough and had a lot more wear in it, he claimed. I had set my heart on a new one, so this advice from someone who would never find himself in the jungle made me angry; taking the suit from him, in a storm of temper, I ripped it to shreds. I passed it back and said through clenched teeth, '**This bloody suit must be replaced!**'. He agreed immediately.

Another important piece of equipment was a heavy sheath knife, which would have been invaluable for anyone unfortunate enough to crash in the jungle and fortunate enough to survive. I used mine for a range of practical tasks, the most important of which was to open tins. Beer was more often available in cans than in bottles, but the problem in tropical temperatures was how to get the beer out of its container without losing most of it in a jet of foam. With a bottle one could reduce its temperature by standing it in water, then ease the cap up just enough to break the seal and let it fizz for a few minutes. The cans presented a more difficult challenge. Unlike today's version they had no tabs to pull, so to drink from a can two spaced holes in the top were required, but the problem was that having punctured one hole with the point of the sheath knife, much of the amber fluid would escape in a jet before the other hole could be made. With practice, I developed enough accuracy and speed to minimize the loss—the can would be placed on the floor and held between my feet with the knife held ready above the top of the can. The two necessary jabs had to be powerful, accurate and very fast. After the second, the knife would be dropped, the can seized and then brought smartly to my mouth. Inevitably a little beer would hit my face, but such losses were acceptable, at least with the first few cans.

After each sortie, we would report details of the attack to the Intelligence Officer. If we had been bombing, although we could not be sure where our own bombs had fallen, we could usually give some indication of what had happened to other pilots' bombs. There was one member of the Squadron, a sergeant-pilot called Bill, who always seemed to know *exactly* what had happened to everyone else's bombs. He would sometimes hover around the IO, adding advice as we moved up in turn to give our reports.

'Where did my bomb drop, Bill?' I would ask. He often disappointed me.

'Yours missed the strip and fell there,' he would say, indicating a wayward position on the IO's map. He had his favourites—the CO's bomb was usually dead on the target, not far from his own. After a while not even the IO took him seriously. Not only was it difficult to see where one's own bomb fell, it was also unusual to see the flak aimed at your plane. But the flak aimed at others during their dive and subsequent climb was often visible as little puffs of black smoke that followed them around and it required little imagination to appreciate that the same had very likely happened to you.

To fill in some of my spare time and also to earn some money, I decided to put on a lecture course in mathematics, pitched at University entrance level. Many of the ground staff had ambitions to improve their technical qualifications when the War was over, which now seemed likely to happen before the end of the year. It appeared that I needed permission from the CO to hold this class, although I couldn't see why this should be so. I decided not to tempt fate with Le Pine, so I approached his superior, a Wing Commander. The WingCo was warmly favourable to the idea as it would help morale, he said. So I called a meeting of all those interested, outlined the syllabus I would cover and said it would cost each man \$1 a lecture; I had about 25 students. It was not long before Le Pine heard about the lectures and he was not pleased. He called me before him, saying that his permission was necessary for me to give such classes, so since I had not sought this the classes must be stopped.

'Would you please take that up with the Wing Commander, Sir?' I said, 'He seemed very pleased with the idea.' I heard nothing more.

The last time I had to suffer Le Pine's peevish anger occurred one morning towards the end of the tour when I landed from what was called a 'dawn patrol'. The task was to take off at dawn, climb to a high altitude and patrol about, keeping an eye open for enemy ships and aircraft, but by this stage of the War the chances of seeing the enemy in ships or aeroplanes was very small indeed. I enjoyed morning flights and was ready to take off about 15 minutes before the sun's first appearance, so off I went into what I considered was near enough to the dawn. To this point I had committed no error, but the 'mistake' occurred when I later landed and filled in the flight log. I consulted the officer on duty about the definition of night flying; he

replied that any flying before day break was in this category, so I entered 15 minutes of my flight as *night flying* and thought no more of it. Later that day Le Pine ordered me to his tent.

‘Who authorized this night flying?’ he demanded. I explained that I had taken off at dawn, which I took to be an ill defined span of time and then later discovered that technically some of the time I was airborne should be formally classified as night-time. It would have been wrong of me not to enter it as *night flying*, but he replied that I should have waited until day break. I argued that in the present context ‘dawn’ and ‘day break’ were not the same thing, otherwise a dawn patrol would be a very short affair indeed, but he rejected this sophistry and reprimanded me for not obeying orders.

The tour ended at the end of March and we returned to Auckland; I was not sorry to leave No 17 Fighter Squadron. I had completed three tours of duty, had flown 76 missions against the enemy and had accumulated 182 operational flying hours—I could therefore expect a posting that would keep me in New Zealand.

# Chapter 6

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## Rehabilitation

### Final Days in the RNZAF

My new posting could not have been more congenial and was to join the Corsair Conversion Unit at Whenuapai, which was under the command of S/L Doug Greig. He was an ebullient, dominant person, but very easy to approach and unconstrained by petty rules and regulations; he allowed me to attend some lectures at Auckland University College. The unit was comprised of six very experienced men whose task was to teach pilots as much about the Corsair as they needed to know before joining one of the fighter squadrons. Besides holding air exercises such as formation flying, night flying, air-to-air attacks and escort formation, we gave lectures explaining the flight controls and the operation of the engine.

The War was evidently in its final stages, so I began to plan a civilian future, learning that, when the War was ended, the New Zealand Government planned to rehabilitate ex-servicemen into civilian life in a number of ways. For a person qualified to attend university there would be financial support for as many years as he or she had spent in the Armed Services, an imaginative and generous scheme, which meant that I would be able to return to my engineering studies and complete a bachelor of engineering degree. My M.Sc. gave me some exemptions from the list of engineering subjects and, with two more second-year engineering subjects, I would be able to complete the degree in two years. Before discovering this, I had planned to complete a B.A. in philosophy and had enrolled in several arts subjects. Thus at the end of 1945 I had examinations in Philosophy II, Economics I, Political Science I, Surveying I and Chemistry of Engineering Materials.

My tardy promotion to the rank of Flight Lieutenant occurred in May, so another loop of braid was required around each sleeve. But the contrast between the faded Flying Officer loop and the bright blue of the new loop would betray my junior status in the rank. The remedy was to first

weather the braid by nailing a strip of it on an outside wall and in two weeks or so, sunshine and rain would have faded it sufficiently for it to be indistinguishable from the old Flying Officer loop—instant seniority! I should have resisted this vanity, but with Germany's surrender during the same month, the War was clearly ebbing away so there was little time left to enjoy the conceits of rank. The Pacific War was still running however, so Corsair pilots still needed to be trained, but two atom bombs were soon to remove this requirement.

A curious coincidence occurred while I was at Whenuapai. Several bottles of beer were stolen from a bag that I had left in the Guard House for safe-keeping until I caught the bus into Auckland later that day. I reported it and then went off to Auckland. About a fortnight later the Commanding Officer asked me to attend a Court Martial since a guard was being charged with theft, my beer being only one of several items. I would have been content to drop the matter, but it was not I who was bringing the charge. I sat in the Court as a witness, although I had very little to say except to confirm my trivial loss. When the prisoner appeared before the officers on the bench, I noticed that he was wearing a odd-shaped glove, covering a badly misshapen hand. Then his face seemed familiar. I suddenly remembered—he was the man for whom I had prescribed morphine a year earlier at Guadalcanal, the guard who had shot himself in the hand. Now here he was, having stolen my beer! Of course he wouldn't have recognized me and, when he had left, I explained my previous encounter with him to the CO and said that for my part I would not want him punished. He was subsequently leniently treated.

At the end of June the unit was transferred to Ohakea, near Palmerston North, and Betty and the baby travelled from Ashburton to join me. We found a flat in Marton, a small town to the north of the airfield. At last we were living as a family and I had the opportunity of acting in the role of a father. Coral was nine months old; I was 22 and Betty, aged 27, looked as if she was scarcely out of her teens. My salary as a Flight Lieutenant was £625 p.a., more than I was going to earn after the War for many years. The dangers of flying were now minimal and life was bliss. We were able to engage babysitters and go to local dances and social functions on the Station. My last flight for the RNZAF occurred on 31st July, being 40 minutes 'flying practice' in a Harvard, a tame conclusion to four years of excitement. It took my total flying hours to 1243, a respectable number for four years of messing about in single-engine aircraft. Two weeks later the Japanese were bombed into surrender and the War was finally over.

The next problem was how to get back into civilian life as soon as possible. I still had my studies but would have preferred to have pursued them in a different environment. It was apparently going to take months not weeks to escape from a Force that no longer had any real tasks for me. Perhaps the aim was to avoid flooding the labour market with ex-servicemen? The



next three months were a mixture of boredom and anticipation for me. I planned to return to Auckland University College in February, 1946 and applied for an ex-serviceman's bursary from this date. In August I was transferred to an aircrew pool at Ardmore to await my discharge papers while Betty and Coral returned to Ashburton. How long the separation would last nobody could tell me and so August dragged into September. I investigated other benefits that the Government had announced for ex-servicemen—for married men there was to be a housing loan of £1500 to enable them to purchase or build a house and a further loan of £100 to enable them to furnish it. (To give some idea of these sums in today's—1999—devalued currency in England, figures of £55 000 and £3500 are about right.)

Towards the end of October there was still no news of my discharge and, as I had no duties at all, I decided to go AWOL (absent without leave). So I covertly arranged for a flight on a bomber transport from Ardmore to Wigram airfield, near Christchurch, and a short train journey would then take me on to my family. When we touched down at Wigram I was in high spirits until I reached the tarmac, where I found an Air Force sergeant waiting for me. He called my name and then drew me to one side. Was I going to be arrested? My absence without leave was going to be the shortest on record. He told me that my discharge had come through and that the duty officer at Ardmore had been unable to find me for the good news. I was to get right back on the bomber, return to Ardmore and immediately report to the Commanding Officer. The journey had been wasted and furthermore I was in trouble on the *last* day of my Air Force career!

The CO was amused at my discomfort and his reprimand was light for a reason that he soon made clear: I was a 'wanted' man—he told me to travel to Wellington to call on the Wing Commander responsible for aircraft maintenance and engineering, who would make me an important proposal. When I met the WingCo, he said that the post-war Air Force would need scientists and engineers like myself and that I should consider completing my engineering degree while remaining in the RNZAF as an officer. My choice was between returning to university on an ex-serviceman's bursary of £273 p.a. or continuing on a salary more than twice that and committing myself to an Air Force career. But it was time to move back to civilian life and the notion of being an Air Force engineer at any rank did not appeal to me. But five years later the RNZAF did capture me.

When the leave due to me had been added, the final date of my discharge was 17th November, 1945. A little before this date, I had my various university examinations to sit and, since I was living with my in-laws in Ashburton until the beginning of the University year, it was arranged for me to take these at Canterbury University College. Therefore I travelled to Christchurch from Ashburton on each examination day to sit for three

hours pondering over questions in philosophy, political science, economics, surveying and chemistry. This all seemed so unreal compared with flying over Rabaul, getting 'smashed' in the mess after a squadron death, machine-gunning the enemy in the jungle and so on. That supercharged life was now past and it would take some time to adjust to the introspective world of books and essays.

Despite the dangers of which I was scarcely conscious at the time, I enjoyed my years in the RNZAF, which changed me from being an introvert into a more affable, sociable person, especially when reinforced by alcohol. But memories of my grandfather's reputation and my own ambitions to succeed in an intellectual sphere put a brake on this indulgence. I had started my Air Force career as a reckless youth and now left it as a confident, ambitious man. Marriage played a role in maturing me, although with hindsight, I believe that I undertook this responsibility too early. The War had foreshortened one's perception of time. Life *might* be short and hence should be enjoyed; for many of my friends it had been too short.

As I have aged, my thoughts have returned more often to my lost air force comrades. Neville Maxwell, Frank Keith, Puke Hulton, Ted Morley, Ernie Laurie, Stan Broadbent, Keith Starnes, Dave McLean and Dave Ellison were brave and unlucky young men. Binyon's sentimental poem 'For the Fallen':

They shall not grow old, as we that are left grow old:  
Age shall not weary them, nor the years condemn.  
At the going down of the Sun and in the morning  
We will remember them.

could describe their *loss* rather than their gain, since it has been my privilege to become wearied with age.

## **Down to Earth**

My task was now to find a job to earn some money until I could return to my studies at Auckland University College in February, so I found a labouring job digging holes for the Post and Telegraph Department. Some weeks previously a high wind across the Canterbury plain had blown down both trees and telegraph posts so now a lot of repair work had to be done. The job paid £7 a week and required little intelligence, although, as I discovered, a certain amount of cunning was helpful. The holes I had to dig were about four feet deep and were to take 'dead-men' logs. A cable attached to a buried log and to an adjacent telephone post provided the tension required to hold the post vertical.

The team consisted of a foreman and two labourers and at first the other two treated me with a mixture of ill natured amusement and contempt. I

had made the mistake of mentioning that in February I was due to attend Auckland University College, when they made it clear that they thought university students were effete and useless layabouts and that I should take up a real job. However they were not typical of New Zealand labourers, many of whom were ambitious for their children to have a better education than themselves, which is in some contrast to what I was to find in England some years later.

At first I found digging holes rather tiring and my hands were soon in blisters. I used leather gloves until my skin had toughened. The foreman would peg the locations of the holes that I had to dig and then I would set about the task at what seemed to me a reasonable speed. Depending on the nature of the subsoil, I found that an hour or so was usually sufficient time to dig a hole, but the other labourer, who was not much older than me, soon complained that I was digging the holes too fast. Two holes in the morning and two more in the afternoon was the correct pace, he said. This gave him and the foreman ample time for boiling the billy and having long tea breaks, during which they gossiped and exchanged dirty jokes—I had to find a way of avoiding their tedious company. Some time before this I had decided that I wanted to become an aeronautical engineer, in preparation for which I had started a correspondence course with an organisation known as the British Institute of Engineering Technology. The BIET had sent me an interesting text-book on aerodynamics, so I decided to include this with my lunch-box to study in the sunshine while I drank my billy tea just out of range of the others' conversation.

My status with the others improved somewhat the day that we were close enough to call into the hotel at Chertsey after work. At that time New Zealand was divided into regions where the sale of alcohol to the public was legal and other regions known as 'dry' areas where it was not. Ashburton was in a dry area that extended for about 15 miles towards Christchurch. Chertsey was a very small farming centre, strategically situated just outside the dry area. Its main asset was its hotel, so it was usually very busy towards the end of the working day when it would be surrounded by trucks and cars.

I was first to the bar and therefore shouted the others to a bottle of beer each. After a while the tension faded and they began to treat me as an equal; I thought that my best dirty joke would cement this change. It was probably the one about a judge interested in sociology... (I'm afraid the rest has been censored by my informal 'editor'!)

My relationship with my in-laws was satisfactory during this period; two months was not too long a time to wait for independence in accommodation. Although Ashburton was dry, my father-in-law Jim Bayley did not need to travel to Chertsey for his drinks, as he, like many others in the town, belonged to a local working-man's club, which operated rather like an ordinary pub save that membership cards were required for entry.

He took me to this slightly bogus club several times. Jim had been a skilled foundry worker in the Midlands before emigrating to New Zealand in the early twenties to escape the post-war depression. He was a likeable, friendly man, who told me about the English working-class life that I would one day be seeing for myself, although I did not realize it at the time.

The labouring work was good for me since it brought me down to earth after the artificial status of being an officer in the RNZAF and it made me appreciative of the opportunities that returning to university offered. I later learnt that a large proportion of ex-officers returning to or beginning university studies found it very difficult to adjust to the more humble life of being students.

The next holes that I had to dig were for my family when I bought a section of land on Hillsborough Road, near Mt Roskill, about five miles south of the centre of Auckland. It was a quarter of an acre, costing me £95. I first had to fence it to keep it clear of sheep. I found a builder, who was prepared to build me a three-bedroom bungalow for just a little more than the maximum loan of £1500 that I could raise from the Rehabilitation Department. The interest was fixed at 3%. The house would take six months to complete, so in the meanwhile we needed accommodation.

A shortage of money was my problem as the rehabilitation grant for a married man was only £5/- a week. On this income, I could not afford to rent a flat and feed and clothe my small family. Betty was not employed nor was she expected to work outside the home—in those days it was rare for a woman with young children to have a job. Her main role was caring for Coral. We had little choice but to move in with my parents with whom I now had satisfactory relations. It was awkward but could have been worse. Betty's pleasant and helpful manner was equal to the challenge; I buried myself in my studies.

Early in 1946 when the jitter-bug was the latest dance craze, Betty and I went to a dance in Auckland. We must have gone to many dances, but this particular one is the only one that I can still recall. For years afterwards I was haunted by an encounter that happened that evening. We were on the dance floor when I happened to notice a party sitting at a table that included Mrs Broadbent, so I walked over to talk to her. Stan Broadbent had been a popular member of Course 27A at Woodbourne in 1942 when we were training on Harvards and I had met his wife at that time. In 1945 he was flying a Corsair low over Bougainville Island when he was either shot down or had engine failure. He crashed into the jungle and was reported missing. He may have been captured by the Japanese, but most of us who knew the area assumed that he had been killed on crashing into the thick tropical jungle.

My meeting with his wife occurred about a year after Stan's disappearance. She was pleased to see me and immediately started talking about

her lost husband. She said that she believed that he might still be alive despite the official report that she had received months previously.

‘You know the area where Stan crashed?’ she asked, ‘What is your opinion, could he still be alive?’.

She was pleading for support for her belief that the husband whom she loved so dearly was still alive and waiting to be rescued, nearly a year after the end of the Pacific War. It would have been so easy to say, ‘Yes, there is a possibility that he survived. He could have crashed into a clearing in the jungle and been looked after by the natives in the area.’ I took my time in answering; I was tempted to console her with hope, however slender, but I finally decided that the ‘truth’ would be better for her in the long run.

‘There is no hope that Stan survived his crash,’ I said firmly, ‘since the jungle is almost impenetrable where he came down. You should accept that he is dead.’

She burst into tears and turned away from me. Shaken I returned to my table on the other side of the hall. Had I made the right reply? That sad encounter troubled me for many years—I never met Mrs Broadbent again.

## The Engineering School

The School of Engineering was housed in a corrugated iron shed, which had been erected behind the Choral Hall as a temporary building in 1908. The shed had originally been planned to accommodate a School of Mines, but the venture had not been a success, so it later evolved into an a rather limited Department of Engineering. This was a very small school, which until 1942 had been confined to teaching the subjects of the first professional year for the B.E. degree. This followed the general first-year course in science which I had already passed—Mathematics, Pure and Applied, Chemistry and Physics. For the second and final professional years students were required to transfer to Canterbury University College in the South Island, but by the time I returned in 1946 it had become possible to take the whole of the mechanical engineering degree in Auckland. As aeronautical engineering was considered to be a branch of mechanical engineering, I was able to complete my studies without leaving Auckland. This would only take two more years since I had been granted exemption from the first professional year because of my M.Sc. and the two engineering subjects that I had already passed.

The teaching staff consisted of three lecturers, one senior lecturer and a professor. Two of the lecturers, Mr Jebson and Mr McLaren, and the senior lecturer, Mr Dawson, had been appointed in the 1920s, and had professional qualifications but no university degrees. The other lecturer, Mr Wallace, who was appointed in 1945, had three degrees but lacked experience. The

Professor was Thomas Leech, an aeronautical engineer from Sydney, who had replaced Professor Lamb in 1940, but who had then disappeared into secret war work. He had some skills as a university politician and on his return he set about trying to improve the standing and accommodation of the School.

It was a dismal understaffed School of Engineering in a decaying red tin shed. That there was a School at all, I later learnt, was due to the unselfish devotion during the thirties of those older staff whose appointments dated from a decade earlier. That their academic qualifications appeared deficient was a reflection of the low esteem in which engineering had been held earlier in the century. Of course engineers were understood to be essential—for repairing motor-cars, wiring houses, surveying new roads, pouring concrete, welding metals and so on—the confusion between ‘mechanic’ or ‘technician’ and ‘professional engineer’ was widespread throughout all English-speaking countries. In New Zealand this changed very quickly after the War following a big influx of well qualified staff in 1948 just after I had completed my degree. Leech deserved credit for the changes, although as time went on he became very unpopular with his staff, not because of the changes he introduced, but for the dictatorial manner in which he implemented them.

Mr Jebson was the lecturer with whom I had most interaction and at first I thought of him as being little more than a technician, who had secured his university post at a time when the competition by engineers for a post in the University was at a low ebb. I recall him teaching a course in thermodynamics where in one of his lectures he encountered a stretch of elementary calculus that gave him some trouble; he started at the right point and arrived at the correct conclusions, but the argument in between was muddled. We questioned him about it, pretending to help him, but really giving him false leads; none of us had trouble in sorting it out, so it did not really matter. Some wag in the class decided to introduce a unit of ‘ignorance’ to be called the *Jebsonian*, but he claimed that ‘unfortunately this unit is too large for practical use and we must therefore measure ignorance in *micro*-Jebsonians!’.

Jebby was an angular man who moved in a curious staccato manner. I once observed him attempting to return a spanner to a box, which then had to be put back into a drawer—he didn’t see me. The spanner would only fit the box one way round, but in the short time he allowed himself for the operation, Jebby failed to discover which way this was. He ended his attempt by forcing the cardboard lid of the box back on, which left it buckled and out of shape. Then he had trouble getting the box back into a rather full drawer; he allowed himself just two attempts, before finally completely frustrated, he rammed the drawer shut as far as it would go with the twisted box visible and jammed.

Mr and Mrs Jebson were a kindly couple, who sometimes entertained engineering students at home. Jebby had a large ancient car with clip-

on side curtains and I recall his driving me and some other students to his house on one occasion for tea. His driving resembled his walking—it seemed to be uncoordinated; on the way home he shot over an intersection without appearing to look either left or right. When we reached his home, Jebby had to travel along a narrow drive between his house and the boundary fence to his garage at the back. One side of the driveway was bordered by a narrow flower bed raised about six inches and Jebby entered the drive far too fast for accuracy so that his offside wheels climbed up onto the brickwork that edged the flower bed. The car then ran the length of the drive tilted at a perceptible angle until Jebby turned off it at the rear of his house. The car lurched into a level position but Jebby gave no sign that this was not his normal approach. He leapt out and led us into tea.

In 1946 Cecil Segedin, the senior lecturer in Applied Mathematics, was not a member of the Engineering School, although he taught the classes in Engineering Mathematics. My mathematics degree gave me exemption from this subject and, when Cecil fell ill one term and was completely unable to lecture, I was invited to teach it for one term. Apart from the elementary lectures I had delivered in the Air Force, this was the first time I found myself chalk in hand before a class. Cecil lent me his notes on integration and explained to me exactly what was needed to cover the syllabus, but although he was by far the best of the lecturers dealing with engineering subjects, I felt that his treatment of integration was too limited since it lacked generality. I thought I saw immediately how it could be greatly improved, so while covering the same syllabus, I changed Cecil's pedestrian account by adopting a comprehensive approach to the subject matter. That the class found it difficult did surprise me a little since surely the material was organized much better than in the previous year? Still, it would give them a better foundation for more advanced mathematics so nothing would be lost. At the end of the term I reported to Cecil, showing him my notes and thinking he would be impressed.

'Oh dear me,' he said, 'I shall have to repeat this course again next term!'. Several years passed before I appreciated why he was so dismissive. In designing my course I had really been indulging in my own fancies as to how the material might be logically presented, but of course I already understood it—I was showing off. After some years of teaching experience, I realized that any first treatment should always be simple enough for most of the class to quickly understand. This is particularly important with an abstract subject like mathematics.

Even by the beginning of 1947 we were still living with my parents, so it was time to move, although my builder was not progressing with our house in Hillsborough Road as fast as he had promised. However, early in 1947 the builder found a solution by allowing us to rent a cottage which he owned in a small seaside village called Torbay about ten miles north of Auckland. I now had a motorbike, so the travelling did not present a

problem and we were pleased to have the chance to live as a separate family at last, although the period with my parents had not been as bad as I had originally feared. The cottage was quite primitive, but it had the merit of only being 100 yards or so from the beach.

In May 1992, about a year before she lost her fight against cancer, I wrote to Coral, my eldest daughter, describing this stage in our lives. She was then a little girl of three and in my letter I recalled how I used to carry her on my shoulders down to the small beach, where she loved paddling along the shore in the sand, and that sometimes I was able to borrow a dinghy to row out around a small island with her. I wanted to turn her thoughts to happier times, when the future seemed bright for all of us. From this beginning, and with her encouragement, I decided to write an account of my life for all my children and the result is this autobiography.

Sometime before the end of 1947 our modest three-bedroomed house in Hillsborough Road was completed and I at last became a householder; the £100 furniture loan for ex-servicemen had been stretched to provide the household goods essential for our comfort. I dug over most of the quarter acre section, planted potatoes, pumpkins, tomatoes, radishes, parsnips, carrots and anything else I could think of that would reduce our food bill. I excavated and concreted under the house to make a garage for the car that I might perhaps afford one day, but in the meanwhile it housed my motorbike and my home-brewing barrel and bottles. My life now appeared to be set on a happy steady course, a state of affairs which was to last for as long as 18 months. At the end of 1946 I completed my first and second professional engineering examinations with good marks as well as completing my correspondence course with the BIET for the examination of the Royal Aeronautical Society and being admitted to Graduate Membership.

## **Student Politics**

I lack the cunning to be a politician, so my inclination is to nominate others to serve on committees or to hold office, but if one misses meetings, there is always the danger of being lumbered with a task. At the beginning of 1947 I failed to attend the Engineering Society meeting at which its Executive Committee and officers were being elected; my friend Cliff Stevenson, who had also served in the RNZAF in the Pacific during the War, had decided to nominate me, so the next day I discovered that I had become the Student Chairman of the Engineering Society. I accepted the role with mock reluctance and took the opportunity to make some changes. Cliff and I often enjoyed dropping into the Wynyard Arms, a pub at the top of Wellesley Street East, to talk shop over a glass or two of beer. His career progressed steadily, including an aeronautical scholarship to Cranfield in England and



later he eventually became Dean of Engineering at Canterbury University in Christchurch, NZ.

One of my activities was to organize a debate on the subject '*That the whole of the University should move to Tamaki*'. Tamaki is an outer suburb of Auckland about seven miles from the centre and at that time it would have given the University College 120 extra acres on which to develop; its disadvantage however was that a large proportion of the students at AUC were in fact part-timers who needed access to a convenient downtown University. The debate was to run for many years and even today (1999) there is still pressure for the move, although there is now a satellite campus at Tamaki with more than 4000 students.

One particularly successful Engineering Society event was a picnic held on Waiheke Island, a marvellous holiday playground a few miles from Auckland. We took a large keg of beer, food and our women (we were all male chauvinists then!) on the ferry trip and then walked across the Island to a relatively deserted stretch of coast called Onetangi Bay. The sun was beating down on a beautiful white beach caressed by a moderate surf, so to keep the beer cool we buried the keg deep in the moist sand under the shade of a pohutakawa tree. After swimming, eating, drinking and some amorous frolicking in the sand dunes, we slept under the late afternoon sun to recover our strength until the time came to return to the ferry. It was the happiest picnic I can ever remember.

My family never went hungry, but we had to watch our expenditure carefully. To augment my income I found a job teaching evening classes at the Technical College where I had been a student before the War. The classes were for apprentices working for City and Guilds examinations in engineering and as they would have laboured as mechanics all day, they were usually quite tired. The Tech was near the University College and next door to the Wynyard Arms. The classes I had to teach ran for two hours starting at 5.15 p.m., which meant that I would not get home to Hillsborough Road for dinner until well after eight o'clock. To stave off the hunger pains, but without spending more than the minimum sum, I used to invent a reason for leaving my class at about 5.30, but before doing this I would set them a task to keep them busy during my absence. I would then walk up to the pub just in time for the free counter lunch that was always served at this time. Of course the food was only for customers, so I would purchase a 'pony' of beer for four pence and, with this minimal badge of custom in my hand, I would move from bar to bar, following the distribution of food like a hawk. The booty would normally consist of fish slices, sausages and small meat pies, which were very tasty and quite filling. I would finally wash it all down with the thimble of beer that had ensured me access and then quickly return to my class. I was never away for more than 15 minutes and did this for several months, but some traitor in the class must have twigged what I was doing; perhaps he had even followed

me up to the Wynyard Arms since one evening, on returning to my class, I was surprised to see the Evening School Superintendent talking to my students. He asked me where I had been—I do not like prevaricating, but he gave me little choice since I needed the pittance the job gave me.

‘I was indisposed,’ I said, straining my face and trying to imply an attack of diarrhoea.

‘You seem to have had the same problem for the last few weeks,’ he replied. ‘If your ‘illness’ persists, you will lose this job.’

It was a heavy blow. After that, I rarely walked up to the hotel and then only when I thought I had a sound excuse for being absent. But I enjoyed the teaching—it was a modest beginning to a career at the blackboard.

My left-wing politics matured, such that I purchased Volume I of Karl Marx’s *Das Kapital* and ploughed through the obscure and boring text, as if it were the first tablet of Moses. In fact my copy of this seminal work really was rather like a bible, being beautifully bound in leather with a page-finding ribbon. However, progress was slow—Engels had attributed the obscurity of the work to the fact that Marx was suffering from carbuncles when he wrote it. In response Marx said ‘... at any rate I hope the bourgeoisie will remember my carbuncles all the rest of their lives’.

Over the 1947–48 summer vacation I had a job in the Engineering Laboratory playing around with some antiquated steam engines, which was to count towards the 18 months’ industrial experience required for the B.E. degree. Also working in the laboratory, and doing only slightly more menial work than me, was a labourer with the rather apposite name of Pinker since I soon discovered that he was a hard-line communist and well read in communist apologetics. He was a good-humoured, interesting person with a ruthless streak and I enjoyed arguing with him. After work we would often go to a hotel for a few beers and more discussion. He had a large library of left-wing and communist books, some of which he lent me, and one day he asked me if I would like to join the Party—he would sponsor me, he said. I asked him what happened at local meetings and the ensuing conversation went something as follows.

‘Are there any interesting debates on current political issues, the class struggle, events in Russia and so on?’ I asked him.

‘Not as many as you might think,’ he replied. ‘In order to overthrow the capitalist system, it is essential to have strict Party discipline, which means that we must adhere to the line that is handed down to us from the Central Committee of the New Zealand Communist Party. They in turn follow the lead of the Russian Communist Party. We do not debate general principles, but we do try to interpret them and apply them to local problems. You would not really be free to think as you please.’

This answer disappointed me. Of course constraints of this kind occur in all political parties, but the communists were particularly restrictive.

‘Is this what is meant by the “dictatorship of the proletariat”?’ I asked.

‘No,’ he answered, missing my irony. ‘That is to do with the transition state between capitalism and pure communism.’ After a pause he added ‘If you really want the freedom of making your own political judgements, the Communist Party is not for you.’

It was good advice: without it I would almost certainly have joined the Party and then in the early 1950s when the true nature of the Russian Communist Party and its evil General Secretary, Stalin, became increasingly clear I would have greatly regretted it.

One problem that caught my interest was the position of professional engineers in the class structure. Were they to be included in the ranks of the capitalists or those of the workers? Which side of the class struggle should they join? That there was such a struggle I had no doubt, so I decided to organize a debate on the subject and persuaded a National Party MP, Dr McElroy, and a Labour Party MP, Dr Finlay, to take opposing points of view with Professor Leech representing the position of the engineer. The title of the debate was ‘*The professional engineer and industrial strife*’ and it drew an audience of about 150 students and staff. This increased my standing in the College and encouraged me to seek election to the Executive Committee of the AUC Students’ Association. I was successful by a narrow margin, which then led to my becoming Chairman of the Social Committee with the task of organizing College balls, Fresher parties and so on. I had now arrived in student politics.

I will not burden this autobiography with an account of the several social functions I masterminded, but I have to admit that making quite sure that there was sufficient booze available, especially for the members of the Social Committee, had a high priority. I did have some trouble with senior chemistry students, who always seemed to have access to flasks of pure alcohol, which they then used to increase the alcoholic content of beer and wine and there was always the danger of their spiking the drinks of friends. Another problem was that of keeping the number of gate crashers down to a minimum.

One of the friends I made at that time was an interesting man named Rom Harré, who was a member of the Engineering Society Committee. I still occasionally see him and his wife Hetty at Oxford University functions, now over 50 years later, and he has become an eminent philosopher of science with many scholarly books to his credit. Each time I see Rom and Hetty, I insist on reminding them that not only did I attend their engagement party, but that I can also still remember the very daring dress that Hetty wore!

On 20th July my family increased by one more daughter, who was born in a maternity hospital in Auckland. An initial minor illness meant that she remained in hospital for a week after Betty had returned home and I had the unusual task of delivering milk to the hospital each day. We named her Jillian; she prefers Jill, probably for the same reason that I prefer Les to Leslie.

## Rhodes Scholarship

By the middle of 1947 I was beginning to consider what I should do after graduating as an engineer. My restoration to modest academic success made me ambitious to progress further and I expected to do well in the final examinations for the engineering degree. I wondered where this would lead me—the idea of settling for a job as a secondary school teacher was now beginning to lose its appeal, so perhaps I should aim higher and go overseas to further my studies. The Calendar of the University of New Zealand listed various overseas scholarships and the one that appealed to me most was the 1851 Exhibition Science Scholarship, which would have allowed me to go to Cambridge University. Lord Rutherford had followed this route to fame, but I knew that this was beyond my own reach since I needed a first-class degree to be competitive. My M.Sc. was a war-time upgraded second-class degree and the B.E. I would earn at the end of the year would not be classified. There was an engineering scholarship to Bristol University that I might have had a chance of winning, but not much else. The two available Rhodes Scholarships to Oxford were strongly contested and in any case were restricted to unmarried men. The idea of seeking an American University willing to pay me a stipend to do research did not occur to me at all; in those days New Zealanders looked almost exclusively to England for their graduate education.

I had almost given up the idea of post-graduate work overseas when a friend, who was aware of my ambitions, said that he believed that the Rhodes' restriction to unmarried men had been relaxed for ex-servicemen. This surprised me, but I immediately went to the Registrar's office and found it to be true. Time was running out—it was nearly the end of September and the completed application form was required in less than two weeks. I would need at least six referees who would be prepared to exaggerate my merits, so I chose men like Mr Maloy and Mr Segedin who had all been helpful to me in the past.

It was to my advantage that the Rhodes Scholarship was not based solely on academic ability—in his famous will Cecil Rhodes described in detail the various qualities of character that his scholars should possess:

My desire being that the students who shall be elected to the scholarships shall not be merely bookworms I direct that in the election of a student to a Scholarship regard shall be had to (i) his literary and scholastic attainments; (ii) his fondness of and success in manly outdoor sports such as cricket, football and the like; (iii) his qualities of manhood, truth, courage, devotion to duty, sympathy for the protection of the weak, kindness, unselfishness and fellowship and (iv) his exhibition during school days of moral force of character and of instincts to lead and to take an interest

in his schoolmates, for those latter attributes will be likely in afterlife to guide him to esteem the performance of public duties as his highest aim.

Rhodes was seeking a superman who combined the best qualities of Einstein, W G Grace (or Don Bradman) and Jesus Christ, who nevertheless was prepared to enter politics where these qualities are at best irrelevant and at worst a handicap!

I had a Blue at rugby, a respectable war record, some leadership in undergraduate affairs and early hints of academic ability, while at school I had been head prefect and had been a troop leader in the Boy Scouts. Under the heading 'sympathy for the protection of the weak', there was of course my interest in socialism and the downtrodden working classes, but I thought it wise to omit this evidence as it didn't seem to fit with Cecil Rhodes' imperialism. I had minute traces of the required attributes, so I had a chance although perhaps not a particularly good one; if the interviewing committee were to stress scholarship above manliness, I would be dead in the water.

The first hurdle was to be selected locally—each of the three main University Colleges in New Zealand, situated in Auckland, Wellington, and Christchurch, were to nominate two candidates while the smaller colleges, in Dunedin and Lincoln, would nominate one each. In addition to stating my claims under the headings of leadership, sporting and social, the application form required me to give an account of my war service, to state the course of study that I proposed to follow in Oxford and to describe the nature of the work which I would aim for in what was oddly termed on the form as 'after-life'. I wrote that I wished to undertake research for a D.Phil. (Doctor of Philosophy) in some phase of Engineering Science preferably related to Aeronautics.

I cannot recall the Auckland interview, probably because I had no real expectation of success, but I was pleasantly surprised. Francis Foulkes, a brilliant mathematician who hoped to study theology in Oxford, was the other candidate selected from Auckland.

The Rhodes Scholarships have become well known worldwide and the election of Bill Clinton, a 1968 Rhodes Scholar from Arkansas, to the Presidency of the United States seals its standing as the most famous of all scholarships. At present 18 countries participate in sending 86 Scholars to Oxford each year, the United States having 32 awards while New Zealand now has three; in addition there are eight Rhodes European Scholarships. In 1948 New Zealand had two annual awards.

The Scholarship attracts considerable, if not excessive publicity, firstly because Oxford is both the oldest and the most famous University in the English-speaking world and secondly because of the novel character of the required qualifications. The media in the elector countries foster the illusion

that Rhodes Scholars are somehow superior to other University scholars, while 'bookworms' and 'professors' are frequently lampooned in the tabloid press. Academic brilliance is inferior to that of the pop star, dress designer, photographer, film director or athlete, but because of the so-called manliness element, Rhodes Scholars escape being stereotyped as intellectuals. However, up until 1953 by far the greatest number of Scholars in fact became university professors (23%); the next most popular profession in 'after-life' was law (18%), followed by business and banking (9%), medicine (6%), and government and international service (6%), politics (2%) being as unpopular as science (2%). These figures are unlikely to have changed all that much over the last 40 years.

Following the Auckland selection Francis Foulkes and I received some newspaper coverage and Betty and I discovered new 'friends' and were invited to several parties. This new status was premature and failure at the next stage would be a little embarrassing. The final interview, which was to be held in Wellington on 25th November, would involve eight candidates competing for two awards, thus my *a priori* chances were one in four. Once again I travelled to Wellington on that express train, which nearly six years earlier had carried me to the RNZAF station at Levin, my feelings a blend of apprehension and excitement. The Chairman of the Rhodes Selection Committee was the Governor-General of New Zealand, Lieutenant General Sir Bernard Freyberg, VC.

On the election day we gathered as instructed at Government House at ten o'clock in the morning. The Committee consisted of four ex-Rhodes Scholars and four notables but, apart from the Governor-General, the only other name I can recall is that of James Bertram, who had been a Rhodes Scholar in the early thirties. With eight candidates each taking 30 minutes, the interviews were going to take all day, so we sat in armchairs in a large, comfortable room, nervously eyeing each other, but tea and biscuits broke the ice and then at 10.30 a.m. the Secretary of the Committee came in to collect the first candidate to be interviewed, and then later there was a break of an hour for lunch. As each candidate reappeared from his ordeal, some of those still waiting to be seen would quizz him on how his interview had gone. I thought it better to remain silent—as the only ex-serviceman in the group I could expect different questions from the Committee.

I was not called until last and it seemed to go well. I was asked about what I wanted to do in Oxford and whether I thought my engineering degree was sufficient preparation to undertake research. The high standard of the Oxford B.A. degree was explained to me and it was suggested that perhaps I should spend the time doing a B.A. in Engineering Science. I thought not, but they evidently believed that *every* Oxford B.A. was at a much higher standard than the corresponding New Zealand degree. They were rather concerned about how I would manage to study in Oxford with a young family to look after. The income would only be £500 p.a., so did I think

I could manage on that sum? The General asked me some details about my war service and I talked about my flying experiences in the Pacific but omitted reference to his philosophically minded nephew, Peter, who had been in No 16 Fighter Squadron with me. Later he asked me if I had enjoyed being in the *Army* and I claimed I had without bothering to correct him. Then it was over and I rejoined the others to await the outcome.

It was now about 3.30 p.m. and we had a long wait while our relative merits were much debated by the Committee. Tea was served and conversation lagged—so much depended on the decisions being taken in the other room, since to win a Scholarship would alter the whole course of the rest of one's life.

After our long agony of waiting, the Secretary of the Committee finally appeared in the doorway. We expected an announcement, but instead he said that the Committee wished to see Mr Packard. In a second I realized that this was an oblique way of identifying the successful candidates. The Secretary paused and we all tensed, then he added 'and Mr Woods'. Bill Packard and I stood up and walked to the door; I could not bear to look at the disappointed faces of the other six candidates and although elated I felt guilty at my success and sorry for them. We were congratulated first by the Governor-General and then in turn by the others. James Bertram later told me that the Committee had taken a long time to agree on the decision. Bill Packard had been 'obvious', he said, but it had been difficult to choose between me and Francis Foulkes, who was such an outstanding candidate that they had been inclined to place him ahead of me. But he was years younger than me and would have a second chance the following year, so I scraped in; Francis was indeed awarded his scholarship the following year.

When Bill and I left Government House the others had disappeared. I remember Bill's elation as we walked down the hill, but I was subdued, thinking of the many tasks that lay ahead—selling or letting my house, raising sufficient money to pay for my family's fares to England, finding employment until the following August, and how to deal with an outrageously large bill for 'extras' that my builder had just produced. I stayed the night with Rudolf Belin, my old school friend who was now working at the Department of Scientific and Industrial Research in Lower Hutt, an outer suburb of Wellington—we did not spare the wine that evening.

## Temporary Junior Lecturer

Professor Leech had managed to secure a substantial increase in the number of staff and was currently engaged in the more demanding task of finding another site for the Engineering School. The red tin shed was no longer a satisfactory home for the growing School and he was not short of ideas as

to where the Department might go—Western Springs, Tamaki, Hobsonville and finally even Ardmore, the airfield more than 20 miles to the south of Auckland where I had been based during the closing stages of the War. The Professor required someone to teach his classes in Fluid Dynamics and Aeronautics, so early in 1948 I was given my first university appointment, a temporary position as a Junior Lecturer with a salary of £400 p.a. I held this post until I departed for England in August and 40 years later this period of eight months was to count towards my entitlement for a pension.

Early in the year I had received my first communication from Dr Carleton Allen, the Warden of Rhodes House in Oxford, which enclosed a pamphlet with information about Oxford and living conditions in England. I was amazed to read that although the European War was three years past, food and clothing were still being rationed. He had written that it would be wise to arrange for food parcels to be sent over and also described other items in short supply. I was also asked to list no less than *eight* colleges in order of preference. How could I do this? I had no idea of the distinctions between colleges. The AUC library had calendars from many universities, so I found the one from Oxford and decided to list the men's colleges alphabetically: All Souls, Balliol, Brasenose, Christchurch, Corpus Christi. . . . Then I realized that to get advice all I had to do was to look at the list of staff in the AUC calendar and identify someone who had been to Oxford—I found a lecturer in English, M K Joseph, who was willing to see me.

'You won't get into All Souls,' he said, 'That is restricted to distinguished Fellows and Fellows by Examination.' I wondered why he was talking about 'fellows' and not 'chaps' or 'blokes'.

'Which college did you go to?' I asked.

'Merton,' he replied.

'How do you spell that?' I enquired, then I wrote the name at the top of my list with Balliol second and the rest alphabetically ordered. Later in the year I learnt that my first-choice college had accepted me: I was going to become a Mertonian, but it meant little to me at the time.

While I had the Oxford University Calendar, I looked up the entry for the Department of Engineering Science and to say I was astonished would be an understatement. It had just *one* professor, *one* reader and about *four* departmental demonstrators! It was smaller than the third-rate school I was leaving and yet I had opted to spend the next two or three years of my life in the place. I also noticed that the Professor and his staff only had M.A. after their names whereas I already had M.Sc., B.E. after mine. What on earth was going on? Perhaps I should have chosen to read for a B.A. in Mathematics in an attempt to upgrade my New Zealand second-class honours? But I really wanted a doctorate to further my career, so I swallowed my disappointment and wrote to the Oxford Professor of Engineering Sci-



ence whose name was Alexander Thom, requesting to be accepted to do research in aerodynamics for a D.Phil. in his laboratory. It struck me that if I succeeded, I would be better qualified than Thom himself! However, I later learnt that this was a complete misunderstanding, since Oxford protocol at that time meant that degrees from other universities were *not* listed in their Calendar, even though they were taken into account when making appointments.

Ardmore Airfield, which I had flown Corsairs from three years earlier had several large hangars and various other buildings, which made it very suitable for a residential college. Since the Engineering School was desperately short of space, Professor Leech, using the contacts he had established during the War years, managed to persuade the RNZAF to allow it to be occupied by the Engineering School, although in the end we shared it with a Teachers' Training College. The young women thus supplied to the site were not thought a drawback by the male engineering students, but the teaching staff of the Training College had good reason to be anxious about the situation.

The move to Ardmore, which was some 25 miles south of Auckland, was a great upheaval for the Engineering School and its staff, but all of them—some reluctantly—and many of the students helped with the move, dismantling machines, packing books and equipment into large boxes and stacking them onto trucks. I had a pleasant job as a truck driver, since I was one of the few with a suitable driving licence.

I had obtained this status near the end of the war while still in uniform when at that time I had needed to renew my motor cycle licence, which had been obtained in the first place by simply showing the Inspector that I could balance on my machine and knew how to change gears. The girl behind the Post Office counter had taken my old licence and copied from it to produce a new one.

'*Only* motor cycles?' she asked, 'What about cars?' I hesitated. 'Well,' she said, looking at the wings on my uniform, 'if you can drive an aeroplane, surely you can manage a car!'

'Of course,' I replied. 'And I have also driven trucks while on active service.' She smiled sweetly and extended my licence to cover both categories.

At Ardmore I had a small office with my few books arranged on a shelf over my desk—my career as a university teacher had begun. I began to prepare my lectures on aerodynamics and fluid mechanics and soon realized that Professor Leech's notes on these subjects were rather superficial. I enjoyed lecturing, but whether or not my small class of about eight enjoyed my performance I never discovered. I am sure I was never as entertaining as Leech, but I had no difficulty in covering much more material.

In the first few months of 1948 I travelled from home to Ardmore on my motorbike. As I was now a member of staff, albeit very junior, I began

to hear the rumbling of discontent among the staff with the way that Leech ran the Department. The separation of the Engineering School from the rest of the University allowed Leech a dominant role at Ardmore, but the staff detested having to travel nearly 50 miles every day to and from their homes in Auckland. Also Leech made decisions concerning the School with the minimum of consultation, at one stage even starting to post up 'daily routine orders' for the staff, army fashion. Since I was a bird of passage, I tried to remain aloof from this struggle.

In July I moved out to Ardmore to live on the job while Betty took the children down to Ashburton and stayed with her parents until our departure for England in late August. Since I would need cash to cover the extra expenses of settling in Oxford, I decided that I would have to sell my house and so set about finding a buyer. At that time house prices were controlled, so it was illegal to sell at a substantial profit. I have forgotten what formula was used to determine the allowed price, but it was substantially less than the market price. Immigrants kept coming from England in large numbers, thus forcing up house prices, so it was common practice to sell at the controlled price with the proviso that the purchaser also buy some items of furniture at many times their real value. I suppose this device was also illegal, but I didn't enquire. I think my house sold for a controlled price of £2200 and its modest sticks of furniture for £600, the latter sum being paid to me in cash. I now suddenly had more than a thousand pounds in capital, but what had I done to earn it? For a socialist like myself justifying this windfall from the market place was not easy, but I needed the money.

Living in barracks again at Ardmore had its advantages, although I missed my family. I collected various books that I imagined would be useful for my research in Oxford and also purchased a number of mathematical texts to read on the long boat journey from Sydney to Tilbury.

A week or so before my departure the final-year students and some staff members organized a party in my honour, and at a stage when a good deal of beer had already been consumed, they showed me a pewter tankard with my name engraved on it, but said that before I could claim it, I had to enter and succeed in an 'intellectual' contest called '*Cardinal Huff*'. A mug of beer was placed before me and a sequence of words and corresponding actions were explained to me—table and nose tapping were part of it, I recall. To become a Cardinal, one had to complete the whole sequence without error; one slip and the mug of beer had to be downed before beginning again. Unfortunately the process diverged since each failure left the contestant less able to remember the incantation. I did not manage to become a Cardinal, but slumped over after several muddled attempts. However, my inquisitors took pity and gave me the tankard after all. It was a merry ending to my first university post—and as it was to turn out to my life in New Zealand.

## To Oxford

In August I travelled to Ashburton, collected my family and took them back to Auckland. The journey I had planned involved travelling first to Sydney by flying boat and then after a week in that city to Tilbury on the P&O vessel, the *Orion*. The flight across the Tasman, a distance of about 1440 miles, took about eight and a half hours, but it seemed to be quite a rapid crossing to me. The four of us sat around a little table in a saloon, which was rather like a cabin in an old-fashioned train and we flew close enough to the sea to be able to see the breaking waves. Food and refreshments were served two or three times, then we landed at Sydney Harbour in Rose Bay in the late afternoon with the famous Bridge visible three miles up the estuary. This was my first visit to a foreign country, excepting my war-time trips to the Pacific Islands north of New Zealand and it was exciting even though the differences between Australians and New Zealanders are not very marked. The flying boat was taxied to a jetty and we disembarked into a surprisingly warm late-winter afternoon.

We spent the week sight-seeing in one of the world's most attractive cities and one particularly memorable day took us to the magnificent zoo on a North Shore headland, where the combination of native bush and harbour views made a remarkable site for a great collection of animals and trees. Beside the usual sequence of pools containing exotic fish, the aquarium had a huge circular pond containing several large creatures and there was a balcony above the pond from which we could observe sharks, turtles and small whales all circling round and round. Coral was impressed by the display and in order to get a clearer view sat right on the edge of the platform with her legs through the bars of the safety fence and her feet dangling over the water. When it was time to leave, I called her to get up but unfortunately since she withdrew her feet too quickly through the bars, one of her shoes was scraped off her foot and fell down into the pool. We watched the shoe slowly sinking into the depths with one of the sharks circling around and nosing it with interest—I feared that he might swallow it. A keeper was found and occurrences of this type were evidently quite familiar, since he produced a long rod with a small net attached to its end and in no time had recovered the shoe from the bottom of the pond. Coral's penalty was to wear a wet, squelchy shoe back to our boarding house.

Dr Keith Bullen had been the Senior Lecturer in Mathematics at Auckland University College in 1940 and by now was the first Professor in *Applied* Mathematics appointed in any Australasian University; also he had just been elected to a Fellowship of the Royal Society. As this new post was at Sydney University, I decided to pay him a visit; I am not entirely sure why—perhaps to seek advice or to be encouraged. Of course he didn't remember me from Auckland University College, but he did spare the time to talk to me about research, mostly his own. He thought it was a pity that

I was going to Oxford, which had no reputation in science, instead of to Cambridge, where in the thirties, he himself had been a student of the great Harold Jeffreys. He was not very encouraging, being very critical of the way mathematics was being taught in England and Australia and, as far as Auckland was concerned, Professor Forder's attempts to raise the standard of mathematics in the College had, he felt, achieved very little. (I later discovered that Bullen had been an applicant for the Chair of Mathematics at the time Forder was appointed.)

The SS *Orion*'s route to England enabled us to spend one or two days in each of the principal Australian cities, thus after embarking at Sydney, we proceeded south to Melbourne, then on to Adelaide and finally to Perth. At each city we spent some time sight-seeing with the ship in the role of a floating hotel. It was an interesting journey around Australia and in those days the normal way to travel to England since aeroplane fares were far too high for all but the very rich. I recall that we paid about £80 for each lower-deck berth, perhaps a little less for the children, which is about three times larger than today's cheapest air fares in compatible currency.

Since the *Orion* was due in the UK just before the beginning of the English academic year, it was carrying a large number of students like myself and there were several Australian Rhodes Scholars—Elliott from Queensland, Frearson from Western Australia, Potts from Adelaide, Shaw from Victoria and Stewart from NSW. There were also many other students, some of whom were making up for opportunities lost due to the war years. One of these was Max Hartwell, a confident extrovert from Sydney who was also going to Oxford. My mathematics lecturer from Auckland, Cecil Segedin, was also on the liner since he was on study leave and going to Cambridge to compensate for his lost years teaching classes at Auckland University College throughout the War.

To be nearly five weeks on a sea voyage would seem unbearably long today, but air transport had not really started then in earnest and Antipodeans were used to the idea of long sea journeys. We read novels, studied the subjects we planned to pursue in the UK, swam in the small pools, played deck games, went to dances, drank in the bars and ate the ample quantities of food that were served by the clock. Some of us even exercised to keep fit, Ren Potts being particularly conscientious; he used to walk quickly round and round the deck with grim determination, while I admired his energy from my deck chair as I sipped beer in the tropical heat.

As we sailed north across the Indian Ocean towards Colombo, I was intrigued to see the night skies gradually reveal more and more northern stars, whose names and constellations were familiar to me but which I could never see from the southern latitudes. There is nothing quite as peaceful as standing alone at night on the foredeck of a liner travelling through calm, tropical seas with a bright canopy of stars above. I wondered what the

future would bring. Would I succeed at Oxford? I knew that research was different in quality from undergraduate study and success in the latter was no guarantee of success in research—I might not be equal to the task.

We stayed at Colombo long enough for us to visit the tourist town of Kandy in the centre of Ceylon and we then crossed the Arabian Sea to Aden, which at that time was a British protectorate. We went ashore, leaving the children in care at the ship's nursery and a taxi driver persuaded Betty and me to enter his cab to be taken to the Crater City, about two miles from the docks. He told us that the journey would only cost a few shillings and it would be registered on his meter, but before we had gone far, he asked us if we would like to see some camels.

'Are they out of our way?' I asked.

'Not far at all,' he replied.

So I agreed although unsure if this was really wise. My fears were justified when he took us off on a long detour to see a few paltry camels standing on a beach after which I insisted that he take us directly to the city, but when we arrived, he claimed that the fare was £5 (over £150 today) and his meter appeared to indicate that same total. I told him it was robbery and that I would not pay it, and he replied that he would get a policeman to settle the matter. By some strange coincidence, we were parked right outside a police station, so he did not have far to go. The Arab official who emerged with the taxi driver from the station had no hesitation in confirming that the fare was correct and that I would have to pay it or go to prison. I paid up.

The journey up the Red Sea was one of mounting excitement since Europe was 'just around the corner'. Betty and I decided to spend a few hours ashore in Port Said, so after docking we joined the queue in the second-class lounge to have our passports stamped. When my turn came, the Egyptian immigration officer asked me my religion, a question that took me by surprise. Without thinking I answered that I was an atheist which caused him to press more questions on me. Max Hartwell, who was not far behind me appreciated the problem and called out *sotto voce*,

'C of E! C of E!' I was rather slow to grasp the point though.

'Oh, my religion is really Church of England', I finally exclaimed, but it was too late. The officer had not experienced such a sudden conversion before and refused to deal with me any further telling me to wait until the others in the queue had been served. After that he asked me to follow him to the first-class lounge where he said his superior would consider my case. I was very puzzled by the whole charade but I was truthful with the higher-ranked officer, who asked me if I were a Jew. This was his main concern since it would be very dangerous for a Jew to go ashore at Port Said at that time, he explained. He accepted that I was a 'failed' Christian and stamped my passport. Max later claimed that my Roman nose should also carry some of the blame!

Travelling through the Mediterranean Sea, the cradle of European civilization, was very interesting. We had occasional glimpses of historic lands that we had only read about in history books or novels. To grow up in New Zealand, which is in essence a 'European' country displaced to the other side of the globe (at least when I was young), was to be deprived of the historically *material* side of the common culture, by which I mean artefacts like antique furniture, old buildings, art museums and classical ruins. Most of the novels that I had read while growing up had had their action set in places in Great Britain and the history which I had learnt at school was largely British embroidered with some European history. I had even memorized the names of the Kings and Queens of England from 1066 up to the present; the Industrial Revolution had been centred on England, New Zealand was part of the British Empire and London was the capital of this Empire. Our National Anthem was a request to God to save the British King—also our King—from some unspecified disaster. At that time it even was common for people born in New Zealand but who also had English forbears to refer to England as 'home'. Some of us would soon *be* 'home'—I imagined that I was almost an Englishman, but a few weeks in Oxford would soon disabuse me of this fantasy.

The final success of the British Labour Party in reducing the power of the House of Lords to delay legislation and hence to thwart the passing of the Iron and Steel Nationalisation Bill during the 1945 Parliament was the most exciting news to reach us on the ship. Many of us were very pleased that at last Great Britain was being freed from the grip of capitalist greed and the draining influence of the class system. I wondered how long it would be before the House of Lords was either abolished or replaced by a democratically elected upper house; I knew it would take time since there remained more important injustices for the Labour Government to remedy, so my pessimistic guess was three or four years. I did not understand patronage at the time. (Fifty years later we are almost there!)

The last lap of our journey brought us into the rougher waters of the Atlantic, although the dreaded Bay of Biscay was calmer than we had been led to expect. The temperature fell, the skies filled more frequently with rain clouds and final farewells were said in case there was no time later. Then at last it was announced that on awakening the following morning we would find ourselves docked at Tilbury where trains to all destinations would be available.

## Chapter 7

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### Kiwi at Oxford

#### The ‘Old’ Country

We disembarked from the *Orion* in the morning and collected our baggage, and travelled first to London and then on to Oxford. The train gave us a stage from which to get a first glimpse of the English countryside, which was enchanting, so tidy and manicured after New Zealand’s natural bush and subtropical forests. I was impressed by the sharp edges of the villages, the streets of closely packed houses abruptly giving way to open fields. In New Zealand the villages and towns have no obvious boundaries; they just gradually peter out into farm land and the houses usually stand alone in sections about a quarter of an acre in size. Most of the English houses were in terraces with very little land and the rows and rows of identical chimneys augured a relatively cold climate.

How green the English landscape looked with copses here and there in small fields edged by thick hedges. In the distance I occasionally saw large country houses, grander than anything I had ever seen in New Zealand, but on the other hand the farms seemed to be quite small and I didn’t see many sheep. (In New Zealand there were 20 or more per head of population.) The very short intervals between towns and villages were a surprise, but the train moved much faster than I had been accustomed to in New Zealand, so we very soon arrived in Oxford.

The railway station was my first disappointment since I expected something grand—a station to match the architectural status of a famous university town—but it was little better than any typical country station in New Zealand’s farming districts. However England was still recovering from a six-year war, a fact which I thought might explain the depressing doorway to Oxford. No doubt a fitting station—in harmony with the grandeur of the older colleges—would be built in due course. (It never happened.)

Finding accommodation was my immediate task since, despite its name, Rhodes House was not a hotel for Rhodes Scholars. It housed the warden

and his family, a small secretariat for monitoring the progress of the Scholars, and a Colonial Library, as well as having several rooms for conferences or social gatherings. Before leaving New Zealand I had been warned by the Rhodes House Secretary that finding accommodation for my family in Oxford would not be easy, so I now bought a map of Oxford, located Rhodes House in South Parks Road and walked there to get advice. Although the Secretary had tried, she had been unable to find us a flat and also she had several other married Rhodes Scholars to worry about. Accommodation was usually bespoke months ahead of the beginning of term, which at that point was only two weeks away. An expensive place was suggested for the next few days, which we took, and the next day I set about searching for a flat or house within a ten mile radius of Oxford. I purchased the local paper, the *Oxford Mail*, and pursued some of the advertisements, but having two young children I soon discovered was a distinct disadvantage—it seemed hopeless.

I walked to the quaintly cobbled back-street, where my map indicated I would find Merton College, and it lived up to my expectations—an enchanting medieval college, nearly 700 years old and set in beautiful gardens. To the south lay the large open field known as Christ Church Meadow and I could see the inviting Thames River—known locally as the Isis—glistening in the distance; my almost random choice of college had been very fortunate. I went to the College office, filled in some forms, and enquired of the Secretary if I could be helped with accommodation. They agreed to certainly give me a room in College, but in those days they had no rooms or flats for married students—indeed the idea that a student could be married seemed novel to them. I accepted the offer of a room for the autumn session, known as Michaelmas term.

I did in fact have an emergency plan that I was loath to adopt; my parents-in-law had relatives in West Bromwich who were expecting us to visit them some time, having invited us to stay with them when on holiday. Betty wrote to them, asking if she and the children could stay with them while I remained in Oxford to find accommodation. We were welcomed to come, so days later we took the train north and within two hours we were in another world. I had no clear idea of how working-class people lived in England until I had stayed for a few days in West Bromwich before leaving my family and retreating to a very privileged Oxford. The popular TV soap opera *Coronation Street*, from years later would have given me a dressed-up version of what I found—rows and rows of mean streets bordered by drab terraced houses with tiny backyards opening on to narrow alleyways, which also served as the backs of identical houses in the next street. Smog and frequent rain added to the depressive atmosphere and the main relief for the inhabitants seemed to be hours spent in the local pubs, drinking a warm, insipid beer called ‘mild’ and consuming soggy fish and chips wrapped in newspaper and soaked in vinegar.



Betty's relatives were unsure of me at first since I was an 'Oxford toff' to be treated with suspicion; I was clearly not one of them. It was my first experience of the class system, which appeared to dominate English life. But when it became clear that I would drink the local beer, tell smutty jokes and consume greasy foods, I was tolerated; I was not an Englishman after all despite somehow being a student at Oxford.

I recall talking to one young man, a cousin by marriage, who was about my age and worked in a foundry. I asked him about his future prospects. 'Are you attending night school to obtain further engineering qualifications?' I asked.

'I do not need to,' he replied, 'I have completed my apprenticeship and am now fully qualified in my trade.'

'So what is the next step?' I asked. He seemed to not understand the question. 'Well, when do you expect to become a foreman?' I added.

'Perhaps I might be one day,' he replied slowly, without much conviction. The apparent lack of ambition quite surprised me since a typical New Zealander in the same position would probably be studying or scheming to climb the ladder, but perhaps here there were no ladders. This man seemed to have a clear view of his station in life and was going to stick to it. I was to meet this lack of ambition or expectation many times from ordinary English people. The problem in England half a century ago was not the classes as such but the near absence of opportunities for individual advancement between them, education being the key to this mobility. What I met in West Bromwich was a community for which the notion of a university education for their children, let alone their going to Oxford, was simply not entertained at the time. Of course there will always be exceptions—I have met many of them over the years—but had I grown up in England as in New Zealand, the son of a fisherman, it is likely that the closest I would have got to Oxford would have been as a day tourist on a trip from a fishing village somewhere on the Yorkshire coast!

After a week I was pleased to leave the aptly named Black Country and return to my ivory tower in Merton College. During the first few days I explored Oxford, walking around its twisted narrow streets and looking into the quaint pubs, the magnificent college gardens and the surprising Covered Market. What amazed me about this market was the obviously low standard of cleanliness with meat and poultry hanging in warm air outside the shops above the dust of the footpaths. Seeing wasps, which at that time did not exist in New Zealand, crawling over sticky buns and cakes displayed in shop windows made me wonder how anyone would wish to buy these pastries. I was also somewhat put off in the pubs by what passed as washing the beer glasses or 'handles'; I would see the barman take the used glasses and swish them once through a trough of well used, apparently cold water behind the counter and then stack them to dry, ready for the next

lucky customer. I developed the habit of examining any glass presented to me for lipstick and if I found any, I would return the full glass, describe its condition in a loud voice and walk out, not returning to that pub as long as I could remember the offence.

At the end of Michaelmas term the Rhodes House secretary at last found a flat for me to rent, so I gave up my College room, collected the family from their 'Coronation Street' in West Bromwich and took them to a new life out in the Oxfordshire countryside. The flat was very inconveniently 13 miles from Oxford at the end of a large country mansion called Adwell House. The nearest shops were a mile away at Postcombe on the A40 highway to London so, while I took the bus to Oxford, Betty had to trundle Jill along in a pushchair with Coral (now four years old) trailing along down a long weary hill to do the shopping; it was not an easy period for us. The house was owned by Lt Col. Birch-Reynardson, whose occupation seemed to be that of gentleman farmer—it certainly appeared to be a more leisurely way of life than that of the farmers I had known in New Zealand, who spent their days working—milking cows, feeding pigs and ploughing fields. He and his wife were kind to us, inviting us to have dinner with them two or three times.

There was no pub in the tiny Adwell village, so one evening I decided to walk about a mile through the snow to South Weston where I had been told there was a pub. I nearly missed it since it was exactly like the other houses in the village, except for an obscure sign on a post near the front door. I found it very strange to enter what looked like a private house and drink beer in the front parlour where the locals were quiet at first, but who gradually thawed when I offered a round of beer.

After about two months of this existence I made a big effort to find a place in Oxford, and struck lucky—a semi-detached house in Upper Wolvercote was just right for us. We took it and in the spring I created a small vegetable garden. Life then seemed more cheerful—my research was beginning to produce sensible results and the Professor was complimentary. I still had several hundred pounds over from the sale of our house in Auckland and decided to splurge this on a motor car to help us to enjoy our stay in the British Isles. There were many historic towns and places, familiar to me from my school-boy history, which I wanted to visit.

As I was a temporary immigrant who was expected to leave the country after two or three years, I was allowed to jump the long queue of English people waiting for post-war cars and to buy directly from the manufacturers. I chose a Vauxhall and after two or three months was invited to collect a car directly from the Luton factory, the normal retail price being about £450, but, since I was going to export it, I paid little more than £300. The number of motor cars in England at that time was a small fraction of today's flood and driving through country lanes was a great pleasure

since the traffic was light and one seldom met cars coming in the opposite direction. I was able to park almost anywhere in Oxford without difficulty since there were neither meters nor fines to fear.

## Merton College

When I left my family in West Bromwich and returned to Oxford to live in Merton College for a term, I discovered just how privileged those young Englishmen were who managed to secure a place in Oxbridge. My room proved to be a large bed-sitting room on the second floor of the Grove Building, an isolated block at the rear of the College overlooking Christ Church Meadow. I was looked after by a lugubrious character named Baskerville who was my scout; he made my bed, cleaned my room and was full of advice. He became more cheerful as he got to know me better, though I never discovered his first name and he would have probably felt embarrassed had I used it. I remember telling one of the porters at the Lodge—the office at the main gate of the College—that he need not call me ‘Sir’.

‘My name is Les,’ I said, full of democratic earnestness.

‘Yes Sir,’ he agreed, and, as I walked away, I realized that I was attempting to undermine a custom that had been ingrained for many centuries, the implicit reasoning probably being that to use my first name would make him my equal and then how could he respect me! Americans and Australasians never had any trouble with first names, using them to show either respect, contempt or superiority, but at that time the middle-class English were still addicted to a stiff formality with names.

Baskerville used to bring me a cup of warm tea in the morning, to cheer me up, he said, and his advice on practical matters, like food rationing and the best shops for this or that, was of some help. He also liked to talk about the size of the tips which his ‘young gentlemen’ ‘invariably’ gave him at the end of each term.

At that time breakfast was not served in one’s rooms since rationing made this impractical. I recall the first morning I went to the Hall for breakfast. I was amused to find that the other students, mostly undergraduates, each had their own butter and jam on the table close in front of them, treasures that they had brought from their rooms. I ate my toast dry and the kippers added little to my diet; I lost patience with the maze of little bones and the resulting aggregate of meat and reinforcing fibres was not worth dissecting. In New Zealand such a fish would have been used as bait to catch a more edible variety.

The evening meal, known as Hall, was more pleasant—we would put on gowns, file in and stand at our benches while the senior members entered the Hall in order of seniority and walked to the High Table, which was at one end of the Hall on a platform raised about a foot higher than the rest of



Merton College viewed from Christ Church Meadow.  
The Grove Building is on the left.

the tables. When everyone was in position, the senior scholar would recite a long Grace in Latin and we would then sit down to be individually served by scouts. During dinner we freely conversed with those around us on any subject except women, politics and religion. Anyone transgressing this rule could be ‘sconced’ by his neighbour, which was a ritual punishment that would give the whole assembly great amusement. Permission for the sconce would first be requested from the senior Fellow at the High Table and, if granted, a scout would be dispatched to fetch a quart of ale in a tankard. The victim was then required to stand and drink the sconce down in one attempt and, if he managed this, the person sconcing him paid for the ale, otherwise the victim paid for the drink and I think also paid a fine as well. I was caught once, but it cost me nothing.

The showers for the whole College were all to be found in a single block unconnected by passages to the bedrooms. I wondered how the English managed to keep warm and clean at the same time and was not impressed. But there were many attractive aspects to the College—I loved listening to the chiming of the chapel bells and the bells of the other nearby colleges, and there was a scholarly serenity that enthused one to study and to think.

I had very little interaction with the Junior Common Room since I was older by about four years and a war experience than the average undergraduate. The concept of a Middle Common Room was still some years in the future. It would have been a help as I made very few friends in college. Instead I found these in the Engineering Laboratory and later in the University Air Squadron.

At Auckland University College in 1941 I had played rugby for the College First XV, at one stage having been a lock in the scrum when the other lock had been George Cawkwell who was taller and heavier than me, so that the scrum had had a decided tendency to screw around. George had won a Rhodes Scholarship in 1946 and was now in his final year, and, having been in the team that played against Cambridge, he had won his Blue at rugby and was now a respected senior. I decided to try to achieve this distinction, but, unfortunately for me, so did over a hundred other freshmen with high rugby credentials. George was on the selection panel and said that he would look out for me, but I resisted this patronage, saying that I should make it on my own merit. However, with each aspirant only having a few minutes to shine, I had little chance to prove my worth as a forward; I kicked the ball once or twice and that was it. Only three freshmen made the grade and they had already represented their countries or provinces before coming up to Oxford. I could have tried for the Second XV but decided that my first priority was to obtain my doctorate; playing college rugby would be sufficient diversion, so I played for the College First XV and thus involved myself with one element of the Junior Common Room.

The Head of the College was called a Warden, which seemed appropriate in view of the restricted hours allowed to the students to be out in the town at night. His name was Geoffrey Mure, but I saw little of him. In my second term he and Mrs Mure once entertained the freshmen in the Warden's Lodgings, providing sherry and wine before dinner, and I remember walking up some stairs with our hosts standing at the top putting on a languid display of interest in their guests. There was something depressingly decadent about the scene, enhanced by the dress that Mrs Mure was wearing, a raiment straight out of the twenties and also the fact that she was sucking at the end of a long cigarette holder. At the party I was introduced to Kenneth Maidment, who at that time was about to depart for New Zealand to be interviewed for the newly created post of Principal of Auckland University College and who was eager to ask me questions about the College and life in New Zealand. I also got into conversation with a group of young Englishmen but I may have made the mistake of expressing pleasure about the election of a Labour Government and perhaps wondering how long it would be before the undemocratic House of Lords was relegated to history. I do remember how at one point in a conversation that was getting quite lively, one of the group dismissed me airily by saying to the others, 'This man does not speak our language!' and then they walked off. He was right, of course.

There were so many ex-servicemen in Oxford just after the War that the old University rules, which required students to wear gowns in the streets of Oxford and not to drink in the pubs, had had to be relaxed. I enjoyed the atmosphere of public houses around town, so different from the men-only saloons then usual in New Zealand. The pub near Merton which I frequented was a 13th century cavern called the Blue Boar, its low ceiling festooned with those emblems of class distinction, old school ties. I grew fond of the bitter preferred by the middle classes, although at that time 'mild' was still available in Oxford. In New Zealand the beer was usually chilled and rather full of gas and the effect of cold, fizzy beer being poured into a warm stomach is easily imagined. I grew to appreciate still beer at room temperature.

At the end of term when I received my battels, or account of expenses incurred, I noticed that the College had made an error by charging me an appreciable sum for tuition fees, although I had received no tuition from anyone in the College; Professor Thom was my only supervisor and his fees were separately included in the battels, so I went to the Bursary to have the bill amended. The Domestic Bursar saw me and heard my complaint, but he said that the charge was correct.

'But I have had *no* tuition from the College,' I said.

'We are charging you for the tuition that you *would* have had, had you come up as an undergraduate in the ordinary way,' he replied.

'I do not understand; I have come to Merton as a *senior* student, working for a D.Phil. I am not an undergraduate and should not be charged as if I were. Please delete the charge,' I insisted.

'All research students who have not been undergraduates here have to pay College tuition,' he responded. 'You have been allowed to skip the undergraduate years, but we must charge you for that privilege. I am afraid you will have to pay.' I gave in with bad grace; it was going to be hard to learn English ways.

## **The Engineering Laboratory**

At an early stage I found the Engineering Laboratory in a modest redbrick building in Parks Road, at the apex of the 'science triangle'. Apart from being ideally located for watching cricket in the University Parks, it had little else to recommend it, being only marginally better than the red tin shed which housed Engineering at Auckland, although it did have some reputation in research. This had been established in the 1930s by Richard Southwell and was being continued by Professor Thom and some of his staff. He interviewed me and as I wished to undertake research in aerodynamics, a subject in which he was expert, he accepted me as one of his research students. I liked Thom and while he had some quirks, he was an

unpretentious Scot with a reputation for being a good supervisor. I once described him as being ‘the Professor of Engineering’ but he was quick to correct me.

‘My subject is Engineering *Science*’, he insisted, almost as if he were not proud to be a real engineer. As I later discovered, there was certainly very little genuine engineering taught in Parks Road and the science was pitched at a very modest level. At least dear old Jebby back in Auckland was an engineer.

Despite Engineering Science being introduced in Oxford in 1904, the subject was treated with contempt for more than half a century by both the colleges and the University, as was evident from the list of staff in 1948—there was one professor, one reader (a quaint name for the rank just below professor), one university demonstrator and three young departmental demonstrators. Of these six staff members only the professor enjoyed the privilege of a College Fellowship; I soon learnt that a Fellow had a higher status than a lecturer or even a reader. Many scientists were both Fellows and lecturers or demonstrators, but not the engineers since the Colleges dominated the University and determined the class structure. To be merely a *departmental* demonstrator was hardly to exist in the arts-dominated complacent Oxford of the late 1940s.

Professor Thom had a hobby that completely absorbed his spare time—surveying and drawing maps of the many examples of standing stones in Great Britain. The ancients had arranged the stones in a regular pattern that usually consisted of two slightly separated semi-circles with two straight sides joining them into one figure. Thom believed that these figures provided evidence of what he termed a ‘megalithic yard’, a unit of measurement employed by the druids responsible for the constructions. In later years he wrote a book about his ideas and whether or not his theory has any merit, at least his field work in surveying the stones was of great service to many archaeologists interested in the origin and significance of such stones.

Around the time I went to Oxford aeroplanes had just started breaking the sound barrier, as the inappropriate phrase of those days expressed it, and transonic flow about wings was therefore a topic of current interest. This is a flow pattern in which the speed of sound is exceeded in small regions above and below the aerofoil, and on the downstream side of these regions one could expect to find shock waves across which the flow was suddenly decelerated from being supersonic to being subsonic. There was uncertainty about precisely where the shocks would be stationed for a given angle of incidence between the aerofoil and the oncoming stream of air, and the asymmetry in the location of the shocks above and below the wing was responsible for the very dangerous and sometimes lethal phenomenon known as ‘control reversal’.

My research project was to calculate the transonic flow around a two-dimensional aerofoil shape using Thom’s own numerical technique of solv-

ing partial differential equations—he had developed his method in the twenties to calculate the flow of a viscous fluid around a circular cylinder. It was remarkable original work for which he never received proper acknowledgement; his hard-won solution revealed the existence of a street of vortices behind the cylinder in agreement with observations. He called his numerical process ‘squaring’, though it was later superseded by Southwell’s similar ‘relaxation’ technique without just acknowledgement. (Sir Richard Southwell was Thom’s predecessor in the Oxford Engineering Science Chair.)

I shall not weary the reader with the details of my research—sufficient to say that had I had one of today’s computers available, the problem on which I spent nearly two years would have been solved in less than a month. I had to use a hand-operated machine known as a Brunsviga, with which each turn of the handle added the number set by the positions of a series of levers to the number appearing in the counting register. Thus to multiply a set number by four, it was necessary to crank the handle four times; hence computing was a slow and boring business and it took me several months to calculate the flow pattern around a given profile. The only interesting challenge lay in discovering a way of dealing with the shock waves. After a year I found myself some more interesting mathematical aspects of subsonic flow that did not require hours and hours of laborious calculation and Thom then arranged through the Aeronautical Research Council (a quango of yesteryear) to pay someone to do the tedious computing for me.

On 10th June, 1949 a third daughter, whom we named Diane, was born into the family. In September Coral reached school age so I started to take her on my bicycle to a nearby state school. I had no particular feeling that I should be sending her to a private school, it being my impression that state schools provided a better education whereas private schools were poor on education but strong on the social graces, which we could teach at home. Besides which it was difficult to manage on the income of £500 provided by the Rhodes Trustees, although the money problem was slightly eased when I managed to find an evening job teaching Mechanics at the Oxford Technical College (now evolved into Oxford Brookes University) for four hours a week at 10/6 per hour.

My research work was advancing well and, with a wife and now three children to support on a modest income, it was important that I completed my thesis as quickly as possible. I used to work through to the early hours, stopping occasionally to rearrange a dozen or more napkins which would be drying in front of a coal fire. My writing up started early in 1950, my plan being to submit the thesis at the beginning of Trinity Term as this would be the shortest time permitted by the regulations, just six terms after matriculation. The thesis was entitled ‘*The flow of a compressible fluid about a body*’. I completed it in May, purchased a cheap typewriter and typed it up using carbon paper to produce the required five copies. As I had no mathematical symbols on the machine, I then had to go through



the 207 pages of each copy, filling in the mathematics by hand—it took ages. (How very different it is today with personal computers!) The thesis resulted in seven publications, a good start for an academic career, and, although the academic premise of ‘publish-or-perish’ was still not widely proclaimed, I seem to have understood the game plan for advancement.

My two D.Phil. examiners were appointed by the Faculty of Physical Science, but I was not consulted about whom they might be. (Today the approval of D.Phil. candidates is required before their examiners are appointed.) Dr C Hurst was my Oxford or internal examiner and Professor G Temple of King’s College, London, was appointed as my external examiner. Three copies of the thesis were handed in to the University Registry and, after some weeks when the examiners had reputedly read my *magnum opus*, I was summoned to a formal *viva voce* examination. For this occasion I had to appear in subfusc, which meant that I was required to wear a dark suit, black shoes and socks, a plain white shirt and collar, a white bow tie and a short gown appropriate to my status as an advanced student.

Professor Temple, a jolly, avuncular ‘Friar Tuck’, started the questioning, his method being to give a brief description of what I had covered in a given chapter and to then ask me several questions about the material in that chapter. Dr Hurst confined himself to questions about the numerical analysis; having taken the trouble to test each column of figures for their consistency and having found some columns that lacked this property, he challenged me about them. I thought it rather trivial to test the numbers rather than the theory, but naturally did not say so. When Professor Temple reached the fifth of my 12 chapters, he suddenly changed his style and, instead of offering his own description of the contents of the chapter, he hesitated and then asked,

‘Would you give us a summary of what you have achieved in Chapter Five, please?’.

This gave me the impression that Temple had not really read beyond the first four chapters, which thought boosted my confidence. How could I be failed if he hadn’t read the damn thing? After an hour or so I was asked to withdraw for a few minutes, before being called back in to be told in the traditional formula for not directly disclosing the outcome at that stage that I need not ‘lose any sleep’ over the outcome of the examination. I slept well after a bibulous revelry with friends.

The Fluid Motion Sub-Committee of the Aeronautical Research Council published some of my early papers and, before each one was accepted, I was invited to attend a meeting of the Sub-Committee in London to describe its merits and to respond to questions about it. At these gatherings the men sitting around the table were usually very eminent in fluid mechanics research. Thom was a leading member of the Sub-Committee and I accompanied him to the meetings, appearing as his protégé and usually managing to fend off difficult questions on my work. The older men were

silent or vaguely supportive, trying to avoid giving the impression that they had not troubled to read my paper, but the younger ones were more critical, and I knew that if either Lighthill or Batchelor asked a question I could possibly be due for a rough passage.

Whenever we boarded the train at Oxford Station Thom always travelled with me in third-class although he was able to claim expenses for a first-class seat. The first time I thanked him for his sacrifice, but he told me it was his usual practice and that he still claimed his first-class entitlement! On one occasion the timing of the meeting made it necessary for Thom and me to have lunch together before an afternoon meeting, so I wondered which fine London restaurant he would choose. It turned out to be a Lyons Corner House and when we were inside he said that the self-service section offered the best value. During the meal he offered me some strange advice, remarking that I should hold my knife and fork so as to cover the handles while eating. I mastered this skill as my first—and probably last—step towards disguising myself as a member of the English middle classes.

## The University Air Squadron

During my first term in Oxford once I heard of the existence of the University Air Squadron I was very keen to join since it offered me two advantages: firstly I would be paid £50 per annum provided I completed 35 flying hours a year, and secondly I would be mixing with pilots once again, a few of whom like myself having been on active service during the War. My only concern was whether I would be able to pass the eyesight test.

I was interviewed by a panel of three Air Force officers, the chairman being the Commanding Officer of the Squadron, Wing Commander Foxley Norris DSO (who later became an Air Chief Marshal). It proceeded well except for two amusing misunderstandings. One of the panel asked me what work my father did, which question I regarded as both irrelevant and impertinent, but I controlled my anger and gave a straight answer.

‘He was a fisherman,’ I replied. This evidently puzzled them—a fisherman’s son at Oxford! I then weakened and added,

‘He owns his boat.’

‘Ah, a fishing *manager*,’ one of them said, smiling; they were on my side—I should have tried harder and told them that he was at present a billiard room proprietor. The second problem arose over my reply to the games that I played. I said I had played football in New Zealand and now played for my college.

‘Football?’ asked the Wing Commander.

‘Yes,’ I replied. Then one of the officers who had taken the trouble to read my *curriculum vitae* turned to the CO and said,

‘He means *rugger*, Sir!’ More smiles of approval. I was accepted subject to a successful medical.

I failed the eyesight test, but it was not the section dealing directly with vision that tripped me up, for, as I entered the room in which the test was held, I was pleased to see a familiar chart hanging on the wall, still etched in my memory from the War years. My failure was with the ‘convergence’ test, which required me to be able to focus both eyes at a point about 12 centimetres from the bridge of my nose. The medical orderly told me not to worry, saying that the skill could be learnt and that I would be allowed to repeat the test in a few weeks’ time. I practised daily to get my focal range down to the required mark and at the next attempt I passed. I was then admitted to membership of the Air Squadron with the rank of Flying Officer in December, 1948.

The main purpose of the Squadron was to ensure the existence of an establishment of worthies favourably disposed towards the RAF and also to entice a few undergraduates to adopt the permanent Royal Air Force as a career after graduation. The Squadron did its flying from Kidlington Airfield a few miles north of Oxford, but most members had not flown before. The ubiquitous Tiger Moth was still being used as the training aircraft and as I had been a flying instructor on Tigers for a period during the War and probably had more experience in this role than some of the regular Air Force pilots attached to the Squadron, I was given the interesting task of instructing the other university students. So after being given a check dual flight, I was pitched back into instructing on the DH82.

I see from my flying log-book that on 5th April no pupil was assigned to me and I remember what happened that day very clearly. So as not to waste my visit to the airfield, I decided on some flying practice. This was my first solo flight in the Oxford area and hence it offered me a chance to get a panoramic view of the university town. I flew over the colleges, but was careful to keep well above their spires at around 1000 feet or more. After a few minutes looking around and identifying various landmarks, I climbed higher and tried a few slow rolls; halfway round each roll it was exhilarating to be able to look *up* and see the beautiful tableau of colleges and churches glistening in the sunshine over my head. After about an hour of this, I returned to the airfield and on landing was ordered to report to the Chief Flying Officer immediately upon returning to Oxford. He was S/L Trevor Gallagher, a New Zealander, who by one of those happy coincidences in life had given me a test when I was being trained as a Tiger Moth instructor at Tauranga six years earlier. He had also flown in the Pacific during the War and I had met him several times during those years; I counted him as an old friend and still do.

When I arrived at Trevor’s office, he was evidently disturbed about some problem or other and I wondered what he could want me for. He explained that he and Foxley-Norris had been walking in Manor Road

when they had noticed some idiot flying a Tiger Moth low over Oxford. It was forbidden to fly over Oxford at *any* height, let alone perform aerobatics just over the spires. The CO had been angered by the display and asked his Chief Flying Instructor to identify the culprit and punish him severely.

‘And,’ said Trevor, ‘I was very disappointed to discover that of all people, it was *you* who was performing aerobatics over Oxford. I must punish you since Foxley is bound to ask me what action I have taken.’

I apologised for putting him in this position. He then thought for a moment and found a brilliant solution.

‘I shall ground you for two weeks and report this disciplinary action to the CO,’ then adding,

‘If we make it the *next* fortnight, that is over the Easter break—when there is no flying anyway—you will not be affected!’ I was grateful for this generous treatment and never ventured over Oxford again.

I had another adventure on 10th May, which did nothing for my reputation as a navigator. Dick Shaw was a Rhodes Scholar from Victoria who was also doing research in the Engineering Laboratory, having spent three years as a Engineering Officer in the RAAF and having now joined the University Air Squadron to learn to fly. Cranfield was an airport about 30 miles from Oxford where after the War an Institute of Aeronautics had been established. So I thought that an interesting way of combining work with pleasure was for us to get permission to fly to Cranfield, to stay there for lunch and to look around the Institute before returning to Oxford. We took off and set course for the short cross-country flight of about 20 minutes to reach Cranfield, but I got lost. I was so used to flying over New Zealand countryside where, if you saw a railway line, you knew exactly which track it was, there being so few. Also the towns and country roads in New Zealand are sensibly spaced out so that seeing one from the air would clearly indicate one’s location. But in England the maze of towns, railway stations, roads and even airports was most confusing. After about 30 minutes I admitted to Dick that we were lost. He had thought as much.

We saw an airfield with two very large white letters laid out on the ground, but failed to find these letters on the maps given to us, so I flew off to another airfield that I spotted in the distance. Perhaps we could identify it and then set a correct course for Cranfield, but we failed again. I saw several railway stations dotted about the countryside and suggested to Dick that we could fly quite low past one of them to read the name of the station and use that information to find our position, but he was not keen on this solution. Then I heard a call over the RT using our identification code. Someone was asking us to give our position, which I didn’t know but hoped to discover any minute. As I did not wish to appear foolish, I remained silent, but the call was repeated at intervals over the

next few minutes. I finally caved in and replied to the speaker, whom I realized was an officer in the Control Tower at Cranfield airport; we were overdue and he was becoming anxious. I gave him a vague attempt at our location, but he must have realized that I was hedging since he immediately asked me to count to 20 slowly over the RT. After I had completed this shaming task, he gave me the course to fly to reach Cranfield. The direction surprised me—we had been looking at the wrong part of our maps! On landing we were required to report to the control tower where the officer in charge was decidedly critical, but who softened when I told him that navigating across the Pacific was a rather easier proposition than flying across England. We were extra careful with our navigation on the return journey to Oxford.

One of the special pleasures connected with the Air Squadron was attending the Summer Camp, which was a period of two weeks in July living on a regular Air Force Station with flying every day. At that time the Oxford University Air Squadron used an RAF station at Middle Wallop between Andover and Salisbury. On one fine summer's day I drove south across the Downs and decided that in good weather there was no place quite as beautiful and interesting as Southern England. When flying started I was again given the role of instructor on Tiger Moths and also the opportunity of flying Harvards for several flights. I enjoyed seeing Hampshire and Wiltshire from the air, going west as far as Stonehenge and east nearly to Winchester, fascinated by the panoply of model farms, villages and woods. Everything seemed more spaced out than in Oxfordshire and navigation gave me no problems. I was glad I had taken my car since after flying hours I was able to explore the local region and find a number of enchanting pubs and interesting churches. Sometimes we stayed in the Officers' Mess and drank beyond the strict need to quench our thirsts—it reminded me of similar dissipations in the RNZAF, but I was glad that this service life was merely borrowed for a fortnight.

One day at the Kidlington airfield the pupil whom I was instructing on circuits and landings and I agreed to meet at the Kings Arms for a drink that evening. He was an amusing and interesting Scotsman, who had been an army officer during the War and we quickly became friends. When I entered the pub, Mac was already sitting at a table with a pint of beer waiting for me and as I sat down he expressed surprised at the fact that I was wearing glasses. The open cockpit of Tiger Moths required goggles to be worn while flying and glasses would not have been very convenient; in any case pilots were supposed to be able to see well enough without them. His surprise was understandable especially as I had been giving him instruction that day on making accurate landings.

'Can you really see well enough to fly without glasses?' he asked a little anxiously.

'I had every confidence in your skill today,' I replied ambiguously.

‘But I am just beginning. As you know, I haven’t gone solo yet!’ he exclaimed. ‘How can you land a Tiger Moth without a clear view of the ground?’

‘Well,’ I said, sensing my opportunity, ‘it’s not strictly necessary to actually *see* the ground, all one requires is an impression of the location of the horizon and I can certainly see well enough for that.’

He seemed unconvinced so I removed my glasses and deliberately looked slightly past him as if he were not quite in focus.

‘I can see you quite clearly,’ I asserted. My glass of beer was sitting on the table just clear of its edge and I kept looking at him while I put my hand on the edge in front of me and felt along it—as I imagined a nearly blind person might—until my hand reached the glass which I then raised to my lips. He thought he was not supposed to see this indication of poor eyesight.

‘Christ!’ he exclaimed, ‘I don’t want to fly with you again.’ But he did after I had convinced him of my joke.

At the beginning of 1950 the Tiger Moth at last gave way to a modern elementary trainer called a Chipmunk. This was a low-wing monoplane still with a fixed undercarriage, but, unlike the Tiger, it had the comfort of a canopy that could be closed, hence no more wind rushing past one’s ears. After an hour’s flying practice, I started giving instruction on the new plane. It was a pleasure to fly but had one unsatisfactory feature that was revealed when one of the regular instructors, F/Lt Welsh, was teaching a pupil how to recover from spins. The pupil managed to put the aircraft into an unusual type of spin, one which was rather flat and very fast and which the instructor was unable to stop so they were forced to jump out. The pupil parachuted safely to the ground, but Welsh was probably struck by the tail unit before dropping clear; he was killed.

The next day Trevor Gallagher had the task of discovering precisely what had caused the novel spin and John Derry, the de Havilland Chief Test Pilot—later killed at the Farnborough Air Show in a DH 110—was advised about the accident and also carried out tests. Trevor took the pupil up to about 10 000 feet and with considerable courage, asked him to repeat *exactly* what he had done the day before. The pupil stalled the aircraft in the usual way, by holding the control column hard back, but when he applied full rudder to initiate the spin, he also moved the control column in the *opposite* direction to the spin. It was apparently this combination that caused the rapid flat spin to develop and it was later appreciated that previous ‘spins’ were no more than spiral dives with the airspeed remaining above stalling speed. When Trevor conducted his dangerous experiment, he had the additional challenge that the propeller stopped rotating. He applied full opposite rudder and held the control column hard forward, but the aircraft did not immediately respond. It took four or five more turns before recovery began, but Trevor persisted and finally achieved stable

flight. The engine had to then be restarted by putting the aircraft into a dive and Trevor finished with only 2000 feet to spare. Later versions of the Chipmunk were fitted with ribs along the fuselage to divert the airflow downwards towards the tail unit, which had previously been blanketed by the wings, rotating in their flat position in the spin.

Many universities had an Air Squadron like Oxford's and each year there was a flying competition between London, Oxford and Cambridge for a prize known as the Hack Trophy. In 1950 I was selected to join the team of three representing Oxford. My challenge came on 1st June when the trophy examiner tested my skill at aerobatics, forced landings and several other manoeuvres that I cannot recall. I performed well except on the forced landing. My instructing duties had given me little time to practise my own flying and I was not as familiar as I should have been with the rate of descent of the Chipmunk with the engine throttled back. I instinctively flew with the Tiger Moth's rather steeper gliding angle in mind with the result that I was too high on the final approach and was forced to side-slip to quickly lose height just before touching down. I lost marks for this clumsy performance and we didn't win the trophy, but this may not have been my fault.

My final month with the Squadron was in July at the Summer Camp, again held at Middle Wallop and this time most of my instructing was on Harvards. It was a welcome holiday from Oxford where everything was beginning to turn out well. I had completed my D.Phil. degree and the Rhodes Trustees had accepted my unusual application to be allowed to continue in Oxford for a third year to study for a B.A. degree in mathematics. My family were now happily housed and fitting well into Oxford life, and above all I had found an excellent solution to my financial problems, which I shall describe shortly. For me it was a time for diversion; I played cricket in the afternoons, visited pubs in the evenings, went to a dance or two and enjoyed a completely worldly life in contrast to my cerebral existence in Oxford. All my flying had been on propeller aircraft, so I was delighted to be given a chance to fly a jet—a Meteor 7. I was given half an hour familiarization and then invited to take over the controls for a period. The next day, 14th July, I gave 15 minutes of instruction on a Harvard; this sadly proved to be my last flight as a pilot of powered aircraft. My two years in the University Air Squadron had been very happy.

## **Personal Concerns**

We had a lease on our house for only one year so I found a pleasant detached house in Headington, which was available for as long as we stayed in Oxford. The rent was more than I could afford on the Rhodes stipend, but at that time I had prospects of a substantial increase in income. The New

Zealand Scientific Defence Corps had not been created long and I had good prospects of being appointed to it. The concept was that young science graduates in New Zealand should be recruited to the Corps to serve for five years in the Air Force, the Navy or the Army. For the first two or even three years they would be sent overseas to further their experience, usually in England, by undertaking research for a higher degree and then following this, they were expected to return to New Zealand to deploy their skills in their chosen service. It was an imaginative method of introducing science into the defence business and many able young New Zealanders benefitted from it. On 21st April, 1950 I was commissioned in the Corps at the rank of Flight Lieutenant.

From the point of view of the NZSDC, I offered the advantage that I had already spent two years doing research. I had asked to be allowed to stay in Oxford for one year to complete a B.A. in Mathematics and after that I suggested that I be seconded to the National Physical Laboratory at Teddington to spend two years researching aerodynamics, so that I would then be ready to return to New Zealand to help design a proposed wind tunnel. The Corps agreed to this and as the Rhodes Trustees had already accepted the idea that I should be given a third year on stipend, I now approached the Warden of Rhodes House with the request that I be allowed to join the RNZAF and still retain my scholarship. I explained that the double salary would give me a chance to get my finances straight. The Trustees very generously accepted the arrangement with the result that for one year my salary leapt from £630 p.a. to about £2200 p.a. (more than £60 000 in today's money). In addition the Corps would pay the rent on my accommodation—I was rich at last!

However, there was one disappointing consequence of my resigning from the RAFVR—I had wanted to continue in the Air Squadron for another year but, although I was well supported by the CO, officialdom would only agree to this if the RNZAF paid the RAFVR £6 per flying hour. This was incomprehensible as my services as an instructor would have saved the Squadron a very much greater sum, but the RNZAF would not pay, so I sadly had to say goodbye to my Air Squadron flying, which had been much the happiest of my Oxford experiences. It was some small consolation to learn many years later that I had been described in official squadron reports as having been an 'exceptional' pilot despite my colonial 'roughness'.

Betty was now pregnant again and since we already had three daughters I hoped that some statistical balance would improve the chances of this child being a boy. Of course I knew that really this was a bogus argument, but logic often fades with emotional involvement and, when we later learnt that *twins* were on the way, my reasoning was that since four distinct outcomes were possible, only one of which entailed two daughters, we had a 75% chance of having a son—our sibling daughters were born on 24th November, 1950. Since I was then reading for Finals in Mathematics, I had



achieved the distinction of being an undergraduate with five children, but as Oxford has been around for more than 700 years, I would be surprised if this is a record. We were running out of girls' names but finally settled on Elizabeth and Patricia. Fortunately we now had the income to provide the home help which Betty needed to look after five children under the age of seven.

Cliff Stevenson who had been in the Engineering School at Auckland University College with me was at Cranfield on a NZ aeronautical scholarship, so Betty and I drove over to see him a few times. One day he introduced us to an attractive young girl, no more than 17 years old I think; her name was Ann and she lived in a village near Cranfield. Later he asked me my opinion about Ann and asked if I thought that he should marry her. I thought about it and decided that the differences between them in both background and age were too much, so I advised against it, but I admit that I was pleased to be invited to be Cliff's Best Man and to propose the usual toast at their wedding. Cliff eventually became Head of the Department Mechanical Engineering at Canterbury University in New Zealand and I visited them once or twice, but remained haunted by one anxiety—supposing they had a fierce row and Cliff said 'Les warned me about marrying you!'. How would Ann react to me on my next visit? The last time I saw Cliff, I was not invited to their home and imagined that my 'advice' had been mentioned. However I recently learnt that this idle speculation was wrong and that their marriage had then been self-destructing 'naturally' for other reasons.

I was due to have my doctorate bestowed on me at one of the graduation or conferment of degree ceremonies in July, and how grand it would be, I thought, to be able to assume the style of Doctor, an illusion that did not last long. The Deans of each College present their own members to the Vice-Chancellor for the B.A., M.A. and D.Phil. degrees at ceremonies staged in the beautiful Wren building on Broad Street known as the Sheldonian Theatre. I first had to meet the Dean of Degrees at Merton to receive instructions; when he had explained the ceremony to me he then asked,

'Have you a degree?'

'Oh yes,' I replied, 'I have a Master of Science and a Bachelor of Engineering from New Zealand.'

'You have no degree,' he responded flatly. This news surprised me but I did not argue about it. At that time the University of Oxford had an arrogance towards qualifications from other Universities whereby only graduates from Cambridge and also Trinity College, Dublin, had the opportunity for 'incorporation', that is of having their degrees transmogrified into the superior Oxford variety.

The College Lodge was in the business of hiring the gowns required for the ceremony and when I arranged this, the porter asked me if I had told my scout, Baskerville, that I would need him on the day.

‘Why should I need him?’ I asked.

‘To look after your D.Phil. gown outside the Sheldonian until you need it,’ was his reply. I had planned on getting Betty to perform this task, but it was made clear to me that the scouts expected to have this privilege and of course the recompense that went with it. So Baskerville was not cheated of his due, despite having been my scout for only one term.

The great day came and we sat in the body of the Sheldonian Theatre wearing our short black gowns and waiting for our Dean to be invited by the Senior Bedel to present the Merton D.Phil. supplicants to the Vice-Chancellor. The Deans of the 30-odd colleges were called in order of their seniority and when our Dean stood up he took one of us by the hand while the rest of us gathered behind him, then, reading Latin phrases from the inside of his mortar board, he presented us to the Vice-Chancellor, who completed the ceremony by shaking our hands. We then departed from the theatre to find our scouts lurking about outside with our doctoral gowns ready; Baskerville helped me on with my gown and I gave him a large reward for his trouble. Finally when all the new doctors were ready, we were admitted through the large south door to walk into the theatre where we bowed in turn to the Vice-Chancellor and then took our seats on a curved bench behind him. After us came the Masters of Arts and finally the Bachelors of Arts with photographs and champagne following the ceremony.

When we got back home I explained to our charwoman who was minding the children, that I was now a doctor, so she immediately started telling me about some health problems which she had recently suffered; I was sympathetic but said that I was really an ‘aeroplane doctor’ and could not help.

In the summer before the birth of our twins we had a vacation in Paris, the children having been left with a relative from the Midlands, so we had a happy if exhausting time sightseeing in the most beautiful city we had seen to date. I had studied French in New Zealand and, although I couldn’t claim to be fluent, I thought I knew how to approximate the nasal sounds that served as communication. I was wrong—however slowly I mouthed the words, I found that taxi-drivers and shopkeepers kept claiming not to understand me. Then at last gathering my meaning they would repeat my question with *exactement* the same sounds which I had used, and which moments previously they had failed to comprehend. What their purpose was I could never understand, but on the occasions when it was appropriate to explain that I was not *really* English but came from New Zealand, I would often find a more rapid response. Poor Betty was struggling with her increasing weight during the rather warm Paris summer when one afternoon she fainted in a street near a café. I tried to hold her up, but she slipped slowly to the ground, her dress climbing up to her

waist; some Frenchmen hastened to our rescue and Betty was half carried into the shade of the café where water was quickly provided—I settled for *un bier*.

The reports appearing in New Zealand newspapers about conditions in England must have been a little exaggerated—we still had rationing but it was gradually reducing. I was very touched to receive two or three substantial food parcels from my primary school teacher from 15 years ago, Miss Rona Wilson. We had kept in touch with annual letters, she having been the first of my teachers to recognize my possibilities and hence having tried hard to persuade my father to allow me to attend a grammar school; I was grateful for this early encouragement. The food parcels were very welcome, but Betty and I could now afford to go to hotel restaurants where by law the maximum charge for a meal was fixed at five shillings per person. With drinks and coffee added in, I never had to part with more than 15 shillings for us both, but the food was usually the rather dull British fare of meat and two veg with the vegetables often overcooked.

Coral was now six years old and attending a small private school a few doors away in our road. I hadn't really given in to the class system—it was just a matter of convenience, I maintained. She had a school uniform including a smart blazer with an embroidered bee on the pocket. The children were happily growing up in a pleasant area of Oxford where our house had a substantial garden, which I tended with the enthusiasm of a young family man for whom all the signs were positive. I was an academic yuppy and my life had reached a plateau of contentment. I bought two family pets, a kitten and a tortoise which the children adored, but one day I had to explain to them that the kitten had wandered away to find another home. They were upset, but not as much as they would have been had I told the truth—I had been backing my car out of the garage early one morning when I felt a small bump. After getting out to see what it was, I then had to dig a hole quickly and bury a squashed kitten. Fortunately no one in the family saw this minor disaster and not long afterwards the tortoise developed a defect that I could not cure and I had to release it to a nearby park.

Bill Packard was the other 1948 Rhodes Scholar from New Zealand, though our paths never crossed until sometime in 1950 when I learnt that he had suffered an attack of poliomyelitis while climbing in the Himalayan Mountains during the summer vacation. He was transferred to Headington Hospital where I visited him several times. At first it looked as though his recovery would at best be partial, but gradually the paralysis faded and he recovered his full health. This was not the good fortune of another New Zealand Rhodes Scholar whom I met in Oxford—just after Cliff Dalton was elected in 1937, he contracted polio and was compelled to wear a calliper on one leg for the rest of his shortened life. Before this disaster he had been an outstanding sportsman who excelled at rugby, tennis and rowing; his

younger brother became an All Black and Cliff might have also achieved this distinction. His illness delayed him for one year and he arrived in Oxford just before the outbreak of the War, then serving as a Scientific Officer in the RAF. He returned to the Oxford University Engineering Laboratory in Michaelmas Term, 1945 and despite his calliper rowed for his college. He had married Catherine Graves, one of Robert Graves' daughters. Cliff took his D.Phil. in 1947 and went into atomic energy research at Harwell and in 1949 he became the Professor of Mechanical Engineering at Auckland University College, three years later following Leech as the Dean of the School. I greatly admired him and our lives were to cross again six years later.

## Maths Finals

It is of course very unusual to study for a bachelor's degree *after* receiving a doctorate, but the second-class war-time degree I had obtained in mathematics was a drag on my pride. In my biased opinion I was capable of obtaining a First and I liked to believe that under normal conditions I would have achieved this. Now I had a chance to test this theory since I would, I hoped, eclipse my Auckland Second with an Oxford First. Of course if I failed and obtained another second-class degree, my mathematical abilities would be confirmed and the effort would have been largely wasted; moreover I wouldn't have the War as a covering fig-leaf the second time. More important than this hubris was the fact that the level of mathematics at Oxford was a year or more advanced than at Auckland and I believed that I needed a better mathematical base for the research in aerodynamics that I hoped to do; the only reason that I had been permitted to enrol for the D.Phil. in the first place was that I had undertaken research in aeronautical engineering for which my qualifications were sufficient.

I had one stroke of bad luck right at the beginning of my year of studying mathematics when the very experienced mathematics tutor at Merton—the man whom I would rely on to sort out my mathematical difficulties—had dropped dead while away on a trip to Ireland. He had been replaced by a young pure mathematician named Philip Watson, who had completed his D.Phil. at the same time as myself, although I was a little older than him. It is generally believed—and is probably true—that some very experienced college tutors are capable of improving the 'natural' class of an undergraduate's degree by one grade. Philip soon showed that he was equal to the burden which I placed on him, my strategy being to try and get as much out of each weekly tutorial as I could, which meant that during the week I had to work through the recommended books and exercises until I found something that I could not understand or that I thought was incomplete or even wrong. I would list these items and then present them to Philip who

always seemed to be able to set me straight. Sometimes the texts *were* in fact wrong, so I learnt not to be dependent on one author's opinion, but to read two or more treatments of the same topic, so that the difficulty was usually solved before I went to my tutorial. I was introduced to the charming custom of taking sherry with my tutor after the tutorial, provided of course that the hour was right for this ritual—the five o'clock tutorial was thus in pole position for this form of Oxford education.

Having a weekly tutorial during which one would have the undivided attention of an accomplished mathematician meant that attending lectures was not strictly necessary. At the beginning of term I was always ready to attend all the lectures that Philip and I thought might be helpful, but, as the eight week term progressed, I would revise my opinion and then attend fewer and fewer of them. Unlike the case at most other universities, the examinations at Oxford were not set by the lecturers, but by a small independent panel chosen from amongst the Faculty members at large, and a panel member might by chance be examining a subject on which he was also lecturing, but this was not common. The result was that the usual redbrick requirement of attending lectures in 'self-defence', that is of being sure to pick up any idiosyncratic views of the subject which the lecturer might turn into examination questions, was not necessary in Oxford.

Some brilliant researchers were awful lecturers. Professor Sidney Chapman was a famous figure in the applications of mathematics, especially in the kinetic theory of gases and in astrophysics, so I started to attend his lectures in mechanics with great expectations. About 20 of us appeared at his first lecture but the presentation was poor. I hoped that it might improve the following week, but it did not and the class had dwindled to less than ten. I shall give him one more week, I thought, then if it is no better, I must quit otherwise I shall be captured by being one of the last two or three; it would then appear as a personal insult to the great man not to continue to go each week until the end of term. I went once too often and hence two of us remained trapped by good manners until he gave up, near the end of term. In contrast Jack de Wet, the Mathematics Tutor at Balliol College, was an enthusiastic and interesting lecturer whose accounts of relativity theory and thermodynamics, together with Dr Rushbridge's persuasive treatment of statistical mechanics, encouraged me to offer these subjects in one of the two advanced papers that we were required to present. Dr Ida Busbridge of St Hugh's College was another good lecturer who presented her material with meticulous precision on the blackboard.

Statistics and probability theory had been neglected in Oxford until 1951, when these topics appeared on the syllabus for the first time; as it was a subject that I liked, I decided to specialize in it. When a college tutor required assistance for his pupils in a subject that was new to him, he would usually farm them out to a more experienced tutor in another college, so

for statistics Philip sent me to David Kendall of Magdalen College who was an excellent tutor and a brilliant lecturer. The notes I took of his lectures on probability were the only ones from Oxford that I considered worth saving indefinitely. I was also farmed out to Dr Kathleen Sarginson, the Mathematics Tutor at Somerville College, who was an attractive woman, not much older than myself. Kathleen had developed the disconcerting habit of giving her tutorials lying on the floor so I felt obliged to join her on the carpet—my marriage vows were just equal to the strain.

Betty and I invited David Kendall to our house for tea on one occasion and when he arrived my daughters were much in evidence, playing in the garden, running up and down stairs and generally giving the impression that there were more than five. We sat down in the sitting room, waiting for our tea and to break the ice, I started talking about the girls. He feigned interest and remarked on what a large family we had; thinking I would amuse him with a silly joke, I said,

‘We have five, but there will not be any more.’ He was hooked.

‘Why is that?’ he asked.

‘I found out what was causing it,’ I replied, waiting for his smile. He lent forward in his chair, remaining serious and asked, ‘What was it?’. Whether or not his response was innocent or ironic I have never decided—it may have been the former, for when he moved to Cambridge some years later to a well merited professorship in mathematics, he married and had a large family.

One great difference between the Oxford of 1951 and that of today was the freedom one had to park almost anywhere. I used to think nothing of driving my car to and from lectures and even parking in the High Street just outside the Examination Schools when my lecture was being held in that building. The police were also not so concerned by drunken drivers; I recall being helped into my car one foggy night at about midnight by some friends from the Engineering Laboratory. Hard ice had formed over the wind screen, so with drunken *bonhomie*, one of them cleared a small circle about six inches across, so that I could see to drive home. To see through it, I had to hold my face close to the windscreen and I drove very slowly, never even reaching second gear. I recall meandering across Magdalen Bridge at a snail’s pace, almost mounting the footpath at one stage; I never saw a car or a bicycle at any point, but, in view of my limited vision, that is not too surprising. Behaviour like that today would quite justly result in one’s driving licence being suspended for some years.

Examinations in Oxford were physically very demanding, requiring one to answer two three-hour papers every day for three or four days on end. In Mathematics Finals there were seven papers, five that everyone sat and two that were chosen from a set of about six. This gruelling test of endurance always fell in the middle of June when there was a fair chance that the weather would be hot and humid, and it was obligatory to wear the formal

dress known as subfusc regardless of the weather conditions. The class of degree awarded by the examiners depended entirely on the results obtained in this four day marathon; in addition to failure there were five possible outcomes: the degree could be unclassified—a mere pass—or it could be classified as an Honours degree and placed in a class numbered from one to four. To achieve a fourth-class honours degree required careful judgement since it was a very narrow band to hit; one could easily manage one question too many and end up with a Third. On average only about four per cent of the candidates would fail completely.

When Maths Finals commenced in June, 1951 I was as prepared as any man of 28 years with five young children and a fondness for parties could expect to be—my excuses were already lined up. At 9.25 a.m. on the first day I stood with a crowd of other candidates in the entrance hall of the Schools Building, waiting for the bell to ring and for the gates barring our way to the upstairs examination halls to be opened. Three hours ten minutes later I was thoughtfully walking down the steps to the High Street when I overheard the conversation of two mathematicians in front of me, who were talking about one of the questions which I thought I had satisfactorily completed. I joined in, but it was a depressing exchange since I had apparently missed an important point and according to these bright students, I could not expect many marks for my answer. After the afternoon session I spoke to no one.

That evening I could not resist looking at the two exam papers I had just sat and, recalling what I had written, I tried to assess how many marks I would get—only a real masochist would do this. I gave myself about 70 marks per paper which was bad news since I had estimated that a score of at least 80 marks per paper would be required for me to be in the running for a First. Still, these papers were on Pure Mathematics and my strength lay in the applied topics, which were to be examined the next day. But the following day I was very disappointed with my performance as I got side-tracked on a difficult question in mechanics and stayed with it too long; now the target for a First receded even further. On the third morning the probability questions were very easy and I scored well over 120—at least on my own reckoning—and by the end of the compulsory papers I judged that I had scored about 20 marks less than the minimum required for a first-class degree, although perhaps it was worse if my pseudo-marking had been too optimistic, but then again I *might* just scrape in. It was also necessary to do good work in the two advanced papers, but this did not worry me as I was well prepared.

The examiners quickly marked the papers with the results being posted in the School building about ten days after the last paper. For most students, getting a Second would have been a happy and honourable outcome, but I was in a very different position. For me a Second would have been my second Second, and something of a disaster or at least a waste of a

year—that is how I viewed it at the time. So when I approached the wall on which the lists of names were posted, I was shaking as if I had nearly hit a tree while flying a Tiger Moth. No one sees their name the first time when anxiously looking through such a list, but steadying myself for a second scan, I finally spotted my name: thank God, a First! There were 66 names on the list, 14 of whom had obtained first-class honours. I was later told that I had comfortably passed the minimum mark for a First on all but one applied mathematics script and that my advanced papers had all been given alpha grades.

My success in Maths Finals entitled me to a B.A. degree and the fact that I now had both a B.A. and a D.Phil. qualified me to supplicate immediately for an M.A. degree! Three degrees in three years must be some sort of inane record. An Oxford M.A. requires no effort of scholarship at all, the usual route being to acquire a B.A., wait until 21 terms since matriculation have elapsed, and then to pay the University a tithe. But if one acquires a D.Phil. within the 21 terms, the full time duration is not required—just the fee. Students from other universities cannot graduate as B.A. until six terms have elapsed from matriculation and as six terms is also the minimum time in which a doctorate can be obtained, such students could not acquire the set of three degrees in less than four years unless like me they inverted the order of the B.A. and D.Phil. degrees.

I had already been through the degree ceremony for my D.Phil., so I thought it would be sufficient to collect the B.A. degree *in absentia*, but when I explained this to David Kendall, he said in mock seriousness that he would report me to the Proctors if I failed to go through with the actual ceremony. He claimed that he wanted to see how the ritual of the Oxford degree ceremony would cope when someone who already had a doctorate was presented for a first degree. On the degree day I put on a scarlet D.Phil. gown and sauntered into the Sheldonian Theatre, surrounded by undergraduates in their short black gowns. The visitors in the gallery, seeing me sitting there very conspicuously in a sea of black, must have thought that I had got lost and should have been sitting with the crop of new doctors, seated in an arc behind the Vice-Chancellor. I looked straight ahead, a little embarrassed, and, after my presentation by the College Dean, I walked out, gave Baskerville my scarlet gown and put on a black Bachelor of Arts gown before re-entering the theatre as a new B.A. of the University of Oxford. Time was running backwards! All of this was repeated a little later for the unearned M.A. degree except that this time the ceremony was more elaborate—when our Dean stood up and read our names, we advanced four at a time and knelt before the Vice-Chancellor who then incanted some Latin as he touched each of our heads with a Bible.

My Oxford student days were now over.



## Chapter 8

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# Research and Lecturing

### National Physical Laboratory

About ten miles south-west of London is an attractive series of suburbs on or close to the Thames; Teddington is one of these, its main claim to distinction being that it is the location of the National Physical Laboratory, which was founded at the turn of the century with the objective of establishing standards for materials testing and measurement. Metrology remains an important activity of the Laboratory, which is situated on the edge of a beautiful deer park with many varieties of trees including some magnificent oaks. This is Bushey Park and about two miles south of the Laboratory, straight through the centre of the park, is Hampton Court Palace, which graces the banks of the River Thames. There were two pubs in a small cluster of shops outside the Palace grounds, imaginatively called the Kings Arms and the Queens Arms, and 50 yards to the west of these pubs the road divides into a short no-exit lane, which serves a dozen or so houses, and the main road. We found a splendid Georgian house to rent on the service lane, facing Hampton Court Green and backing on to Bushey Park; deer would sometime peer in through our back windows, so it was an ideal spot for the older children.

When the New Zealand Scientific Defence Corps seconded me to the NPL in 1951, the Laboratory had a large Aerodynamics Division covering both theoretical and experimental aspects of the subject. The theory group was located in two large buildings that had previously been private houses. I was given an office in Cromer House to work on aerodynamic theory under the general supervision of a Welshman named W P Jones. The most eminent member of the team was Dr R A Frazer who was approaching retirement and one of the youngest was Dr J Trevor Stuart whose brilliant career was then just beginning. Other scientists whom I met in the Division included Douglas Holder and Brian Squire; Douglas and I would meet again in Oxford when in 1963 he became Professor Thom's successor to the Chair of Engineering Science.

I found Brian Squire a helpful, interesting man, who was a brilliant aerodynamicist and who should have applied for the Chair of Aeronautics at Cambridge, but didn't as he was convinced that George Batchelor, an Australian at Cambridge, would win this prize; in fact the post went to W A Mair from Manchester. Brian said to me one day, 'Les, if one has not been elected to the Royal Society by the age of 45, one should forget it.' I congratulated him on his 46th birthday, but he was in fact elected not long after, later becoming the Zaharoff Professor of Aviation at Imperial College. Sadly, he died by his own hand in 1961.

Mr Jones addressed me as 'Dr Woods' for many months, then one day, being my senior, he broached the awkward question of whether a more familiar style of salutation might now be adopted—he shyly invited me to call him 'Jones', which allowed me to venture in turn that he could either address me as 'Les' or 'Woods'; he chose the latter.

Another interesting person I met at the Laboratory was Dr Leslie Fox of the Mathematics Division, who a decade later became Professor of Numerical Analysis in the University of Oxford and a fellow of Balliol College. His method of answering the telephone particularly amused me, since his response, which was delivered in a loud, flat monotone, was simply '*Fox!*'. I expect he thought that to add *here* or *speaking* was redundant and to label himself 'Doctor' was pompous. In 1949 a paper written by Leslie had attracted my attention and encouraged me to undertake some research on the topic of calculating eigenvalues. In the paper that I subsequently submitted for publication, I immodestly remarked that my method was definitely better than his! I was surprised that the referee was not convinced, even advancing a cogent defence of Fox's ideas, but, after some debate, a modified version of my paper was accepted. When I arrived at NPL, I was looking forward to meeting my rival, who proved to be a curious blend of abruptness and charm—more Antipodean than English, I thought, although he came from Yorkshire in fact. He mockingly described my method of research as being: 'To tear down the other man's flag, trample it in the mud, and then to hoist your own banner, triumphant.' I later learnt that he had refereed several of my papers, always kindly and with helpful suggestions even though I was attempting to displace his own work.

Jones' own special field concerned the flutter of aeroplane wings. At certain airspeeds the aerodynamic and elastic forces acting on some wings are capable of producing a vibration, which would be dangerous if it occurred during flight. A similar phenomenon is the flutter of a slat in a venetian blind, which happens sometimes when a window is open and the blind is down. I was asked to take an interest in this field, so Jones put a stack of weighty research papers that he had written on my desk and asked me to read them. It was heavy going and I was thankful that I had spent an extra year at Oxford reading mathematics. Wing flutter had already been very well researched before I had a chance to make any contribution,

but there was one aspect that had been neglected. When wings or aerofoils are placed at a steep angle to the air flow, there is a tendency for the flow pattern to not adhere to the shape of the profile, but to separate off allowing the formation of a turbulent body of air just behind the upper surface. This region of separated flow makes a big difference to the oscillation forces acting on the aerofoil during its fluttering motion. I developed a theory for this type of flow, which involved some complicated mathematical functions not previously tabulated.

My research progressed very well at the NPL, Jones making few demands on my time and allowing me to develop the various ideas that I had brought from Oxford. The experimental work being undertaken on wings with suction, with separated flow, with spoilers, and fitted with air jets to act as flaps, gave me a range of problems of topical interest on which to work. The idea of using a narrow sheet of air flowing in a jet from the rear of an aerofoil in the role of a flap was thought to be so important at the time that the idea was classified as secret. Thus a paper I wrote, which presented a new theory for the jet-flap, was given this grading, but not being a real Englishman with suitable security clearance, I was not entitled to see secret papers, so when I requested a copy of my own paper in its final typed form, this was refused!

My political views had slowly drifted to the centre since I had become disillusioned with communist Russia and now realized that Stalin was really a murderous tyrant. The fact that one man could remain with supreme power for more than a quarter of a century clearly indicated a dictatorship where the proletariat were the slaves—perhaps the capitalist newspapers were not far off the mark in their treatment of the USSR after all. I was attracted to the concept of a mixed economy as advocated by the Labour Party, which offered a way of harnessing the productive drive of private greed with the compassion of public welfare. Churchill's return to power in the 1951 election was disappointing for me, but still within three years I would be back in New Zealand where Labour Governments were more securely established; perhaps I might even make a career as a politician. On the other hand, apart from the miserable weather, one could have a good life in England, at least as a scientist. I enjoyed the Teddington, Kingston and Twickenham regions with their parks and river scenes, but no doubt if I had been living in some dreary Midlands town my attitude would have been less favourably disposed. Anyway, by joining the NZ Defence Corps I had mortgaged my future for some years ahead.

## First Scientific Conference

By the end of 1953 I had accumulated about 20 publications and hence decided that if I were to apply for a university post some day, it would

do me no harm to have a higher doctorate. The New Zealand D.Sc. was normally awarded for a collection of published papers, which could vaguely be described as being 'distinguished'. The word 'vaguely' certainly fits my research output at that time, which with hindsight was not very challenging stuff—I was exploiting a mathematical skill which I had developed, and which allowed me to publish a large number of papers in a short time. But at least some of my research was being used by other scientists and it is sometimes said that a minimum test of the value of a publication is whether or not it has more than three readers—the author and its two referees!

Years later I was dismayed to discover that research that breaks new ground or challenges received wisdom is often more likely to be turned down by referees than the routine mathematical extension of old ideas. With promotion often based on the length of one's publication list, young scientists usually tend to play safe. I myself was not conscious of doing this, but with a large family, I was determined to get ahead as fast as possible. My submission for the D.Sc. was examined by Professor Mair who had just arrived at Cambridge and by my ex-supervisor, Professor Thom of Oxford. They agreed to the award. My work must have had some merit because shortly afterwards Mair invited me to write a book on my research for publication in the Cambridge Aeronautical Series.

In 1952 I had an opportunity to attend my first international scientific conference, the *Eighth International Congress on Theoretical and Applied Mechanics*, which was to be held in Istanbul later in the year. I admit that the venue and not the science was the real attraction for me. Dr Ernie Marsden<sup>1</sup> was the NZ Scientific Liaison Officer based in London to whom I reported, and in order to get the New Zealand Scientific Defence Corps to pay the expenses, I had to convince him that attendance at this conference was absolutely essential for my scientific development and therefore relevant for the plans to build a wind tunnel in Auckland! I am sure that Ernie did not believe this exaggeration, but he agreed to the expedition nevertheless.

In August Betty and I set out to drive from Teddington to Istanbul allowing ourselves ten days to cover the 2000 miles or so. Fortunately Yugoslavia had freed itself from the communist block the previous year, so that the country was now open to tourists, allowing us to travel by land to Greece and then on to Turkey. By today's standards this journey would be modest, possibly even routine, but in 1952 it was an adventure, especially the passage through Yugoslavia and the journey through Northern Greece to the Turkish border, where horses were more numerous than cars and roads sometimes turned into dirt tracks across ploughed fields; occasionally we had to drive over simple wooden bridges with planks missing here and there. Paul Germain, a distinguished French aerodynamicist, also made the

<sup>1</sup> Marsden, later Sir Ernest, was a New Zealander who worked with Hans Geiger and Rutherford at Manchester. It was his experiments on alpha scattering that had led Rutherford to discover the atomic nucleus.

journey by car and we passed each other several times on the long journey, which seemed to develop into a race. Years later he told me that, one time when he was behind us after we had negotiated a precarious bridge, it was so weakened that when his turn came, it was clearly unsafe and he was thus held up until repairs were made. Good-humouredly, he pretended to believe that I had sabotaged the bridge to slow him down.

The most interesting part of our journey was through Yugoslavia, now sadly devastated by ethnic hatred, our route being through Trieste, Ljubljana and Zagreb and then on a long motorway to Belgrade. It is interesting that, as with Fascism, Communism was good for highway construction—motorways in England were a long way into the future.

We were sitting at a café in the centre of Belgrade when we were approached by a rough-looking young man with his leg in plaster. He laid his crutches across a chair and asked if he could join us. We were a little anxious about this approach by a stranger, but he seemed harmless and told us his name was Tommy. I bought him a drink and some food, when he spun us an interesting tale, saying that he had been a Chetnick and after the War had served a stretch in prison. (At one stage the Chetnicks had been allies with the Germans.) He was now unable to either get employment or leave the country. He had once tried to escape in a train, which was due to cross into Italy, but communist soldiers had come to check the passengers while the train was still moving; he had jumped from the carriage and broken his leg.

He offered to be our translator if we would transport him to the Greek border where he planned to escape to freedom. Considering his disability, I thought that the risk of taking him with us was quite small. Tommy proved to be quite useful translating for us; he asked us to take him first to his village, which lay deep in Serbia, not far off our route to the south, so after several hours of travelling over dirt roads, which passed through wild but attractive countryside, we drove into a small farming community and then on to Tommy's parents' home. Even in the village the roads were unsealed and dust was everywhere. The house too was primitive and not all the rooms had the luxury of floor boards. I parked my car with some anxiety since in this environment it and its contents represented considerable wealth. Tommy was welcomed home by his parents and numerous relatives and we were also greeted warmly.

I had never tasted *slivović* before—this is a home-made plum brandy with a pungent flavour—and my opinion of its quality was eagerly sought by Tommy and his relatives. To minimize the distorting effect of its taste on my facial muscles, I downed the potion in one quick toss of the head and then tried to smile; the hosts were impressed and kindly offered me more of the stuff. Clearly another solution was required, so I started surreptitiously sharing my drink with a pot plant near my elbow. They provided us with a meal and then showed us where we could sleep later in

the evening—we were to have the main bedroom, which did have floor boards, and the three of us were to share the bed, Tommy, Betty and myself. We declined the honour, which made things awkward as there was limited accommodation, but I recall that a neighbour helped out by taking Tommy that evening. The toilet was little better than a boy scout latrine—a single wooden pole supported by stakes over a murky trench. I had little sleep, being anxious about the car and its contents, but this was misplaced since the family and neighbours were kind and honest, although quite poor.

In the morning we said goodbye to Tommy's relatives and rejoined the main road passing through Nis and then on to Skopje, where Tommy found a good hotel for us and then went off to some cheaper place for the night, which I paid for. The next day we set off to cover the remaining 90 miles or so to the Greek border. Tommy said he would leave us well before arriving at the border control post in order to move into the forest to hide until night when he would then cross the border at an unguarded spot. Unfortunately a few miles before we reached Gevgelija, the last Yugoslavian town before Greece, we were stopped by a policeman and asked to show our passports. Betty and I passed this scrutiny and then came Tommy's turn. I was fearful that we would be arrested for aiding an 'enemy of the state', but Tommy produced a crumpled letter from his pocket and spoke a few words while the policeman appeared to read this document. After some interrogation, we were allowed to proceed and we had travelled only another mile or so when Tommy said we should stop and let him walk into the forest. I asked him about the document he had shown the policeman and he said it was a letter from the US Embassy in Belgrade refusing him a visa to enter America. It was in English and all that the policeman could understand was the Embassy crest at the top of the page. Tommy had told the policeman that the US Embassy had employed him to accompany us as an interpreter and that he would be returning after leaving us at the border. We had become attached to Tommy and were a little sorry to say goodbye. He finally asked one last favour: 'Could you please give me some shirts?'. Perhaps I was mean since I only found one shirt in my luggage that I was willing to pass on, but I did give him a fist full of dinars. I also gave him our address in England and asked him to write us after he had escaped. But he never wrote; perhaps he was caught, for we later noticed lookout towers along the border short distances apart.

Our route took us down to Salonica where we spent two nights, but the hotel we chose was at a noisy intersection and we were awoken in the early morning by the deafening sound of horses dragging carts over the cobbled streets beneath our window. Later that day I visited a bank to change some travellers' cheques and was amazed to see tellers walking between counters with armfuls of bank notes up to their chins—it turned out that an exchange rate of 43 000 drachma to the pound was the problem.

## Istanbul

The next town on our route was Alexandroupolis, nearly 200 miles to the east, where we had a pleasant meal. Later that evening we heard Paul Germain's car stop at our small hotel, which encouraged us to get up early for what we suspected would be the most demanding sector of our journey—90 miles travelling north over dirt tracks to the Turkish border town of Edirene and then 130 miles eastward to Istanbul. About halfway to the border the road seemed to peter out, leaving us crossing a field following cart-tracks, and later at another point the road degenerated into a boulder-strewn excavation with pot holes so large that one had to inch past them, making it a very slow journey. All we had with us to eat was some fruit and a watermelon that we had purchased in Alexandroupolis, so we were looking forward to having a late lunch in Edirene after clearing passport control. We achieved this at about two o'clock and then asked where we could buy Turkish currency. Istanbul was the depressing answer—three hours' drive away! Our watermelon assumed great importance and about halfway to the city we stopped and divided our meagre ration.

We only had the name of our hotel but I assumed that it was well known and that we would have no trouble locating it. At some point near the centre of the city I stopped and approached a taxi driver, showing him the name of the hotel and then handing him a map of the city.

'Taxum!' he said.

'No, we don't want a taxi,' I replied, pointing to my car. 'Where hotel please?'. But he did not understand even my pidgin English.

'Taxum, taxum!' he cried. I took my map and walked away, but he followed, apparently still seeking trade, 'Taxum, taxum!'.

'Bugger off,' I said and turned my back on him, but he then grabbed my arm, and, pointing to a region near the top of my map, said:

'Taxum!'.

At last I understood—this was the name of the district in which our hotel was to be found! How ill mannered I had been. He used sign language to indicate that he would drive there and that we should follow him—it was a good ten minutes drive, but he refused a tip. His kindness quite shamed me.

We enjoyed being in Istanbul with its beautiful mosques and fine buildings, but away from the main streets the poverty was striking—I had not previously seen such a stark contrast between affluence and poverty. The first chance I got I changed some traveller's cheques at a bank, having read warnings about dealing with unofficial money-changers. However, the official rate was about eight dinars to the pound, so I was annoyed with my scruples when I found out that other English scientists attending the Congress, including the doyen Sir Geoffrey Taylor, had received twelve dinars for their pound from back-street bookstalls.

I presented two papers at the meeting, one on aerofoil design and the other on a numerical method of solving fourth-order differential equations. It was a competent beginning to a scientific career but more importantly, the Congress gave me the opportunity to listen to and occasionally to meet the eminent aerodynamicists whose work I had studied. One of these was Dr Theodorsen, who gave a talk on the role of vorticity in generating turbulence. At question time Theodorsen was too aggressively challenged by young James Lighthill, whose brilliance was already acknowledged. George Temple, the meeting Chairman, later told me that he chastized James for this intemperate attack.

The hospitality provided by the organizers of the Congress was outstanding and included a boat trip on the Bosphorus, a visit to the Blue Mosque and a concert of ethnic dancing and music. The Turks also provided a lavish banquet of food and drinks, which encouraged some of the English, who were still on food rationing at home, into some gluttony, myself included. At one stage near the beginning of the buffet W P Jones happened to see me shovelling food down and came over to join me.

‘Is vodka a long drink or a short drink, Woods?’ he asked me. The question surprised me, but 50 years ago I imagined that this Russian spirit would not have been very familiar in Wales and feigned ignorance, but after a pause said,

‘I think it is a long drink, Jones,’ but added as insurance, ‘But I am not sure.’ I was bemused to see him take a tumbler from a table, fill it up with vodka and then drink it like beer—he appeared to like it. Our paths then diverged and about an hour later I came across a rather changed man.

‘Hello, Jones. How are you enjoying the evening?’ His manner was ebullient:

‘It’s marvellous, isn’t it? Jush call me Bill,’ he enthused as he tottered past me. The following morning one look at his face made it clear that he was suffering—it was back to ‘Jones’ once again without question.

On the return journey we took a different route, which gave us the opportunity to see Athens. Our car was loaded on to a small steamer, which took one night to reach Piraeus from Istanbul. We crossed the Sea of Marmara, passed through the Dardanelles and then over the magical Aegean Sea to Greece. The accommodation was primitive, the men packed together in a large cabin and the women in another and passengers had to bring their own food on board. It was a very hot night, so Betty and I sought relief by trying to sleep on deck, but this plan was largely ruined by several voluble Italians standing near us half of the night.

To save money we stayed at a youth hostel in Athens, but this was a mistake; I had never seen such filthy accommodation. The lavatories were no more than holes in a porcelain slab with places for one’s feet and a tidy-up stick was an added refinement, but not always used.



David Bland was an applied mathematician from Manchester who had also attended the Congress and who now accompanied us on a visit to the Acropolis and other tourist sights in Athens. We then drove north to see the ruins of two or three ancient cities before David returned to Athens, while we drove north into the mountains of Macedonia and then crossed into Yugoslavia. We circled around the forbidden and mysterious country of Albania, finally reaching the coast at Bar; the journey up the coast to Dubrovnik and then on to Split was enchanting. In Dubrovnik we went to what before the communist regime would have been a very fashionable restaurant, so I was surprised to see men having dinner dressed in either rough working clothes or in some cases just wearing singlets and no shirts. Either they were very poor or else they were demonstrating solidarity with their fellow workers; the women took more trouble over their appearance.

A week later we were back in Teddington and it was time to think about my research again.

## **Some Ambitions**

Betty and I would visit West End theatres occasionally and I can recall one play with John Mills in the leading role, but it was the trip back to Teddington after that play that remains firm in my memory. In those days most houses were heated by coal fires burning in open grates, which polluted the atmosphere so badly that in certain weather conditions any naturally occurring fogs would turn into smogs, a nasty mixture of water vapour and sulphurous gases. For older people with lung complaints these acrid fogs could be lethal. Typically the light from overhead lamps could only be seen by standing directly beneath them—a few paces away from the lamp post would be far enough for any signs of illumination to disappear. We left the theatre to find that a dense smog had developed, so the 12 mile drive to Teddington was clearly not going to be much pleasure. I found that in the centre of London the easiest method of proceeding was to follow buses, provided of course they were proceeding in roughly the correct direction, but this would mean that we would keep having to stop with the bus as its passengers got on and off. Sometimes I would brave the dark yellow murkiness by myself and, with the nearside door held slightly open, I would be able to see the kerb by light reflected from my dipped headlights and thus keep my correct position on the road. Parked cars were usually infrequent enough to allow this, but when the curb fell away at intersections, there would be a hesitant wandering across the road to pick up the continuation of the main road. This particular time I was averaging only about six miles an hour and when we came to more open country by good fortune a bus overtook us with Kingston as its destination. This should get us almost home, so I closely followed the bus, which was moving

at a speed born of long familiarity with the route. After about 20 minutes I noticed the conductor standing on the rear platform and waving to us, so I waved back. Perhaps he had not seen my response, since he continued to wave and I assumed he was being friendly until the bus stopped in the darkness and I looked around and realized that we were in the bus depot. We finally arrived home at about two o'clock in the morning.

In 1953 I was promoted to the rank of Squadron Leader without an aeroplane in sight and I then became a member of the Commonwealth Advisory Aeronautical Research Council, which included scientists from Australia, Canada, Great Britain, India and New Zealand. I expect I was invited to join such an illustrious quango because the other two New Zealand scientists on the Council were not actually aerodynamicists. I enjoyed the lunches and the illusion of making important decisions even if in fact they led nowhere.

After a year in our splendid Georgian house on Hampton Court Green, we moved to a large house in Teddington. A kind neighbour across the road owned a cottage in Wales near the stretch of coast known as Freshwater West and invited us to make use of it. So I took the family to this cottage and enjoyed a week wandering up and down the long beach, exploring deep rock pools with the girls, who had a happy time finding crabs and shells and small fish. Fresh milk straight from a cow was provided by a local farmer and in fact, apart for the temperature of the water, it was rather like being in New Zealand—I began to think it was time to depart to my homeland.

Sometime in 1953 it became clear to me that the NZ wind-tunnel project was unlikely to proceed, which meant that there should be no objection to my seeking another job before my five years with the Defence Corps were completed. I saw an advertisement for a post at Sydney University that was within my reach—a Senior Lectureship in Applied Mathematics. There were two eminent professors in the Mathematics Department there at that time, T G Room and K E Bullen. I optimistically reckoned that it was just the right staging post from which to obtain a professorship in NZ after a few years. I needed three referees prepared to vaunt my claims and Sir Richard Southwell, Professor Thom and Professor Temple were all willing to accelerate my departure from England. My application was successful and the appointment was to date from February, 1954.

Near the end of 1953 Professor Semple, Professor of Pure Mathematics at King's College, London took me to lunch to thank me for some part-time teaching I had done for King's during the year. He told me that I was moving to a very unhappy mathematics department, for it appeared there was a quarrel between Room and Bullen that was well known in mathematical circles and he advised me to steer clear of this conflict. I wished I had known about this six months earlier, but it was now too late to withdraw—too many wheels were now turning.



Farewell to LCW at Cromer House, NPL, Teddington, Middx, 1954.

*Front Row:* N Gregory, J T Stuart, LCW, R A Frazer.

*Second Row:* H B Garner, W E A Acum, W P Jones.

*Third Row:* C S Sinnott, J Williams, R C Pankhurst.

In January I organized a sherry party at Cromer House to say goodbye to the friends and acquaintances I had made at the NPL. The Director of the Laboratory, Sir Edward Bullard, appeared and said some kind words—my NPL career was now over. I was sad to be leaving as I had become very attached to the Laboratory and its setting close to Bushey Park.

The return journey to Australia had none of the freshness and excitement of our first P&O adventure; I was becoming a little anxious about the sort of department I was going to join, a feeling that was increased by a letter I had received from Professor Bullen just before our departure from London. In it he stated that he would not be in Sydney when I arrived, but that I was to give courses of lectures on Quantum Theory, Relativity, Elasticity, Fluid Dynamics and Mechanics no less, but, if I wished, I could make use of his own lecture notes on these topics. In Mechanics I was to work through the textbook he had written on the subject and which all students were required to purchase, and he gave me a very precise statement of which sections of his book had to be covered and which were to be omitted. It struck to me that I was being treated as being a rather junior lecturer, not as a senior one. Of course I appreciated that I had to work to an agreed syllabus, but the detail he provided was unnecessarily confining

so I decided to ignore it, especially as he would not be around to harass me. This turned out to be only the first of my mistakes.

The last week of the journey was interesting when we visited the capital cities of Perth, Adelaide, Melbourne and finally Sydney. I went ashore at each port to visit the State Universities and make contact with the local applied mathematicians, then in Melbourne I paid a visit to the Aeronautical Research Laboratory at Fishermens Bend and renewed my acquaintance with Mr L P Coombes, the Superintendent of the Aerodynamics Division, being optimistic about making a contribution to the work of the laboratory. It was their experimental programme that particularly interested me since theoretical research which is not related to experiments or observations has never had much attraction for me. My problem in moving to Australia was where to find this input to my work, having been spoilt at the NPL.

## Teaching at Sydney University

We finally reached the splendid city that was to be our home for the next half a dozen years and were met by Dr Fenton Pillow, who was a member of the department I was joining and who was soon to become a close friend. The University had arranged temporary accommodation in a seaside chalet at Newport Beach about 20 miles north of the city centre, so Fenton drove us across the famous coat-hanger bridge to the North Shore and then up the coastal road past a series of fine beaches. We found the summer heat and blazing sunshine a little uncomfortable after so many years living in the English gloom. Fenton gave us the key to our house and said that he looked forward to my appearance in the Mathematics Department in a few days' time.

The mosquito netting over each bed in our chalet reminded me of my years in the tropics and I found that local mosquitoes were quite the equal of their tropical cousins. My daughters were attacked by a variety of nasty insects and within a week sores covered their legs and arms—it took some months before they acquired the immunity of the locals. We found a local school for Coral and Jill, but it was not a satisfactory situation since I hoped to find better accommodation very soon and then they would have to move again. Meanwhile they could at least enjoy playing on the beach and become acquainted with the Australian way of life, which included fish and chips, ice creams and fresh fruit all rather superior to those they had been accustomed to.

After a few weeks the University found more suitable accommodation for my family in an attractive suburb called Turramurra about ten miles north of the Harbour Bridge. Mosquito nets were unnecessary and there it was much cooler. The houses were large and spaced out in a parkland

setting with eucalyptus and other native trees providing shade. Many of the properties including the one we were renting had tennis courts and there was a convenient school close by. It was just the sort of area in which I should have liked to have purchased a home, but my salary was not yet sufficient, so an early promotion would be necessary. With this in mind, I worked long evenings on my research, still extending the ideas I had gathered while at NPL. Of course with hindsight I should have been pursuing a fresh line of research since the widespread philosophy of publish-or-perish seldom leads to very original work.

The mathematicians were housed in the Physics Building and one department included Pure Mathematics, Applied Mathematics and Statistics with the geometrician Professor Room as its Head. In Bullen's absence, Kevin Westfold acted as Head of the Applied Group, but most of the staff considered themselves to be simply mathematicians, neither specifically pure nor applied; the idea of dividing mathematics into these categories was only just emerging.

Keith Bullen, a New Zealander, had the distinction of being the first Professor of *Applied* Mathematics in Australasia. Room had wanted a senior person to look after the teaching of what to him must have been the dull, pedestrian topics of Dynamics, Mechanics and Mathematical Physics and had no intention of adding an equal to his department, one with whom he might eventually have to share administrative authority. Bullen however had his own ideas; sparks tended to fly and this was the battlefield into which I had stumbled. What I did find on my first visit to the Mathematics Department was a convenient, nearby hotel (now gone) with the curious name of 'Lalla Rookh'<sup>2</sup> where Fenton and I were to spend many happy hours in the bar talking about research, but more often examining the faults of those in authority above us.

My most challenging lecturing duty was to a class of about three hundred first year students studying Mechanics in the 'B' stream and hence who mainly intended to take engineering or physics rather than mathematics for its own sake. The lectures were delivered in a large hall known as the Wallace Theatre, which had rows of benches tiered up to large doors at the rear and which in the summer heat were usually open. At my first lecture I copied on the blackboard the notes that Bullen had sent me defining the parts of his book on mechanics that were essential reading and the parts that were not. This tiresome task took about ten minutes. I managed to avoid saying that I found his treatise pedantic and boring, but when I had finished, I said that my treatment would be based on Lamb's classics on the subject, although the students could expect to pass their examinations if they knew the material described on the blackboard—I would be covering

<sup>2</sup> I later learnt that the hotel was named after the last Tasmanian aboriginal woman, who died last century.

it all, though perhaps in a different order. Then I set about explaining the subject in my own way.

I shall not pretend that I was a brilliant lecturer and in fact I soon discovered that at least for a large elementary class I fell short in several ways. On the very first day I had not been talking for very long when someone helpfully called out:

‘Don’t talk to the bloody blackboard, face the class!’.

I took the point. Apparently one needed to learn to write on the board while facing away from it. The best I could manage was a sideways stance, with one eye on the board and the other on the class. I would never be able to approach the skill shown by one of the senior lecturers in the Department, Freddie Chong, who was able to face the class and as a parlour trick to draw perfect concentric circles on the board behind his back. Another difficulty I had was keeping the noise level down so that I could be heard. Australians talk a lot in classrooms, unlike the more subdued English, and telling the students to be quiet had no more than a momentary effect. I would have to raise my voice, but all that would happen was that the background hubbub would increase to cancel my effort. It was a divergent process—the louder I spoke, the louder the students became. Kevin Westfold knew the answer.

‘Follow Room’s technique,’ he suggested. ‘Speak more softly and when the keen students who fill the front benches cannot hear, they will become annoyed with the talkers and insist that they be quiet.’ It worked.

I found that some students who were learning Chemistry enjoyed bringing their new skills into the Wallace Theatre with stink bombs, acrid smoke-generating substances and explosive mixtures being smuggled in from time to time. If I turned my back to write on the board, there was always the chance that a chemical event might take place and when I asked the culprits to leave the class, no-one would stir. So I would identify the row in which the deed had been done usually by a cloud of smoke or by the direction in which the entertained students were facing. For example if I thought the centre of activity was row eight and no-one had confessed, I would demand:

‘Everyone in the eighth row, please leave the Theatre!’.

On one occasion with my attention on one end of the row where I imagined the villains to be, I ordered out a row that happened to have several nuns sitting at the other end, causing both amusement and anger. One mature student sitting near the front stood up and made a short speech—he was apparently a Dutch immigrant familiar with the ways of the Nazis in Holland during the war years. He said that my method was the same as that used by the Nazis—rounding up hostages and killing the innocent with the guilty! He had a point though I was tempted to tell him that I had fought for the Allies during the War. I told him that the class was undisciplined and invited him to come up to the rostrum and conduct a discussion on how the problem could be rectified while I would leave and he could then report to me later. Later that day he came to my office and

apologized for his odious comparison, but spoilt this a little by insisting on lending me a copy of Dale Carnegie's famous book *How to Win Friends and Influence People*. The class was easier to manage in the following weeks; I suppose they had become used to my style or perhaps more likely I had improved my lecturing technique.

Bullen was due back in Sydney soon. I told Fenton that I was pleased not to have had him monitoring me right from the beginning of the year since he might not have approved of my not basing my lectures on his textbook.

'But he will learn soon enough,' Fenton said, 'In fact he may have already been told!'

'Who would tell him?' I asked.

'Don't you know that his son is in your Mechanics class?'

'Good God, now you tell me!' I exclaimed.

The fat was clearly in the fire, however when we met Bullen made no comment, but later in the year he told me that I would not be setting the final examination in Mechanics as he would do it. I complained that this was unusual since all the other lecturers were setting the examinations in the subjects that they had been teaching.

'What is the problem?' I asked. 'I am setting exams in the several advanced subjects which I am teaching students in their final year. Surely I can manage the first-year examining?'

'It requires a lot of experience to set suitable questions for an elementary course,' Bullen rationalised. 'Perhaps in a year or two you will have this skill, but not now.' I resisted mentioning his son. At the Lalla Rookh Fenton was amused at my annoyance, but his own turn was to come. When Bullen anointed him Librarian of our modest collection of books just before departing on some leave, Fenton assumed that this gave him authority to re-arrange the books according to subject rather than alphabetically by the authors' names. But on Bullen's return Fenton was reprimanded and the books were restored to their original, unhelpful order.

Around the middle of 1954 I found a modest house, which at £3750 was just within my financial reach. It was in Chatswood, a well established suburb about five miles north of Sydney Harbour Bridge and moreover it had a clay tennis court on its quarter-acre section of land. The children were very happy there, becoming familiar with the several large blue-tongue lizards living in the stone wall around the tennis court; they played in the Sydney sunshine and learnt to avoid the more dangerous of the spiders that came with the house—the venomous redback and funnel-web spiders. Coral, Jill and Diane attended the Chatswood primary school only five minutes walk away and Betty and I joined the local Parents and Teachers Association.

I was disappointed with my salary of about £1750 p.a. since while I had not expected to be affluent as a senior lecturer, I had thought we would

live rather better than we were managing. I had no expensive vices, seldom bought new clothes, did not smoke and kept my expenditure on alcohol below £2 a week. A way of supplementing my income was urgently required; I became efficient at DIY, undertaking painting, plumbing, electrical work and even some crude carpentry since I could not afford tradesmen's rates. I also made a little money as a mathematics tutor at St Paul's, one of Sydney University's residential colleges.

One pleasant change for the family occurred when my sister Beverley, who was now 17 and about to begin her studies at Auckland University for a degree in chemistry, spent some weeks with us. My father had initially ignored my firm advice about her education and planned to send her to the Technical College, but unlike me she had the wit to cry her way out of this fate and ended up at Auckland Girls' Grammar School, where she had an excellent scholastic record and became dux (top scholar) of the school. We took her and the children to a holiday home on Lake Macquarie where the fish, although small, seemed eager to be hooked—it was a happy week for us all. Beverley enjoyed her stay in Sydney, spending much of her time travelling across the famous bridge and on to Bondi Beach where the surfing was excellent. She was free from family constraints for the first time; I knew exactly how she felt.

Notwithstanding his obvious intelligence, my brother Alex, who was two years younger than Beverley, was firmly consigned to the Technical College where he had to contend with my remembered record. If I was 'against the tide', Alex was 'against the storm'! He was occasionally punished for events beyond his control and, sadly, as a young man he did not prosper. He wanted his father's love but Father had none to offer, so Alex became quite wild and once or twice got in trouble with the police, although over nothing very serious. If he couldn't have Father's love, then at least he could have his hatred, so as soon as he was 21 he changed his name to Woods—I didn't learn of this until many years later however. He lived the life of a beachcomber, slowly but futilely building a yacht in Innsfail, a small town in Queensland. It never sailed. He died of a brain tumour in 1997.

## Uncivil War

Room and Bullen had offices just across the corridor from each other, but communicated by letters, which would travel up and down the corridor between secretaries. There was one tearoom for all mathematicians, but one day, when Room had annoyed him beyond measure, Bullen announced that in future he would have tea in his office ante-room and that the applied mathematicians were welcome to join him. He no doubt expected a few loyal colleagues to follow him into exile away from the pure mathematicians, but Fenton and I both ignored him.



I never had any problems with Room, who was always charming to me, but he treated Bullen as if he were just a senior lecturer. I expect he was surprised that Bullen wanted to do more than just organize the lectures in applied mathematics and get on with his own research. The problem partly lay in the difficulty that Bullen had in communicating with others—he was rather deaf and his hearing aid was not a complete success. He had developed a rather pompous, guarded manner, and, although he could be very charming, there was a formality which would have required several large whiskies to dispel. He was an important figure in seismology, having been President of the International Association of Seismologists (1954–57). He had also won numerous medals but found it hard to rise above his international status.

Because of the confused signals coming from the Mathematics Department, the Science Faculty decided to set up an Advisory Committee consisting of all its senior lecturers, the hope being that the differences between the two professors could be resolved or at least moderated by this body. I enjoyed the excitement of the Advisory Committee gatherings, which were rather like Cabinet meetings into which the Leader of the Opposition had mistakenly blundered. With Room at one end of the table and Bullen at the other separated by half a dozen good-humoured senior lecturers, arguments between the principals were often diluted by common sense.

One particular discussion remains in my memory—several of us including Room believed that the final-year students were being overloaded with far too many demanding lectures. Room felt that Bullen was including too much mathematical physics whereas Bullen wanted equality in the hours devoted to pure and applied. In fact he had a hidden agenda of splitting the Department into two with himself as the Head of a Department of Applied Mathematics, but this would in fact take several years to achieve. Room proposed that we reduce the hours by 20%, but Bullen would hear nothing of it (pun unintended), insisting:

‘Unlike pure mathematics, applied mathematics encompasses a demanding range of topics, which require many hours of lecturing to cover properly.’

At the Advisory Committee meeting, I made a crafty intervention by suggesting that, while we should follow Bullen and retain the same number of lectures, we should also agree with Room to reduce the total time by running each lecture for only 45 minutes! Bullen said that it was a good idea but that it would not work since from his experience he knew that the pure mathematicians would cheat and continue lecturing in their classes for the whole hour regardless of any arrangement.

‘How can you say that?’ Room demanded.

Bullen replied ‘I have often waited outside a lecture room for a pure mathematician to conclude his lecture so that I could begin mine, and I

have been kept waiting well beyond the time I should have started my lecture. Pure mathematicians cannot be trusted in these matters!'. No agreement was ever reached on this.

Early in 1955 I was beginning to think of finding another job when by chance I saw an advertisement seeking a Professor of Mathematics to replace Forder in Auckland; now there was a chance to return to New Zealand as I had always hoped I might. Not believing that any other senior lecturers in the Department would have any interest in emigrating to New Zealand, I mentioned the advertisement to my friend Bill Smith-White, who told his friend, Freddie Chong, and Freddie was definitely interested—anything to escape the civil war in the Department. But I had some knowledge of Freddie's background in research and was confident that my record of publications was somewhat better than his, and he had also stopped his applied mathematics research several years earlier, although he remained a good scholar in a fashionable branch of pure mathematics. He was also apparently a good tutor, having been employed to give Bullen's son extra tutorials.

Anyway, I was a genuine Kiwi and had fought for my country, facts which the Selection Committee would surely not ignore. Choosing my referees presented me with a problem since if I avoided my chief Bullen, it would look suspicious, but then again if I included him, he might scupper my chances. But perhaps on the other hand he might be pleased to see me depart! I gambled and asked Bullen if he would support me as a referee; he kindly agreed, but did not tell me that he had also accepted the same role on behalf of Chong and my old mentor in Auckland, Cecil Segedin!

At the interview I had several surprises—Forder himself was present, although it is unusual, if not improper, for a retiring professor to play any direct role in choosing his successor, and Chong did not appear. I later learnt that on the same day Freddie had been interviewed for a similar post at Canterbury University in the South Island. His absence gave me a sense of confidence for the only other candidate being interviewed admitted to me that he did not expect to succeed, but that being short listed would increase his chances of being promoted to a senior lectureship in his department at Dunedin University.

The Chairman of the Selection Committee and I had something in common—we were both Mertonians. Kenneth Maidment had been Principal (a title that was shortly to be changed to Vice-Chancellor) of Auckland University College since 1950 and I got the initial impression that he was on my side. I was asked if I would lead research in pure mathematics, but since my reputation was clearly firmly established in applied mathematics, I thought this was a silly question and implied as much in my answer—very few mathematicians nowadays spread themselves over both pure and applied mathematics, although a few pure mathematicians fancy that some

of their research is relevant to real world problems. In 1955 I was certainly willing to *foster* pure mathematics in Auckland.

‘Perhaps in due course,’ I ventured, ‘the University would consider appointing a second professor to cover the subject?’.

Towards the end of the interview I received another surprise, when Maidment asked me if I would like to be considered for the Chair in Mechanical Engineering, which was about to be vacated. I thought quickly—if I told the truth and said ‘yes’, it would imply that my interest in the Mathematics Chair, which was what I really wanted, was perhaps transitory and this might tell against me. So I said ‘no’ very firmly. I was later told that I had interviewed badly—much too assertive. Chong was contacted in Christchurch and offered the post even before he was interviewed—Bullen must have provided an excellent reference for him. Although Chong’s several publications were all in applied mathematics, he claimed that he would be able to lead research in pure mathematics. Three years later the truth dawned and the University acting on the advice I had offered at the interview, appointed a professor of pure mathematics.

Over the years I had become interested in thermodynamics, an interest inspired partly by Max Born’s brilliant Waynflete Lectures, which had been published under the title *Natural Philosophy of Cause and Chance* by Oxford University Press in 1949. I therefore decided that I would offer an optional course for the applied mathematicians at Sydney University, which covered the subject along the lines adopted by Max Born but with a few of my own ideas as well. The second law of thermodynamics is a much misunderstood principle, despite having had more publicity than almost any other scientific concept ever, and, more than a century and a half after its inception, philosophical controversies still erupt in the subject. The overworked and often vague notion of entropy is excellent for fogging up a discussion and one can often win a scientific argument by introducing this usually undefined term with sufficient confidence.

I thought I should confirm with Professor Bullen that he had no objection to my undertaking these voluntary advanced lectures on thermodynamics. As far as I could tell no-one else wanted to give such a course, so I would not be upsetting other plans. Bullen was cautious however.

‘How do you plan to cover the subject?’ he asked. After I had give him an outline, he still hesitated, then said,

‘Well, that’s not the way *I* would treat the subject and in fact I had myself intended to give a thermodynamics course next term, so I am afraid you will have to defer your plans till another year.’

‘Perhaps the students would benefit from having two ways of viewing the subject,’ I asked hopefully.

‘No, we don’t want to confuse them,’ he replied firmly. I was very disappointed.

Senior lecturers who wished to be considered for promotion to readerships were invited to submit their claims to a promotions committee of the Professorial Board towards the end of 1955. I did so, but Bullen opposed my advancement, apparently saying that if anyone on his staff deserved promotion, it was Kevin Westfold, not LCW who had only been at Sydney University for a short time. There was some justice in this, but no suggestion that Bullen's attitude would change the following year.

In those days each university department had just one professor, who was the permanent chairman of it and therefore had great power over his staff, appointing them (via a committee who naturally deferred to the professor), controlling their promotions, assigning duties both pleasant or otherwise and writing references for those who wished to escape. In Australia staff associations labelled the phenomenon as the 'God-Professor' myth. Of course there were a few democratically minded department heads, but the system encouraged an authoritarian style of leadership. I resolved that if one day I should ever become a professor I would devolve as much administration to elected committees as I possibly could, to leave myself time to undertake a lot of research.

My first research student was a charming, hard-working man named Simon Rosenblat. I gave him a research problem which required him to calculate the aerodynamic forces on an aerofoil in unsteady motion in a wind-tunnel. Many years later Simon became the Professor of Applied Mathematics at the Technion in Haifa, Israel and later still Head of the Mathematics Department at Melbourne University. Michael Newman was my second research student, but his interests were really in pure mathematics; he now holds a professorship in this subject at the Australian National University, Canberra. To have two such able students was a good beginning to my career as a supervisor.

## **Bailing Out**

I was intrigued by a message which arrived from Kenneth Maidment who was in Sydney *en route* to England and wanted to see me about the proposal he had made when I was being interviewed for Forder's Chair a few weeks earlier. Cliff Dalton, a NZ Rhodes Scholar with whom I had overlapped in Oxford in 1948, had accepted the post of Chief Engineer with the newly established Australian Atomic Energy Commission and would be vacating the Chair of Mechanical Engineering at Auckland in a few months' time. He asked if my answer from the interview remained the same. Was I now interested in the post? I said that I most certainly was.

Maidment said he would recommend that I be offered the Chair, but warned me that he had not yet discussed this with the engineering professors and that there was no certainty that they would agree. There were

two professors involved, the Professor of Electrical Engineering, Gordon Bogle, who, like Cliff, had been a Rhodes Scholar, and the Professor of Civil Engineering, Neil Mowbray, who had no doctorate, but many years of practical experience in civil engineering. Unfortunately for me, Neil was two years senior in post to Gordon and, as he enjoyed explaining to me some years later after more than a few drinks, he had put up with two Oxford D.Phils. for long enough and now that he was the senior professor, he wasn't going to have another bloody D.Phil. in the Engineering School. His attitude finished for ever my chances of returning to a post in my own country. It is curious that, when we next met, he was on extended study leave from Auckland at the University of New South Wales, working for that over-rated badge of academic achievement, a bloody Ph.D.

The most notable personality whom I encountered during my period at Sydney University was Harry Messel, a flamboyant Canadian who had recently been appointed to the Chair of Physics there, and, as the Mathematics Department was located in the Physics Building, I frequently ran into Harry. It would be hard to find a greater contrast between two men than that between Messel and Bullen—Bullen was soft-spoken, formal, unsympathetic and quietly self-important, whereas Messel was loud, given to strong language, enthusiastic and seemed not to give a damn about his own importance. What especially seemed to annoy Bullen was the enormous publicity that Harry was given by the local press since he managed to raise large sums from local businessmen to establish a Nuclear Physics Foundation, the money being used to employ additional well qualified senior staff—several readers and two or three professors. To keep the money rolling in he would report every item of research progress to the news media—Harry was an enthusiastic driving force transforming the Physics Department, but in the process also making a few enemies amongst the older staff and in the University administration. For most of us, however, his exaggerations were understood to be for a good cause and he put Sydney University's Physics Department on the map.

Bullen once complained to me that, despite his own distinction as a world leader in seismology, the local press showed no interest at all in his achievements, whereas the 'upstart' Messel whose scientific achievements were obscure received excessive attention. Bullen could not resist making derogatory remarks about Messel, even in the presence of junior staff and research students; I tried to show my distaste by praising Messel's achievements, but I had to be careful since I might soon need another reference!

My extrovert friend Max Hartwell, whom I had first met on the steam ship *Orion* travelling to England, had returned to Sydney from Oxford in 1950 to take up the post of Professor of Humanities at the newly created New South Wales University of Technology. Unfortunately this was not really a new establishment, but merely an upgraded College of Technology, which continued with most of the same teaching staff—worthy teachers but

for whom research had never been a condition of their employment. While many of the professors had been imported from other universities, some were men who had been heads of department in the old Tech and who now found themselves titled professors without any previous university experience. This mistake, which was repeated in many other countries and more recently in England, meant that it would take decades for the transition to a genuine university environment to be completed. At the beginning of 1956 when I was becoming increasingly concerned about being trapped in an unhappy department, the University of Technology was considered rather second rate compared with the University of Sydney, but now more than 40 years later the University of New South Wales, as it is now named, has matured into one of Australia's leading universities. In fact in 1998 it was ranked tenth in order of merit out of all the Universities in the Asian region, while Sydney University was ranked 20th.

Around this time Max advised me that the University of Technology was looking for someone suitable to fill the Nuffield Research Professorship of Mechanical Engineering, since the first holder, Dr A H Willis, had now been offered the Foundation Chair of Mechanical Engineering. I took an elitist line, saying 'I would rather be a Reader in Mathematics in a *real* university.' But a little later I thought there would be nothing to lose by visiting Al Willis and discussing the possibility of my applying for the post. The idea of being a research professor without administrative duties appealed to me. I liked Al but not the shabby buildings which housed his modest, ill equipped department and which were crammed on a site in a very noisy part of Sydney, not far from the central railway station. Most of his staff were technical college teachers without university experience and I was reminded too much of that red tin shed in Auckland where I had studied a decade previously. One positive feature however was the expectation that in a year or so the Department would be moved out to a new much larger site at Kensington, a suburb some five miles south of the Harbour Bridge and not far from the famous Bondi Beach, several faculties already having been established at Kensington. But I felt I should persist for a while longer at Sydney since Bullen might get to like me and recommend my promotion to a readership.

It did not surprise me that Bullen failed to deliver a course of lectures on thermodynamics; having foiled my plan, he probably either forgot the argument he had used or didn't care.

Fenton and I were very keen on the idea of student seminars, which would give the senior students a chance to research an advanced topic and then deliver an account of it to their peers and a few of the staff; Fenton had arranged one such seminar and hoped that Bullen would lend his support by attending. We were standing in the corridor talking about the plan when the great man appeared, so we took it in turns to argue the merits of these student seminars. But Bullen asserted that they had no value

and that he would not be attending them. I tried once more to persuade him, but then Bullen said more to me than Fenton, 'You are *very* naive!'. I was reminded of S/L Le Pine trying to goad me into an indiscretion on Guadalcanal ten years before, so I held my tongue and studied the floor; Fenton also remained silent. Bullen clearly expected a response, but we denied him any reaction remaining frozen in a tableau of rejection until he gave up and silently departed.

One day probably towards the end of March, Bullen asked me to come to his office at 2 p.m. to discuss some minor matter or other. I had lunch first and very probably visited the Lalla Rookh with Fenton—my memory of what preceded my meeting with Bullen is rather dominated by what happened at the encounter itself. I was ten minutes late and as soon as he had made it clear that this had offended him, I apologized, but he left me standing in front of his desk while he expressed the enormity of my discourtesy to him. When he had finished dressing me down, I took the plunge and told him that he had also offended me more than once. I made several points—not allowing me to set examinations for the first-year students, a class which included his own son, about his pretence about giving lectures in thermodynamics to thwart me and his unhelpful attitude towards my promotion. I had well and truly burnt my bridges now. I finished by saying that I would take the first available university post at whatever level to leave his petty domination, then I was out of the door before he could start to speak. I had gambled on the post at the University of Technology still being available and that I would be appointed to it.

## Chapter 9

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# University of New South Wales

### Out of the Frying Pan

Professor J P Baxter, the Vice-Chancellor of the University of Technology (as the University of NSW was called in 1956), was an impressive man, who was a chemical engineer with experience in the UK nuclear fuels industry having come to Sydney as the Foundation Professor of Chemical Engineering. Following a short period in this role, his political skill enabled him to capture the post of Vice-Chancellor. Since his background was industrial rather than academic, he was more used to a hierarchical structure of command in which those of lower rank obeyed orders. On the other hand he was very positive and during the early stages of developing a new university this was supposed to be an asset. He had also been the prime mover in getting the Australian Atomic Energy Commission established. The Commission had acquired an extensive site in wild bush-covered hills called Lucas Heights about 20 miles south of Sydney, its plan being to build a test nuclear reactor with associated laboratories—basically a reduced version of the Atomic Energy Establishment at Harwell in England. Clifford Dalton, a New Zealand Rhodes Scholar whom I had met in Oxford, was about to become the Laboratory's Chief Engineer and another New Zealand acquaintance, Charles Watson-Munro, had accepted the more senior post of Chief Scientist.

After verifying that the Nuffield Research Professorship was still vacant, I polished up my *curriculum vitae*, adding the further information that I was interested in nuclear engineering and if appointed would offer a graduate lecture course in this subject, scheming that this would attract support from Baxter, who as Vice-Chancellor would be the Chairman of the Selection Committee for the Professorship. In the month before the interview I purchased the book by Glasstone and Edlund on Reactor Physics and quickly learnt the principles involved. As the subject was mainly concerned with the diffusion of neutrons through a background material known



as a moderator, the mathematical concepts were already familiar to me, which made it an easy subject for me to master.

The interview progressed smoothly with Baxter asking most of the questions; the idea that I would give lectures in reactor physics did indeed appeal to him and, as I was genuinely interested in the subject by this time, I felt comfortable about my ploy. In fact it may have been unnecessary overkill as there were no other serious candidates for the position; I was appointed to the Professorship from May, 1956 at the age of 33. Lest it be thought that this was rather young to become a professor, I should point out that in the fifties and sixties universities around the world were rapidly expanding, making it commonplace, at least for scientists and engineers, to be appointed to university chairs before the age of 40 and sometimes even before the age of 30.

What was then unique about my professorship was that I was not the head of a school or department, but instead was the first example of a second, or as I preferred to describe it with a hint of irony, a 'subordinate' professor in a department of the university. The concept of having several professors in one department had not yet been established; across Australia Keith Bullen was the only other person in this position and it was evident that he didn't like it. My attitude was different from his since I was only too glad not to have any routine administration to perform and I was soon on good terms with Al Willis, the Head of the School of Mechanical Engineering. I was free to give whatever advanced lecture courses I wished, so I prepared courses on the kinetic theory of gases, thermodynamics, statistical mechanics, advanced fluid mechanics, and neutron diffusion theory and delivered them to small audiences.

As a member of the Professorial Board I soon got drawn into university politics and was surprised to discover that the University was governed from the top in a rather undemocratic fashion. Baxter apparently regarded the Board as only being qualified to deal with the minutiae of academic business and the larger issues involving buildings, finance, extension to other campuses, promotions and so on were decided by his Committee of Deans; since the deans were appointed annually by the University Council on Baxter's own recommendation, he had very nearly absolute power. The Heads of Departments, namely all the professors except for myself, depended on Baxter's patronage for the funding they needed to develop their schools, so it seemed to me that most of them were unduly cautious in what they said at the Board meetings, whereas after the meetings they would often voice their annoyance or even anger at some of the things that had been rubber stamped. Of course many of Baxter's schemes were good for the University but his autocratic style was better suited to the world of business than to a university.

Perhaps because I was independent of Baxter's patronage, I felt freer to give my opinions and even to occasionally oppose him at Board meet-

ings, but even if I had been the head of a department, I doubt if I could have held my tongue since I lacked the guile of a natural politician. I wanted to change things via frontal attacks rather than by flanking movements and I was under the illusion that it was only necessary to identify an injustice in order to have it removed. What was sadly missing in the early days of the University's development was a group of irreverent arts professors—a philosopher, an historian, an economist, and so on, men and women with real university backgrounds and a sense of academic freedom.

From the beginnings of the University—initially termed an Institute of Technology—there was certainly one outspoken arts professor on the Board, namely my friend Max Hartwell, an economic historian. The original function of his faculty was to provide service teaching in the Humanities for the engineers, technologists and scientists. The concept, borrowed from the famous Massachusetts Institute of Technology in Boston, was to broaden the education of these supposed philistines and it was therefore compulsory for them to take some studies in the Faculty of Humanities during each year of their degree course.

Max Hartwell frequently opposed Baxter's treatment of administrative issues, which should have been referred to the Professorial Board. Not long after my arrival at the University there was an incident which made me think that Bullen's minor tyranny was not so bad after all—it arose out of the failure of the University Council to appoint a left-wing historian, Russell Ward, despite a very positive recommendation from Hartwell's electoral committee. The problem was not so much the Council's failure to appoint Ward, but that a political test had been used to exclude him. It emerged that the Commonwealth Security Service were routinely asked to check recommendations for academic appointments; Ward had been a member of the Communist Party until 1949, but according to a letter he wrote in 1960 had had nothing to do with it since that date. When his efforts on behalf of Ward were unsuccessful, Hartwell resigned and accepted a Readership at Nuffield College, Oxford. Supposing that I had joined the Communist Party in 1941, would I have been elected to my Chair? I very much doubt it.

A year after my appointment I decided to see what I could do to reduce Baxter's power and the issue that I chose was the appointment of the deans by Council on the recommendation of the Vice-Chancellor. Normal university procedure in Australia was that deans were elected by the faculties. Faculties were composed of all the lecturers and professors in a particular area, e.g. science, engineering, arts and so on and these elected deans would then automatically become the chairmen at meetings of their faculties. In a paper to the Professorial Board I argued that the appointment system created a significant reduction in the status of faculties and in the degree of self-government within the University. The question was referred to the faculties who of course opted for elected deans, but Baxter countered this

by completely ignoring the Board and submitting a report entitled '*The academic administration of the University*' directly to the Council, which claimed:

It has become increasingly evident that the Professorial Board and the Faculties are becoming too large for them to be effective instruments of executive action. . . tending to undermine the executive responsibility of heads of schools, a situation which causes me considerable concern.

His solution was to relegate the faculties to having no more role than that of electing standing committees to merely advise the all-powerful deans—of course his argument was rejected. I had not only stirred up a hornet's nest but I had also got the Vice-Chancellor to show his true colours; some experience at a junior level in an established university would have taught him that there is a great difference between the intellectual freedom essential to the university ideal and the line of command that too many English managers still believe is required in industry.

The matter finally came to a head at a meeting of the Professorial Board in April, 1959. Unfortunately the inter-faculty committee set up to consider the question of elected deans made the blunder of using the word 'chairman' instead of 'dean' when they said that they wanted elected chairmen, having taken the deanships for granted. Baxter seized on this and said that if it was just the faculty *chairmanship* which was at issue a solution could be found. Taken by surprise I failed to press firmly enough at this last stage for elected deans, since had I done so there was a good chance that I would have won—the outcome was two posts per faculty—an appointed dean and an elected chairman.

Later in the year Professor Phillips resigned from being Board Chairman and I was approached by a group of professors who said that they wished to nominate me to succeed Phillips, with Rex Vowels, the Professor of Electrical Engineering, being proposed as the Vice-Chairman. I accepted and soon after I was paid a visit by a rather angry Rupert Myers, who said that the post should be occupied by someone with more experience of the University and who would be more likely to establish harmonious relations with Baxter and the Council. Like Baxter, Myers had also come to his professorship of metallurgy directly from industry and clearly understood the importance of seniority—he was the heir apparent.

'We should compete for the job,' I said, but he was unwilling to do this and did not stand.

However there was one snag; I had asked for study leave for 1960 and when my supporters discovered this they thought that I should either defer my leave or change places with Rex Vowels. With some regret I put my interest in science above administrative power, so I became the Vice-Chairman of the Board until my departure for England in December, 1959,

and Rex became the Board Chairman. Myers achieved his ambitions by not only becoming Vice-Chancellor from 1969 to 1981, but also in later receiving a knighthood for his contributions to university administration.

## Fission and Fusion

For several years I had continued with the same type of research I had been doing since I left Oxford—subsonic flow around aerofoils with unusual boundary shapes, specializing in what are called separated flows, that is, flows in which the gas does not adhere closely to the aerofoil surface everywhere. This occurs when aerofoils stall or when spoilers or air brakes are introduced to force the flow away from the aerofoil surface to increase the drag. Anyone who has been for a flight in a glider will appreciate that this is a very practical study, since to land a glider air brakes are essential to steepen the angle of descent on the approach path.

However, my research was essentially mathematical rather than physical and I finally decided that I was unlikely to solve any new and important problems by continuing with it; also, now that I was a professor, the need to frequently publish papers in learned journals was not so pressing. My manuscript entitled '*The Theory of Subsonic Plane Flow*' summing up this line of research was published by Cambridge University Press in 1961 and the book, which received both some good reviews and one or two uncomplimentary ones, must have had some merit since it remained in press for 25 years.

In 1959 some Russian scientists visited Sydney and included the University of New South Wales on their itinerary. I was asked to show academician L I Sedov over my laboratory. He was a very distinguished aerodynamicist from the University of Moscow and incidentally also an important member of the Communist Party. I showed him the typescript of my book and as I turned the pages he responded via an interpreter,

'Yes! That is in my book.' Then a few pages later: 'Yes, yes, also in my book.' He kept this up until the end—there seemed to be nothing in my work which had not already published by the great man and I felt somewhat put down. Research books usually contain some sections not already published by others, but apparently mine did not. Sedov, who I discovered years later had been particularly incensed at the way Western scientists seemed to ignore USSR research, was clearly enjoying the encounter. Finally I asked, 'Has your book been translated?' Had he replied 'no', then I would have had some excuse, my command of Russian being rather limited at the time. But he dashed my hopes with 'Yes, it has.'

'Oh dear,' I replied, 'I must read it. Would you be kind enough to send me a copy.'

‘Yes of course,’ he smiled. ‘Which version would you prefer—the Russian or the Chinese?’

His book was translated into English soon afterwards and I was able to see that while our books did have considerable overlap he had somewhat exaggerated it.

It was unfortunately the case that academic success was—and still is—too often measured by the number of papers that one has published, rather than by the quality of these works. It is certainly easier for referees to count papers than to understand them and in any case the value of the ideas contained in a publication often takes years—even generations—to be fully appreciated. For this reason it is quite inappropriate to use market-place criteria to judge academic productivity. Sadly this nonsense is widespread today; the rewards in science most often go to those who write a large number of papers conforming to the current paradigms. A kind of Gresham law operates (the tendency for money of lower intrinsic value to circulate more freely than money of higher intrinsic value) since good research papers that challenge received wisdom are more likely to be rejected than unadventurous papers that merely tread water within accepted models.

In 1957 I gave a one-year course in nuclear engineering designed for the final year of the mechanical engineering degree and some selected postgraduates and then in 1959 I extended this to the level of a Master’s degree in Nuclear Engineering, the first of its kind in Australia. I invited Cliff Dalton, the Chief Engineer at the Australian Atomic Energy Laboratory at Lucas Heights, NSW to contribute to the lectures, since he was operating a real nuclear reactor and could supply the practical background that I lacked.

‘Why are you planning a Master’s degree, Les?’ he asked.

‘To provide the trained engineers who will be required in the nuclear age,’ I replied optimistically. ‘And you will soon want more staff at Lucas Heights.’

‘What degree did you take in nuclear engineering?’ Cliff asked me.

‘Well... none, I just read it up for myself.’

‘Engineers able to do that are just the sort we need at Lucas Heights. Anyone without the initiative to master the subject for himself would not be good enough for us, so you are wasting your time with this course!’

This elitist view of graduate studies had more than a hint of Oxford about it but in fact Cliff did contribute to my course. He was a brilliant man, sometimes inclined to be a little scornful of less able people, but sadly died a few years later, much too young. My lecture notes in reactor physics were later published as a Methuen monograph under the title ‘*An Introduction to Neutron Distribution Theory*’.

The vast energy released in hydrogen bombs is obtained by the fusion of heavy hydrogen atoms to form helium and ever since the first bombs were exploded scientists have been struggling to develop controlled ther-

monuclear fusion so that the resulting energy could be used to generate electricity. In 1958 an international conference at Geneva swept away the secrecy with which most of the early postwar research had been shrouded. The conference proceedings were mainly concerned with the physics of very hot hydrogen plasmas and the way in which magnetic fields could be used to confine this medium.



Inaugural Meeting of the Australian Institute of Nuclear Science and Technology. LCW extreme left, J P Baxter, centre and pointing, Sir Leslie Marton on his left.

*From right:* H Messel (2nd), C N Watson-Munro (3rd) E Titterton (5th).

A hydrogen plasma is created when a gas is raised to temperatures high enough for the atoms to divide into independently moving electrons and ions, a process termed ionization. The original hydrogen atoms are electrically neutral whereas when ionized the liberated electrons and hydrogen ions carry equal and opposite electrical charges. An important feature of the charged particles of a plasma is that their motion is influenced by the presence of a magnetic field and if this is strong enough, the electrons and ions gyrate about the field lines in tight circles, that is, they are confined by the field. As a topic of study and research the subject is both interesting and challenging as well as of great practical importance. The sun is largely a mixture of hydrogen and helium plasmas and strong magnetic fields are responsible for many of the phenomena observed on its surface and in the corona surrounding it, sunspots and flares being conspicuous examples. More than 99% of the universe is in a plasma state.

To make hydrogen ions fuse to make helium, and in the process releasing a relatively large amount of energy, it is necessary to overcome the force of repulsion between positively charged particles. The most obvious method is to heat the plasma to such a high temperature that when its component ions collide their kinetic energy is sufficient to overcome the repulsive force between them. With heavy hydrogen—a form of hydrogen in which the ions are twice as heavy as normal hydrogen—the temperature necessary for this to occur efficiently is about 350 000 000 °C, which is about 20 times hotter than the core of the sun! With a hydrogen bomb the initial heating is supplied by igniting an atomic bomb, i.e. one in which fission provides the ignition energy. Of course the subsequent energy release is uncontrolled and in order to achieve a slow controlled generation of thermonuclear energy other heating methods are required to reach this fusion temperature. Assuming that this can be done, the problem then becomes how to confine such a hot energetic plasma long enough for sufficient fusion reactions to occur to generate energy for engineering applications.

In 1958, when I first became acquainted with plasma physics, the subject was not well understood and even 40 years later many mysteries still remain, some of which I shall return to later. With my background in fluid mechanics and thermodynamics it was just the sort of new field of research that I had been looking for, although at first I did not recognize this. I included lectures on controlled thermonuclear fusion in my nuclear engineering lecture course, but expected to continue my research into the behaviour of fission reactors.

To develop my ideas in reactor physics I needed contact with an experienced experimental group, hence I decided to take study leave at the earliest opportunity and at the beginning of 1959 I started to plan leave for the following year. I planned to join the Boiling Water Reactor Group at the Atomic Energy Research Establishment (AERE) at Harwell, just a few miles south of Oxford. My family and I could live happily in that pleasant city, my children could attend convenient schools and my scientific career could be steadily advanced. It was all agreed, but late in 1959 the leader of the Reactor Group wrote and told me that shortly prior to my arrival date the Group would be moving down to a new laboratory at Winfrith on the south coast and hence I should alter my plans about living in Oxford.

## Getting On

The Australian Mathematical Society was inaugurated in 1956, with Thomas Cherry, Professor of Mathematics at Melbourne University being one of the leading lights. Fenton Pillow and Kevin Westfold from Bullen's Applied Mathematics Group (which was not yet a department) attended but, as I recall, Bullen himself could see no need for such a society.

‘Pure and applied mathematicians do not mix well together,’ he advised, but at that time I did not believe this. Anyway, I was rather surprised to be elected a member of the first Council and in 1958–59 even held the office of vice-president. I served on the editorial board of the Society’s journal, being responsible for the applied mathematics section, so that at that time I knew most of the applied mathematicians in the half dozen universities of the Australian Commonwealth. My Australian career was flourishing although more as a mathematician than as an engineer.

In 1958 I visited Professor Oliphant’s physics laboratory at the Australian National University in Canberra where I was scheduled to give several seminars to his theoretical physics group. Mark Oliphant, one of Rutherford’s distinguished students, had played an important role in the development of the atomic bomb. After the War he had returned from a chair at Birmingham University to the newly formed ANU, a research university modelled on the Institute for Advanced Study at Princeton, USA. His great and seemingly endless project—the homopolar generator (HPG)—was still under development and would continue to be so for many more years. Possibly as a consequence of an experience in Birmingham, Oliphant had developed a curious aversion to engineers, believing that they were just handbook technicians, who were hardly capable of designing new machines; he considered it much better to use physicists for novel engineering designs, so when I explained to him that I was actually a professor of mechanical engineering, he expressed some astonishment at the range of seminars I had offered.

‘Real engineers don’t understand these things,’ he exclaimed.

I was therefore not surprised when one of Oliphant’s physicists asked me if I knew how to determine the stresses transmitted across layers in a large spinning wheel—the homopolar generator. I was to meet the same attitude of physicists towards engineers a few years later at Culham Laboratory in England. The intelligent reading of handbooks is not to be scorned. After the War many physics departments had directed their teaching and research more and more towards atomic and nuclear physics, considerably reducing their coverage of the classical topics in physics like fluid mechanics, elasticity, electric circuit theory and thermodynamics. These subjects continued to be pursued and advanced in engineering schools, which became more scientific and often virtually departments of applied physics. The danger here is that engineering design—real engineering—usually gets relegated to the Technical Institutes (now renamed universities in Australia and the UK), where the average students are usually less able.

Oliphant’s problems with his machine were not solved until a New Zealand engineer, Richard Marshall, was appointed to ANU. Oliphant wanted to use liquid metal brushes made of a sodium–potassium alloy to carry the generated electricity from the HPG to the load, but these proved very dangerous, one member of staff being very lucky not to lose his life.



Marshall returned to the best engineering practice and designed copper-graphite sinter brushes, which were installed in the HPG in 1966. Although the machine then became operational, it was not used for any serious purpose until a few years later when it was employed to supply the electrical energy for a small fusion machine known as a *tokamak*. Richard had been a brilliant engineering student whom I first encountered in a class on curve tracing that I had taught at Ardmore, Auckland nearly two decades previously. Nearly 30 years later our paths were to cross once again in Austin, Texas.

In 1958 I gave in to vanity and decided to submit some recently published papers to the University of Oxford for a higher doctorate, which was awarded. I had by now accumulated three Bachelors, two Masters and three Doctorates, but I don't think that this was entirely a sign of insecurity since I could justify each degree in its turn from two major subjects and two universities.

Although my financial circumstances were now satisfactory, I still found it necessary to maintain my house in Chatswood by my own labour. I painted or wall-papered all the rooms, replaced rotten timbers in my two verandas, installed outside lights and replaced the plumbing throughout the house, starting from the mains near the front gate. Replacing the rusted wire netting around the tennis court was closest to my talents since it reminded me of those crayfish pots that I had covered with netting 20 years earlier for my father.

After I had restored the tennis court to working order, I would play against my two eldest daughters, with Coral and Jill at one end and I at the other. Coral was now 14 years old and Jill 11; Diane was a slightly left-out middle daughter, while the twins, Elizabeth and Patricia, clung together through thick and thin. The tennis court and a decaying wooden platform at one end of it became a playground for the girls and the lizards, spiders, ticks and other denizens of the Australian way of life became more natural and gradually less feared. Trips to the splendid North Shore surf beaches each weekend were enjoyable but the return journeys in endless traffic queues, which crawled along in the hot Sydney sun, detracted a little from the pleasure. Picnics in the bush with the chance of seeing a koala bear or a snake were appreciated more by my family than myself, but it was a sunny, open-air life with scarcely a cloud on the horizon and we were happier as a family during those years in Sydney than at any other time. However it seemed to me that an even better life was just around the corner since something was missing, although I could not decide what this might be. Perhaps I was beginning to miss the scientific stimulus of living in England.

I was accumulating the usual vain badges of authority—Chairman of the local Parents and Teachers Association, member of the Australian Aeronautical Research Council, editorial board member of the journal *Nuclear Energy*, as well as Professor Bullen in a forgiving mood even saying that

he would propose me for Fellowship of the recently established Australian Academy of Science! Success with that would have allowed me to put the letters FAA after my name, an extra A at last. I was starting to be carried with the tide—it was surely time to move on.

I told my Harwell contact that I did not want to go to Winfrith with the Boiling Water Reactor Group and asked him what else I might do. He referred me to the Controlled Thermonuclear Reaction Division, which had been set up only a few years earlier at Harwell with the objective of finding a way of controlling the release of fusion energy. With my recent interest in plasma physics this seemed like an ideal solution since the family could still live in Oxford. I was accepted to be an associate of CTR Division for the year 1960, but when the University (but essentially Baxter) granted me a year's leave, one important constraint was imposed. I had only served four years with the University and was therefore entitled to just two terms' study leave. In order to be granted the whole year I was required to sign a legal document agreeing to repay my salary if I did not return to the University and stay for a further two years after the end of my leave. Although I had no intention of absconding, I signed this with some misgiving since it was an important reduction in my future freedom of movement. Suppose that I was made an offer in the UK that I could not refuse? But on reflection I reckoned that this was a remote possibility.

We left for England in November on the *Fairsky*, an Italian vessel offering the lowest fares with a commensurate standard of service, although the children loved it. The route was unusual—we travelled north from Sydney around Cape York, through the Torres Strait, past Java and on to Colombo, the trip being designed to minimize the fuel used, but incidentally maximizing tropical discomfort. Aden and its expensive camels were missed out this time and the excitement of our previous trip 12 years before was not recaptured, though the children had fun, the older ones having to fight off the attentions of enterprising stewards. The Red Sea floated by and Betty and I decided to see Cairo by leaving the ship at Suez early in the morning and then boarding again in the late afternoon at Ismailiya while friends looked after the children. The museums were marvellous, but the squalor and market place hustling rather depressing.

When we finally arrived at Waterloo Station in London, we were pleased to be met by an AERE driver and taken to temporary accommodation at the Manor House in Buckland, a small village about 13 miles from Oxford and 11 from Harwell. It was Christmas and the lake behind the house was frozen with the snow thick on the ground. The children skipped stones across the ice and threw snowballs at each other. The late afternoons were quite dark and an attractive pub, the Lamb, was just down the road. The contrast between this and Chatswood in Sydney could have scarcely been greater; a few days later I started my career as a plasma physicist.

## At the Crossroads

Finding suitable accommodation in Oxford was my first task. After a month at Buckland, via a contact at the Engineering Laboratory I managed to find a small cottage in Begbroke, a village a few miles north of the City of Oxford. The two eldest girls had been accepted by Oxford High School, a superior establishment much favoured by University dons, while the other three attended a modest state school in Yarnton, which was within walking distance of our house. I purchased a new Morris Traveller for about £1100, which was a poorly designed family car, certainly not worth a penny more. Compared with Australia or New Zealand living in England with its small inefficient shops and class-based education system was not easy, but I had only a year to run. Also I knew that travelling around English villages was much more interesting than baking on Sydney beaches each weekend.

The head of the CTR Division was an extrovert Australian named Peter Thoneman, who had started research on confining hot plasmas at Oxford University's Clarendon Laboratory just after the war. While I was studying flow around aerofoils, he was starting on the much more exciting problem of controlling the power of the hydrogen bomb. Peter was absorbed by the science and found administration a tiresome diversion; he had received considerable publicity a few years earlier due to his role in developing the toroidal fusion machine known as ZETA, but unfortunately spin doctors—not the scientists directly involved—had advertized the belief that thermonuclear neutrons had been obtained in the machine. Had this really been true, it would have been a great achievement. The effective administrator was Dr Sebastian Pease, a suave Cambridge-educated Englishman, he and his wife Susan making us very welcome at dinner one evening at their home. Perhaps the most interesting and knowledgeable scientist in the division was Roy Bickerton; I was to learn a lot from him, about sailing as well as fusion research, and many years later he would encourage me to take up gliding.

I was given a desk and asked to work on the basic magnetoplasma problem of why the plasma escaped so rapidly across the magnetic field lines when the ions and electrons were supposedly confined to circulating about these lines in very small circles. Collisions between particles would certainly alter their trajectories and result in some motion across the field lines; this was understood, but the mystery was that the observed cross-field flow was *thousands* of times greater than such collisions were apparently capable of producing. Since this was the central problem in magnetic field confinement, I had really been thrown in at the deep end and little did I imagine that it would take me 24 years to solve this mystery! Hundreds of plasma physicists worldwide were wrestling with the same problem and, as I write this, a few still struggle on. When finally in 1983 I found the

solution and tried to publish it, I soon discovered certain problems about large government-sponsored laboratories and those who run them, as I shall recount later.

I struggled with the confinement problem described above for some months and then, in order to show something useful for the time I spent at Harwell, I changed to an easier task involving plasma oscillations. Experiments were then being conducted at Harwell on the speed and damping of waves propagating along a magnetized plasma column and, since there was little doubt that the damping of these waves was due to collisions between particles—the same phenomenon was supposedly responsible for the loss of plasma across the magnetic field—the experiments were judged to be relevant to the confinement problem. One idea which was gaining acceptance was that plasma turbulence had the effect of greatly increasing the collision rate between the charged particles and that this might be the cause of the enormous cross-field losses. But if this were true, the same turbulence should also very rapidly damp waves propagating along the plasma column. I produced a theory to explain the speed and damping of these waves in a mixture of ions, electrons and uncharged nuclei. Fair agreement with experiment was obtained without any allowance for the presence of turbulence, which was therefore evidently not the culprit.

In March or April of that year I received a letter from Dr Matheson, the Vice-Chancellor of a newly established university in Melbourne named Monash University, in which he asked me if I would accept their Foundation Chair in Mathematics. I was greatly tempted and asked for some time to consider the offer. To be a foundation professor bestows on one considerable authority in appointing staff, designing new courses and so on—a great challenge with real power, at least in the early stages. To complicate matters I then received another equally attractive offer, the Chair of Mechanical Engineering at Sydney University, which at that time was more prestigious than the Nuffield Research Chair which I held at the University of New South Wales. I could now escape from Baxter's kingdom and inch up the academic ladder, but I was still pondering which of these offers to accept when a third possibility appeared.

A letter redirected from Sydney reached me at Harwell; it was from Jack de Wet, the Mathematics tutor at Balliol College, who had been one of the examiners when I had taken Finals in the Mathematics School ten years earlier, and asked if I would consider accepting the College's Foundation Fellowship in Engineering Science. This would be associated with the post of demonstrator in the Engineering Science Department.

'Of course not!' I thought, 'Who would exchange a professorship in Sydney for a mere demonstrator's position in Oxford?'. Quite apart from status, the salary was also certain to be inadequate. Two years earlier my Auckland University College rugby friend, George Cawkwell, at the time

a Classics Fellow of University College, had asked me to consider *their* Foundation Fellowship in Engineering Science and it would have been the first such Fellowship in Oxford. (In 1958 the University of Oxford had at last recognized that Engineering was more than just a trade.) At that time I had dismissed the idea, informing George that I was already a professor no less and that there was no way I could consider returning to the ranks. But I was not really concerned with status—it was mostly the thought of all those hours that I would be required to spend tutoring undergraduates.

I remembered Jack de Wet as an excellent enthusiastic lecturer and a Rhodes Scholar from South Africa with a warm, engaging personality. I owed him something so I agreed to see him, as well as it being a good excuse to miss a day's trek out to Harwell, but I felt certain that my answer would still be 'No thank you'. I was looking at the magic carpet of spring flowers under the chestnut trees in the large Balliol quad when Jack found me and we sat down on a bench while he explained why being a Fellow of Balliol was not to be equated with a mere professorship in the Australian 'outback'. He pointed out that I could continue with my new line of research at Harwell, that the total salary package was somewhat larger than at first apparent and that housing would be provided at a nominal rental. Also there were allowances for children, books and entertainment; the students were bright and I would enjoy teaching them, and so on—Jack was very persuasive. But what tempted me most was the opportunity to continue in plasma physics research, perhaps with a consultancy at Harwell; there was no plasma physics laboratory in Australia at that time so had I returned I would have been isolated as a scientist.

In a letter to Matheson I declined his offer and at the same time strongly recommended that Foundation Chair of Mathematics be offered to Kevin Westfold. This advice was accepted and Kevin had a distinguished career at Monash, years later ending up as a Pro-Vice-Chancellor. But the Sydney University Engineering Chair was more difficult to reject, since it would have provided an excellent career, and perhaps lead on to 'higher' things like a Vice-Chancellorship; my ambition was getting a little out of control! Harry Messel was keen for me to accept the post and there would be no problem with the University of NSW over not fulfilling my obligation to return for a period following my leave since the Vice-Chancellor of Sydney University had already reached agreement with Baxter. I was in a quandary; the decision would dramatically alter the rest of my life. I approached Bill Williams, the Warden of Rhodes House and a Fellow of Balliol for his advice. Rhodes scholars were supposed to return to their own countries to use their Oxford education to help glue the Empire together, but he did not mention this obligation as he explained that Balliol was the premiere intellectual college in Oxford and that it would be a good choice.

Was it fair to my young family to stay in England? I'm afraid that I didn't ask them, perhaps because I was so unsure myself. Betty's agreement

was essential and it took more than one visit to the pub in Begbroke for her and I to rationalize the decision to stay. It was probably madness to swap the comfortable physical life of a Sydney suburb with its near-egalitarian social structure for the damp, inefficient, class-ridden, medieval city of Oxford. I expect it was self-indulgent to decide to stay but I knew that it would be a lot more interesting to live in Oxford than in Chatswood, Sydney. It was years however before my occasional regrets about this choice faded into acceptance. Once the College knew of my decision, they provided us with a large flat in Rawlinson Road in North Oxford even though it would be some months before I started work as a tutor. Knowing that I would have to pay the University of NSW two years' worth of salary if I remained on leave for the whole year, I immediately wrote to Professor Baxter, explaining my decision, and telling him that I would now only take the two terms' leave to which my four years of service had entitled me and that I would spend three months back at the University there performing my duties as a research professor before returning to England. I knew that he would not be pleased despite my being something of a thorn in his side, but no reply came and it was now July. To be away just two terms and therefore avoid the financial penalty I would need to return within the month. I sent a telegram, but there was still no response so I flew back to Sydney. When I appeared back in the University and asked to see the Vice-Chancellor, I shortly received the peevish response, 'But Professor Woods is on study leave in England!'. I never managed to see Baxter. I found a tiny flat in Bondi, returned to my office and started to serve my three months in exile from the family.

I was sad to leave my friends in Sydney, both those whom I had made in the Chatswood area in which we lived and those at the Universities of Sydney and New South Wales. My department head Al Willis had always treated me kindly and let me get on with whatever research and teaching took my fancy. The Nuffield Research Professorship had given me the opportunity to broaden my research interests, first to the reactor physics underpinning nuclear engineering and later to the plasma physics relevant to fusion energy. I was to be replaced by two professors with a new professorship of nuclear engineering in addition to the Nuffield Research Professorship. The latter post went to my friend Ray Bryant, who was already in the Mechanical Engineering School.

The Professorial Board said farewell to me at a party in December and gave me a simple Gladstone bag. Rex Vowels, who now was the Board Chairman, found it awkward to describe my change of job in his speech and asked me beforehand, 'So you are leaving your professorship to become...?'

'A demonstrator,' I replied.

'No, that's not right, you will be a Fellow or something, won't you?'

I refused to let him off the hook.

'I am leaving a *professorship* in this university to become a *demonstrator*

in Oxford,' I said firmly, eyeing the Gladstone bag, but Rex refused to describe my translation in these terms—he stuck to Fellow, whatever that meant to him. Of course I was being mean since I failed to tell him that at that time two of the demonstrators with Fellowships at Balliol were also Fellows of the Royal Society.

I made one fatal error of judgement since in order to win Betty's support for the move, I promised her that her parents who were English could join us in Oxford when we had settled down. They did not wait but on learning of our decision immediately sold their house in Auckland and set off for England. They were both crowded into the flat in Rawlinson Road when I returned and our marriage was immediately stressed as a result.

Before departing for England, I took the opportunity of visiting Auckland to see my parents and friends and got some publicity in the NZ Herald by posing as an expert in thermonuclear fusion. On 30th November, 1960 the newspaper published my views:

### **Harnessing of H-Bomb May Take 50 Years**

The early optimism over thermonuclear fusion had given way to recognition that it was a long-term project. "It might be 50 years before the enormous energy in the hydrogen bomb can be brought under control," said Dr L. C. Wood, a former Auckland yesterday.

Dr Wood, who will take up an appointment as Foundation Fellow in Engineering Science at Balliol College, Oxford in January, will leave Auckland for Sydney this morning. He has been on a short visit from Australia to deliver a lecture at Auckland University on recent developments in thermonuclear fusion. . . "Heavy hydrogen has a big advantage over a nuclear reactor using uranium in that it does not lead to extensive radioactive waste and is a clean source of power." . . .

Oh dear me! My name was not the only thing that they got wrong. Of course I was not responsible for the clumsy wording, but I did believe what I told the reporter. In fact I now think 50 years to be an underestimate and, as for fusion being a *clean source of power*, this exaggeration was very popular with fusion researchers at the time. Don't talk to reporters unless you have a very thick skin.

It remained only to escape from Baxter's grasp. I wrote him a long explanation, justifying my departure without paying him his ransom. I said that the terms of my appointment as the Nuffield Research Professor required me to engage in engineering research, that there were no official lecturing duties and no formal requirement to be on the Campus when I conducted this research. In any case I had taken only the amount of leave that my four years of service in the University had justified, and if

he wished to press for the two years' salary he believed the University was legally entitled to have from me, I would wish to put my case before the University Council in person. He surprised me by backing down, finally accepting my resignation in writing and without mentioning money. I was clear away or so I thought. More than a year after I had settled in Oxford I received a request from the University of NSW for a very large sum of money—about one year's salary. It did not take the College law tutor, a New Zealander named Don Harris, very long to compose a firm legal response for me and I heard nothing more.



## Chapter 10

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### University of Oxford

#### Teaching Duties

A typical Oxford college is a microcosm of the University, each embracing most of the subjects taught for the B.A., the first attainable degree in all subjects. In 1960 Balliol College had four tutors in History, three in Philosophy and in Classics, two in Law and in Economics, two in Chemistry and in Physics and one in each of Politics, English, Mathematics and Biology. In addition there were seven Professorial Fellows and four Research Fellows. The teaching for more minor subjects like Modern Languages, Geography, Music, Zoology, Botany etc was usually obtained by hiring the services of teachers who had university appointments, but who had not yet secured a college Fellowship. They were paid only a fraction of the salary that Fellows would receive for the same work and were described as being ‘tutors and lecturers not on the Foundation’; it was a class system, which in later years the University did its best to eliminate.

In the last century the colleges were largely independent of the University, whose main function was simply to confer degrees, but the growth of science studies, in which a university contribution via laboratories and lectures became inescapable, gradually altered the balance. A legacy from the past was that—at least in the older colleges—the Arts Fellows outnumbered the Science Fellows by more than two to one.

My duties as the Balliol Tutor in Engineering Science began in January, 1961 and, having been an undergraduate at Merton College a decade earlier, I had some notion of what was required. Each engineering undergraduate would come to see me for an hour a week, usually by himself (there were no women in Balliol at that time), to explain his progress or otherwise with the work I had set the week before. Written work was always expected, either in the form of essays on some aspect of the topic under attention or as a set of engineering science problems solved or at least attempted. At the beginning of each term I would identify the relevant



Oxford's Spires: Balliol's Front Quad in the foreground.

university lectures in engineering science that the undergraduates should attend, although there was no particular relation between my tutorials and those lectures. If the weaker students found the lectures difficult or apparently irrelevant, they would often gratefully drop out without necessarily consulting me.

Tutorials required the student to read books, not the scribbled notes he may have accumulated from sometimes poorly presented lectures. After working for a week (or sometimes desperately during the evening preceding the tutorial), he would have to show me that he understood the material by presenting an essay or a set of solved problems and by then discussing the ideas involved. Tutors had to cover a large part of the entire syllabus of the three-year degree course and, as at that time I was the only tutor in engineering science in Balliol, I had to teach all the topics in the degree course whether I initially understood them or not<sup>1</sup>. In the ideal version of this system university lectures are scarcely necessary and the Engineering Laboratory remained essential only for the practical work required of the undergraduates.

Lectures were not part of the college tutorial system, although sometimes it was expedient to give mini-lectures to the handful of college under-

<sup>1</sup> The College now has three tutors in Engineering Science.

graduates in a given year of the course. University lectures were normally given by ‘demonstrators’ (i.e. lecturers) in the Engineering Laboratory and would be attended by the undergraduates of all colleges. Science teachers thus wore two hats, firstly as college tutors—generalists who dealt only with the undergraduates of their own college—and secondly as university demonstrators—specialists with responsibility for all the students in the university taking the particular subject of their demonstrations or lectures. The lecturers were naturally supposed to cover most of the material set out in the University syllabi and the tutors expected to do the same, but there was no planned correlation between the syllabi, the tutorials and the lectures.

Even the examinations were semi-detached, since they were set by small independent groups of teachers, wearing still different hats. The examiners were expected to give some attention to the formal written syllabus, but there was an informal syllabus of greater importance, namely the previous dozen or so years of examination papers. In effect the students would get two independent treatments, both aimed at helping them with the principal object of their studies, to pass their final examination.

The system has great strengths but also some serious weaknesses, an obvious one being the variability of tutorial skill from college to college. As far as the teacher is concerned, by having two jobs he is in some degree insulated from the whims of the head of his university department and can largely withdraw to his college if he feels he is being badly treated in his university position. As I discovered in Sydney, the departmental chairmen in redbrick universities often exercised too much patronage over their staff. Another important feature was the selection of the undergraduates in the December preceding their arrival in Oxford, the choice between the candidates called up for interview being made by the tutors in the subject. The chosen undergraduates would therefore know that their own tutor had selected them, which usually would establish a favourable relationship from the outset. Not wanting to disappoint one’s tutor was an important goal, well, at least in the first year.

The students during my early tutorial years were not served as well as those coming later, especially in subjects of which I had little knowledge or interest. Mathematics was my strength and fortunately most of the required subjects had a substantial mathematical content. When baffled by a problem I would usually resort to first principles, the set of laws or equations on which the subject was based, which I usually knew. Then the pupil and I would spend the rest of the tutorial developing the subject from these laws; rather slow, but, as I rationalized, more illuminating than the quick cookbook approach which might instead have been given by an expert in the subject. Of course my undergraduates soon learnt that the question ‘What are the first principles?’ simply meant that I did not know how to solve the problem immediately!

In my weaker subjects, I aimed to have the brightest student early in the week, since there would be a good chance that he had worked out the solutions to the set problems correctly—the later students then benefited from my acquired wisdom. It should be remembered that although at that time engineering was at the bottom of the pecking order in science, I was teaching students who were usually bright and well motivated. Of the 13 undergraduates waiting for me optimistically early in 1961, three got first-class degrees, five got Seconds, three got Thirds, one managed a Fourth and one failed—a slightly better than average distribution.

An important merit of the tutorial system was its flexibility, since one could guide the undergraduates according to their needs and ability. One of my early pupils, David Clarke, was so gifted that after only one term we agreed that he should attempt the Engineering Laboratory examination normally taken after four terms of study—he came near the top. We later resolved that he should spend his second year studying additional mathematics rather than engineering, which was evidently too easy for him. Many years later after an impressive career including being the top First of his year, he became Head of the Oxford University Engineering Laboratory and a Fellow of the Royal Society.

Another brilliant pupil, Christopher Brennen, a year earlier than David, was an all-rounder with interests in sport, acting and college politics. He took a comfortable first-class degree and a D.Phil. under my supervision and made a career at the very selective California Institute of Technology. He was awarded medals for his research in Fluid Mechanics, became the Dean of Students, and later a Vice-President there. College tutors often establish a relationship with their pupils which lasts well beyond the College years.

Tutorials that finished at six o'clock were always a little special since we would repair to the College Buttery, meet the other engineers and then relax over a pint of beer. On one occasion, when I was a little late in arriving, as I approached the group I heard a voice speaking with mock authority in an intonation very similar to my New Zealand accent—Richard Weyman was entertaining his engineering peers. I stood behind him, while the others, soon aware of my presence, first tried to silence him and then fell silent themselves. Richard suddenly grasped that something was wrong—he turned towards me and paled.

'A pint of beer, please, Richard,' I said and he paid the fine cheerfully. At the end of his course it was gratifying to be invited to his wedding.

In those days teaching at other universities was rather differently organized; if there were tutorials at all, they would be university based and given to groups of students, perhaps 10 to 20 at a time with individual attention being only marginally better than in lectures. Students were ex-

pected to work through some set problems, raising their hands when stuck, at which point one of the three or four often bored lecturers present would try to resolve the student's difficulty *sotto voce*. These tutorials served the deserving earnest rather than the extremes of the bright or the dull and were popular with women students, who perhaps had stronger feelings of responsibility towards their studies.

Redbrick lecturing was inclined to be rather specialized, with each member of staff clinging possessively to the topic which he or she had taught for the previous few years or so. Attendance at lectures was essential unless a friend's notes were available because the lecturers would set the examinations for their own subjects and these could be heavily loaded with their own idiosyncratic view of what was relevant and important.

The final one or two lectures of a course would be especially critical for it was during these revisions that students would often try to pump the lecturer for clues to what questions to expect in his examination. Given that the lecturer's own standing in the university was influenced by the perceived difficulty of his examination questions and the number of students who passed, the temptation to coach was strong. Examining was an integral part of the lecturer's duties, the only escape being promotion to a professorship followed by a claim to be too busy with administration to give anything other than advanced lectures!

In the Oxford system however, the lecturers would have no idea of which questions would appear in the examinations, unless they by chance also happened to be examiners at that time, a voluntary role, which usually extended over three consecutive years and which was due only every ten to 20 years. The voluntary aspect required the examiners to be paid for their duties, but the money never matched the time-consuming effort demanded. However, the advantage of the system was that the examination questions tended to be of a general nature, since the examiners would not necessarily have given the lectures for the papers they were setting. The previous examination papers would set the standard and helped to ensure continuity.

One serious disadvantage was that new subjects or new aspects of old subjects often took a very long time to seep into the system. Tutors, who had to teach over a wide range of the syllabus, did not welcome change since it meant that they would have to learn new topics. It is not that they were lazy but more that in Oxford the hours of teaching were unusually high.

In my own case I was required to teach nine hours a week for the College and the same for the Engineering Laboratory. Eighteen hours a week is more than twice the number of hours that a typical lecturer at a redbrick would be required to teach and moreover the range of subjects he needed to master would be much narrower. So what on earth was I doing in Oxford wasting my time with all this teaching when my real interest lay in research? Well, I did not intend to remain a demonstrator for very long.

## The Engineering Laboratory

I have written of lecturers, but the description of university duties also applies to readers and professors, not that this made much difference in Engineering Science since then we only had one of each. Readers were junior to professors, but had the great advantage in Oxford that they could also be Tutorial Fellows of colleges and therefore receive all the associated financial benefits—housing allowance, entertainment allowance, book allowance etc. Professors on the other hand were excluded from these perks; they were Professorial Fellows of their colleges, which in effect meant that they were peripheral members of the society, to be seen but seldom heard at college meetings. It was a quaint system but perhaps the least unfair of the anomalies involving Fellowships at Oxford Colleges<sup>2</sup>.

The then Professor of Engineering Science was still Alexander Thom, the Scot who had been my D.Phil. supervisor ten years before. He was a Fellow of Brasenose and until 1958 had been the *only* Fellow in Engineering in the University! Dr Hans Motz was the sole reader, while I was the sixth elected *tutorial* Engineering Fellow in Oxford; had I accepted an offer in 1958 from University College, I would have been the first. (In 1996 there were 42 such tutorial Fellows with some colleges having three in the subject; the engineering professors numbered 15 and there were nine readers.) I got on well with Thom, although his frugal ways would irritate me at times; I once wanted folders for my lecture notes, those with the usual internal sliding clips to hold the pages firmly together, but the Laboratory office only had plain folders without clips. So I approached Thom to rectify this deficiency.

‘Professor Thom, the Department lacks folders into which lecture notes can be fastened,’ I said.

‘Ah,’ he replied, ‘the problem can easily be solved. What I do is to make two holes in the plain folders at the right distance apart and press two-pronged button clips through the holes from the outside.’ It seemed quicker to visit Smith’s.

In 1962 having heard of Thom’s impending departure I decided to apply for his position, thinking that I had a fair chance—although I expected that my mathematical background might count against me by giving the correct impression that I was not a *real* engineer despite my degrees and previous professorship. On the other hand the first two holders of the post—Jenkins and Southwell—had both been Cambridge mathematicians and I was therefore surprised when Douglas Holder was appointed since he had spent his whole career in the National Physical Laboratory at Teddington, and was

<sup>2</sup> This was the situation in the past—recent changes now give Tutorial Fellows the chance to acquire the title of Professor by application and, if they succeed, neither their duties or salary are altered! Some eminent scholars have scorned this as being merely hubris.

an aerodynamicist like myself. But being an experimentalist rather than a theoretician, he was no doubt assumed to be a closer approximation to an engineer than I was. Swallowing my disappointment, I naively thought that perhaps Douglas would appreciate my university experience and that, working together, we would develop Oxford engineering into a respectable course.

The new engineering building was on too small a site, so it was built up to eight floors, making an ugly landmark slightly north of St Giles'. The Duke of Edinburgh, who was well into his 'advancement of science' phase, was persuaded to formally open the tower some months after we had moved in. How excited the teaching staff became over this royal visitation! At a meeting called to discuss how to maximize the impression we made on HRH, it was proposed that we should have a carefully timed rehearsal with a mock prince taking a specified route through the several laboratories. This obsequious nonsense would have wasted a whole afternoon.

Fed up with this, I expostulated:

'Forget the rehearsal. The Prince will choose his own path and timing, regardless of our plans. Let's behave naturally and not waste too much time trying to be what we are not.'

The Administrator at the time knew better, saying that he had been involved in several royal visitations and knew how important it was to plan carefully. I stood up and said that I now understood why I lacked the talent to become a *real* Englishman, adding that I had better things to do and then left the meeting.

## Balliol College

The College was founded by John Balliol, the father of King John Balliol of Scotland, some time between 1263 and 1268. In 1963 we celebrated the College's Septcentenary, thus heading off Merton's more secure claim by one year. The Master of the day was Sir David Lindsay Keir, who during the War years had been the Vice-Chancellor of Queen's University, Belfast. He was very grand and always wore dark formal suits, even it was rumoured when paddling at the seaside. It soon became clear to me that he was greatly irritating the senior Fellows by insisting on controlling every committee and then being ponderously slow about it. Conspiracy was in the air.

At my first Governing Body meeting I was formally admitted as a Fellow by swearing to be loyal and faithful to the College and at that meeting I was introduced to an amusing eccentricity, which only the English could have invented. One of the agenda items concerned the danger posed to undergraduates who climbed into college after hours. The standard route involved fixed pitons which occurred naturally on the outside wall, these

being used to reach windows well above the footpath. However, some of them were found to be loose so it was resolved to make sure that these aids to defeating College rules were really secure so that the route was safe! Today the undergraduates are trusted with keys.

The money to support the Engineering Fellowship was raised on the initiative of Sir Harold Hartley, who for 40 years from 1901 had been the Fellow of the College in Natural Science and Chemistry. He knew that he was a very distinguished man and told me of his pride at being invited to advise the Duke of Edinburgh on scientific questions. He had held a succession of senior posts in the chemical, aviation and railway industries and had many connections with the great and the good, not therefore being short of confidence. In 1959 he circulated the following letter:

Dear X,

Oxford is at last going to take engineering seriously. The new Engineering Laboratories will be built during the next two years when a new professor will be appointed. I am writing to ask for your support for a plan I suggested at the Gaudy this year.

I said that Belfast had commemorated the Master's ten years of Vice-Chancellorship in the David Keir Building devoted to technology, and that old Balliol men might well show their gratitude by founding a David Keir Tutorial Fellowship in Engineering. That I know is something in which he is keenly interested.

The School is growing and there will be thirteen undergraduates in Balliol reading engineering next term, and we now have the Maurice Lubbock Entrance Scholarship each year. What is needed to complete the picture and to take care of the undergraduates is a Fellowship. The capital sum needed is between £20 000 and £25 000. In these days one cannot expect to get large subscriptions towards it but I am sure there are many who would subscribe by means of a 7-year covenant.

I am writing first to a few old friends and pupils to ask them to give it a start.

In August, 1960, he was able to circulate the following thank-you:

I am writing to let you know that the preliminary appeal to which you subscribed so generously produced £10,685 in covenants and cash from 71 old members. Encouraged by this start the College has already elected Dr L. C. Woods, Research Professor in Mechanical Engineering in the University of New South Wales, formerly a Rhodes Scholar of Merton, to a Tutorial Fellowship in Engineering, which he will take up in January, 1961.



Sir Harold invited me to visit him in his London office; I knew it was a summons, but I was grateful for his efforts to establish the post which I now held. He was very supportive and I might have made more of the situation, but my dislike of patronage of any sort had grown even greater since my return to England.



Balliol College Hall, 1985.

At the end of 1961 an ideal college house fell vacant upon the retirement of the history tutor, A B Rogers, who was the senior Fellow of the College, i.e. he had held his Fellowship longer than anyone else, 35 years in his case. When he discovered that ‘his’ fine house, 7 St Cross Rd, was to be occupied by the most junior Fellow, he was distinctly disdainful, having a clear sense of what was right and proper. It was said that when the College first introduced Ladies Night, he strongly resented the intrusion, referring to the infrequent event as ‘Sex-Fiends night’. He married late.

The three-storeyed house backed onto the College playing field, known as the Master’s Field. It was built in 1898 and lived in for many years by Harold Hartley; we were only the fourth family to occupy it in 60 years. It was very central since to reach the centre of Oxford took less than five minutes of walking. I had been in this fine house only a few days when my

neighbour, a Balliol Fellow in Classics, knocked on my door. I invited him in and after a few pleasantries, he came to the point.

‘I need your help. There is some sort of electrical fault in my kitchen and the lights have failed. Would you mind using your engineering skills to sort it out for me please?’ I advised him to ring an electrician.

The celebration of Balliol’s 700th anniversary (in 1963) took place in the Master’s Field. It was a lavish party, with no shortage of food or drink, but unfortunately the fireworks display had to compete with a steady downpour of rain, although marquees had been erected. Sir Harold was there, seated out of the rain and receiving court from his juniors, that is everybody else. Important guests—those with money and influence—were being encouraged to contribute to the Septcentenary Endowment Fund; the Fellows were also putting their hands into rather shorter pockets. It was an impressive display of Balliol solidarity, bolstered by an overweening confidence of being the very best, which produced a warm glow and lots of money, about £1 000 000, quite a stack in those days.

Professor Richard Southern, who had recently departed from the College to become the Chichele Professor of Modern History, wrote an account of Balliol, which appeared in the *Oxford Mail* the day before the party. To quote from his article:

The celebration has taken several forms. For the future, the collection of well over half a million pounds may prove to be a decisive event. For the present the commemorative service, the parties and the fireworks, the assembly of many eminent persons give ocular proof of abundant life. . .

At the other end of the scale (discussing books about the College) is a little pamphlet by Sir Harold Hartley on ‘Balliol Men’. This is a brief account of the notable members of the College during the last 60 or 70 years. The roll-call gives an impressive picture of Balliol men in the seats of power. It will provide material for many a Balliol speech, and perhaps so unblushing a success story is best kept for the glow of after-dinner talk.

Quite different from either of these is the third work, a revised edition of the *History of the College* by H.W.C. Davis, first published in 1899. It was the work of a distinguished historian, who as an undergraduate at Balliol in the last years of the great Master, Benjamin Jowett, had known the chief instruments of Balliol’s rise from a relatively lowly position to an eminence quite unlike that of any other college at any other time.

The College owed nothing to fortune, almost nothing to wealth, and everything to the determination and dedication of a small group of men with Jowett as their leader. . .

The difference between Jowett's Balliol and every other college was roughly this: when Oxford emerged from its clerical seclusion in the middle of the last century, most colleges faced the world like bathers on a cold day dragging their feet reluctantly towards the sea. Balliol rushed out with zest. There were dissident voices even in Balliol. The Master, Robert Scott, who had been dug from his country living in 1854 to keep out Jowett, was one of them.

Perhaps he was right. But Jowett won the day; the cries of caution were ignored; the College hastened to abandon its clerical sanctuary and plunged into the world—and liked it. Its enemies said that it liked it too much. To rush on martyrdom is an act of nobility. But to rush on fame and fortune requires some explanation.

Whatever the final judgement may be, the results were not accidental. The careers of Grey of Fallodon and Beveridge, to mention only two outstanding men, were decisively influenced by a word from the Master of Balliol.

Three Archbishops of Canterbury, two Prime Ministers (there should have been three), three Viceroy's of India, two or three Lord Chancellors, Cabinet Ministers, High Court Judges, Ambassadors, Permanent Under-Secretaries, Knights and Barons innumerable are the fruit of a plan long matured and carried out with a self-sacrificing diligence beyond all praise. . .

Phew! I was to discover that speeches at Balliol dinners were often hubristic rambles over past glories. I had now arrived at the very pinnacle of academic status and the tide was flowing my way at last! Well, not quite—there was trouble brewing in the Engineering Laboratory.

There were three other New Zealanders in Balliol's Senior Common Room, the most colourful of whom was Dan Davin, who in 1936 had been a Rhodes Scholar in the College. He was the Assistant Secretary of the University Press and had a reputation for an unrestrained enjoyment of social occasions. Like me he had served with the NZ forces in the War and had flirted with left-wing political views. Christopher Hill and I had pressed for his election to a Professorial Fellowship against the wishes of the then Master, Sir David Lindsay Keir, but Dan soon allayed Keir's worst fears and in 1965 became a popular member of the Senior Common Room. We often sat together at what became known as the rebels' table, at the weekly Concilium Night dinners in the SCR. He seldom drank wine, preferring a tankard of beer, which would be specially brought to him by the SCR butler. The others were Don Harris, a law tutor and Arthur Prior, a distinguished philosopher, who was sadly around only for three years before his death.

I should mention one development that gave me some gratification. In 1957 the widow of the Hon. Maurice Lubbock and her son Eric (later MP for Orpington, and in 1971 elevated to the House of Lords as the 4th Baron Avebury) initiated the creation of a trust as a tribute to her husband, with the principal objective of providing scholarships and tutorial Fellowships in engineering and related sciences, including management studies. The several companies with which Maurice Lubbock had been associated contributed to the fund, as did many friends, relatives and associates. The first action of the Trustees was to establish annual scholarships at Maurice Lubbock's old college, Balliol, with the first scholar, Howard Davies, being elected in 1958; the Lubbock Memorial Fund also contributed to my College salary.

I used to attend meetings of the Trustees and one day they asked me for suggestions on how they might spend more money. I suggested a grand lecture, which would be publicity for both the Lubbock name and for Oxford engineering. They agreed to an annual lecture to be given to a scientific and lay audience on engineering in relation to its environment—its industrial applications, its place in society and significance for managers, sociologists, economists and other groups, as well as in education. I think my suggestion ended with the word 'society' above, but the Trustees were inspired to adopt an all-embracing definition with nothing left to the imagination. I had come a long way since, just after the War in Auckland, I had organized a debate on the '*Professional engineer and industrial strife*'. I seemed to have changed sides! When I was asked to find a suitable lecturer, I thought that my champion, Sir Harold, would be full of sound advice as to suitable captains of industry to give the first lecture. I therefore wrote to him for his opinion. His reply surprised me, since it included the sentence:

I did give the first Fawley and the first Graham Clark Lectures and I am opening the discussion at the Power Convention next Wednesday on Research and Design, so I wouldn't like you to rule me out on the grounds of senility—but we can talk about that.

Of course he got his way and gave the first Lubbock Lecture. He chose to talk on '*The contribution of engineering to the British economy*', not a very specialized topic, but it did attract an audience of influential managers.

Sir Harold later asked me for the name of an appropriate sponsor to support my case for election to the Royal Society. While I was flattered, I was taken aback at the random element of patronage involved in such a seemingly important process. I said that perhaps George Temple, who was by then the Sedleian Professor of Natural Philosophy at Oxford and who had examined my D.Phil. thesis in 1950, might be willing to support me.

## Changing Titles

Back at the Department, the first matter which Holder and I disagreed on was the role of mathematics in the low-level engineering degree of that time. I pressed for some advanced engineering mathematics to be taught in the third year of the course, which would have included statistics and computing, but Holder opposed this. Even with this proposal, the course would still have had less mathematical content than many other UK engineering programmes at that time and certainly a lot less than the course in Auckland. The second disagreement arose when I wanted the degree course to be extended to four years with some specialization in the final year. There were precedents—chemists had a four-year degree as did those pursuing the *Literae Humaniores* degree, which had apparently steadied the nerves of so many diplomats in the days of the Empire. Engineers need first to understand some mathematics and physics, before pursuing the usual engineering science subjects and then finally specializing in electrical, mechanical, civil or some other branch of real engineering—but this was not possible in only three years. I had persuaded Thom to this view but, perhaps because of his inexperience, Holder was cautious and held back. I spoke firmly at departmental meetings, but the Faculty followed their leader. (Twenty years later a four-year degree rather similar to the one originally proposed made its long overdue appearance.)

Holder followed Bullen and did not support me for a readership when in 1964 a modest promotion exercise was allowed. He told the Science Faculty Board, who were judging the applications, that I did *only* theoretical work. However, I had a champion present, Hans Motz, the Engineering Science Reader, who gave a different account of my research, generously claiming that it was *always* applied to practical engineering problems. When Professor Temple learnt of this conflict, encouraged by Jack de Wet, he decided to rescue me and pressed my case for a readership, but in mathematics not engineering, so that at the beginning of 1965 I received a letter from the Secretary of Faculties that said:

I have the pleasure to inform you that the General Board, on the recommendation of the Mathematics Board (and with the concurrence of Professor Holder in the consequential termination of your appointment in the Engineering Laboratory), has appointed you Reader in Applied Mathematics. . .

Besides increasing my salary, this transfer meant that I was required to teach no more than six hours a week for Balliol, so I quickly made a case for a second tutorial Fellow in Engineering Science. This was warmly supported by my Balliol colleague, Jack de Wet, whose son Steve was reading Engineering Science at Balliol and courting my eldest daughter, Coral. In 1965 the appointment of Dr Alastair Howatson to the new post allowed

me to forget what little I had learnt of electrical engineering. Alastair had worked in industry for a few years before taking a succession of university posts and later proved to be an excellent tutor and College Officer, remaining in the post until his retirement in 1995. I was now in the unique position of being a tutorial Fellow in Engineering and holding a readership in mathematics. My total teaching load was more than halved and my research in plasma physics could flourish.

About the time that I left the Engineering Laboratory, David Spence arrived in Oxford from the Royal Aircraft Establishment in Farnborough to become a lecturer in engineering science and a tutorial Fellow at Lincoln College in applied mathematics, his two roles thus being the inverse of mine. David was a brilliant New Zealand scholar with degrees from Auckland University College and Cambridge University, and at RAE he had succeeded to an individual merit post as a Senior Principal Scientific Officer. His first research student was Gary Brown, who later became the Director of the Aeronautical Research Laboratory at Fisherman's Bend, Melbourne. A few years later David became the Reader in Theoretical Mechanics and in 1981 departed to a well deserved Chair at Imperial College.

We had become acquainted through a NZ friend we had in common, Mac Head, DFC, DSO, who had been an outstanding bomber pilot during the War. After the War he went to Cambridge University and eventually became a reader in the Department of Aeronautical Engineering. There he was haunted by a sense of remorse, probably derived from his war-time experiences and exacerbated by the death of a student in an aeroplane, which crashed after being fitted with one of his wing experiments. He found relief from his sense of guilt and an unhappy personal life in Cambridge pubs, where I was always pleased to meet him. I shall always remember his mournful description of his state of mind not long before his death: 'Les, I am suffering from LMF.' He knew that I understood that cruel airforce term—lack of moral fibre. He was hard on himself and paid a high price for his DSO.

In 1964 Betty and I suffered a serious shock. We had decided that Coral's relationship with Steve de Wet was unwise, so we attempted to cool it by sending her to Paris to stay with a family we knew there and whose daughter had visited us earlier in the year. However, Coral had given Steve her Paris address with the result that we were rung up in the middle of one night by a very worried Frenchman, who said that Coral had disappeared from his house; in fact the couple had eloped on a tour of the Continent. We were not contacted for about six anxious weeks, during the last two of which Coral and Steve were in fact only a few miles away, being sheltered by Betty's mother. The crafty old lady kept her secret as long as possible, enjoying her power. The inevitable marriage took place in 1965 and we had to wait until 1977 before Steve found a new partner and divorced Coral.

In 1961 I had been appointed as a consultant in plasma physics for the Controlled Thermonuclear Division of the Atomic Energy Research Establishment at Harwell. This relationship continued when in 1963 the Division was optimistically expanded into a single laboratory and moved to Culham, a site only about ten miles from Oxford. I used to spend one day a week at the Laboratory, doing this for nearly two decades. Almost all my research was relevant to experimental investigations at Culham—instabilities and waves of various kinds including shock waves. The instabilities were judged to be important because the plasma losses, which I have mentioned earlier, were (wrongly) thought to be due to turbulence, which in turn was attributed to one or other of the many instabilities that could be generated in a plasma by the flow of an electric current.

In 1963 the University accepted funds from Culham Laboratory to establish a Professorship in Theoretical Plasma Physics within the University's Department of Theoretical Physics. The first holder was a lively and charming Canadian named Bill Thompson, who had been the Head of the Theory Division at Culham, so his appointment although well deserved was no great surprise; he was to be a bridgehead between Culham and the University. However Rudolf Peierls, the distinguished Head of the Department, had really wanted a different kind of theoretician and so was not overjoyed at the appointment, but the University insisted. What university turns down gifts for specified purposes, whether the post has priority or not? Sadly Bill remained only two years before departing for the La Jolla campus of the University of California where substantial funding for fusion research was promised. Before he went, he and I discussed possible successors for his professorship, almost all of them Americans, and he wrote encouraging letters to many of them, but I expect that the Oxford salary was too small to tempt them since none applied.

At this stage the University decided that departments bidding for additional professorships had to be able to claim that the topics covered by these appointments were at the very top of their priority list. Plasma physics was certainly not top for Peierls, so another department had to be found. The most sensible place would have been Engineering Science, where there was already a strong group working in the subject, including Drs Hans von Engel, Hans Motz, Raoul Franklin, John Allen and Alastair Howatson. However it would have been difficult for Holder to claim that plasma physics really was his top priority when there were several more important gaps in the Department's teaching and research. So where could the vacant professorship find a home? I raised the question on the Mathematics Faculty Board, explaining that the subject was really a comprehensive branch of applied mathematics, which covered several of the subjects that we already taught. Perhaps they thought that I coveted the post for myself and decided to be kind, since the Board had no difficulty in claiming that the Mathematics of Plasma, as they preferred to describe

it, was the very subject that had the highest priority for them! And in as much as another professorship in some branch of applied mathematics was urgently needed, this was an honest rationalization.

I dismissed the idea of applying for the professorship, even though by now my accumulation of research papers in plasma physics gave me a plausible case. Apart from the fact that I knew of more experienced candidates who I hoped would be attracted to Oxford despite the low salaries, there were two good reasons why I did not apply when the post was first advertised. In Oxford unlike Cambridge, University professorships are permanently allocated to colleges, by which I mean that the Chair of Engineering Science, for example, is always associated with a Professorial Fellowship at Brasenose College, the Sedleian Professorship of Natural Philosophy is always held at The Queen's College and so on. Bill Thompson had held his post at St Peter's College, which was at that time a semi-clerical society, having been established in 1947 as a Hall and then promoted to being a College in 1961. One of its primary objectives was to promote religion and encourage candidates for Holy Orders and missionary work abroad, hence a move to St Peter's from free-thinking Balliol did not particularly appeal to me. The second problem concerned salary. Although professors were paid more than readers, the increment fell well short of the loss of various college allowances and in fact promotion would have meant an effective drop in my salary of about £2000, in those days a substantial fraction of my total income. Thus my self-appointed role was to find the professor, not to try to become him.

The post was finally advertised in 1967, two years after Thompson's departure, and I sent copies of the advertisement to several Americans, with no response. There was however, one good English applicant, Dr Brian Taylor, who had replaced Thompson as Head of the Theory Division at Culham. He was offered the Professorship, but, being full of doubts about the wisdom of leaving his secure Culham post, he came to see me about the teaching he would have to undertake in Oxford, his idea apparently being to remain based in Culham and to visit the Mathematical Institute to give lectures as required by the University rules. He would have also been required to spend time supervising research students, but previously, when I tried to arrange supervision for my students during my absence on study leave, he had been reluctant to allow members of his Division to undertake this—the fusion programme was paramount and research students would be a waste of time, he maintained.

Unfortunately, unlike the case in the USA, this negative attitude was common in English research establishments, consequently the staff, having no contact with the enquiring and sometime critical minds of clever young people with no particular commitment to received wisdom, never had to



revise the foundations of their subject. Hence they were prone to drift into fixed patterns of research, seldom questioning the assumptions on which their speculations were based.

After pondering for three months, Taylor turned the offer down; I was not disappointed. The University decided to wait a couple of years before advertising the post again in 1969. At my prompting, Professor George Batchelor of Cambridge University was put on the Electoral Board for the Professorship. He was puzzled why I didn't apply, but I explained that I would really prefer to strengthen plasma physics in Oxford and my promotion from a readership would not achieve that. The notion that being a professor was somehow a status to be coveted was not much in evidence in the Oxford of the 1960s; some of the leading scientists, historians, and philosophers in the country were tutorial Fellows of Oxford colleges. In fact Balliol College had no less than five ex-professors from other universities, all content to be tutors and Fellows.

I had now moved out of my beautiful College house in St Cross Road to a house in Boars Hill, a leafy suburb four miles south of Oxford away from the temptations of the city for my family of teenagers. This move meant that should I change my mind and apply for the post, I would not be evicted from a college house, but there was also a more important fact; by good chance, a friend of mine, who was familiar with the minutiae of University regulations, found an obscure rule, which stated that if a tutorial Fellow was promoted to a newly created professorship and his college was agreeable, he could remain at that college rather than having to transfer; his successor of course would have to go to the appointed college. So the issue was whether or not I was Bill Thompson's successor.

'It really is a new professorship,' I explained to the University Registry, 'since it is in Mathematics and not Theoretical Physics.'

I expect the Board of Physical Science were so fed up with trying to fill the post that they accepted this dubious argument without question, so I then applied with a reasonable chance of success. The only English competitor ahead of the field was Brian Taylor and he clearly did want the post or so I thought. I happened to be at Culham a few days after sending in my application and saw Brian—maybe he would be a good referee for me, I thought. I told him that the Professorship had been advertised again and that I had now decided to apply for it. He seemed thoughtful at the news and then told me that he was still interested! Hell, I thought, my only chance now is that the University are so fed up with his earlier procrastination that they will bypass his application.

However, the University offered Taylor the Professorship once again, but wisely imposed a time limit of three weeks on his acceptance and told me informally that if he balked again, the post would be mine. So I waited with the last day of the three weeks' period passing and still no news from Brian, but the next day I was informed by the University Registry that

he had withdrawn the day before and that the post was therefore mine. It remained only for me to approach Balliol and ask them to allow me to retain my connection with the College; the Fellows generously agreed to my remaining as a Professorial Fellow.

I was now restored to a professorship, but in the Oxford of those years this meant no effective change in status, simply a drop in salary, compensated for by not having to give any more undergraduate tutorials. My principal duties were to deliver 28 hours of lectures per year spread over at least two terms and to supervise suitable research students as they appeared. I did miss the tutorial role and its contact with interesting and often bright young men, as well as having drinks with my students in the Buttery. College Gaudies are cheerful weekend reunions of past undergraduates, with the main event being a dinner in Hall. A particular set of three to five or more successive years are invited annually and students may have to wait ten years between these occasions. I always look forward to my years, i.e. 1960 to 1970, for then I get to meet old friends, to learn of their triumphs and disasters and to drink with them again as if back in the 1960s Buttery once more.

## Touring the World

One of the attractive features of an academic career is the opportunity to take study leave, although still working of course, but removed from the ties of teaching and with luck in an interesting country. This allowed me to visit the United States, Canada, Australia and of course New Zealand, at various times. International conferences are another perk of belonging to a research community and in the 1960s and 1970s I made full use of my opportunities, friends feigning surprise when they sometimes found I was still in Oxford.

In 1963 I had my first opportunity to visit the USSR when the Georgian Academy of Sciences hosted an international symposium in Tbilisi on '*The Applications of the Theory of Functions in Continuum Mechanics*' under the auspices of the International Union of Theoretical and Applied Mechanics. This coincided with the 70th birthday of a Georgian scientist whose work I greatly respected. He was N I Muskhelishvili and he was the chairman of the symposium. *En route* I stayed in Moscow for two nights in their premier tourist hotel and I recall coming back to my room after dinner and feeling around for the light switch. My hand came across a moveable circular object, standing about an inch out from the wall and my fingers curled around its base to touch the supporting structure. A small electric shock made me realize that this *was* the switch and that the supports were the electric wires! The women spies whom I had been warned about failed to materialize, so I finally fell asleep in the world which 20 years previously

I had imagined was leading the way to a new world order where class no longer existed.

The following day I walked around Red Square, and being a tourist I was waved to the head of the queue for the Lenin/Stalin wax-works. I then had a look at an opulent underground railway station, noted the semi-religious declarations about Lenin being still living, practised my O-level Russian on the locals, saw the famous Moscow store, Gum, found nothing to purchase, and visited some of the nearby museums.

The Aeroflot transport that took me and other scientists across the snow-covered Caucasus to Tbilisi seemed rather cramped, with cabin baggage being placed in net racks just above our heads. Sandwiches were handed around, but some of the locals had sensibly brought their own food, which produced a picnic atmosphere in the cabin; I hoped that the pilots were not also as relaxed.

I found Tbilisi an attractive city with a balmy Mediterranean atmosphere; Stalin was still a local hero, standing there on his plinth, and when I queried this survival with my guide, with perhaps a hint of criticism, she was very firmly for Stalin, and even a little cross with me so I shut up.

The conference was a great success and I met many internationally distinguished scientists, including academician L Sedov, whom I had met previously in Sydney 15 years before and whose book I had notably failed to read. He now spoke in English and greeted me pleasantly, saying that he would introduce me to Professor Gurevich, who had written a book on plane ideal flow, which was rather like my own treatise on the same classical subject. Professor Gurevich, who I had in fact already met, showed his respect to the Party member, bowing slightly when Sedov and I approached him.

‘Professor Gurevich, I wish to introduce you to Professor Woods who has a very singular characteristic.’

I thought to myself, ‘Goodness me, how kind, I wonder what...’.

Then Sedov went on, ‘He *never* refers to Russian authors!’ and having delivered this black compliment, he quickly disappeared. Gurevich, who had referred generously to my work in his book, was embarrassed by this comment, but I have to admit that Sedov’s remark was accurate, so when I wrote a long chapter on analytic function theory in 1971 for a book on continuum mechanics, I stuffed in all the references to Russian authors that were vaguely relevant, including one to Sedov’s own book.

One other encounter on this occasion involved a clever eccentric by the name of Clifford Truesdell. Ten years before when I was working at the National Physical Laboratory, my boss, ‘Vodka’ Jones asked me if I would like to become a reviewer for *Applied Mechanics Reviews*. Not realizing the true purpose of this question, I agreed.

So he said, ‘Review this article on vorticity and you will be accepted.’

He gave me a very turgid, mathematically convoluted paper by Trues-

dell; I was trapped by ambition. The instructions called for a critical review, so I obliged the editor, but it was not an easy paper to read and as far as I could see of very little practical value. So I gave it the treatment I thought it fairly deserved.

Truesdell was an unmistakable figure—short, wide and dominant—a sort of Henry the Eighth, except that he preferred the style of the 17th century, occasionally writing scientific papers in Latin. Everyone knew him. At one lecture by chance we came together on a bench and he peered at my name tag; I looked the other way.

‘Woods!’ he exclaimed.

‘Yes,’ I allowed, wondering if he had ever read my review.

He did not hesitate: ‘Some years ago you reviewed my paper on vorticity.’

‘True,’ I admitted, ‘You have a good memory.’ He said no more. Our paths were to cross several times in the coming years, but one might say that our ‘friendship’ peaked at Tbilisi. I shall return to Truesdell and his so-called rational mechanics in the next chapter.

The conference banquet started at about three in the afternoon—at first I thought it was simply a rather late lunch, but the courses kept coming, with small amounts each time, but continuing well into the evening. Copious vodka and wine slowly modified our personalities so that we turned into Russians, willing to leap up and propose toasts willy-nilly. After the usual friendship between nations stuff, the toasts became mathematical.

‘To the complex variable,’ shouted one Russian. We laughed with joy at this clever idea, for there need be no end to it.

‘To the zeta function,’ called another.

‘To conformal mapping,’ I shouted a dozen toasts down the line when I thought it was my turn. As the toasts became more abstract, the evening advanced into chaos—thank goodness the conference was over the next day. I was flattered at the end of the meeting when Muskhelishvili gave me an autographed copy of his seminal work *Singular Integral Equations*.

I attended a plasma physics conference in Tbilisi three years later at the same hotel and on one hot evening when I couldn’t sleep, I lay in bed listening to a deep rumbling noise that went on and on. It was two o’clock in the morning and the moon was shining, so I went to my balcony and looked out. Below in the unlit street I could see an endless stream of tanks, rocket carriers and army transports, mysteriously cranking through the night, and estimated that they were moving in a direction which would take them to the Azerbaijan border. There were also soldiers on foot, who were randomly examining the buildings. I slipped back into the shadows on my balcony and continued to watch for another 20 minutes, before going back to bed wondering what minor rebellion was afoot.

One of the consequences of my interaction with Monash University over their Foundation Chair of Mathematics was that in 1961 they appointed

me as their UK representative, which involved my occasionally going to London to help interview candidates for senior appointments. I was able to tell them about the joys of living in Melbourne, having spent a few days there myself. The Vice-Chancellor thought I should spend some real time with them and I also wanted to work with Wolf Kunkel at Berkeley near San Francisco, so in the middle of 1964 I took a term's study leave and purchased round-the-world air tickets.

Our first stop was Nairobi in Kenya where we were met by Michael Gwynne, who was a senior Research Fellow in Tropical Ecology attached to Balliol. We spent several exciting days with him in the Tsavo National Park and Betty kept a record of the different species of animals that we saw which reached a total of 59. Now 30 years later I wonder how long it would take to reach the same number outside a zoo.

We left Africa via Johannesburg and travelled across the Indian Ocean to Perth and then on to Sydney. It was a great pleasure for us to see beautiful Sydney again and also the many friends whom we still had there; we went to familiar restaurants and learnt to enjoy a more extroverted style of companionship again. The stop in Sydney enabled us to spend some time with my sister Beverley. She had completed her degree in Chemistry, and then had gone on to Auckland Training College to get a Dip.Ed. At this stage Michael Willis, a chemist who was the son of a clergyman, had entered her life. Among other things, her marriage to him was an escape route from home, the next step being to leave Auckland behind, so they emigrated to Sydney. Beverley found employment as a science teacher in a succession of Sydney schools, finally rising to be a Head of Department. I have three nephews, Peter, Graeme and Bruce, who are all engaged in successful careers, but Beverley and Michael divorced when their children had grown up. Later she left schoolteaching to take a responsible post working for the NSW Ombudsman. She is a caring, intelligent woman and it is sad that our lives have been spent a hemisphere apart, depriving each of us of the support that only siblings can provide.

Our next stop was Monash University in Melbourne where we stayed for three months and where I gave lectures in fluid mechanics and magnetohydrodynamics. Monash was a new university, still in its early developmental stage, but, unlike the University of NSW, it had no Technical College legacy to impede its early progress. There were several professors in office whom I had interviewed in London; they had no complaints about my advice on the good life in Australia, which consisted of rather more than Foster's lager, barbecues, the beach and gambling.

We continued to move eastward as required by our round-the-world air tickets. This took us back to New Zealand for a week, followed by three days in Fiji and three days in Honolulu.

We finally arrived at the University of California at Berkeley, where I joined the Department of Aeronautical Sciences. I did some research on

ionizing shock waves in collaboration with the Radiation Laboratory, just up the hill from the fine campus, whose eucalyptus trees reminded me of Sydney. I was very impressed by the high academic standing of the University. It was 1964, the first year of student rioting. The hippies in Telegraph Avenue, the police helicopters overhead and the anxious reactions of the professors, who seemed uncertain whether to side with the students or the administrators, made an exciting amalgam for a visitor with no stake in the outcome. The instant warmth and hospitality of the academics we met contrasted sharply with our experience in England, but perhaps as visitors we had some novelty value. I also remember the good-natured efficiency of the waitresses, who were clearly not labouring under a class system.

The coast from Bodega Bay past the Bay Bridge and on down to Monterey, and the charm of San Francisco, with its fine fish restaurants and scenic views, were completely captivating. The dramatic views in the Yosemite National Park and the majestic redwoods, which even outranked the great kauri trees of New Zealand, were also greatly enjoyed.

When my research project was successfully completed, we travelled across the Continent to spend a couple of days with Ronnie Bell and his wife Margery at Providence, Rhode Island before returning to Oxford. Ronnie was a very distinguished physical chemist, who had been a Fellow of Balliol since 1933. He was a candidate for the Mastership of Balliol and, being unusually circumspect, thought it proper to absent himself from the College so that his presence would not bias the election; I shall be returning to this election later.

In 1966 I managed another excursion to the United States, this time as a Visiting Professor of Mathematics at the Massachusetts Institute of Technology (MIT) in Boston. We took Diane, Elizabeth and Patricia with us, where they attended local schools and learnt how to smoke. We followed the historical trails, visited Salem and enjoyed the beaches of Cape Cod.

When we first reached Boston, we were met at the airport by an Oxford colleague, Alan Tayler, who was about to return to Oxford from a period of study leave at Harvard University. He had a massive Oldsmobile he wished to sell, a bargain at \$100, he said.

‘So what is wrong with it?’ I asked.

‘It runs beautifully, but it does have a little rust,’ he admitted. Under an old rug on the floor at the rear I discovered a loose metal plate covering most of the width.

‘What is this for?’ I asked.

‘Ah, that is to stop your feet reaching the ground below,’ he said, removing the plate to reveal that the rust had eaten a hole about a foot across; the ground was visible below!

‘I added the plate,’ he smiled. ‘It is a real improvement and there is also a new battery.’ I have never been a match for second-hand car dealers,

so I paid the sum and collected the car a week or so later, at which point Alan told me it needed plenty of oil and that I should check it frequently.

About 20 miles further on we were ready to drive down to Providence and from there to New York. Oil and petrol were taken on board and with suit cases and refreshments for the family loaded, away we went on our adventure. The car ran smoothly for at least 40 miles, but then, although it was a hot day, I was surprised to smell burning. My feet which were resting on the transmission casing were becoming hot and I needed more and more throttle to maintain speed. Finally the car slowed down and stopped completely, refusing to start again. I later discovered that the transmission had burnt out through lack of oil and a few miserable hours afterwards I was dealing with a *real* second-hand car dealer, who towed the Oldsmobile to his garage and said he would find us a suitable replacement. After a night in a local motel, I called on the entrepreneur who said that he was prepared to offer \$25 for the Oldsmobile because it did have a good battery. He then sold me a \$800 car, which he claimed was an amazing bargain because it had been driven very sedately and only by 'mother'. His son warmly confirmed this desirable feature, but I was lucky to get \$450 for it two months later.

When I returned to Oxford, Alan made the mistake of asking me about the Oldsmobile; he was obviously fond of it. I told him the sad story and he explained that the oil that he had referred to was *transmission* oil not *engine* oil. I had never driven an automatic before and had never heard of transmission oil. Alan generously returned half the money I had paid him, although I did not deserve it. Alan's death in 1995 was a grievous loss to Oxford Applied Mathematics.

In the summer of 1968 I was a visiting professor of plasma physics in the Physics Department of the University of Texas at Austin, where Bill Drummond, a leading plasma physicist with a flair for raising money for fusion research from oil companies and the state government, had built up a strong group. One of their interests was in what were mysteriously called 'collisionless' shock waves, this research being prompted by the nature of the shock wave caused by the solar wind impinging on the Earth's magnetic field—one of the first satellite discoveries. The shock wave was thought to be too thin to be explained by collisions between the charged particles of the solar wind plasma.

Elizabeth and Patricia came with us on this trip, reluctantly since they were overly fond of the Oxford teenage scene. Diane had also been meant to come, but just before we left England she disappeared. We had no warning and correctly suspected that she had eloped, so we advised the police, but since she was then 18, they could take no action. It was a great shock to me; suddenly the family was falling apart. I forgot the fact that at the same age as Diane I had left home to join the Air Force. Betty and I blamed each other. In my mind the rift was serious, but after we sent the

girls back to prearranged secretarial jobs in England—not in Oxford—our marriage appeared to recover. Coral had married four years earlier and Jill had a romantic attachment that looked as if it would result in marriage. I shall return to family matters in the next chapter.



My beautiful daughters.

*From Left: Pat, Jill, Coral, Diane and Liz at Coral's wedding.*

Certainly the most interesting adventure we had while in Texas was leaving it to spend two weeks in Mexico. Betty and I travelled down to Monterey where I became acquainted with that seductive blend of tequila and fruit juice known as a margarita. To see people promenading around the town squares in the evening was a delight; in Austin they seldom got out of their cars. The trip to Mexico City was very interesting with the landscape and vegetation dramatically different from anything we had ever seen before, and we were particularly impressed by the giant cacti dotted over the arid hills. We saw poverty stricken peasants washing their clothes on stones in rivers and waved to them but did not risk stopping. The smog in the overcrowded capital city was oppressive even in those days; we stayed sightseeing for a few days. One day outside the city we saw a threatening black whirlwind towering 1000 feet or more and hurried on. We crossed to Acapulco, which we had heard so much about, but were disappointed; it was not a match for Sydney beaches, let alone Hahei in New Zealand.

Another very long motor trip took us to Miami Beach where to justify the expense, I read a paper at the US National Conference on Plasma Physics. The beach was hard to find amongst the grand hotels which



lined the foreshore. A visit to the Everglades, where a propeller driven boat carried us over the dank, alligator-infested swamps was a particularly exciting adventure.

In 1969 we found ourselves in Maryland where I had a summer appointment at the University's Department of Physics and Astronomy. From there I was invited to several universities to give seminars—Johns Hopkins, Princeton, Columbia and the Berkeley and La Jolla campuses of the University of California. It was a frenzy of visits, sightseeing and research, never again repeated.

The Hofmeyer Fellowship had been set up to allow Fellows of Balliol to travel to Johannesburg to spend a term teaching at the University of Witwatersrand. The Fellow was also expected to visit other universities and encourage a more liberal attitude towards the black and coloured population. I was appointed to this pleasant but challenging duty in 1970. I visited the University's Department of Mathematics and Computer Science to give several lecture courses and a few seminars. We saw native dancing and went down a gold mine where I failed to win a gold ingot by managing to lift it with one hand.

We obtained a pass from the Education Department of the University to allow us to visit the squalid shanty town just outside Johannesburg known as Soweto. This was a dormitory town for African workers, who were not permitted to live in the city. There we met the headmaster of a secondary school, who had acquired his education in the USA. He was a strange mixture, resentful of the fact that with all his experience his salary was less than that of a newly qualified white teacher and yet proud of his command of Afrikaans, the despised language of apartheid.

I visited and gave lectures at several universities—Cape Town, Durban, Pretoria, Potchefstroom, Stellenbosch and Roma and attempted to visit two colleges for Africans, Fort Hare and the University College of the North, but I was thwarted by excuses from the Afrikaners who ran these institutions—it was an inconvenient time, they claimed. Apparently my mistake was to express the wish to meet and talk to African students. I found little to choose between the so-called 'liberalism' of the English-speaking people I met there and the confident racism of the Afrikaners—both groups benefitted equally from the policies of the Nationalist Government, the main difference being that the English seemed to be guilt ridden.

Betty and I spent several days in Lesotho, which was then under a dictatorship and in effect a 'homeland' for Africans working in the Orange Free State. We met an Englishman at Roma, a college in Maseru. He was married to a charming Indian colleague and told me that whenever they found it necessary to visit a sister college in Botswana, travelling across the 'Free State' was an ordeal. She was not supposed to travel with him

since the races could not mix, so she had to sit in the back seat of their car and look as inconspicuous as possible, sometimes even having to hide under the seat.

We drove into mountainous Swaziland, which was free and easy with gambling casinos and brothels for those Afrikaners whose sexual predilections were illegal in South Africa. We pressed on into Lorenço Marques, the capital of Portuguese Mozambique—when we saw the town, it was a peaceful, attractive seaport, but revolutionary disaster was soon to engulf it.

My first research student, Simon Rosenblat, had become the Professor of Applied Mathematics at the Technion in Haifa, Israel and he arranged for me to visit his department to give a series of lectures on Thermodynamics there. So early in 1971 Betty and I settled in a flat in Haifa and at work I shared an office with Sydney Goldstein, a very eminent fluid dynamicist, who had been the Founding Professor of Mathematics at the Technion 15 years earlier and who was now visiting from Harvard. Sydney talked to me about his very considerable experiences during the War in England and later at the Universities of Manchester and Harvard. He wanted an audience for his reminiscences and I was happy to oblige.

What a fascinating country it was. Simon took us to see Nazareth and then to a fish restaurant on the Sea of Galilee. We visited Tel Aviv where at the University I found a group interested in plasma physics. Then we moved on to spend several days at the religious capital of the World—Jerusalem had recently been taken over by the Israelis, so the Old City was still being tidied up when we visited it. Despite my lack of faith, I was intrigued by the Via Dolorosa with its various stations of the cross. The bazaars and markets with their spices, sweetmeats, fruits and vegetables gave a memorable impression of the Middle East; a bus trip to Bethlehem was an essential detour for the devout and the merely curious alike. I was surprised at the blatant commercialism of the priests at the religious shrines, but we are catching up in England, since some Oxford colleges now charge visitors to see their gardens and chapels.

In 1972 I was elected to an AVCO Distinguished Visiting Professorship at Cornell University, where I gave lectures on my specialist topics. On the conclusion of the first of my seminars, I was invited to enjoy the Happy Hour at the University Club as the guest of the Mathematics Department. I had a small misunderstanding with the barmaid there concerning the whisky I had ordered. She came back with a glass full of ice cubes and the amber liquid scarcely visible. I had ordered whisky, I complained, not frozen water.

‘Could I have *just* whisky please?’ I asked. She came back with a larger glass with more whisky, but still the ubiquitous ice in place robbing the taste of the Scottish tincture. As a guest, I suppose I should have given in, but I took the glass in hand and pointed to it.

*'Nothing but whisky in this glass please!'* (I had yet to learn the expression 'straight up'.) She took me at my word; there was not even much air in the glass she brought back. It cost the department \$23 and gained me a reputation that I have tried to not live up to.

## College Business

What surprised me about Christopher Hill, Balliol's distinguished 17th Century historian, was that he waited so long into the 1950s before resigning as a member of the British Communist Party since the truly evil nature of Stalin's empire became perfectly clear not long after the War. I was pleased that this background did not concern Balliol in 1964 when we were seeking a replacement for Sir David Keir, but I wonder how many other colleges would have shown such tolerance. At first Christopher seemed an unlikely candidate for such a grand establishment post.

'New Fellows and their wives are not welcomed socially by the College as much as they should be,' Christopher claimed to me one day. He asked me if I would help him with this task with a pub meal here and there.

'What a generous idea,' I agreed. I was flattered to be asked to help with this mission and, together with our wives, we and the newcomers had several happy outings, this social work continuing spasmodically until my departure for the world tour I have described earlier.

The other internal competitor for the Mastership was Ronnie Bell, a distinguished chemist, and his success would have brought the first scientist into this grand post. As I mentioned above, I met him in Rhode Island during the election campaign and asked him why he had taken leave at this particular time.

'I thought it wise to let the College make up its mind without me around appearing to influence the result,' he said with innocent honesty. It never occurred to me at the time that I had already unwittingly played a role in the campaign. A straw vote taken a little earlier had showed that Ronnie was behind Christopher; not too surprising, considering that more than two-thirds of the College were Arts Fellows.

Aware of this, Ronnie asked, 'Should I withdraw? What do you advise?'

'If you do,' I said, 'the scientists who are backing you will be very disappointed. It is high time that Balliol had a scientist as Master and you are greatly respected.' He did not withdraw.

Unfortunately, respect was not enough since Hill was also popular. The straw vote gave him a substantial majority and then on the appointed day the College made it unanimous with a formal vote in the Chapel. I was disappointed, for Bell had a dignity and balanced judgement that would have served the College well in the coming years of student unrest.

When Hill took over in 1965, the College committee structure was altered so that, rather than have the Master as Chairman of all the committees, these tasks would be shared around. I became Chairman of the Buildings Committee at an important time in the College's development. We had those funds from the Septcentenary Appeal, some of which were to be spent on new buildings. One was required near the back gate, so an informal competition was launched and a chosen architect submitted an acceptable plan at a reasonable price—about £80 000, I think. Other architects' estimates were much higher for the same number of rooms, so we gave the contract to the first chap. Small improvements and extensions suggested later by my committee were surprisingly expensive; soon the architect had the figure up to £120 000, and the College was uneasy. Some months later, he asked to meet me and the Domestic Bursar as he now had his builder's quotation. It was £160 000 and rather higher than he had expected, he claimed.

He asked if the College would want to continue—we were very concerned since the costs had doubled in less than a year. I asked the Bursar to bypass the architect and to check with the builder and subcontractors directly. We got a shock. The builder's first estimate for the very plans that the College had approved was over £200 000! The architect had managed to pare this down to £160 000 by reducing the quality of the finish, cutting down on the noise insulation between the rooms and various other cheese-paring moves, all taken without our being consulted. There was a dramatic meeting between him and all the Fellows at which I asked him about the reduction in the density of the bricks separating the rooms. He replied that it would make little difference to the transmission of sound between the rooms, but I had done the calculations—perhaps he did not realize that I was an engineer. He was nonplussed when I explained the fallacy in his reasoning and other College members joined in the attack. After the meeting we decided to sack the man and not to pay him any fees. He brought a case against the College and I had to appear as a witness in court; I was in Maryland at the time of the hearing and the College paid for my return. I had been looking forward to the encounter, but the lawyers for both sides struck a deal five minutes before we were due to enter the court room whereby we paid him half the fees for abandoned work. We later found an honest architect to complete the project.

Christopher Hill's Mastership was not without its troubles and he was sometimes accused of encouraging the College undergraduates to be mutinous, but this was merely a speculation by Fellows of other colleges, who were angry at the student revolution of the late 1960s and who were looking for a scapegoat. It is true that Balliol undergraduates had the reputation of being in the vanguard of any student unrest in the town and it was natural to blame the leadership of the College for this. Also Christopher was rather better at interacting with the undergraduates than with the Fellows

and whether or not he continued to welcome new Fellows in local pubs I do not know since my help was not requested again. He did reduce the College formality, although this had never been great compared with other colleges.

Hill's ironic sense of humour sometimes made me uneasy. At one College function at which visitors were present—it may have been a gaudy—he introduced me to one of the guests, with whom he had been in conversation.

'Les, you do think that the House of Lords should be abolished, don't you?'

'Of course,' I replied, 'that undemocratic anachronism is long overdue for the chop.'

'Meet Lord Blah!' he said with a triumphant smile (his Lordship's real name has now been forgotten by me). Talking to him could often be something of a challenge.

When the College economics tutor, Tommy Balogh, was elevated to the peerage by Harold Wilson, at the party to celebrate this event, during his short speech Hill included the quip that it appeared that Wilson had discovered a brilliant means of undermining the House of Lords; two birds with one stone!

In 1978 there was a change of Master, but I was abroad at the time of the election. At a much earlier discussion on general principles, I had suggested that perhaps it was time to abolish the post, but Lord Balogh's support for this revolutionary idea was sufficient for its demise. I later proposed that the post be held for a set period, rather than until retirement, since I argued that this would allow a younger man to be elected, as the chilling thought of having the same Master for, say, 20 years, would no longer act as a filter. This idea was accepted, so when Antony Kenny, aged 46, became a candidate and it became known that he was prepared to accept a limited period as Master, his case for election was somewhat strengthened. Following his election, his resolution that after 12 years in office he would resign and seek a job elsewhere was formally recorded.

Tony Kenny was very different from his predecessor. He was just as friendly, although more formal and took his duties seriously, as one would expect from one who had served as a Catholic priest in Liverpool. He was also more ambitious and tried to improve the lot of Professorial Fellows, a change in College attitude that I much appreciated. Under his leadership the College recovered steadily from its turbulent years and ten years after his election an attempt to move the goal posts by those who wished see Kenny continue as Master, despite his earlier promise to depart, almost succeeded. But six of us held the goal posts firm, which robbed the proposal to invite him to continue as Master of the unanimous support that such a conspicuous reversal of policy would have required.

Kenny departed to become Warden of Rhodes House (a post known irreverently to Rhodes Scholars as the '*Rodent of Wardes House*'), which

coupled with his Presidency of the British Academy lead to his knighthood in 1992; his list of honours is seriously impressive.

In 1989 we elected a very remarkable man to the Mastership, Baruch Blumberg. With him we broke the mould in four ways: he was a Jewish scientist and an American with a Nobel Prize in Medicine. His style was an attractive blend of modesty and enthusiasm, but, because of his age, we only had five years before he retired and was replaced by the present Master, Colin Lucas, who is now the Vice-Chancellor. Since I retired in 1990 I have had little interaction with these Masters.

During my 38 years as a member of Balliol College, I found most of the Fellows friendly and tolerant of my antipodian ways—even my firm support for the NZ All Blacks when playing against British rugby teams! Three particular friends were Jack de Wet, Bill Williams and David Turner. Jack was an outstanding tutor in mathematics and I was disappointed when in the early seventies he left Balliol and returned to his homeland South Africa to become Dean of Science at Cape Town University. When Coral's marriage to Jack's son Steve failed, it made not the slightest difference to our friendship. Bill Williams was the Warden of Rhodes House during most of my time at Oxford; he had a very distinguished war record as an intelligence officer to Montgomery and was later knighted. It was Bill who encouraged me to accept a fellowship at Balliol and we were linked through our War service and then Rhodes House. I miss his ironic asides—he once identified an ambitious Chairman of the General Board as being 'one of Nature's head prefects'. David Turner, a distinguished physical chemist, has been kind and helpful to me during my various trials. I appreciated his wit and gentle irony and still do as we occasionally meet in the Balliol College Common Room.

# Chapter 11

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## Struggles in Research

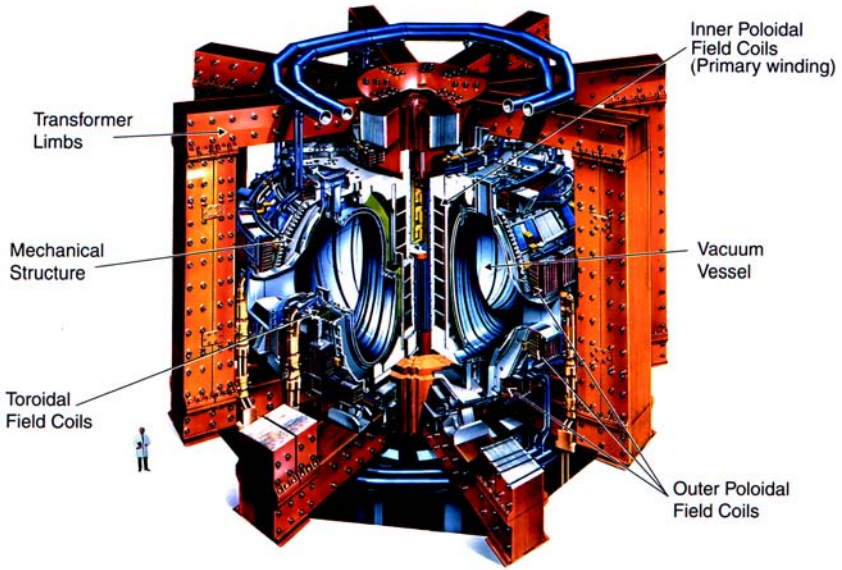
### Tokamaks

Since the university post in plasma theory had been funded by the UKAEA, following my election to the Professorship, I felt obliged to try to solve problems associated with fusion research. From 1971 onwards my main aim was to discover why the magnetic confinement machines at Culham Laboratory so comprehensively failed to retain either their energy or plasma mass. Unless the confinement problem could be solved, it seemed that the dream of unlimited fusion power would never be realized and thus this was the central issue in fusion research.

Ten years before, when I was first attached to CTR Division at Harwell, I had made an attempt to solve the puzzle of cross-field transport, but I had soon given up to work on more tractable problems involving waves and shocks. These had led to a sequence of satisfactory, routine publications, but now, since there was no longer any need to publish for promotion, I was free to attempt the hard task of understanding magnetic confinement, or rather the lack of it, in tokamaks. Dozens of theoreticians in many countries were also working on the problem and had been doing so for several years; I had a lot to learn but also had the advantage of no preconceived ideas—I could pursue unconventional approaches and run the risk of either failing or perhaps achieving a great success.

The Joint European Torus (JET) is currently the largest tokamak in the world. The word ‘tokamak’ is taken from the Russian words for ‘toroidal chamber-magnetic’—**toroidalnaya kamera magnitnaya**. The concept was developed in the USSR at the end of the 1950s and its advantage over similar toroidal machines being developed in the United States and Great Britain at the same time lay in the greater stability obtained by using much stronger toroidal magnetic fields. ‘Stability’ in this context means no more than the persistence of the magnetic field and electric currents—at least in the early machines—for times of the order of *milliseconds*! The famous

British ZETA machine, which received much publicity in the 1950s, was so-called stable for less than about five milliseconds, whereas comparable tokamaks lasted ten times longer.

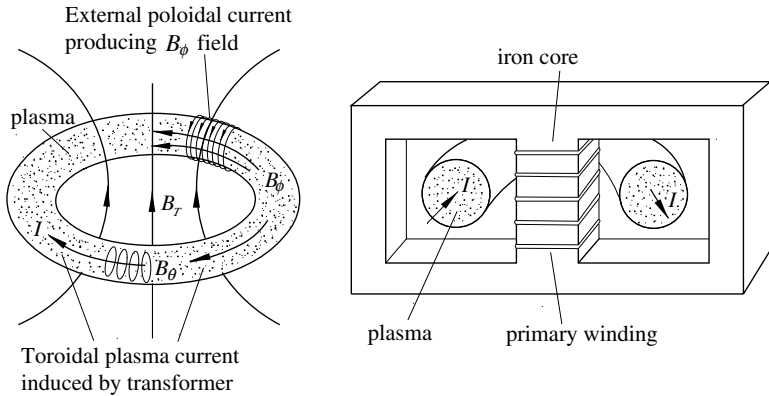


The Joint European Torus.  
The largest tokamak in the world.

Because much of this chapter concerns my struggle to understand this machine, a sketch is provided overleaf to help the reader appreciate the following account. The figure is a schematic outline of a tokamak and a photograph of the JET tokamak appears above. The electric current passing through the primary winding induces a toroidal current in the plasma, which heats it and establishes a poloidal magnetic field,  $B_\theta$ , while a much stronger toroidal magnetic field,  $B_\phi$ , is generated by an external poloidal current. To escape to the walls of the torus, the charged particles—electrons and hydrogen ions—must cross the magnetic field and the stronger this is the longer the particles will remain within the torus. The longer the ions remain within the torus and the more of these there are, the more likely they are to collide, and, if these collisions are sufficiently energetic, to fuse and liberate energy. The three most important parameters favourable to successful confinement are therefore the time  $\tau_E$  that the ionic energy remains confined within the torus, the number of ions per unit volume,  $n_i$ , and their temperature  $T_i$ .

In a fusion reactor very high values of  $T_i$  and  $n_i$  must be maintained long enough for the energy released by fusion to more than balance the energy





Tokamak currents and fields.

losses due to radiation, conduction, convection and particle loss, with the excess energy then available to drive some kind of turbine. The break-even point, when production of fusion energy just balances the losses, is called *ignition*. It was found that the conditions for ignition strongly depend on the sort of plasma employed. For example, if the plasma is entirely deuterium, the ions of which are a neutron and proton bonded together, it is necessary to have  $n_i\tau_E$  no less than  $1.5 \times 10^{20} \text{ m}^{-3} \text{ s}$  (150 million million million) and  $T_i$  greater than 3000 000 000 K, an almost impossibly high temperature. Such a reactor would function on the D–D reaction and in the 1950s it appeared rather fortunate that there was a more accessible fusion process, namely the D–T reaction in which deuterium fuses with tritium, which has two neutrons and a proton in its nucleus; for the same value of  $n_i\tau_E$ , a temperature of only 300 000 000 K is sufficient to achieve ignition. The temperature at the centre of the sun is thought to be about 16 000 000 K, which gives the reader some impression of the challenge that faced fusion researchers. The much lower temperature required in the sun is balanced by a density about a million, million times greater than that in a tokamak, so, while the reaction rate is very much slower, the number of ions involved is enormous.

While there is a vast amount of deuterium available in the oceans, tritium does not occur naturally and needs to be bred in the reactor using a lithium blanket, which when subjected to impacting neutrons produces tritium. However, there is a heavy penalty to pay since the diffusion of tritium into the walls of the reactor would present a serious radioactive hazard and furthermore, unlike the virtually inaccessible D–D reaction, the D–T reaction produces neutrons, which being uncharged, and therefore unrestrained by the magnetic field, would also generate radioactivity

in the reactor walls. Radioactivity was scarcely mentioned in the early euphoria for controlled nuclear fusion. Perhaps it was a problem that could be solved after the physical viability of the project had been established. Likewise, the engineering difficulties of utilizing the heat to be generated in the reactors received scant attention—the physicists were in charge, not the engineers.

In any serious engineering project involving new concepts there are three stages in its development, namely establishing the basic science, designing the engineering structure and above all showing that the project is economically sound; evidently there is no point in pursuing the project if the basic scientific idea cannot be proven. With controlled fusion, the success of the hydrogen bomb as a weapon of mass destruction had certainly demonstrated part of the underlying science, but it remained to be established that controlled release of energy was possible in quantities that exceeded the input of energy required to ignite the plasma.

But this was only the beginning—there also had to be an engineering design for the conversion of this energy into electrical power with the safety of the operators guaranteed, which meant that very expensive remote handling would be unavoidable. Also the energy required to fabricate the system had to be recoverable in a much shorter time than the lifetime of the machine and, finally, the energy output of the reactor had to be commercially competitive with other forms of energy. These three stages are not essentially successive—one could suppose that the confinement science had been established and then ask what engineering design would be required to handle both the heat energy and radioactivity expected from the reactor for a reasonable life span of the generator. If no possible design could meet the demands of safety and energy transfer then the question of the scientific feasibility could be set aside and the project abandoned. A similar approach applies to the economic phase—if the projected cost of the fusion energy output substantially exceeded other forms either available or potential, again the project should be abandoned.

One of the serious failings of the worldwide fusion research programmes was the neglect of the engineering and economic problems. Researchers acted as if these issues need not and in fact could not be seriously addressed until the scientific questions had been answered. Some work was allowed on these questions, but not enough to risk the emergence of adverse conclusions. The physicists in charge were confident that there was an impending energy crisis just a few years ahead and that fusion energy was the only real prospect to survive this. A coherent international fusion community was developing, whose leaders required political skills to ensure funding for the mounting expense of finding the Holy Grail.

Returning to the science, I mentioned above that for ignition  $n_i \tau_E$  should be no smaller than  $1.5 \times 10^{20} \text{ m}^{-3} \text{ s}$  and, to illustrate this, I shall assume that a confinement time of one second is possible; then  $n_i$  should be

at least  $1.5 \times 10^{20} \text{ m}^{-3}$ . Under normal atmospheric conditions, the number of molecules in a cubic metre is about 10 000 times greater than this, so the plasma in a tokamak is much more like a vacuum than the air we breathe. Even so it has not been possible to get the number density as high as this, especially at the high temperatures required, the problem being that above a certain critical number density there is a serious instability appropriately termed a disruptive instability, which results in a sudden drop in the temperature and current. This collapse imposes impulsive magnetic forces on the structure of the tokamak, which are sufficiently large to distort the structure. Such catastrophes are expensive and are avoided as far as possible, but unfortunately the critical number density is too low to allow the ignition point to be reached, for at achievable number densities ignition would require confinement to continue for several seconds.

This leads me to perhaps the most dismal discovery, one that must have deeply puzzled those early experimentalists, who had worked so hard to establish the facts on magnetic confinement. The first and simplest theory—the one on which the initial optimism was based—predicts that the energy in a machine like ZETA under normal operating conditions should have been confined by the magnetic fields for well over a minute instead of only about five-thousandths of a second, and for a comparable tokamak like the Russian T-10 this theory predicts about 25 minutes for the confinement time. A new approach that made allowance for tokamak geometry and grandly termed ‘neoclassical theory’ reduced the confinement time given by the early theory by a factor of about 50 to 100. This modification brings the theoretical T-10 confinement time down to about 20 seconds, still some 400 times larger than observed. The reader will understand that these figures are very approximate, but they do correctly illustrate the situation. With the enormously complex JET tokamak at Culham, the presumed neoclassical confinement time of over a minute is to be compared with the observed time of a second or less.

Scientists are resourceful at clinging on to favourite theories and it is sometimes said that scientific progress is made more by the demise of scientists wedded to past theories than by their acceptance of new ideas. So how could neoclassical theory possibly continue as being valid in the light of the observations? A recent book on plasma confinement written by a leading neoclassicist expresses it thus:

When the transport coefficients in experiments differ significantly from the neoclassical predictions, the transport is said to be ‘anomalous’. In fact it is not uncommon for the diffusion coefficients inferred from tokamak experiments to exceed neoclassical predictions by two orders of magnitude (factor of 100) or more, especially with regard to electron diffusion. The study of anomalous transport is a rapidly evolving field of current research.

This belated admission first occurs on p 391 of a book entitled *Plasma Confinement* (Hazeltine and Meiss, Addison-Wesley, 1992, pp 412).

It was claimed that turbulence was responsible for the failure of neo-classical theory to give values of  $\tau_E$  in agreement with tokamak experiments and that plasma turbulence was a consequence of the existence of plasma instabilities, e.g. waves whose amplitude could grow larger and larger, a bit like waves breaking on a beach and generating a sea of very rough water. A Pandora's box of plasma instabilities—literally dozens have been identified—gave plasma theorists enough work to fill out the century. I thought that I should join the hunt—success should allow me to claim full membership of the fusion community, but alas I was to fall at the first fence.

## Thermodynamics and Philosophy

Turbulence is a notoriously difficult subject; progress has been slow, although many books have been written on the subject. There has not been much real progress with the basic concepts since Reynolds' pioneering work early in the 19th century and the contributions of Prandtl and Taylor early this century. I had made some small contributions to the subject in my work on magnetohydrodynamic shock waves where the wave-breaking analogy had some relevance, but I found the work of some others to be mathematically elaborate, short on physical principles and full of *ad hoc* assumptions. I wondered how I might bring some general ideas to bear on the subject in order to get quickly through to the essential nature of turbulence, at least as far as the transport of energy and mass across magnetic fields was concerned. Perhaps I was lazy and looking for shortcuts. I remembered that catch-all concept 'entropy' and wondered how to calculate the entropy of a turbulent magnetoplasma. I believed that if I could manage that, I would be well on the way to determining the transport laws.

After some months I realized that this was not going to be the route, the problem being that in order to define the entropy or rather its rate of production I had first to know how to specify a turbulent state, but to do that I had to understand the nature of turbulence—I seemed to be going around in circles. I decided that perhaps I did not know enough about the thermodynamics of transport, irreversible thermodynamics as it is called. There are two efficacious ways of learning a subject—writing and delivering a series of lectures, or writing a book for publication. The first has the advantage that if there are bright students in the audience there will be some feedback, which improves both one's understanding and presentation. I tried both methods. The book was published by Oxford University Press in 1975 under the title *The Thermodynamics of Fluid Systems*. At the end of the preface I thanked two of my research students (Stanley Morris and

Helen Troughton) for checking the manuscript and proofs. I married Helen three years later, but that adventure belongs elsewhere in this story.

What I stressed in the book was the importance of time-scales in defining the state of a thermodynamical system and, since entropy is a function of state, time-scales are central to the whole subject. Another way of expressing this point is to say that the information one has about a system defines its state and this information depends on how refined the time-scale of observations is—e.g. a high-speed camera reveals much more detail than a standard camera. Professor Buchdahl wrote a good review for the *Journal of Fluid Mechanics*, which was very encouraging.

In 1996 Stanley Morris wrote that Ilya Prigogine (a Nobel Laureate in entropy production and transport) would be visiting his research centre to deliver a lecture. ‘Can you think of any googlies that I could bowl him?’ he asked. I replied:

I realized some years ago the futility of using definitions to make discoveries in physics. It seems to me that Prigogine’s use of entropy has this flaw. Always remember that entropy is no more than a useful potential function, you can define it to suit your description of your system, but it will not add any physics. The whole of kinetic theory can be developed completely without entropy being mentioned and until you can define a state space on which to base your definition of entropy, no progress will be made. You need to stay with the physical description to understand the mechanism and once you can define state space, entropy may be useful, but not essential for further progress.

I suggested that Prigogine be asked to define the entropy of a non-equilibrium state before he strayed away from equilibrium as was his wont. Unlike momentum or heat, entropy cannot be treated as a physical property. Absolutely anything that Prigogine or anyone else can say about a physical system invoking entropy and which is true, can also be said without this concept by deploying physics directly.

When I was young, I read an article that claimed that the purpose of scientific theory was to describe phenomena rather than to explain them; this both surprised and disappointed me. Apparently we could achieve no more than an empirical account of the real world and could not expect to understand it. This conservative philosophy is known as *instrumentalism* because it maintains that a theory is no more than an instrument for making predictions. The opposing view is that theories relate to underlying *mechanisms*, which are responsible for the observed phenomena—to know the mechanism is to understand the phenomenon. This is thus a more ambitious philosophy in which physical theories are understood to be at-

tempts at explaining what the world is really like and it is hoped but not guaranteed that these attempts will steadily approach ever closer to the 'truth'.

However this realist philosophy usually depends on some metaphysical elements introduced to enlarge the fabric of the hidden world and thus to aid explanation. Classical examples are the imaginary fluids termed 'caloric' and 'phlogiston', invented in the 18th century to explain the flow of heat and the increase of weight with burning. It was the liberal introduction of such unobservable elements that added force to the instrumentalist position, an extreme form of which is known as *positivism*, which holds that all statements other than those describing or predicting observations are meaningless. Knowledge is only what can be verified directly. *Logical positivism* augments positivism by admitting mathematical entities logically connected to observations, even if they are not directly measurable.

Positivism in science was greatly boosted in the first half of this century by the difficulty in giving the formalism of quantum mechanics an objective and realist interpretation. Hidden variables of one sort or another, even including parallel universes, have been advanced as possible solutions, but a consensus has not been reached; thus the debate continues and I myself believe that it will ultimately be resolved in favour of a realistic explanation rather than an instrumentalist description. In any case this unresolved difficulty with realism at the smallest scales does not justify our rejecting it at the deterministic mesoscopic and macroscopic scales.

Macroscopic studies which are particularly vulnerable to the influence of positivism are continuum mechanics, thermodynamics and plasma physics, and this timid philosophy encourages axiomatic treatments of these subjects. This is a formal approach borrowed from pure mathematics, in which the physical concepts are reduced to a minimum. Unfortunately applied mathematics is sometimes taught as if it were pure mathematics, which allows the subject in question, say thermodynamics or continuum mechanics, to be rapidly developed without reference to the experimental evidence and in a style that can be assimilated by mathematically trained students for whom intuitive arguments involving analogy and other heuristic elements carry no conviction.

But what is really wrong with logical positivism? The catch is that it is impossible to eliminate all imaginative speculations from science as some metaphysics is unavoidable. Also what is metaphysical today might become 'real' tomorrow. A classic example is William Harvey's (1578–1657) explanation of the circulation of the blood and the function of the heart as a pump. Although he had no microscope to see the capillary vessels connecting the arterial and venous systems, from evidence implying a circulation he maintained that they must exist. Molecules were considered as largely metaphysical until Einstein interpreted the microscopic dance of very small bodies in a suspension as being due to their uneven bombard-

ment by microscopic particles. These had to be molecules, then unseen but their existence was confidently inferred. Maxwell's great discovery of the connection between light and electromagnetism was based on an entirely metaphysical speculation about the nature of the ether, an imaginary medium, which was later rejected as meaningless by Einstein, but Maxwell's work easily survived the removal of its metaphysical origin. A metaphysical conjecture that became real was the idea that electricity consisted of two fluids, oppositely charged and we now talk about 'electron fluids' and 'ion fluids'. Pauli's (1930) invention of the neutrino to ensure the conservation of energy and momentum during beta decay is another good example of a bold metaphysical creation—it was not until powerful nuclear reactors were available that the existence of neutrinos could be confirmed.

In the preface of my book I made clear my realist philosophy:

And perhaps it is right to admit too that a growing aversion to axiomatic thermodynamics, with its *penchant* for substituting deductive mathematical constructions in the place of physics, has stimulated me to write this book and in it to emphasise the approximations inherent in thermodynamics, or at least those approximations inherent in time-scales. It is, of course, the existence of such approximations that makes thermodynamics such a rich and diverse branch of physics.

A chance to explain my ideas about thermodynamics came in 1972 when I was at Cornell University as the AVCO Distinguished Visiting Professor. In a lecture entitled '*The time variable in thermodynamics*' I set out to show how important time-scales are in determining an entropy function. If one views the system of interest on a long time-scale then many transient details can be ignored, while, at the other extreme, very short time-scales allow much greater detail to be included in what we call the state of the system. The more we know about a system, the more detailed is the state we assign it and, because of the way that entropy is defined, the smaller is the value of this property. Unlike mass or temperature, entropy depends on the observer's choice of time-scale, therefore it is not an objective function in the ordinary sense. It was James Clerk Maxwell, the greatest 19th century physicist, who first appreciated that entropy had this unusual dependence on the observer's information about the system under consideration.

## Travel Time

In 1973 I received an invitation from the New Zealand Vice-Chancellor's Committee to make a tour of the NZ universities, which was a marvellous opportunity for Betty and me to return to our homeland and see far more of it than when we had lived there. I gave lectures at five universities,

usually about fusion research about which I was cautiously supportive at that time. The best party was the University of Canterbury's Centennial where I represented the University of Oxford; there was a ceremony in which dozens of universities were represented by visiting academics draped in full academic dress and when at last my turn came to walk on to the podium, I presented the Chancellor with a congratulatory address written in Latin by Oxford's Public Orator. I am glad that I was not required to recite it! There was a range of seminars over the two or three days of the celebrations and I gave a talk entitled '*Beware of axiomatics in applied mathematics*', which was later published in an British journal. While we were in Wellington, a small earthquake made the hanging light globe on the ceiling of our hotel room swing about, reminding us that we were back in a country where this was a frequent event.



NZ Rhodes Scholars in the UK and the Warden of Rhodes House.

(At New Zealand House, 1976.)

(From left) *Sitting*: Professor N Davis, Dr M Barak, Lord Porritt, Sir Edgar Williams (Warden), Sir Robert Aitken, Mr W Kalaughter;  
*Standing*: Messrs D B G McLean, C R Laidlaw, D M Stewart, V R Ham, G L Cawkwell, Professor M Cooper, Dr K A K North, Mr D M Davin, Sir Geoffrey Cox, Professor L C Woods, Professor D L Shultz, R W Burchfield, Mr E P Haslam, Mr C B Cato, Dr J A Matheson, Mr R B Stewart.

The British Council arranged for me to visit Romania in the summer of 1975, so I spent a few days in Bucharest and a week in Iasi, a town quite close to the USSR border. In Bucharest I was surprised by the crude boasting of the then President's genius in the bookshop windows



with Ceausescu's ribbon-draped photograph placed at the top of a pile of books reputedly authored by him. I studied this phenomenon with some amusement until the press of soldiers in the streets made me wonder if I should show some caution. I decided later that some vodka would help me sleep through the hot night in my small hotel bedroom overlooking a busy street near the centre of the city. I found a store selling a wide range of items and joined a queue that slowly took me to the counter.

'Vodka, please,' I said pointing to a bottle that seemed to contain the desired liquid. I was asked for money or so I guessed, but when I produced some notes, the money was rejected. The shop assistant beckoned me towards another counter and in sign language indicated that I should first pay for the vodka there. So I joined another long queue and when I reached its end, I produced money and again said 'Vodka, please'. The teller was very kind and she spoke some English.

'How much does it cost?' she said, but I did not know. She directed me back to the other queue with a note since I apparently had to first find out the price. The first queue was even longer by now, but after another ten minutes I managed to get the price of the bottle of vodka written on the notepaper before returning to the second queue, where luckily the teller waved me to the head of her line. I paid her the money and received a ticket to present at the first counter so once again had to join the first queue. I think this experience of communist shopping used up more than half an hour and as soon as I got back to my room, I decided not to wait for nightfall—I had a neat lukewarm vodka with a sense of achievement.

In Bucharest academician C Jacob was my host. I gave a lecture on thermodynamics to his staff and research students. Their English was fair, but questions were not asked about the lecture, rather they wished to know about the University of Oxford, so I briefly explained our tutorial system.

'What about employment after graduating?' someone asked me. I replied that most Oxford graduates managed to find jobs, although a few failed to at first. I said that graduates from the provincial universities often had more of a struggle to find employment, which seemed to surprise them. Jacob explained to me and the class that they had no such problems in Romania where *every* graduate was guaranteed a job. He said that the top graduate in the year would be assigned to the most important vacant post, the next graduate on the list would be allocated to the second most attractive position and so on down to the very last man, who despite his position could look forward to being a useful member of society.

'Everyone is looked after in our society,' the academician smiled and I feigned approval.

Lunch was an interesting affair, since Jacob had apparently not arranged anything in advance. About six members of his staff accompanied us to what might have been the best restaurant in the city, but it was crowded and no places could be seen for our party of eight. However, Ja-

cob was not merely an academician—a waiter was summoned, instructions were whispered and a minute later I saw a group walk out, leaving a whole table vacant. This was quickly cleared and we were invited to take our or rather their places.

I wanted to ask about their attitude to their dictator, although not mentioning this word of course, so I approached the subject obliquely, but they understood what I was fishing for and clammed up. Later when we were walking to see some churches of which these atheists were so proud, Jacob and I pulled ahead of the others.

‘We cannot trust others in this country, Professor Woods, so your question at lunch could not be answered. But for myself, I detest the leadership and this may also be true of some of my staff.’ This surprised me, for I had believed him to be a Party member, but I thanked him for his openness and we talked no more politics.

The long train journey to Iasi was hot and boring, and made no more pleasant by the presence of a slovenly army major and his even more slovenly wife in the same first-class cabin. They had prepared for the ordeal with ample vodka, so they lay about, snoring loudly during much of the time, though at one stage she removed her shoes and started picking her black, sweaty feet, not missing a single gap between her seemingly numerous toes. I began to miss the English class system.

There were more lectures in Iasi where I was looked after very well by a scientist who had been at Balliol as a British Council Visitor the year before. John took me to see some churches very close to the Russian border, which were painted on their exteriors. Afterwards we drove to a restaurant on the edge of an attractive lake and when we sat down, he asked me if I liked carp. I replied that ‘carp’ wasn’t a normal part of my diet.

‘Ah,’ he said ‘then you will like this fish. It has been freshly caught in the lake.’ It was indeed fine carp, the Romanian name for it really being the one he had said.

At the end of my visit I visited the Vice-Chancellor to pay my respects. His Professor of English was on hand to translate, so I told him how much I had enjoyed visiting Romania and in particular how interesting my visit to the painted churches ‘near the Russian border’ had been. He did not wait for the translation.

‘That is *not* the Russian border!’ he exclaimed. ‘There are *Romanians* on both sides. It is the present USSR border, *not* a Russian border’. He went on more calmly to explain that Romania’s geographical position had led to its being invaded many times from all sides, and that I should not judge the country by its present circumstances. The Professor of English was evidently not a spy.

Of all the cities in the world, I have found none to quite equal Vancouver with its towering mountains as a backdrop to a beautiful seaside, making it possible to ski in the morning and swim or fish in the afternoon. In

1976 I took two terms' leave to go to the Mathematics Department of the University of British Columbia. Helen Troughton, one of my post-doctoral research assistants and a Canadian citizen, was able to visit the Department at the same time, an arrangement which *inter alia* allowed us to continue with the fusion research for which she was being supported by Culham Laboratory. The University occupies a marvellous site on a headland above a sequence of stony beaches on which are strewn hundreds of logs half-buried in the sand. The nudists' beach there also adds many points of interest.

## Reputedly Controversial

I started my innocent stirring with an article in 1969, which was published in the *Bulletin of the Institute of Mathematics and its Applications* and entitled 'What is wrong with applied mathematics?'. My main theme was that too much attention is given in universities to teaching and research on classical topics such as fluid mechanics and not enough to statistical and industrial applications. A similar point had been made in a Royal Society report on 'Postgraduate Training in the United Kingdom' chaired by James Lighthill, which I quoted in my article:

It remains, however, to mention the main danger that we see in the British system. . . Instead of mathematics that is genuinely throwing light on, or suggesting, experiments or observations in the natural sciences, or in connection with technological processes or engineering projects, there is an arid pursuit of formal mathematical solutions to problems which are ostensibly related to the field of application, but which are really without practical significance.

With sub-headings like 'Lack of Relevance', 'Excessive Preoccupation with Continuum Mechanics', 'Failure to meet a Professional Demand' and 'Separation of Theory and Experiment', I hoped that I would stir up some members of the mathematical establishment, but I did not expect the editor of the *Bulletin* to receive and publish a sarcastic *ad hominem* rebuttal from a leading member of the fluid mechanics community. Keith Stewartson appeared to have missed the main point of my article for his defence of the *status quo* referred only to continuum mechanics, claiming that applied mathematicians working in this subject are 'aware of the importance of experimenters and theoreticians working hand in hand'. But being aware and doing something about it are quite different things. The year before at the Mathematical Institute in Oxford, my colleagues Leslie Fox, Alan Tayler and John Ockendon had started to broaden applied mathematics into a more practical subject by setting up the very successful 'Study Groups with Industry'. Twenty years later this evolved into the very successful

Oxford Centre for Industrial and Applied Mathematics (OCIAM), which has since been copied all over the world.

The foundations of thermodynamics have always attracted debate, sometimes acrimonious, and when one adds a sprinkling of philosophy, the mixture can often ignite. The concept of entropy and how to define it has a long history of generating serious arguments between scientists, particularly those with a penchant for axiomatics. One afternoon in the early Seventies, I was giving a seminar at the Mathematical Institute in Oxford on some application of thermodynamics when I was asked a question by Professor Albert Green that had me momentarily flummoxed. I had written on the board the most basic equation in the subject, one known to all engineers and physicists, the century-old definition of entropy, which for a simple system reads  $T dS = dU + p dV$ , where  $T$ ,  $S$ ,  $U$ ,  $p$  and  $V$  are the temperature, entropy, thermal energy, pressure and volume of the system and the 'd's mean 'an infinitesimal amount of'. The state of the system is described by the pair  $(U, V)$  and the equation amounts to specifying entropy as a function of this state. The addition of more detail to the state adds more terms to the right of the equation and hence alters the entropy accordingly. The question was simply 'Where did *that* equation come from?'

Professor Green was Professor Temple's successor to the prestigious Sedleian Professorship of Natural Philosophy, so I knew that the question was unlikely to be a matter of ignorance. So I deduced that he must subscribe to the visionary views of Clifford Truesdell's School of Rational Mechanics, which had only contempt for the traditional view of 'state'. As I had written previously in my article '*Beware of axiomatics in applied mathematics*', in reference to the so-called rational approach:

Entropy and temperature are not defined or explained physically, but are introduced as 'primitive concepts' in the non-equilibrium situations under consideration. . . . state space is not employed at all and time-scales are never mentioned, so there is no measure of what non-equilibrium really means. The well-known and little appreciated point that entropy is in the 'eye of the beholder' (i.e. depends on the observer's time-scale) is brushed aside and entropy itself is imagined to have the same physical status as energy or mass. Some acquaintance with Gibbs' Paradox (relating the *information* one has about a system to its entropy) or with the entropy increase obtained in statistical mechanics by coarse-graining of phase space (equivalent to reducing the 'information' one has about the system) would have given pause to any but the most determined axiomatiser. Truesdell shows his determination on p 374 of '*Irreversible aspects of continuum mechanics*' in *Proceedings of the IUTAM Symposium (Vienna, 1966)*:

First the classical authors insist on *defining* temperature and heat in terms of something else, preferably something mechanical or the result of some primitive or mechanical experiment. As I have said for many years, disregarding the scoffs of those endowed with physical intuition, temperature and entropy join mass and place and time as primitive undefined variables, described only by such properties as are laid down for them in mathematical terms. Whenever anyone tries to do anything rational with temperature and entropy, some physicist rises to ask whether a temperature always exists, and how to define entropy.

Truesdell's expectation was immediately satisfied at the symposium—a physicist did rise and ask him about the meaning of temperature in a very high frequency field. His surprisingly frank admission was as follows:

I think the physical explanation of temperature is a thing that does not belong in a course in mathematical thermodynamics, any more than a physical explanation of mass belongs in a course in mathematical mechanics. As for 'physical meaning', I claim no physical applicability for anything I ever say. That is, the application of the theory is left to the appliers.

The axiomatic approach to science has not in fact been applied to explain any new phenomenon emerging from real experiments (as distinct from *gedanken* experiments), principally because the method becomes an end in itself, leading to a decay in physical intuition and imaginative thinking.

But returning to Professor Green's question, I have never subordinated my honest opinions to tact, although I believe that I have always tried to be politely impersonal on controversial issues. My answer was that the  $T dS$  equation was *the* standard definition of entropy, accepted by all engineers and scientists who had studied thermodynamics. It did not appear to please Green and was the beginning of an 'entropic' contest lasting several years, which gave more amusement to the research students attending the seminars than pleasure to their professors.

In 1981 I published '*The bogus axioms of continuum mechanics*' in the *Bulletin of the Institute of Mathematics and its Applications*. I shall quote some extracts:

The underlying philosophy is the logical positivism of Duhem, Poincaré and Carnap, although in most treatments of 'rational' continuum mechanics, the logic has swamped the positivism, leaving a negligible empirical component. Truesdell states clearly the

anchoring role of the axiom—‘Once the axioms of the theory have been stated, we shall not alter or ‘approximate’ them’—and one is tempted to add ‘come what may’. It is the purpose of this article to argue that if most of the axioms of rational continuum mechanics are not soon weeded out, they will choke what little there is of value in it. In the meanwhile the more serious danger is that lecturers, unaware of the dry rot in the foundations of the subject, will be seduced by its sophistries and its evasions of sometimes difficult physical concepts, in using it in courses to mathematics students. . .

The only other way (besides experiment) of testing a phenomenological theory is to discover if it can be reduced to a more fundamental or to a more inclusive theory, which should give the kinetic theory of macroscopic behaviour great importance for the verification of continuum mechanics. Alas, this is not acceptable, for the positivist philosophy firmly shelters rational continuum mechanics from any confrontations with conclusions drawn from kinetic theory, apparently because its special molecular models are tainted with inadmissible metaphysical elements, a Duhemist view-point that still exists.

Professor Green replied in a later issue of the *Bulletin* with a defence of the axiomatic approach; I replied to Green, pointing out his mistakes; Green defended again, although accepting that he had made one slip; I grew weary and the interchange stopped. It was a good-natured debate, without visible personal rancour and although in my view I won the scientific argument, in the long run I was the loser.

In 1978 while in Sydney on a visit, I was invited to give a talk to the Physics Department at the University of Sydney. I had long been interested in the history of thermodynamics in the 19th century, so I decided to talk about the greatest scientist of that period, James Clerk Maxwell. I entitled the talk ‘*Maxwell’s models*’ since this gave me a chance to mix my three main interests, thermodynamics, electromagnetism and philosophy. His realist approach greatly appealed to me, so I began with:

Maxwell was unequalled in his skill at finding and using analogies between physical phenomena not merely in illustrative roles, but also as genuine research tools. His analogies were sometimes substantive, as with the ‘billiard ball’ model for kinetic theory (treating a gas as a very dilute collection of microscopic spheres) and sometimes fragile and unreal, as in his mechanical development of electromagnetic theory (in which he used an impossible mixture of fluids, elastic solids and wheels); but to Maxwell they always allowed ‘the mind at each step to lay hold of a clear physical conception, without being committed to any theory founded

on the physical science from which that conception is borrowed, so that it is neither drawn aside from the subject in pursue of analytical subtleties, nor carried beyond the truth by a favourite hypothesis'.

Maxwell was a significant philosopher of science, who understood the unavoidable role of metaphysics. In his presidential address to the 1870 British Association meeting he said:

'I have been carried. . . into that sanctuary of minuteness and of power, where molecules obey the laws of their existence, clash together in fierce collision, or grapple in yet more fierce embrace, building up in secret the forms of visible things. But who will lead me into that still more hidden and dimmer region where Thought weds Fact—where the mental operation of the mathematician and the physical action of the molecules are seen in their true relation? Does not the way to it pass through the very den of the metaphysician, strewn with the remains of former explorers and abhorred by every man of science?'

## Actually Controversial

I never thought of myself as being in any way controversial in science until, towards the end of the 1970s, I found that I could not agree with the accepted ideas in plasma physics on several important questions of theory. Unlike the disputes described above where those holding like views to me were in the majority, I was about to become completely isolated from the plasma physics fraternity. Until about 1979 I had taken it for granted that the foundations of the subject were sound. When I then discovered the serious flaw to be described shortly, I tried to convince theoreticians at Culham Laboratory that the subject needed revision, but without any success. The error amounts to nothing more complicated than ignoring Newton's Second Law of mechanics, namely that the force acting on a body is equal to the rate of change of its momentum.

I had learnt my fluid mechanics as an engineer, not as a theoretical physicist, so for me the pressure in a fluid was a *force* exerted by the collisions between molecules. The force on a body is the sum of the changes per second in the momentum of all of its molecules and without collisions, the momentum of each molecule is unchanged and there is no force acting on it. Between collisions the molecules move over short distances, the average value of which is termed a mean free path, denoted by  $\lambda$ . Absence of collisions, i.e. infinitely large values of  $\lambda$ , would mean that no forces

could be transmitted through the gas, in which case it could not be said to have a pressure. Of course if such a rarefied gas were in a container, the bombardment of the walls by the molecules would certainly exert a pressure on the walls, but this still involves molecular collisions albeit with the wall molecules and not gas molecules.

The plasma in a tokamak is a mixture of gaseous ions and electrons, each gas being quite rarefied, so that except near the confining walls, the mean free paths in these gases are many times larger than the size  $R$  of the machine and therefore collisions in the usual sense are infrequent. We are on the borderline between having a fluid, that is a gas so dominated by collisions that it acts as a continuous body, and a ballistic medium, in which the particles move like independent bullets. The ratio  $\lambda/R$  called the Knudsen number is the key; if this is small, we have a fluid, if it is large, we have a ballistic medium and if it is in between, we have a problem for this is a difficult regime to deal with.

The kinetic theory of gases is a study that begins with the microscopic motions of individual molecules and by summing the contributions of vast numbers of them, aims to obtain a fluid, or at least a macroscopic picture of their collective behaviour. In philosophical terms, we say that fluid theory is reduced to kinetic theory. Although widely believed, this is not true, for when we start from kinetic theory, the summing process leads to the same equations, regardless of whether collisions are frequent or non-existent. The summed equations are fluid equations *only* if we can add the information that the Knudsen number is small compared with unity. If this cannot be done, there is no certainty that the medium has either a pressure or a temperature. While fluid equations involve pressure gradients, ballistic equations do not, thus the fallacy in standard plasma theory is simply the tacit assumption that ballistic media *do* support pressure gradients. What apparently confuses the plasma theoreticians is the fact that the summed equations include a momentum flux term, which is zero if there are no collisions and equal to the exerted pressure if collisions are frequent. They choose the second case whether there are collisions or not, but it should be evident that it is not possible to derive equations relating fluid *forces* from an expression that states no more than that the total *number* of particles is conserved.

In strong magnetic fields the charged particles—electrons and ions—gyrate about the lines of magnetic force, the points about which they gyrate being known as guiding centres. We may simplify the description by taking averages over the molecular velocity around each complete orbit, which reduction leaves us with equations for the velocities of the guiding centres. The next step is to sum over these velocities and arrive at an expression for the average guiding centre velocity. In the case where the magnetic field is uniform, these two averaging processes are physically equivalent to summing the kinetic equations and therefore the velocity ob-



tained,  $\mathbf{u}$  say, should be exactly the same as the fluid velocity,  $\mathbf{v}$ . But unless care is taken to include the effects of collisions in the guiding centre approach, no pressure gradient appears in the equation for  $\mathbf{u}$ . To match this lack, the fluid equations must be replaced by ballistic equations, i.e. the pressure gradient must be set equal to zero, but this is not done. With the accepted theory, it follows that when there is a pressure gradient, the guiding centres and the fluid substance move separately; for example the guiding centres could even move in a direction *opposite* to the fluid. Yet by definition all the particles are attached to these guiding centres and *must* move with them. Since the fluid velocity is nothing but the average mass motion of the particles, the contradiction is immediately obvious or so I thought.

In his *Introduction to Plasma Physics* (Plenum Press, 1977), F F Chen observes:

There is no fluid drift even though the individual guiding centers have drifts; the particle drifts in any fixed fluid element cancel out. . . . The particle drift was calculated in Chapter 2 [pressure gradients and collisions omitted] and the fluid drift can be calculated from the off-diagonal elements [of the pressure tensor]. It is extremely difficult to reconcile the fluid and particle pictures when the finite-Larmor radius effects are taken into account.

It is indeed difficult if one is careless enough to include the effect of collisions in one description but then ignore them in the other. Most texts on plasma theory manage to make this elementary error.

Culham Laboratory had been paying me a modest consultancy fee of £500 a year for working one day a week in the Laboratory. This was stopped while I was on leave during part of 1977 and not resumed when I returned, even though I continued to visit the Laboratory. In 1980, when struggling with a financial loss, I decided to ask the Director of Culham Laboratory, Dr R S Pease for it to be restored. Seeking to impress him I advanced an idea I had for explaining the so-called anomalous<sup>1</sup> heat and particle transport in tokamaks. In the course of this I happened to remark on the equivalence of guiding centre and fluid velocities, a point that was incidental and not at all essential to my main thesis.

‘That is quite wrong!’ he asserted. This surprised me—not that I might be wrong, but that he knew anything about the matter. I tried to get him back to the substantive point, namely my new ideas concerning transport in tokamaks. But he continued:

‘I, myself, have studied guiding centre theory,’ he said. ‘And it is well-known that fluid velocities and guiding centre velocities are *not* the same.’

<sup>1</sup> In plasma theory this convenient evasion qualifies any process that is not in agreement with established theory. For me tokamak transport is *not* ‘anomalous’.

After some further unsatisfactory interchanges, I asked him about restoring my paid consultancy; he was willing to renew my pass to enter the Laboratory, but I could only come as an honorary (i.e. unpaid) consultant. His passing shot was 'How could we justify giving tax-payers' money to you!'. The JET tokamak cost European tax-payers more than £300 000 000.

That marked the end of my formal connection with the Laboratory. I resolved that I would have to solve the transport problem completely before approaching any director again, but I was determined to try since I had nothing to lose.

In 1963 Sir Harold Hartley gave Professor George Temple the nod to my being sponsored for a Royal Society fellowship. Six years later George had managed to complete the paperwork, which meant that he had the required six sponsors all signed up. At this stage George revealed his mission to me, so I enthusiastically gave him copies of my 70-odd papers plus the two books I had published by that stage. Not long after George retired into a monastic order and Albert Green replaced him as the Sedleian Professor. George did not communicate again with me, although my stack of papers should have been updated each year. Six years later Albert, who was then on the vital selection committee stopped me in the Mathematical Institute and said how pleased he was to see my name on the list of candidates, but advised me not to dwell on it, since he knew of cases taking 20 years or so to pass the finishing line! I understood his veiled message. After seven years, names are dropped and I thought no more about it.

## Family Changes

As far as my teaching and research adventures are concerned, the story has now reached 1980. But what happened to my family of five young girls—Coral, Jill, Diane, Pat and Liz—in the Oxford of the 1960s? I haven't mentioned them very often in my tale—does this failure mimic reality? Perhaps I was so preoccupied with my own advancement that the family came second. I am sorry to admit that there is some truth in this. With five daughters and no sons, in those days it was the mother who was expected to guide them through the dangerous teenage years. I provided the material goods, while Betty supplied the social and moral instruction. However, such a division would not serve today and hindsight tells me that it should not have done in the 1960s. But five teenagers, spread in age over a range of only six years, were very demanding, especially on their mother. I occasionally took my daughters to the theatre, sailing on the Thames and sometimes attempted to assist them with their studies. We went on the usual holidays, camping in France and Italy, visits to the seaside and so on. I was ambitious for their educational advancement and felt that they should not expect to rely on husbands for their later financial support.

My serious mistake was not understanding the pervading influence of the English class system. With my socialist leanings and New Zealand upbringing, I anticipated an egalitarian society into which my daughters would easily fit. I therefore initially sent them to state grammar schools, rather than to exclusive fee-paying establishments, which for five would have been something of a financial strain. My argument was that they would be better educated in the state schools, but I then did not understand the social dimension and the moulding influence of peer pressure on teenagers. Had we been in Scotland, my choices might have succeeded, but Oxford was a seriously stratified society and still remains so. Drugs were readily available and until 1967 we lived just five minutes walk from the centre of the city. In addition, the girls had been uprooted from a relaxed Sydney life, where the social environment had been largely determined by the suburb in which one lived. Like their parents, they belonged to no particular class, which had advantages as well as disadvantages in a snobbish southern English town.

Coral and Jill survived the experience, but left school without any A-levels, their lives developing in similar ways. Despite my initial foreboding, Coral's marriage to Steve de Wet appeared to be a happy union for twelve years, before he confirmed my fears by finding another partner and leaving Coral with my three grandsons, James, Simon and Nicolas. She married twice again, her final husband, Nick Scholfield, like Steve having been an engineering undergraduate in my first year of tutoring in Balliol. He is a fine man, whom I am pleased to claim as a son-in-law. Coral died on 24th April, 1993 before she could read more than a few pages of this autobiography; it was her illness which had prompted me to start so that I could tell her about the days when she was a bright little girl and I an optimistic young man. A little while before she died of cancer, she asked me to keep going with the chronicle.

In 1969 Jill married David Lloyd, an Oxford graduate in Japanese, and they had two daughters, Emma and Silkie. The marriage failed and, showing great determination, Jill became a mature student, taking a degree in biology. She then spent some time working in Africa, but sadly I have not seen her for many years. With the youngest children, I tried to correct my earlier mistake by sending them to expensive boarding schools, but they could not settle there as they did not fit in. (What a disastrous, divisive education system this country is cursed with!)

As described in the previous chapter, Diane ran away from the family just before we departed for Texas in 1968, having expected to take the youngest three with us. We made desperate efforts to find her, but our concern for the twins forced us to leave without her. She did not want to be separated from her man and, by the time we returned in 1970, she had married Eddy Burroughs, who had had a hard start to his life, having been raised in an orphanage. He had passed through a drug phase and



At sea off the south coast of England.

now worked as a bricklayer with ambitions towards fine art. Sadly Diane's adopted working class environment did not serve her well. She became stressed and fell a victim to over-prescriptions valium, which in turn led to anti-social behaviour and to a period confined in a hospital unit. She has now recovered and lives in Oxford again, so we now have lunch together most Sundays. Her first son, William, became a train driver and is settled, while her second, Henry, has just completed a degree in mathematics at Leeds University.

Patricia found the temptations of Oxford too much and with Betty's and my encouragement decided to emigrate. That was 25 years ago. She married a hard-working Panamanian, Gaby Alvarez, now lives in Brisbane and has two children, Tania and Daniel, who have both returned to serious study after a few wild years and are doing well. Pat herself is studying for a degree in Applied Science and, being qualified as a welfare worker, is also working as a locum in an Adult Mental Health Centre. I am proud of her determination and progress.

Elizabeth had a son, Stephen, by her first partner in Oxford and at the age of 31 emigrated to New Zealand where she met her second partner, a Dutchman named Maurice Laporte, who now works as a toolpusher on an oil rig for the Chinese Government. They left Auckland and spent three years in Holland to see if it was a better place to live, but apparently it wasn't. I was sorry about this, since visits to Holland to see her and her young family would have been easy from Oxford. They returned to

Auckland with their two children, Mauricy and Eli, and I have to admit that growing up in Auckland will provide a very good start in life for them. Liz has trained and worked as an estate agent.

All this adds up to twelve grandchildren. My eldest grandson, James de Wet, now has a young family of three—Joshua (8), Emily (7) and Reece (4), thus in a decade or so, I might just be a great, great grandfather! Time has gone by so fast.

Now I reach the very difficult and painful point of describing the breakdown of my own marriage, which happened in 1973 during a visit by my father and mother from NZ to see us in Oxford. For them it was a great adventure, allowing Mother to see the country she had left as a young girl of 12 and my father to at last see England, the land which New Zealanders of his generation affectionately used to call the Mother Country. Maturity had softened my attitude to my father and I was pleased to have the chance to show them around Oxford and Great Britain; I recall a trip to Woodford, near Epping Forest where my mother remembered some of the old shops even after an absence of 63 years. They took various bus tours on their own and it was a happy time for them, except for one ill-fated trip to Wales. This would have been fine, except that my mother-in-law insisted on coming with us and had also managed to persuade her daughter on this. I opposed it firmly since three in the back seat of my car would scarcely fit and besides the old lady was cheerful company only after either of us had drunk two or three whiskies. I wanted my parents to have a relaxed and happy time, but gave in very reluctantly. However, the ensuing row between Betty and myself fatally disrupted our marriage and arguments over responsibility for our wayward children, which had started during our year in Austin, Texas, added more fuel. After some false starts on both sides we parted permanently at the end of 1974; our house in Boars Hill was sold in 1975 and we were divorced in 1977, the marriage having lasted over 30 years. Betty stayed in Oxford for a few years before returning to Auckland where she remarried. I loved her deeply for very many years; she was a beautiful, cheerful, and efficient wife and I wish I could have been a better husband. I still write to her now and again, mainly about Diane's progress.

In 1977 I was free to marry Dr Helen Troughton, a slim, attractive Canadian, who had been one of my research students and was now working on fusion research at Culham Laboratory on an AEA grant. She had a broad range of interests including music, literature and cooking. We were married in a registry office with a wild pair of witnesses, Professor Richard Cobb CBE, the eminent historian of revolutionary France and his drinking accomplice, Ronald Robinson DFC, Professor of Commonwealth History—it would be hard to imagine a better pair for a riotous party. We had a short honeymoon in Tenby and then moved into a house in north Oxford.



My 'Trotski' period ~1964.



Degree day for Helen.

In 1978 we travelled to Sydney where encouraged by Dr Barry Thornton, Head of Mathematics and Computing of the NSW Institute of Technology, I took up a post in his department. Barry had been a research student of mine some 20 years before when I had been at the University of NSW. Following a worldwide phenomenon, the Institute has now transmogrified into a University.

Helen and I had a memorable holiday on the semi-tropical paradise of Lord Howe Island where the fish queue up to be caught. We then went on to Auckland where my mother quickly adjusted to the new situation by tactfully removing a whole set of photographs featuring Betty from the walls, although she insisted that she now had *two* daughters-in-law. Helen and I travelled the length of the North Island, saw Lake Taupo, Rotorua, and the beautiful coast between Tauranga and Mercury Bay. Dear Aunt Flossie was there to add colour to our visit to Hahei—life seemed almost perfect.

Upon our return to England, Helen had no difficulty in obtaining a succession of commercial and banking posts in the City of London, although this meant that each day she had to either drive from Oxford to London, or else take the train. It was a stressful routine after which she always insisted on preparing our evening meal. We moved to a house in Five Mile Drive, which had a pleasant garden and we were content, even happy.

Helen bought a piano and gave me great pleasure with her playing; at one time she had considered a career as a pianist and had been selected to study at the Julliard School in New York. I purchased a clarinet and took lessons again. We loved attending the Balliol College Concerts, which occurred on Sunday evenings four times a term. Helen was not always easygoing in conversation, particularly if she believed that she was being patronized as a woman; she often said that she would have preferred to have been a man. I preferred her as she was, but I had to show some care—her opinions were firm, but liberal. She showed an interest in my research and was always ready with advice and encouragement, which I was certainly going to need in the following decade.

# Chapter 12

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## The Tokamak Fiasco

### Energy Transport

If any research I have done is remembered in the next century, it will be my work on the transport of heat across strong magnetic fields. This has enabled me to understand the curious behaviour of tokamaks, but, much more importantly, it has allowed me to tackle some of the outstanding problems in solar physics as I shall describe in my final chapter. So far as tokamaks are concerned, I fear that this knowledge will be of no consequence for the future; to quote the subheading of an article in the journal *Science* (volume 274, 6 December, 1996):

The \$10 billion International Thermonuclear Experimental Reactor project is meant to show that fusion is a practical energy source. But a new set of calculations says that ITER (International Thermonuclear Experimental Reactor) will fizzle.

My own calculations led to this conclusion a decade earlier, but were ignored by the fusion community, who in my judgement already possibly suspected then that the early optimism was unjustified. Government sponsored research is easily corrupted by personal ambition, especially if the leadership puts preservation of their laboratory and careers above scientific and engineering truths. Perhaps the vast sums of money that have been lavished on fusion research will have some useful ‘spin-off’ for *pure* science, but the cost has been far too high.

I have always been an idealist as far as science is concerned—one explains a new idea to the right audience and the concept will either be shown to be mistaken or will be accepted as reasonable and worth testing experimentally. The possibility that the research would be completely ignored by a community of scientists reputedly urgently seeking an understanding of the phenomenon in question never occurred to me.



It would take many pages to give a detailed explanation of how energy is transported across a magnetic field, so here I shall only give a simple physical description of what happens with the minimum of mathematics. For a physicist or applied mathematician, the reasoning is elementary and although the following is inevitably incomplete, I hope it conveys the general idea. A rigorous treatment, originally written optimistically for the benefit of fusion physicists and explained with increasing clarity, can be found in three recent books of mine<sup>1</sup>.

The essential principle is as follows. Suppose that the temperature  $T$  increases in the direction  $OY$ , at the rate  $dT/dy = T'$  as indicated in figure 1. In a plasma with no magnetic field, heat normally flows from hot to cold, i.e. down the temperature gradient, and the magnitude  $q_1$  of this heat flux is proportional to  $-T'$ , a result known as *Fourier's Law*. Thus  $q_1 = -\kappa T'$ , where  $\kappa$  is a positive number proportional to the mean free path,  $\lambda$ , which is the average distance a particle moves between collisions. If in addition the plasma is flowing with a velocity  $v$  that changes magnitude in a direction at right angles to the flow direction—a pattern known as sheared flow—the rate of shear,  $v' = dv/dy$ , induces a secondary heat flux  $q_2$  in a direction at right angles to the temperature gradient (see figure). This heat is proportional to the product  $T'v'$ , and represents the difference between the heat carried to the right at the top of the figure and that carried to the left at the bottom. It is usually quite small compared with the primary heat flux  $q_1$  and is well known, or should be, since its calculation dates back to the 1930s.

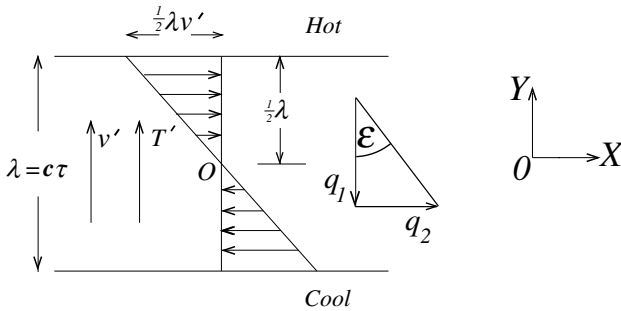


Figure 1. Fluid shear generating a heat flux  $q_2$ .

Magnetic fields, if strong enough, have a dramatic effect on Fourier's law. Charged particles spin in very tight orbits about the lines of magnetic force and are therefore unable to transfer their energy very far in the cross-

<sup>1</sup> *Principles of Magnetoplasma Dynamics*, Oxford University Press, 1987; *Kinetic Theory of Gases and Magnetoplasmas*, Oxford University Press, 1993; *Thermodynamic Inequalities with Applications to Gases and Magnetoplasmas*, Wiley, 1996.

field direction. Hence the stronger the magnetic field, the more it inhibits the transfer of energy *across* the field. The particles can carry their energy *along* the field lines without hindrance from the field since they behave like ‘beads’ stuck on the magnetic field lines, able to move freely along the lines but not across them except when their circular orbits are distorted by occasional collisions with other particles. The heat flux now has three distinct components,  $q_{\parallel}$  along the field lines,  $q_{\perp}$  across the field lines and a remarkable new component,  $q_{\wedge}$ , which is at right angles to both the magnetic field  $B$  and to the temperature gradient. This is the *transverse* heat flux, a well-known phenomenon and easily understood (see figure 3, below).

The situation is depicted in figure 2, which shows a section of the torus comprising the tokamak (see the figure near the beginning of the previous chapter). The temperature gradient points outwards from the torus cross-section in the same direction as  $q_{\perp}$  and it was assumed that this was the only heat flux that removed energy from the system, since  $q_{\parallel}$  merely circulates around the torus and  $q_{\wedge}$  is similarly confined within the torus cross-section.

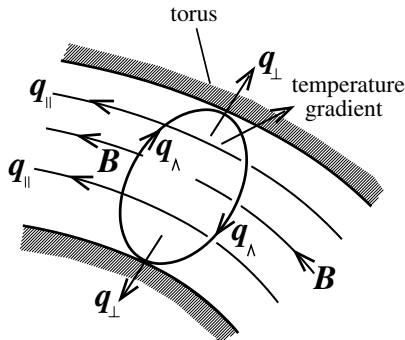


Figure 2. The three components of heat flux in a magnetic field.

However, the important factor is the ratio of the time between successive particle collisions, say  $\tau$ , and the time it takes a particle to gyrate around a magnetic field line, which is the reciprocal of the cyclotron frequency,  $\omega^{-1}$ . The value  $\omega\tau$  is enormous in tokamaks—for electrons it is more than a million. The interesting point is that  $q_{\perp}$  is proportional to  $1/(\omega\tau)^2$  and, as  $\omega$  is proportional to the strength  $B$  of the magnetic field, by making  $B$  large enough one can reduce  $q_{\perp}$  to a very small value. This is the basis of magnetic confinement, but there is a catch. It is the apparently harmless *transverse* component that does the damage. We find that  $q_{\wedge}$  is  $\omega\tau$  times larger than  $q_{\perp}$ , i.e. the energy circulating around the cross-section of the torus is more than a million times larger than the heat  $q_{\perp}$  flowing outwards. This would not matter if the flow pattern were not sheared, but alas the

electron fluid is very much sheared, its velocity falling off from a high value near the centre of the plasma within the torus to negligible values near the outside edge.

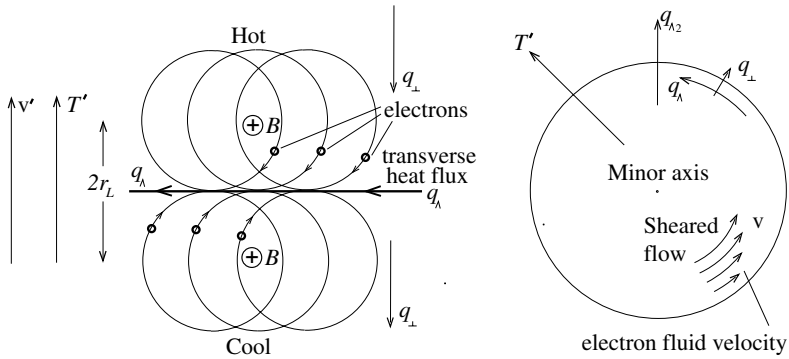


Figure 3. Transverse heat flux in a strong magnetic field.

This shear has just the same effect as described earlier, i.e. it produces a secondary heat flux  $q_{\perp 2}$  at right angles to itself. Although somewhat smaller than  $q_{\perp}$ , this secondary term is vastly larger than the flux  $q_{\perp}$  on which the plasma theorists pinned their hopes of confinement. Furthermore it can flow either directly outwards from the torus or sometimes inwards, which is when a thermal instability results. It is bizarre that tokamak theoreticians failed to consider the possibility that only a very small deflection of  $q_{\perp}$  would be sufficient give a radial component of energy flux *much* bigger than  $q_{\perp}$ .

### Tokamak Politics

I published my first version of the theory in 1983 and pointed out its obvious application to tokamaks, but I still had some problems to solve including getting the correct value for the effective collision time,  $\tau$ . Armed with the published paper, I again approached the Director of Culham Laboratory, now Dr Mick Lomer, with the request that one of my friends at the Laboratory, David Ashby, be allowed to spend some time undertaking computer calculations using the theory to test its power to predict the observations; it would have cost the Laboratory very little.

Lomer, whose background was not in plasma physics, agreed to look into it, so he sent the paper for assessment to the Theory Division Head, Dr J B Taylor, FRS. My theory was apparently at variance with Taylor's own ideas and with a colleague he wrote and circulated a Culham report that rejected my approach. I received a copy via Dr Lomer and my request for

support was flatly denied. I responded with a detailed analysis of Taylor's misconceptions about my ideas, but there was no reply. Had he or anyone else published a rebuttal of my theory, I could have answered it formally in a paper, but this normal scientific procedure was denied me.

I had succeeded in publishing the one paper mentioned above, although to manage this, I was forced to pretend to recant my belief (not essential to the argument) that average guiding centre velocities and fluid velocities were identical in a direction across the magnetic field. As time went by, it appeared to me that no one in the fusion business was interested in my ideas since except for that just described I had no reactions at all.

For the fusion community, especially for those theoreticians who were capable of understanding my work, I believe that there were two essential difficulties. First, if my theory were true a large number of them would have had to admit to nearly three decades of wasted research, which would have been embarrassing. Secondly, since my theory showed that the energy loss could *not* be attributed to any sort of turbulent malfunctioning of the tokamak principle but was intrinsic in its design, there was little chance of the scientific merit of the enterprise ever being established. The community might have been even more disturbed had my explanation of the disruptive instability been developed at that stage.

This disruptive instability has been mentioned in the previous chapter and its existence is readily explained by my theory. It comes about because even under normal operating conditions plasma energy is able to flow *up* temperature gradients. As it does this, the temperature profile becomes steeper and according to my theory, steeper profiles are better at holding the energy within the tokamak than flat profiles are. (This is the opposite to what happens with neutral gases.) The process is divergent—the more the heat flows inwards, the steeper the temperature profile and the better the energy is confined, hence as a result the temperature steadily increases near the centre of the tokamak. Of course this cannot continue indefinitely—the temperature reaches a peak and then triggers an instability that suddenly flattens the profile. Provided the number of particles within the tokamak is not too great, the energy supplied to the machine from outside heating sources is sufficient to restore the steady heating of the central region of the tokamak. This reheating continues until the instability once again causes the temperature profile to flatten. The temperature–time curve resembles a sawtooth structure, with the gentle climbs in temperature being followed by sudden collapses, a phenomenon first observed in the 1970s, but the physical reason for it was never understood; my theory gave values for the period of the sawtooth oscillation which were in good agreement with observation.

Unfortunately above a certain density of particles within the machine the external heating is insufficient to restore the steady temperature climb, so the profile collapse cannot be stopped and the mild saw tooth instability

turns into a disruptive instability, which may seriously damage the tokamak. Naturally this disaster is carefully avoided. With existing machines the critical density is too low to allow the ignition point to be reached, for, at the currently achievable densities, ignition would require confinement to continue for several seconds, far more than JET has so far achieved or seems likely to achieve. But even if one day ignition is reached, the limitation on the density of particles within the machine has serious implications for the economic viability of tokamaks. The fusion power density depends on the square of the number density of particles and, in order to make the energy investment into the tokamak hardware profitable, it is necessary to have as large a value of the number density as possible—certainly a good deal larger than the values capped by the disruptive instability.

I wrote more papers, improving my explanation of second-order transport theory, but they were all rejected. The natural referees for the journal editors to approach were scientists in the fusion business, who were people with a personal investment in the *status quo*. One editor told me that he had approached no less than *eight* plasma physicists, none of whom was prepared to even referee the paper! Whether their responses were due to ignorance or politics, I was not told.

Helen suggested a solution. ‘Write a book on magnetoplasma dynamics and set out all your ideas on transport in the text,’ she said. My OUP book on thermodynamics had been a success and a second edition was looking likely, so the University Press would no doubt be agreeable to the idea. Indeed they were, so I set about the long task of writing a general account of the subject with only a final chapter devoted to my new ideas about transport in tokamaks. By this stage I had accumulated so much observational support for my theory that any reasonable independent scientist would have had no trouble in accepting that at the very least it deserved attention.

My book entitled *Principles of Magnetoplasma Dynamics* and running to 521 pages was published by Oxford University Press in 1987. A final chapter of a hundred pages dealt entirely with tokamaks, describing a wide range of observations and the theories that had comprehensively failed to explain them. I developed my own theory and compared it with a variety of different phenomena—mass, energy and momentum confinement times, the period of the sawtooth oscillation and the conditions under which major disruptions occurred etc. In all cases theory and observation were in close agreement. Now at last, I believed, there would at least be a scientific debate and if I had made a fundamental error, I would soon be told. I looked forward to reading the reviews, the most influential of which would be that published in the Fusion Community’s journal, *Nuclear Fusion*. The reviewer was Dr Alan Ware, a respected and experienced researcher in the fusion business. I shall quote from his review, published in 1988:

... He applies his formulas to the prediction of particle, energy and toroidal momentum containment times and thermal diffusivities; in each case he claims and illustrates good agreement with experimental results. At first sight, this is a textbook; there are exercises at the end of each section and there is the attractive feature of mathematical notes inserted in the text to aid the reader with various aspects of vector and tensor calculus. However, the author has used this book as a vehicle to present his own novel theories of transport in a magnetoplasma—work, which to the best of the reviewer's knowledge, has not been published previously and which involves basic ideas fundamentally at variance with what is accepted by the plasma physics community. This is a strong statement and it is therefore necessary to be precise about the basic departures which the author makes from standard theory.

First, the author claims that there can be no pressure gradient force on a gas or plasma without collisions and that collisions are necessary to drive particles down the pressure gradient. The 'proof' of the first part is given (for a simple monatomic gas) on page 8. . .

[This did not convince Ware, and yet in essence it amounts to no more than a statement of Newton's second law of mechanics—the force acting on a body is equal to the rate of change of its momentum. In a gas the bodies are the molecules and the force is that experienced between colliding molecules—no collisions, no forces and certainly *no* pressure.]

The author extends the above 'proof' to the case of a plasma in a strong magnetic field and, on p. 11, he consistently states '...when collisions are thought to be unimportant, [the pressure gradient] should be set equal to zero.'... More importantly, when dealing with the forces experienced by a particle, the author states that an extra force [the pressure gradient divided by the particle number] must be added to the usual electric and magnetic forces and the guiding centre drift contains the extra term... [a term containing the pressure gradient].

[The simple point is that pressure gradients in a fluid are a consequence of the unbalanced collisional forces acting on each molecule and are obtained by summing over all the molecular forces. It follows that unless a share of the pressure gradient force is added to the other forces acting on *each* molecule the summation will not yield a pressure gradient.]

This is done even for a tokamak plasma in the banana regime, and not surprisingly, his formula for a banana<sup>2</sup> width... is very different from the standard formula, and his quantitative estimate on page 428 for the bootstrap current and the neoclassical pinch effect [called the Ware pinch!] is zero.

I wonder why he did not comment on the very damaging line in my book:

The Ware pinch term dominates... [the neoclassical expression for the radial mass flux], so had neoclassical theory been correct, tokamak discharges would have been impossible.

In fact typical values for the Ware pinch yield *inward* velocities, which for JET are typically  $0.5 \text{ m s}^{-1}$ . The outward velocities due to the neoclassical terms are only about one hundredth of this value, so had this theory had any validity, tokamak discharges would have been strangled at birth. This bogus pinch even exceeds the outwards mass flux that is inferred from measurements, so the fusion community should have been grateful that I showed it to be zero!

Besides a short paragraph in which he wrongly attributes my basic formula (a generalized form of that described in the previous section) to an error in my analysis, Ware made no comment on the remarkable success that followed this ‘error’. He concludes:

The author has clearly put a great deal of work into preparing this book. There is much that is attractive about the style of presentation and the book contains a lot of useful information. However, the good parts are so interlaced with statements and results which are contrary to standard plasma theory and in the opinion of the reviewer, are drastically wrong and, that he cannot recommend it either to students or his plasma physics colleagues.

I can understand him wanting to protect students from heresy, but perhaps his colleagues would have been equal to the challenge of new ideas?

The editor of *Nuclear Fusion* invited me to respond to the reviewer’s statements and my reply was printed after Ware’s attack. I began with (addressing the editor):

Your choice of reviewer for my book was wise. Dr Ware has had a long and distinguished career in magnetofusion research—it would be difficult to find anyone with a clearer understanding of the concepts sanctioned by plasma physicists or with a longer perspective

<sup>2</sup> Quite a good description, ‘bananas’; this describes the motion of particles in the toroidal geometry and is the basis of the irrelevant neoclassical theory mentioned in the previous chapter.

of their failure over 30 years to solve the problem of transport in a magnetoplasma. An author who claims to have solved this central problem must expect a very searching review, but would hope for one that, besides identifying flaws in the arguments, also fairly acknowledges any success of his theory.

Dr Ware's first criticism is that the book is a wolf in sheep's clothing—it is disguised as a textbook with exercises, etc., but is really a vehicle to present the author's own novel ideas of transport in a magnetoplasma. These theories have not (the reviewer believes) been previously published and, moreover, they involve basic ideas 'fundamentally at variance with what is accepted by the plasma physics community'. Dr Ware might consult my article in *J. Plasma Phys.*, **29**, 1, (1983), 143–154, which describes the basic concept, although its application to tokamaks remained to be made. In order to have this article accepted, I was required to delete one of my heresies concerning guiding centre velocities, now properly restored in my book.

No student capable of reading a preface would be deceived into believing that the book is conformist in its treatment of transport. In any case, since no generally accepted solution of the tokamak transport problem has previously appeared, perhaps I should be excused for rejecting those received ideas that have thwarted progress for such a long time. Furthermore, from the perspective of a rather older science—gas dynamics—my modifications are completely orthodox.

Take Dr Ware's first difficulty, namely my claim that the pressure gradients necessarily require particle collisions. This claim is scarcely original. Even Newton was partially anticipated by Boyle in 1660. Bernoulli, Herapath, Clausius and, of course, the great Maxwell himself, all contributed to what must be the oldest successful conclusion from atomic theory, namely that pressure and its gradient are a result of molecular collisions, both with wall molecules and with like molecules within the system.

I addressed Dr Ware's several related misconceptions and in my concluding paragraph remarked:

The question that must occur to any reader of Dr Ware's review and of Chapter 6 of my book (the one dealing with tokamaks) is: 'How can a theory so "flawed" by its contradictions of standard plasma theory yield so many distinct results in fair and sometimes good agreement with a wide range of tokamak observations?'

I did receive one other review that was more than favourable to my work, but it was written by someone outside the fusion community.



This is the right place to conclude the saga about my nomination as a candidate for a Fellowship of the Royal Society. One day in his monastery, Professor Temple must have discovered a box of my papers and decided—without consulting me—to send them to his successor but one in the Sedleian Chair. By this time Green had retired early to maximize his pension and Professor Brooke Benjamin was in command. Brooke was in no hurry and about two years later (in the mid-Eighties) he revealed his mission to me. I was surprised and then very, very annoyed at being passed around like a parcel. ‘Let me have my papers back, please, Brooke!’ In truth I may not have said ‘please’.

‘No, I will nominate you again. Be patient. But I will need to get support from scientists in the Royal Society familiar with your recent work in plasma physics,’ he said.

‘Well, you could approach either Pease or Taylor at Culham Laboratory, but the result will be the same,’ I replied. I didn’t hold my breath. Three years later Brooke with a proper show of reluctance accepted my request for my papers and books to be returned and told me that faint praise was the problem. I was not surprised.

## Getting Exalted

In 1983 as part of its centennial celebrations, Auckland University conferred honorary degrees on ten New Zealanders. Dame Kiri Te Kanawa’s singing commitments did not allow her to appear with the rest of us, so she had received her Mus.D. in December, 1982. Except for Dame Kiri, the most distinguished of the honorands was the Governor-General, Sir David Beattie. For my D.Sc., the Public Orator’s address gave a brief survey of my career, which contained the passage:

All Rhodes led to Oxford and still do. But over the years the administrators of the Rhodes Scholarship have wisely modified some of the extreme positions adopted in Mr Rhodes’s will without abandoning that on balance sane use of his South African millions, helping Oxford survive the competition from Cambridge [a Cambridge man speaking!] and to that end injecting brains and not too rarely brawn from overseas. The young Professor Woods was one of the first for whom the Rhodes rule of celibacy was waived.

Another passage that did no harm to my ego went:

Professor Woods has indeed addressed himself to the fundamentals of the subjects with which he has dealt. He has solved problems but is no mere problem-solver; devised techniques without

being only a technician. To continue Bacon: natural philosophy makes a man deep; moral philosophy, grave. Depth and gravity are indeed added in Professor Woods' case to the subtlety of the mathematician.

I was very pleased that my father lived long enough to be able to attend the ceremony, but sadly my mother had died the year before. I saw as much of my father as the celebrations allowed, since it was clear that he would not long survive a prostate cancer. How I wished that there could be enough time for us to become friends in a true sense, but it was not to be. For many years I had admired a beautiful chess set that he had carved and when at our last meeting he gave this treasure to me, I knew that he did not expect to see me again. He accompanied me from his house to the bus stop, insisting even though it was going to be a painful walk for him. I looked back at the weary old man from the window of the bus and waved a last goodbye. He waved back and turned slowly away to retrace his steps—it was the last sight I would ever have of him. All that hate and anger I had had as a young man seemed pointless—I did love him after all, but almost too late. He died a few months later after I had returned to England.



My parents in the 1960s.

Aunt Flossie, then over 90 years old, made the trip from Hahei to Auckland to witness my triumph, supported by her son Vaughan. My daughters, Diane and Elizabeth, were also present. Apart from my disappointment that my wife Helen did not come to Auckland, it was a highlight in my life.

To be recognized by my Alma Mater was an acknowledgement that I have greatly appreciated, but had I written the citation, I might have worked in something about the relationship between pressure gradients and molecular collisions!

I was walking through the University grounds one morning when I was accosted by a young man who said, 'Professor Woods, can you spare me some time? I would like your advice about going to Oxford to do research in theoretical physics.' At first I thought that the newspaper publicity about the centennial celebrations had enabled him to recognize me.

'My name is Grant Deane,' he said, smiling.

'Mr Deane you will need to have a first-class degree in physics from Auckland and then you must persuade someone in theoretical physics at Oxford to accept you as a research student.'

As a starting contact, I gave him the name of Dr David Brink, Balliol's distinguished theoretical physicist.

'I'm your cousin Faye's son,' he confessed. The last time I had seen Faye was when she was about four years old and I had been given the boring task of minding her while her mother, my aunt Daisy, was away. To be approached by a complete stranger who after some conversation turns out to be a relative is an uncommon experience, but looking back over the intervening years, I am very glad that that encounter occurred. Before meeting Grant again, I was to spend a year in Oman, setting up a new department of mathematics and computing.

I started writing my controversial book early in 1984 while visiting the University of British Columbia on study leave—it was to take me three years, in the meanwhile, I was to experience some administrative authority.

When I returned to England that summer, I was invited to become Chairman of the Mathematical Institute. An outsider becoming the Chairman of what was then one of the leading mathematics departments in the world! How had *I* achieved this status? Merit played no role at all, I must admit; it was simply my turn, the post being automatically given to the most senior professor available and sanity was a minor consideration. Power at last! Well, not much real power. I lacked the patience to interpret the technical communications, which steadily radiated from the University Administration Offices. I am good at delegating, but I had no academic staff under my control, so everything had to be done by persuasion. My style is direct rather than political, but fortunately the then Administrator, Mrs Sheila Robinson, was tolerant of the absent-minded facade I affected for protection. I found that it was easier to say 'yes' to *prima facie* reasonable requests from the academic staff, than to say 'no' since I thought that one could refuse a request only after spending time carefully considering the arguments. How naive of me!

I was better at writing letters to the University administration, usually complaining about their meanness in providing funds for the Institute.

We were treated as an arts department and funded accordingly, although I thought a fairer comparison would have been with a department like theoretical physics. In 1984 we had only two personal computers in the building, while every staff member of the mathematics department at MIT had a high quality Sun computer sitting on his desk; Oxford engineers were also well provided with personal computers. Previous chairmen—usually pure mathematicians—had been too modest in their claims; I thought I would do better. My case for five more PCs was well argued; I avoided the word ‘antediluvian’, but said how ridiculous it was that such an eminent department could only claim two PCs in as late as 1984. I thought my language was firm but not offensive, but the application was turned down.

A few weeks after this rebuff, I met the Chairman of the University Equipment Committee in Marks and Spencers.

‘Patrick,’ I said, ‘why has your miserable committee treated Mathematics so badly?’.

‘We try to satisfy the major requests first,’ he answered. ‘Small sums do not receive much attention. You didn’t ask for enough!’

My next application, expressed in firm, mildly sarcastic terms, was for about 40 PCs whether we actually needed them or not. It succeeded and it was not long before these machines were all gainfully employed. Initially most of the pure mathematicians in the Institute—the majority—were a mite scornful of computers, but when they realized that PCs made jolly good typewriters for mathematical papers, their attitude changed. One distinguished professor even complained that the pure mathematicians were spending more time as typists than as researchers!

One of my more pleasant duties as Chairman was organizing parties at the beginning and end of the academic year. All postgraduate research students, visitors, faculty members and their partners/wives were invited to come to the Institute for drinks between 6.00 and 7.30 p.m. and I would select a range of white and red wines, some very good and some well into the Bulls Blood category. In the afternoon the secretaries, notably Val and Brenda Willoughby, would prepare plates of savoury biscuits and cheese, then, just before six o’clock, I would remove the corks and verify that the wine was in good condition. Try as I might, I never managed to find one that was corked! The bottles would be set out on the tables and then the party would begin. For the first few guests, I would pour their choice of wine, taking some interest in who managed to identify those of top quality, then I would drift about, glass in hand, setting an example. I was translated 40 years back in time—once again Chairman of the Social Committee.

I also used to arrange sherry parties for the many mathematical visitors who would come to spend a term or more with us, and then there were champagne parties for those members of the Institute who had been pro-

moted or who had received international awards for their research. It was my opinion that funds spent promoting the social cohesion of the Institute were money well spent.

Two important awards were won during my five years as Chairman. In 1986 I received a letter from Saudi Arabia from the secretary of the King Faisal Foundation, describing a new International Prize for Science, which was very lucrative and apparently designed to be comparable to a Nobel Prize. It was supposed to be restricted to those whose work had yet to receive the imprimatur of an important medal or prize and I was asked for nominations from the Institute, as no doubt were department heads at the major universities from all over the world. Pure mathematics is not normally described as being science, so I reckoned that an applied mathematician should be nominated. Who should it be? There were three already decorated as FRS; which one deserved a bar? I could not decide between Roger Penrose and Brooke Benjamin. Roger had already received one international prize, but Brooke had not although his reputation was certainly international. Some advice from someone above the contest would be helpful and by good fortune, resident in the building we had the highly distinguished Royal Society Professor in Mathematics, Sir Michael Atiyah himself.

Michael thought conscientiously about the problem and the question of precisely what was meant by ‘previous recognition’ was carefully analysed. It emerged that while some parts of his *own* work had certainly been recognised by awards (he had three medals and one international prize at the time), there were other sections that apparently had not, thus he was of the opinion that this meant that he was not really ruled out by the conditions of the prize. He won the prize and, on reflection, it is very likely that only Michael could have lifted this particular award and, in doing so, he brought more distinction to the Mathematical Institute; it was a champagne occasion. Roger Penrose had only to wait a year before receiving his prize from the Wolf Foundation—metaphorically speaking, from the other side of the Jordan. For several years I nominated Brooke annually for a Wolf Prize in mathematics, but sadly he died just when it seemed possible that his turn might be coming.

## OCIAM

In 1984 the Mathematical Institute was becoming overcrowded and our annexe at 41 St Giles was also full. My predecessor, Professor Ioan James, and I were invited to look over a large building not far from the Institute known as Dartington House, but our chances of getting a floor or two of this building were not good as there was a lot of competition. Our one card was that our existing annexe, which would have to be given up, was

just the right size for another department also wanting to increase their space. The matter was not settled in our favour until I returned from the Arabian adventure to be described shortly and wrote a forceful claim to the University administration. Early in 1987 I was able to allocate rooms in the new territory to those lecturers and professors willing to trek across St Giles, which presented an interesting problem.

The Oxford Mathematics Faculty prided itself on there being no separation of the staff into pure and applied divisions, even at the graduate level. Two decades earlier I had floated the idea that, as in most other universities there should be separate sub-faculties of pure and applied mathematics, but this ‘radical’ idea had been treated as if it might somehow corrupt Oxford mathematics and was turned down. The pretence that the two branches were merely two sides of the same coin meant that applied mathematics was largely viewed as *mathematics* with applications, rather than as *sciences* with a mathematical structure. It is a pity that instead of calling the subject applied *mathematics*, it was not initially called mathematical *science*, using the term ‘science’ in a general sense to embrace physics, engineering, economics, biology, computing and so on.

To preserve the sacred balance in Dartington House, I had to ensure that the pure and applied people migrated in equal numbers, but none of the leading pure mathematicians wanted to move, so initially we had no more than a token number of purists in the extension and even they soon retreated. I was able to report to the Faculty Board that this imbalance was not my fault, but it was perfectly clear to me that it would gradually lead to what I had wanted in the 1960s—separate departments at least at the graduate level. I also gave Alan Tayler, an applied mathematician and the most senior person who moved, the responsibility of being in charge of our Dartington House space. He, with the support of John Ockendon and others who had been displaced from the Numerical Analysis building, set about building up the Oxford Centre for Industrial and Applied Mathematics—OCIAM. This group, which now has several senior members, many research students and numerous visitors, has become very famous and in the last decade has been copied world-wide. Hilary Ockendon is the (acting) director and a professor—Jon Chapman—of the subject has recently been appointed. It remains only for OCIAM to be recognized as a separate department, with its own finances, then at last Oxford will have arrived at what was suggested 30 years ago. What’s 30 years in an institution over 700 years old?

## Sultan Qaboos University

In the middle of 1985 I was invited to go to Oman to become the Foundation Professor of Mathematics and Computing in the Sultanate’s first

university, irresistibly named after the ruler, Sultan Qaboos, whose oil revenues were generously supporting the costs. Divorce settlements are costly, so I decided that two years in the heat might be a sound investment; it would be lonely, since Helen was certainly not going to give up her City job to improve her tan. Anyway I had my book to write, so it would be a good opportunity to work long hours sorting out the tokamak catastrophe. The appointment required me to affect belief in the Christian faith, since atheism was unacceptable in an Islamic country.

Formal education in the Sultanate was instituted only in 1970, so it was not until the mid-1980s that candidates suitable for advanced education appeared on the scene. Cleverly anticipating this, in 1980 His Highness the Sultan ordered the construction of a university and, with Mrs Thatcher's entrepreneurial son lurking in the sand dunes, it was not surprising that an English company won the building contract.

In September, 1985 I travelled first-class by Gulf Air to Muscat to spend a week deciding if I wanted to accept the post. I was accommodated in a splendid hotel, shown around Muscat with much kindness by the Dean of Science, George Gamlen and introduced to the Vice-Chancellor Elect, Sheikh Amor. The Sheikh was originally a school teacher from Zanzibar, which country had an historical association with Oman and George was even less prepared for his key position, having spent most of his career in the UK chemical industry. A brief period at the University of Salford as a chemistry professor had satisfied the Omanis as being adequate preparation for the post of Dean. I met some of the other staff in the College of Science and soon realized that with one or two exceptions I was relatively over-qualified, but I needed the money, so I decided to accept a two-year appointment, taking leave from my Oxford post.

I arrived in Muscat on 4th December, 1985, weighed down with boxes of papers reporting the latest observations of the confinement of mass and energy in tokamaks, which I would need to write the final chapter of my book. The campus was about 40 miles north of the city, situated in an arid plain, about ten miles in from the coast. I was allocated a brand new three-bedroomed terraced house on the edge of the developing campus, which like almost all the new buildings in Oman was air conditioned, so I had to put up with the steady background noise of the units maintaining the temperature at about 25 °C. Occasionally these machines failed, in which case the situation was treated as a serious emergency and day or night, engineers would soon arrive to correct the fault. The average summer temperature was about 38 °C, but on a really hot day temperatures of nearly 50 °C were sometimes reached; in winter day-time averages of 24 °C were very welcome.

As there would be no pupils until September, 1986, my main tasks were the drafting of suitable syllabi and the selection of staff. Advertisements had already garnered a miscellaneous bag of applicants with Indians, Egyp-

tians and English dominating. Most of the English applicants would have seen a circular that I had prepared earlier in the year and distributed from Oxford to all UK departments of mathematics. There was no shortage of acceptable candidates, but there were many whose degrees had a bogus ring to them—degrees from obscure backwater colleges, untraceable in any lists of approved tertiary institutions.



Department of Mathematics and Computing.  
Sultan Qaboos University, 1986  
Ibrahim Eltayeb on my right; Peter Robinson on my left.

I decided to visit a leading secondary school in Muscat to gain an impression of the mathematical standards I could expect of the successful candidates for university places in science. I was met by a smiling, slightly obsequious Egyptian mathematics teacher who was proud to show me his class in action. I stood at the back of the room, while the master continued at the blackboard with a lesson on quadratic curves. The particular curve drawn on the board cut the horizontal axis in two places and a boy,



a young man really, was called forward and asked to locate and explain the significance of the first intersection. With a little prompting, he said it was at  $x = 2$  and was a root of the quadratic equation; the maestro then asked the class to repeat this in unison; ' $x = 2$  is the first root of the quadratic equation,' they chanted. This inspired instruction was then repeated for the second root with more chanting. I later discovered that rote learning was normal with the Egyptian teachers, who had dominated the school system, and was a little depressed by this discovery—if there is one subject unsuited to rote learning, it is mathematics.

I also found that the students had only a modest command of English, which was to be the language of instruction in the sciences. Courses in English were to be included in the early years of the degree, but the first year was clearly going to be difficult for many of them. Therefore when I saw an application from Dr Ibrahim Eltayeb, Professor of Mathematics at the University of Khartoum, I was surprised and pleased for I knew that he was a first-rate applied mathematician and furthermore, being Arabic speaking, he would be a great help in the early days of the Department.

I first met Ibrahim in 1981, when I was invited to visit the University of Khartoum as an external examiner for their degree in mathematics. He had degrees from London and Newcastle, which was impressive for someone who had grown up in a small village on the Nile, south of the Egyptian border.

Ibrahim's crocodile stories were fascinating and a particular one I remember is as follows. When crocodiles were shot, they were sometimes lost by managing to struggle back into the river, so some men in his village devised a scheme to catch a crocodile which would prevent this happening. It appears that crocodiles are creatures of habit, sunbathing in the same spot each afternoon, so the men planned that one of them would shoot the creature and at that instant, four others would run from their places, each seizing a leg, and after lifting the crocodile up on their shoulders, they would carry it a safe distance away from the river. The shot was fired, the men ran out and the crocodile was carried a few yards before they realized that the marksman had missed. How far they ran while solving the disengagement problem, Ibrahim did not tell.

All the visiting examiners were invited to an afternoon garden party, where tea, iced fruit juices and cakes seemed to be all that was on offer. I expressed a little disappointment to one of the locals and was slyly advised that for persons of my religion, the glasses of iced orange juice could be supplemented with gin, and yet retain their innocent appearance. It was a jolly tea party after all.

I recall one exciting journey that Ibrahim and his friend and colleague, Mohammed Hasan, arranged for me. It was planned that we should spend a morning travelling along the Blue Nile in a powerful speed boat owned by a relative of Mohammed's. With an early start, I did not need to worry

about the sun, so I wore a short-sleeved shirt and shorts. After about an hour speeding along the wide river the engine stopped since we had gone too fast and the petrol had all vanished. It was about 100 yards to the bank, so I cheerfully volunteered to enter the water and to propel the boat to the bank by pressing my bent legs against its stern and then straightening them quickly. After each push, I ended up some yards away from the boat and had to swim to catch it up, so when we finally reached the bank, I was exhausted but pleased that I had played a role which I thought was beyond the others. But I may have been mistaken in this.

‘Just as well there were no crocodiles about!’ I jokingly remarked.

‘Didn’t you see them?’ asked Ibrahim. ‘We passed quite a few just before the engine stopped!’ This could have been his very English sense of humour.

We took all day to return to Khartoum, one of the party having to walk a considerable distance to obtain petrol. My fair skin was burning in the midday sun, but there was no shelter, so eventually I had to get into the water and remain submerged, with only my nose exposed. When I finally got back to my hotel, I was very severely burnt and in increasing pain. I ran the bath full of cold water and lay in it for an hour, a move that may have prevented a more serious outcome. When Helen met me in London at the airport, my face was in peeling strips.

Returning to my account of Sultan Qaboos University, I enjoyed my authority over appointing staff—no committees to argue about the merits of applicants, no trial lectures given by candidates and no special interests pressed by college representatives. All I had to do was to make my choice and go to the Vice-Chancellor, and describe the applicant’s merits, but before I got very far, he would tire of the recital and say, ‘You think he is a really good man?’

‘Yes, Sheikh Amor, we would be fortunate to have him on the staff.’

‘I agree with the appointment, Professor Woods,’ he would reply.

I liked Sheikh Amor and not only because he trusted me. He was a gentle, dignified Arab who did his best, but unfortunately he had to accept many inexperienced administrators on his staff. Foreigners were employed to do the teaching, but the university administrators were almost entirely inexperienced Omanis, who muddled along in confused uncertainty, so it was clear that what the University really needed were some experienced university administrators, preferably from the UK. Had the Dean of Science been an experienced academic with the courage to give firm advice to the administrators, things would have been so much better in the early days, but unfortunately George Gamlen was short on both these counts. While on the personal level George was kind, he was erratically autocratic in dealing with teaching staff and compliant towards the Arab administrators. Sadly, he was an embarrassing disaster for the English community in Muscat.

I recall with some amusement a meeting of the heads of departments at which entrance requirements were being discussed. The Head of Islamic Studies declared that if a candidate for his School had already memorized the Koran, then that would be evidence enough for the candidate's immediate acceptance, but this concept of university scholarship was quite foreign to me and I said so. I thought of adding 'If a candidate for science appears with no more qualification than having memorized large sections of mathematics, then I would reject him,' but I was prudent and kept quiet. Lecturing in mathematics started on Saturday, 20th September, by which time I had a staff of seven good men. I established a departmental committee that met weekly and all the tasks I could identify were delegated to the staff. They appreciated my democratic style while I appreciated being free to continue writing my book and to occasionally argue with George over policy.

Being a non-Muslim, I was entitled to a liquor permit, a little booklet that included a passport photograph, five pages of strict regulations and a page for each month of the year on which the store keepers had to record all purchases. My monthly allowance was 150 Rials Omani, which was more than £300. Alcohol was relatively cheap and, although well short of being either a teetotaller or ungenerous with hospitality, I managed to spend only 181 Rials over the entire year.

I enjoyed travelling about Muscat, a beautifully manicured Arab city, squeezed in between coastal mountains and the Gulf of Oman, but I found Nizwa, a town about 100 miles away and up in the mountains, much more interesting. Nizwa had many old buildings made from mud bricks, crumbling here and there, and had an enchanting souk, with everything which the discerning Arab might wish to bargain for, as well as a market square where goats and sheep were bought and sold. There were some small villages *en route* to Nizwa set amongst date palms and reminiscent of the biblical scenes I had seen on Sunday school cards 50 years previously.

My father was aged 12 when Halley's comet arrived near the beginning of this century. He told me that it had been a great sight, spanning a third of the heavens and, it was his frequently stated hope that he would see it once again before he died, but he missed it by two years. He would have been deeply disappointed by the miserable tadpole-like image that appeared in 1986. A party of us from the University travelled about 20 miles up into the hills on the Nizwa road to get away from Muscat's light pollution. We took some cans of beer with us, which was dangerous, for had we been stopped and searched there would have been a serious charge to face. Anyway, we saw the comet through binoculars, although it was just possible to detect it with the naked eye, provided one knew exactly where to look.

Helen came out for a visit and we had a happy time together, travelling around the Muscat area in a hired car, but I wished she could have stayed



Market square at Nizwa, Oman.

longer as I was lonely. I attended conferences in England, Belgium and Italy, although getting away from Oman required official permission even to attend scientific meetings and publicize the Sultan's new university. In the end I found these constraints too much and, since the Department was up and running, the syllabi were written and there were two good potential successors as department head, I decided to resign. Also there were other problems—I doubted if I could restrain my annoyance much longer with the Dean's inept management of the School of Science and I was also becoming concerned about the way things were developing at the Mathematical Institute back in Oxford where my Vice-Chairman, Brooke Benjamin, was making waves. Sheikh Amor wanted me to stay and I felt a little guilty about going, but it had been an interesting adventure, my book was now with Oxford University Press and it was time to depart.

## Losses and Gains

The money I had saved allowed me to replace my rusting car and to find a better house. Helen agreed to a move and after some searching we settled on a modern house with a large garden in Boars Hill. She asked me if I would be happy living in Hamels Lane and appeared content when I said that I would. That she was 'settling me' prior to leaving me did not occur to me at the time, and even when she said that she wanted

to spend a few weeks living alone in a flat in Oxford, I viewed it as a temporary arrangement and helped her find a place. I believed that she would return since apart from occasional bickering our marriage was happy, or so I thought. But Helen was working hard, travelling by car to the City of London early each morning and then upon returning home after 7 p.m., she would insist on preparing our meals despite my offers of help. She was a perfectionist, determined to do everything, shopping, housework, meals and her demanding City job—it was too much for her. Her only escape from her self-imposed duties was to leave me, or at least that is how I later rationalized her departure. We continued to see each other at weekends for dinner in local restaurants for the next two years; they were amicable meetings with plenty of wine and laughter and although at the end of each evening I would beg her to return to me, sometimes in tears, she never relented. I was deeply depressed by losing her.

I returned to my clarinet for solace and reached the stage of playing the undemanding popular tunes of the War years. One advantage of living in an area where the houses are well separated was that I had no fear of my modest performances being overheard, but I did regret that after the War I had not persisted with the instrument, perhaps to the level of being in an amateur orchestra. I remembered Frank Keefe and his ‘Rustle of Spring’; nearly 50 years had passed since his death and the deaths of all those other lively young pilots whom I had known.

My second cousin, Grant Deane, had failed to impress David Brink and was not accepted to undertake research in theoretical physics, so in the summer of 1986 when I was in Oxford on leave from Oman, he rang me to see what could be done about it.

‘Would you like to do research in plasma physics under my supervision?’ I asked. He immediately agreed and in due course was accepted by Trinity College as a graduate student. When I finally returned from Oman Grant was already settled in Oxford. I had always been careful to give my research students projects which did not require them to adopt my heretical notions about transport in tokamaks as I considered it unfair to set them against the tide of opinion; they had careers to make, possibly even in fusion research. But when Grant learnt about my new ideas for cross-field transport, he insisted on applying and extending them to tokamaks and to a similar but even less successful machine known as a reversed field pinch. We both knew the risk he ran, since it was unavoidable that one of his D.Phil. examiners would be someone from Culham, but perhaps he would be able to protect himself by adopting the Galilean approach that my theory was merely an *hypothesis*, which he was going to test, even to destruction.

One of Balliol’s recent benefactors was William Coolidge, a wealthy American with connections to the Massachusetts Institute of Technology in Boston. One of his schemes financed Balliol Fellows to visit departments at MIT for a period of a few weeks, so I decided to spend six weeks at



Fellows of Balliol College, 1989.

MIT's Plasma Fusion Laboratory, since this would give me the opportunity of explaining my theory of tokamaks to one of the strongest US research groups. Their tokamak called ALCATOR had achieved quite high values of the particle density and gave the impression of having merits over other machines of comparable size. The Director of the Laboratory was very helpful and also agreed to support Grant Deane at MIT for a few weeks. I gave a series of six lectures on my theory and distributed detailed lecture notes—first reactions were cautiously favourable. The scientist with whom I shared an office was particularly enthusiastic; his name was Jay Kesner and he wrote a departmental report entitled '*Woods scaling in ohmic and auxiliary heated tokamaks*'. He produced graphs showing that for eight widely differing tokamaks with energy confinement times,  $\tau_E$ , ranging from 5 to 400 milliseconds, my theory gave values for  $\tau_E$  typically only about twice larger than those observed, an achievement to be compared with the values, hundreds of times larger, given by other theories. His abstract included:

This law is applied to tokamaks with both ohmic and strong auxiliary heating. Excellent agreement with data is found.

His honest report also contained the following pessimistic conclusion:

[Referring to ignition curves based on my theory:] We observe that a minimum density is required for ignition. At low density the alpha [fusion] power cannot beat thermal conduction. At high density Bremsstrahlung [a type of radiation] creates a difficult barrier in heating power. Since the maximum tokamak density is limited we are not guaranteed that ignition is possible. [My underlining.]

Plasma physicists at the Laboratory initially decided that my lecture notes should be printed and widely circulated; recognition for my discovery seemed imminent! After my return to Oxford, I waited patiently for news about the lecture notes, but nothing happened, not even a response to my letter of enquiry about the notes. The change in attitude was sudden and probably dictated by senior people whose future employment at MIT was dependent on the success of the fusion enterprise. My theory was evidently not good news.

About two years later, I proposed to Oxford University Press that Grant Deane and I should write a book on tokamak transport. Remembering his earlier support, I suggested Kesner's name to OUP as a suitable reviewer. He never contacted me, but in fact wrote an adverse report, stating that my ideas were flawed and not accepted by the plasma fusion community. I expect that Kesner's senior colleagues probably played a role in his conversion. The attitude of the MIT researchers reminded me of Galileo's clerical critics who refused to look through telescopes at Jupiter's moons.

Apart from modest support from his college, a little parental support and his own savings, Grant had no funding. In earlier years, I found that Culham Laboratory had been quite willing to aid good students, particularly if they worked on a topic of interest to the Laboratory while the supervision remained my task. In 1988 I proposed to Culham that Grant be supported to do research on the reverse field pinch (RFP), my idea being that the behaviour of this interesting, albeit useless device, of which the Harwell machine known as ZETA was a prime example, could be explained by my second-order transport theory, possibly with the same success as had been achieved with tokamaks. After some delay, they agreed to support Grant, but only if he spent two or three days per week at Culham, and adopted their approach to the problem, which involved some muddled speculations involving their old standby, turbulence. Had he accepted, he could not have remained as my research student, but without any pressure, he opted to stay with me. Fortunately, not long after we found another source of income for him, working on the MHD generation of electricity for the Ministry of Defence.

At last his thesis was ready. Grant had shown great initiative and had managed to explain several phenomena for the first time; it was first class work and should have resulted in several publications. In his Preface, Grant hopefully included the disclaimer:

[Referring to my theory:] Despite its considerable explanatory power when applied to tokamaks, Woods' theory has not gained widespread acceptance from the plasma physics community. Our concern here will not be with the acceptability or otherwise of Woods' theory. Rather we will be interested in the ability of this transport mechanism to provide explanations for phenomena which lie outside the compass of currently acceptable theory.

In the spirit of Popper, we shall accept the theory as a hypothesis to be discarded should it fail to meet the demands of observation.

Grant and I agreed that Dr Derek Robinson, a group leader at Culham, would be best choice for an examiner external to the University. Unfortunately Derek was unfamiliar with the protocol of examining a D.Phil. thesis, so, when he received it sometime later, he formed an *ad hoc* committee of himself and three members from the Theory Group to judge the work. Thus Grant had *four* external examiners, all experts in the received view of plasma theory, and one internal examiner, who, although lacking this particular handicap, was ill equipped to hold the balance. The thesis was accepted, but only if it were to be modified where it appeared to disagree with accepted wisdom, and most galling, if it included a survey of that quite useless diversion known as neoclassical theory. Grant appraised the University Proctors of his unjust treatment, i.e. in having five examiners instead of the regulatory two, but was advised to do the work requested. With my encouragement, he struggled on, quickly modified the thesis, added a bland survey of neoclassical theory and the work was then accepted. Grant wisely decided that his future lay in oceanography, and is now in a tenure-track post in the Scripps Institute of Oceanography at the La Jolla campus of the University of California.

The evident failure of the fusion programme will never be admitted by those whose careers and livelihoods depend on maintaining the myth of 'steady progress'. Scientific breakthroughs occur on schedule synchronously in advance of funding requests and progress is sanguinely recorded in glossy annual reports. Professor C K Chu, of Columbia University, NY, who had years of experience interacting with the group at Princeton University's Fusion Laboratory with its expensive and inefficient tokamak, likened the fusion enterprise to that of 'reaching the moon in a balloon'. Each year minor improvements allow the balloon to rise a little higher, thus allowing claims for more funding.

'One day, about the middle of next century, we will get there!' the aficionados declare. In the meantime, if a theory appears that seems to dispel the mysteries and perhaps imply that that day will never come, it is to be ignored. My theory has *never* been proved to be wrong; it agrees with observation in so many particulars that if it were fundamentally flawed, its success would have to be described as being an amazing coincidence.



On 11th May, 1989, I had an encounter that was to change my life. We needed to replace a secretary in the Institute—Miss Suzanne Griffiths seemed anxious at the interview, but had an excellent record, which included several years in the Foreign Service. She was well dressed, perhaps a little thin and angular—a Miss Brodie figure I thought at first, but then I am not always observant when it comes to the opposite sex. The administrator, Mrs Sheila Robinson and I agreed on her appointment and I dismissed her from my mind. By chance Suzanne became my secretary, her anxieties faded and after a week or two she had changed into a more cheerful, confident young woman. Perhaps she was no Miss Brodie after all. At this time there was great concern in the University about sexual harassment, so how was I going to scrape up a social relationship with a lady who worked for me and whose continued employment was in my gift, at least until a probationary period of three months had been served?

My first mistake was to give her a letter in the Institute, containing a pansy from my garden. So when she opened it in front of the other secretaries and the pansy fluttered out like a large spider, I expect she had to resist screaming. Anyway, I did include a letter in which I addressed the problem of sexual harassment. It more or less said ‘If you refuse this advance, it will make no difference to your employment’. But even to write that was more than a trifle gauche, for perhaps it might have implied the opposite. Nevertheless, she responded favourably, I met her family at her mother’s flat in Woodstock, and then began to see her several times a week, but secretly as far as the Institute was concerned. I declared love at an early stage, but she never said ‘yes’ and she never said ‘no’. It was soon clear that she would have to obtain employment elsewhere. She had no trouble doing this and following some holidays in France and Wales, she did say ‘yes’. We were married in a registry office on 8th February, 1990. Two days later we had a memorable ceremony in Balliol College Chapel where our marriage was triply blessed since *three* clerics, two of them related to Suzanne, worked to seal our union. Grant Deane was my Best Man and his wife, Bonnie, read the lesson. Bonnie is a remarkable black woman, who was at Trinity College, Oxford on a Rhodes Scholarship from Harvard, and who, despite being physically handicapped by the loss of one leg from birth, managed to win medals in downhill skiing. After Oxford her career included a period at IBM and then a year working for President Clinton in an important economic post. The College provided a splendid meal for our guests, mainly College Fellows on my side and relatives on Suzanne’s. The speeches were above average, with Grant speaking well, describing the vagaries of being my student, reminiscent of those students who had to suffer my instruction on how to pass between adjacent poplar trees in a Tiger Moth nearly 50 years before! Was I really that bad?

Deciding that five years was enough of administration, I resigned as Chairman of the Mathematical Institute in October, 1989. My Professorial

Fellowship in Balliol terminated a year later, then it was all over. I was now a retired professor, whose main work was largely ignored, but at least I had an attractive wife to share my years. Life was good, although one small cloud appeared on the horizon. Suzanne was subject to periodic mood swings, apparently triggered by a period of stressful employment she had experienced in London two years before. I learnt of this illness in France before our marriage, but it did not deflect me, since I loved her very much and believed that with love and care this problem would fade.



Suzanne and me in Queenstown, South Island, NZ.

Suzanne and I travelled to Australia, spending a few happy days in Singapore *en route*. We started our Australian visit in Canberra where I gave some seminars on my research at the Australian National University. When we moved on to Sydney, we stayed with my sister, Beverley, not far from the University of New South Wales, where 30 years before I had been a professor arguing with the Vice-Chancellor. Beverley took to Suzanne with warmth and encouragement. After two weeks in Sydney spent visiting the beautiful beaches, the elegant shops, the Opera House and other attractions that make it one of the finest cities in the world, we travelled to Brisbane where I introduced Suzanne to my daughter Patricia and her family. Fenton Pillow, retired from his professorship at Brisbane University, and his wife also made us welcome. We moved on to Port Douglas, beyond Cairns, where Suzanne had some friends, and saw the Barrier Reef. Wild tropical

rain flooded the area and, being so very different from the gentle English variety, gave Suzanne some concern. She became fearful that crocodiles were lurking in the flooded grass outside our chalet and might wish to visit us, but, with some help, she soon overcame her imaginative reactions to a new world.

A talk, entitled ‘*Can philosophy of science help research at the physical sciences?*’, given in the University of New South Wales Applied Mathematics Department, was reported in the University magazine, Uniken, on 21st April, 1990:

If a white-haired Professor of Mathematics from Oxford is right, mankind’s multi-billion-dollar search for clean fusion power has been a waste of time and money.

This was, he claimed at a UNSW Department of Applied Mathematics seminar on 3rd April, because physicists had allowed themselves to become locked into inappropriately rigid logical constraints and had failed to take due account of the ‘real’ world.’ [Not quite what I said, but with an element of truth to it.]

I said that neglect of the philosophical foundations of science was dangerous because it left scientists vulnerable to older, failed philosophies, of which they were usually unaware. I cautioned against the legacy from positivism, that philosophic approach begun by the 19th century thinkers Comte and Duhem and promoted by the Vienna Circle early this century. Some younger physicists, I said, had unknowingly taken from positivism a presumption that a physical theory should be primarily a mathematical construct with elegant definitions and theorems, but with little input from the real world. Some even ‘laundered’ their work to fit this mould despite first obtaining their results from physical thinking.

As examples of a far more successful philosophy I mentioned Faraday’s conception of lines of force and Maxwell’s kinetic theory of gases, which used colliding ‘billiard balls’ as a model of a gas.

Faraday’s lines of force were a metaphysical construction, yet they were fantastically successful, and Maxwell with a completely bogus metaphysical model also came up with perhaps the most important theory of the 19th century—the electromagnetic theory of light—even though it was claimed (by Pierre Duhem in *The Aim and Structure of Physical Theory*, Atheneum, NY, first published in 1906) that he falsified a theory of elasticity to get there.

I asserted that the heart of physics is in *mechanisms*, not mathematics, important as that tool is in exploiting the models. This realist approach explains why British science in the 19th century, bolstered by a strong Scottish philosophical tradition, was much more successful at advancing our

understanding of the physical world than the more abstract French school at the time. Although it largely faded away after World War II, positivism, I maintained, had done a lot of damage to science and that some scientists, such as plasma physicists, were still trapped in this outmoded, restrictive philosophy.

A particular danger of the positivist approach was to use words to describe the terms in equations without considering whether these words had physical meaning. For example, the equations describing a plasma—the form taken by matter at very high temperatures—include a term called the momentum flux tensor, which can be interpreted as pressure in the similar equations describing a gas. In a gas, pressure is the collective effect of collisions between the particles, whereas in a tokamak plasma there are very few collisions. Plasma physicists nevertheless spoke of ‘pressure’, leading to various paradoxes and predictions not in accord with experimental results. Had these theoretical plasma physicists retained a grasp of reality and remembered that there could be no pressure gradients without particle collisions, it is possible that 30 years’ research and experiments costing hundreds of millions of dollars to reach the conclusion that tokamaks were a blind alley, could have been abbreviated. (Of course even more realism would have been required to lead them towards the central role of second-order transport.)

Following our spell in Australia we went to New Zealand, where I was proud to show Suzanne the beautiful country of my birth. We made a motor tour, first visiting the famous Waitomo Cave, where from a small rowing boat we were able to see glow worms flickering on its ceiling, resembling stars in the bright night sky. Lake Taupo followed, where 48 years before I had imprudently flown a Tiger Moth so close to the water that my wheels had touched the tops of the waves, causing the control column to jerk in my hand. The thermal wonderland of Rotorua gave Suzanne both pleasure and a little anxiety as we looked into great cauldrons of boiling mud and walked around the edge of a steaming, multi-coloured lake. Our journey then took us up the coast to Tauranga where in 1942 with my flying partner, Russell Coulter, I had acted the fool, diving onto the sea from 600 feet to execute a ‘roll off the top’. I wondered where he was now; perhaps, like many of my war-time friends, he was dead. Continuing north up the coast of the Coromandel Peninsula, we called into Whangamata where my Uncle Jack Tew had a seaside cottage. I could not remember where this was, so I found his telephone number and rang him. The answering voice told me that the directory was out of date; Uncle Jack had died two years before.

We set off along the beautiful coast road towards Mercury Bay. The weather was clear, allowing me to see the Alderman Islands where 60 years before I had fished for hapuka on my father’s launch. Finally we reached Hahei where Aunt Flossie was expecting us. She lived alone in the old

cottage, but now there were dozens of new cottages scattered along the beach frontage and back for several blocks into the original farmland. The isolated beach paradise of my youth was now being shared by hundreds of people. Flossie proudly showed us her Queen's medal and some photographs of her with Sir Paul Reeves. She took to Suzanne whose social skills were equal to the task of accompanying a fragile aunt to an open-air church service later in the morning.

We returned to England and a few months later I retired from my University post and was elected to an Emeritus Fellowship at Balliol College. At last everything seemed to be set fair, and although its importance was rapidly fading, I thought I might even persuade the fusion community to read my book and learn why magnetic confinement had failed! I had some interesting lines of research to pursue and two remaining research students to see through. Fortunately both Jason Reese and Richard Kennaugh were sufficiently advanced to require just the occasional pub supervision and they both managed their D.Phils without a struggle. Perhaps I might write another book or two, using my computer and printer to produce 'camera ready copy'. I was also beginning to realize that my ideas about magnetoplasma transport, which had worked so well for tokamaks, could have many possible applications in the solar atmosphere.

Suzanne's health was steadily improving and she began to look forward to the day when, a few months after stopping her medication, she would be able to have a child. Despite my age, this was an event which I looked forward to with more enthusiasm than I confided to Suzanne, as I did not want to put her under any pressure. My retirement would be a blissful period. How mistaken I was.

# Chapter 13

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## Ebb Tide

### Consultant

I retired in 1990, but, having ignored light-hearted advice to marry a rich widow, it was essential for me to continue working to supplement my retirement pension, which had declined noticeably with Helen's departure. First I accepted a six week visiting appointment at the Katholieke University of Leuven, Belgium to give some lectures on thermodynamics. My host was Xavier de Hemptine, whose rather unorthodox views on non-equilibrium statistical thermodynamics made my departures from the received wisdom in plasma theory seem timid. I spent a considerable time reading and correcting the manuscript of a book he was preparing on the subject, but he was reluctant to accept my suggestions. Hemptine's book, scarcely altered, was published two years later and I was surprised and a trifle embarrassed to read in his preface that:

During a six weeks stay at my university as a guest-professor at the end of 1990, professor Lesley C. Woods (professor of mathematics and fluid dynamics at the Oxford University) [sic] has been kind enough to read the preliminary version of this book's manuscript and, as an expert in the field, to make invaluable scientific and stylistic comments and suggestions. To him goes my biggest gratitude.

I wish he had valued my suggestions more, but who am I to be critical of a scientific maverick? His charming wife was from the Belgian nobility, so the most interesting part of the visit was being entertained in their chateau by the whole extended family.

One of my lectures, which was widely publicized beforehand, was entitled '*The quest for fusion power: why it failed*'. The leader of the Belgian fusion research establishment together with one of his staff appeared in

the audience. I had met him some years before in Canberra so I recognized him, sitting grim faced with his colleague, towards the back. He kept his powder dry until question time and then he rose, I thought to ask a question. Instead he made an aggressive statement, attacking my conclusions, but not the theory that led to them. His main point was that even though fusion in magnetically confined plasmas was not an easy engineering project, it was vital to pursue it in view of the rapid depletion of world supplies of coal, oil and eventually uranium. The project had *not* failed—more time was needed. I pointed out the awkward scientific fact that tokamaks are inherently unstable at economic densities. Of course in today's world (1999) another argument that the nuclear power merchants (fission or fusion) can and do deploy is that fossil fuels produce greenhouse gases and environmental pollution to a much greater extent than nuclear power. But what about the inexorable accumulation of long-lived radioactive waste?

This trip was followed by four years working as a consultant to the Ministry of Defence on electro-thermal propulsion, research in which I was able to make use of my knowledge of plasma physics. However the magnetic fields are not strong in electro-thermal launchers, so there was no role for my special knowledge of cross-field transport. My research student, Richard Kennaugh and I wrote two dozen lengthy reports on various aspects of these speculative devices for the destruction of the 'enemy', whoever they might have been. I rationalized my work by the conviction that these guns would probably never work efficiently in a killing field.

Later I was invited by an MOD group at Fort Halstead to take an interest in a different type of launcher known as a railgun, which consists of two parallel conducting rails, across which a large voltage is suddenly applied. In one version, the circuit is completed by a conducting block placed across the rails and this member, called the armature, is free to slide along the rails while maintaining electrical contact. It carries the load or shell and when the circuit is completed, the armature is accelerated to the end of the rails, projecting the shell towards its target. Velocities considerably higher than those achieved with conventional guns are possible.

When the MOD project was cut back, I had to find another consultancy and by an odd chance a New Zealander, Dick Marshall, whom I had once taught, had risen to eminence in the railgun business as a result of some seminal research he had done in Canberra. He was now at the Institute of Advanced Technology at the University of Texas in Austin, where the research concentrated on railguns. I contacted Dick and was soon engaged as a consultant by IAT, which lasted for several years. I found some interesting problems and wrote several reports, one of which was published in an electrical engineering journal. The future of railguns rather depends on finding a solution to the power supply problem, which means reducing the size and mass of the energy source so that field mobility can be attained.

What I found rather unreal at the time was at the several international conferences I attended a few Russian scientists appeared and read papers. Furthermore their expenses were partially met by the Americans!

I became a member of the European Thermodynamic Network through which I have met some interesting and able scientists. I gave up trying to convince the fusion community that my theory explains their failure to control fusion via magnetic confinement. In any case, their time has probably passed.

## **Divorced**

Suzanne and I enjoyed our stay in Leuven, although her debilitating illness kept her in bed for much of the time. I kept a graph of her oscillations between exuberance and depression and gave this to her doctor; gradually the period of these oscillations lengthened and we began to look forward to her restoration to full health. We had a very pleasant visit to Vancouver in 1992 where at a conference on rarefied gas dynamics I managed to argue with Carlo Cercignani, a leading kinetic theorist, on the relation between pressure gradient and particle collisions. Suzanne seemed more lively and happy on this visit and her illness appeared to be almost conquered. I wish we could have stayed abroad longer, for it is clear to me now that Suzanne would have greatly benefited from living in another country for a year or more at that stage. The change from England and her close family would have given her the space to gain confidence and develop a self-reliant spirit. But back in Oxford she compulsively telephoned her mother every evening at dinner time; the umbilical cord could not be cut. I was partially to blame however, since I willingly allowed her mother who lived alone, having been divorced several years earlier, to accompany us on several holidays. I also encouraged Suzanne to study for an Open University Degree in Fine Arts. Paradoxically this proved to be a sad mistake.

In the summer of 1993 Elizabeth Howe, Suzanne's much admired Open University tutor, was murdered by a psychopath at an OU Summer Meeting; it was widely reported in the media. This proved to be a serious setback for Suzanne and her medication was increased, but possibly too much. Then in August she fainted on the stairs at home, fell down and cracked her skull with such a blow that prompt neurosurgery was essential to save her life. Very luckily I happened to be in the house when this happened. The following year two exciting events accentuated the manic phase of her illness—the decoration of a Foreign Office friend with an MBE and the marriage of her youngest sister. Her health suddenly deteriorated, requiring months of hospital care. I visited her every day and she steadily recovered, although not completely.



On returning home however, she decided that living in the relative isolation of Boars Hill was the basic cause of her continuing illness, although a year before she had said how much she enjoyed the peace and quiet of her home. I was unable to shift this *idée fixe*, so we set about finding a suitable house in North Oxford, which was not easy since we could not find a house that we both liked and which I could afford. We were still looking for a house when things fell apart completely. With her mother's encouragement, she covertly shifted the blame for her illness from the house to me.

We had what I thought was a happy visit to Toulouse in April, 1995, following which she abruptly decided to return to her mother's keeping and to divorce me, the real reasons for which I was never able to discover. I had not the slightest warning of this disaster—I later discovered that it had all been planned months earlier. She subsequently claimed through her solicitor that the trip to Toulouse had been no more than a means of giving the marriage a second chance, although I had never been told that my first chance had passed. Her sister Diana later confided to me that Suzanne was inherently unable to discuss any issue which might lead to a confrontation, however minor.

It took me more than three years to recover from what seemed to me to be a cruel and heartless betrayal. During the first two years I wrote more than 60 letters to her, trying my best to decipher her behaviour and suggesting many concessions, including accompanying her to church, putting up with the Royal Ascot pomp with which her family were taken, and even having her mother live with us. She never responded. I purchased several books dealing with her illness and realized that I should have done this from the outset of our marriage. It was a costly divorce for such a short marriage, for her health did not immediately permit her to undertake a paid job. However I am pleased to learn that she has now recovered her health.

I started playing my clarinet again, which had helped when Helen left me, but did not seem quite enough distraction when I lost Suzanne. Roy Bickerton had enthused to me about gliding and wondered why I had not taken it up, so I joined a local gliding club. To speed up my progress to going solo, in 1996 I spent a week at the Long Mynd, a beautiful hill near Church Stretton with splendid views across Shropshire to the mountains of Wales. The villages and small farms there are so enchanting, just as I imagine the whole country must have been in the 18th century. I managed to find a thermal to give me a solo soaring flight of 40 minutes; when I returned to the Long Mynd a year later, I stayed up for an hour. In 1997 I joined the Oxford University Gliding Club, which is associated with the RAF Gliding Club at Bicester. During 1996 I attended scientific meetings in Barcelona, Jerusalem, San Diego, Baltimore, Beijing and Austin which helped to keep me sane.



First solo in a glider. Instructor, John Stuart.

## Escape to the Antipodes

I had always intended that some day I would spend a lengthy period in Sydney, visiting my sister, my daughter Pat in Brisbane and seeing old friends before going on to Auckland to see my daughter Liz and some long unseen grandchildren. Now was the time to go! I let my house and packed my bags. I had taken the precaution of acquiring an international driving licence, so driving a car abroad would not present a problem or so I thought.

I arrived in Sydney early in November where it was pleasantly warm. I settled down in my sister Beverley's house, which was very close to the University of New South Wales in Randwick. My nephews and their children made a fuss of me, at first anyway, and I felt happy again. I decided to purchase a car to enable me to join the Southern Cross Gliding Club, which flew from Camden, some 67 km south of Randwick. Then Bruce, one of my nephews, told me that an international driving licence alone was unlikely to save me in the event of serious accident and that I could be wiped out



My sister Beverley in 1998.



LCW in Sydney, 1998.

financially—he advised me to take the local test. I studied the booklets, passed the theory at the second attempt and then managed the road test. But they would only issue me with a provisional licence, which required me to display red ‘P’ plates and which limited me to  $80 \text{ km hr}^{-1}$ . So I produced my international driving licence as evidence of long experience. ‘Where is the licence on which that is issued?’ I was asked.

‘Oh, it is locked up in a drawer in England,’ I replied.

‘Get it sent over here and we will change your provisional licence for a full licence. Otherwise you must display the P plates.’

‘How ridiculous’, I said, ‘I have been driving for nearly fifty years.’

‘Well you could always claim that you were driving your nephew’s car!’ the officer jested.

I accepted the P plates, but they soon fell off.

I became a Visiting Professor at the University of NSW, just a short walk from Beverley’s house, which allowed me to use the library, the swimming pool and other facilities. I was surprised by the number of students on the campus from Asia and learnt that Australian universities must now export tertiary education to secure much of their income. Being in Sydney, where I had lived for six years in the 1950s, enabled me to see some old friends from those mainly happy days—Barry Thornton, Ray Bryant and

John Bennett, especially—and I stayed a week in Canberra with an ex-research student, John Love, who is now a professor with an international reputation in fibre optics.

Research on prominences, those vast, much photographed arches that can extend up to 200 000 km above the photosphere, filled in much of my time; I attended a conference of applied mathematicians at Coolangatta to meet old friends and incidently to read a paper on why Boltzmann's famous kinetic equation is wrong, which mistake I claimed has cost world-wide science about \$10 billion. (The equation lacks some terms that become important only in strong magnetic fields.) What the great man did was entirely satisfactory for his purposes, but his equation was pushed beyond its range of validity by scientists more at home with mathematics than physics. As Coolangatta is near Brisbane where my daughter Patricia now lives, I was able to see her and her family after the conference. I was also able to see Fenton Pillow and his wife Jill, and gossip about mutual enemies with some pleasure.

On fine Wednesdays I went gliding and appreciated the advantage of being towed up to 3000 feet before being released to find thermals. In my Oxford Club at Bicester we use winch launching, which usually gets one to about 1200 feet, leaving only about 2 minutes to find a thermal before having to land. The typical, non-thermal assisted flights lasted about 4 minutes at Bicester, and 18 minutes at Camden. The January bush fires were a hazard, preventing flying on some occasions; once the tug pilot said he was unable to see the airfield from 1000 feet owing to smoke drifting in from fires several miles away!

After a few weeks, I managed to persuade an instructor that I was ready for solo. So off I went, but towed up to 2000 feet instead of the usual 3000 that I had had with the local instructors. I was so pleased with myself that I forgot the first rule after releasing from the tug—look to see where the airfield is! At 3000 feet this is not so imperative, one can mess about looking for thermals for several minutes before thinking of 'home'. I forgot that I was at a lower height and even worse that there was a cross-wind blowing me away from the field. I did look at last, believing that the tug had left me only about two miles from the field. At first I couldn't see it. 'Good God!', I thought, 'where is the damn field?' There it was in the far distance, about five or more miles away and I had only 1500 feet left. What a fool I would look, landing 'out' as they say, on my first local solo. So I set off for the field, flying at optimum gliding speed, trying to will the glider into not hitting a down draught. I had no choice but to go directly to the into-wind landing path. At at height of 700 feet I was rescued by a small, considerate thermal and managed to scrape into the circuit at this height. A very short downwind leg and a normal approach was followed by a decent landing, which my instructor was watching. 'Well done', he patronized, with more accuracy than he knew. When I left Sydney for

Auckland in July I had achieved a C certificate equivalent to a bronze endorsement of my UK gliding certificate and I had increased my total flying time up to nearly 50 hours.

While in Australia I visited six universities, and besides talking about the tokamak disaster, I gave seminars on three topics in solar physics: ‘*Why the sun’s corona is so much hotter than the photosphere*’, ‘*How sunspots are generated*’, and ‘*Why solar loop prominences resemble railguns*’. I had to work quite hard on preparing these subjects, since my background knowledge in solar physics was not strong. What I found quite exciting was the fact that I now had a whole new field of research to explore and one in which its theoreticians were faced with many problems, which had hitherto defied solution. My own particular advantage is that in many ways the magnetic field loops in the corona resembled tokamak fields so that the methods that I had developed for tokamaks could also apply to these coronal fields. This work should keep me busy for another decade, God willing.



Nuffield Research Professors at the University of NSW (1998).  
Brian Milton (4th), LCW (2nd), Al Willis (1st), Ray Bryant (3rd).

I had the good fortune in Sydney to make the acquaintance of Robert Bray, an eminent scientist, who was particularly strong on the observational aspects of solar research. With Australian colleagues, he has written definitive books on sunspots, coronal loops and solar granulation. It is the observational side of solar physics that I need to give the greatest attention, since the theories that have been advanced to explain such observations are seldom well developed and sometimes (in my judgement) plainly wrong.

## Back to Oxford

I was sorry to leave Sydney where I had renewed many friendships and felt very much at home, despite the lapse of 38 years. I had been invited to join the '1954 luncheon club' at Sydney University, an interesting cross-section of senior academics, which reminded me a little of Balliol. I had also been interviewed for an Australian Broadcasting Company science programme by Robyn Williams who had been a visiting fellow at Balliol the previous year. In this broadcast I took the opportunity to criticize the way in which Australian universities had gone in for the *bums on seats* method of maintaining their finances, with Mickey Mouse courses invented to attract the largest number of students, I claimed. I must admit that I had enjoyed being away from England, living in a country where class and pomp are rightly despised, and a republic is on the near horizon. Will NZ follow in 40 years time?

In Auckland I stayed for six weeks with my daughter Elizabeth and her two charming children discovered their grandfather. Once again I went about the various universities giving seminars on such topics as the 'The influence of the philosophy of science on research', 'The Oxford University tutorial system' and of course the usual tokamak disaster stuff, although the latter attack had become rather like shooting fish in a barrel, with fusion research being run down. By this time Seddon Memorial Technical College where I had been a slightly reluctant student 60 years earlier had transformed itself into the Auckland Institute of Technology with ambitions to become a university. They claimed me as *their* 'Rhodes Scholar' and gave me an award to hang on my wall at home. It was my early patron, Cyril Maloy, who had raised my expectations at the Tech and was indirectly responsible for the course that my career had taken—I gave a seminar on the philosophy of science at AIT and was very pleased to have the opportunity to pay a tribute to Cyril, who was in the audience.

I arrived in Los Angeles to be met by Christopher Brennen who had arranged two days of meetings with some of Caltech's leading applied mathematicians. Best of all I was able to meet a very distinguished observational astronomer, Hal Zirin; I had read his book, *Astrophysics of the Sun* and greatly appreciated his ironic humour, especially when discussing the work of some theoreticians.

In La Jolla I stayed for three weeks with my cousin Grant Deane and Mike Buckingham, a scientist at Scripps Institute of Oceanography, took me out to Warner Springs for an hour and a half gliding about the hills where an amazing thermal lift got us up to 10 000 feet very quickly.

I encouraged Grant to go sailing with me at San Diego's Brighton Beach, a fine stretch on one side of a wide estuary, so we hired a 14 ft sailing dinghy after I told the operator that I was a very experienced sailor. (I once had my own 16 ft Albacore on the Thames and sailed it along the south



My patron, Cyril Maloy, with me in Auckland.

coast on several occasions.) Grant had not sailed much before, so I was the captain, full of authority and advice. The wind was gentle with gusts every now and again. After about 30 minutes during which Grant advanced his seamanship, we were sailing before a firm breeze when my peaked hat blew off. I directed Grant to go about, which put me on the down-wind side of the boat and we set off to recover the hat. I got it, leaning well over the gunnel and reaching out just as a strong gust struck the sail. To save the day I had to release the cleated mainsail rope quickly, but alas, I was too slow struggling up against the steep angle the dingy had assumed and over we went, me sinking into the murky brown water, spectacles and all. Unfortunately the long mast turned around to point downwards and stick itself firmly in the mud 12 feet below, so we floundered about with little chance of ever righting the boat. I had my watch and wallet, not to mention my shoes, on my person where fortunately they stayed, but 'laundering money' became a real experience for me later that day. We were about 100 yards from the shore and soon attracted a group of small motor boats, water scooters, people paddling about on rubber air-beds and other well-wishers, full of useless advice, much too cheerfully given. Pride comes before a fall not only on dry land. Sixty-five dollars later, we were able to laugh about it over a very late lunch.

At last I returned to England and my home again, but now better able to face the decade, which I expect remains to me, with lots of scientific work and some gliding targets to achieve. My health is good—well good enough—I have developed a stiff neck which I suppose makes me more of

an Englishman. The gout is tolerable, especially now that I have stopped passing the port and my inherited prostate weakness allows me to spend more time thinking than sleeping at night. But when I read the obituaries of friends and acquaintances, always checking on their ages, I notice that some are going early, even younger than me. Not being religious, I am expecting no after-life, so I must make the most of the time that remains to me. Balliol College is a pleasant sanctuary which softens my loneliness; I really am privileged in my declining years.

My various failures I can attribute to some extent to my recalcitrant attitude towards the Establishment—I remain ‘against the tide’. From an early age I was determined to be independent—beholden to no-one, to never seek patrons—an approach which is natural enough in an egalitarian society like New Zealand’s, but which is quite likely to fail in England. I find England a maddening country with its quaint titles, ersatz democracy, pretence and snobbery, yet I cannot bear to live elsewhere for long. Of course Oxford is a very privileged city, but I am implanted in the middle of the class system that has such a negative effect on education at large in the country. I suppose that I am a hypocrite—a bit like a millionaire socialist. I remain moderately hopeful, although I am now quite sure that the tide won’t turn.





# Index

---

- aerobatics, 70
  - over Oxford, 163
- aerofoils, 178
- Aeronautical Research Council, 160, 161
- aeronautical research, 141, 145, 168
- air force, 48, 50, 52, 127
- Allen, Carleton, 144
- Allen, John, 231
- Ardmore Airfield, 129, 145
- Ashby, David, 275
- astronomy 24, 308
- atheism, 30, 39, 55, 89, 149, 287
  - agnostic, 89, 90, 110
- Atiyah, Michael, 285
- Atomic Energy Research Establishment, 207, 231
- Auckland Institute of Technology, 310
- Auckland University, 29
  - College, 31, 32, 40, 94, 111, 130
- Australian Atomic Energy Committee, 200
- Australian Mathematical Society, 207
- Avebury, Lord Eric, 228
- axiomatics, 261
- Balliol College, 223–228, 297
  - business, 243–245
  - concerts, 271
  - Engineering Fellowship in, 212, 217
  - Fellows of, 217
  - Master of, 238, 243
  - NZders in, 227
  - professorial fellow of, 234
  - reputation of, 226, 244
  - Septcentenary party, 226
  - tutorials, Buttery and, 220
- Balogh, Tommy, 245
- Batchelor, George, 162, 178, 233
- Baxter, Philip, 200, 214
- Belin, Rudolf, 26, 33, 50, 111, 120, 143
- Bell, Ronnie, 238, 243
- Benjamin, Brooke, 281, 285, 292
- Bennet, John, 308
- Bickerton, Roy, 211, 305
- billiards, 41, 42, 43, 47
- Bland, David, 185
- Blumberg, Baruch, 246
- Bogle, Gordon, 197
- Boltzmann's equation, 308
- books published, 205, 253, 273
- Bougainville Island, 98, 116
- boy scouts, 27, 33
- Bray, Robert, 309
- Brennen, Christopher, 220
- Brink, David, 283
- Bryant, Ray, 307
- Bucharest, 256
- building sites, working on, 44
- Bullard, Edward, 187
- Bullen, Keith, 46, 147, 207

- Chong and, 194  
 Messel and, 197  
 Room and, 186, 189  
 Woods and, 187, 191, 195, 198  
 bullies, 7, 22, 23, 111  
 Busbridge, Ida, 173  
 Cairo, 210  
 capitalism, 51, 88, 138  
 capping ceremony pranks, 46  
 carbon monoxide poisoning, 9  
 Cawkwell, George, 212  
 Cercignani, Carlo, 304  
 Chapman, John, 286  
 Chapman, Sidney, 173  
 Chipmunk aircraft, 166, 167  
 Chong, Freddie, 190, 194  
 clarinet, 44, 50, 56, 293, 305  
 Clarke, David, 220  
 class system  
   English, 150, 152, 153, 223, 267  
   in NZ, 40, 87  
 Cobb, Richard, 269  
 communism, 39, 138, 257  
   newspaper for, 121  
   philosophy of, 88  
   rejection of, 179, 181  
 Communist Party, 138, 202, 243  
 conscientious objectors, 88  
 controlled thermonuclear fusion  
   CTR Division, Harwell, 211  
 Cooks Beach (NZ), 2, 14  
 Cornell University, 242, 255  
 Corsair aircraft, 103, 112–113  
 Cranfield, 164  
 crayfish, 1, 2, 36, 37  
 crocodiles, 289, 290  
 Culham Laboratory, 208, 231, 263, 295  
 Dalton, Cliff, 171, 196, 200, 205  
 Dardanelles, 184  
 Davies, Howard, 228  
 Davin, Dan, 227  
 Davy, Sir Humphrey, 4  
 de Wet, Jack, 173, 212, 229, 246  
 Deane, Grant, 283, 293  
 Derry, John, 166  
 Douglas Social Credit, 51  
 Drummond, Bill, 239  
 Eltayeb, Ibrahim, 289  
 Engineering Laboratory  
   (Oxford), 158  
 Engineering School (Auckland), 133  
 engineering science at Oxford, 142, 144, 159  
 engineers  
   status of, 24, 134  
 English Research Laboratories  
   failings of, 233  
 entropy, 252, 253, 255, 260  
 Espiritu Santos, 96, 112  
 examinations for M.Sc., 119  
 examiners, D.Phil, 161  
 eyesight, 65, 88, 119, 162, 165  
 fighter pilot  
   training of, 91  
 Fighter Squadrons  
   No 14, 122  
   No 16, 93–96, 111–113, 122,  
   No 17, 120, 121  
   No 18, 109  
 Finlay, Martin (MP), 111, 139  
 flying  
   as an instructor, 67, 75, 77  
   at altitude, 93  
   at night, 66  
   between trees, 78  
   controls, freezing on, 72  
   drogue towing, 67, 82–86, 90  
   first solo, 58, 59  
   forced landings, 60, 76  
   in formation, 92, 93, 96 101  
   into telephone wires, 75

- lost, 165
- low, 75
- on operations, 104
- weaving, 93
- with belly tanks, 93, 95
- Forder, Henry, 45, 148, 194
- Fox, Leslie, 178, 259
- Foxley Norris, Christopher, 162
- Franklin, Raoul, 231
- Freyberg, Bernard, 142
- Freyberg, Peter, 97
- fusion
  - energy of, 205
  - research in, 247, 250
- fusion programme
  - failure of, 296, 302
  
- Gallagher, Trevor, 74, 163, 166
- gelignite
  - fishing with, 3, 36
- geothermal regions in NZ, 19
- Germain, Paul, 180, 183
- gliding, 305, 306, 308
- God–Professor myth, 196
- Godsif, Jack, 86
- Goldstein, Sydney, 242
- Governor-Generals of NZ
  - Sir Bernard Freyberg, 142
  - Sir Paul Reeves, 16
- Green, Albert, 260, 262, 266
- Green Island, 100, 101, 106, 121, 122, 123
  - cloud cover over, 106
  - emergency landing on, 108
- Greig, Doug, 127
- Guadalcanal, 93, 97, 113, 121
- Gwynne, Michael, 237
  
- Hahei, 13, 15
- Halley's comet, 291
- hapuku, 13
- Harré, Rom, 139
- Harris, Don, 227
  
- Harsant, Florence, 5, 14, 15, 15, 16, 270, 282, 301
- Hartley, Harold, 224, 228, 266
- Hartwell, Max, 148, 197, 202
- Harvard aircraft, 64, 65
- Harwell, 207, 210
- H-bomb, 207, 215
- Head, Mac, 230
- Hill, Christopher, 227, 243, 244
- Hofmeyer Fellowship, 241
- Holder, Douglas, 177, 222, 229
- Hoskin, Bernie, 91, 109
- House of Lords, 245
- Howatson, Alastair, 229, 231
  
- Institute of Mathematics and its Applications, 259
- irreversible thermodynamics, 252
- Islamic Studies, 291
- Istanbul, 180, 183
  
- Jacob, C, 257
- James, Ioan, 285
- Japanese
  - aerial combat with, 96
  - as gardeners, 116
  - attitude to prisoners, 104
  - on Bougainville, 98
  - shore batteries, 100, 116, 122
  - skull, use for, 114
- Jebson (Jebby), W N, 134, 159
- Jerusalem, 242
- Jones, Mervyn, 112, 115
- Jones, W P, 177, 184
- Jowett, Benjamin, 226
- jungle survival packs, 104, 117
  
- Keefe, Frank, 56, 122
- Kendall, David, 174
- Kennaugh, Richard, 301
- Kenny, Anthony, 245
- Khartoum, University of, 289
- Kittyhawk aircraft (P40), 92, 113

- as bomber, 100
- belly tank of, 109
- Kunkel, Wolf, 237
- landing strips
  - accidents on, 99
- Laurie, Ernie, 96, 103
- Le Pine, Boyd, 121
- Leech, Tom, 46, 134, 139
- Lighthill, James, 162, 184, 259
- Lindsay Keir, David, 223
- logical positivism, 261
- Lomer, Mick, 275
- London smog, 185
- Love, John, 308
- Lubbock, Eric *see* Avebury
  - lecture, 228
  - scholarship, 224
- Lucas, Colin, 246
- Lucas Heights, NSW, 205
- magnetic confinement, 206
  - failure of, 212
- Maidment, Kenneth, 157, 196
- Maloy, Cyril, 26, 33, 36, 38, 310
- Mansill, Roy, 121
- Maoris, 4, 15, 16, 17, 40, 64
  - Florence Harsant and, 5
- marriage, 79, 94
- Marsden, Ernest, 180
- Marshall, Richard, 209, 303
- Massachusetts Institute of
  - Technology, 238, 293
- mathematics, 120, 135
  - applied, 147
- Maths Finals, 168, 172, 175
- Maxwell, James Clerk, 255,
  - 262–263
- Maxwell, Neville, 44, 48
- Mercury Bay, 2, 8, 9, 300
- Mercury Islands, 12
- Merton College, 144, 152–158
- Messel, Harry, 197, 213
- Methodism, 89
- Mexico City, 240
- Monash University, 212, 237
- Moscow, 235
- Motz, Hans, 222, 229, 231
- Mure, Geoffrey, 157
- Muscat, 287–289, 291
- Muskhelishvili, N I, 234
- Myers, Rupert, 203
- National Physical Laboratory
  - Teddington, 168, 177, 222
- New Britain Island, 101, 106
- New Caledonia, 95
- Newland, Tom, 57, 77
- Newman, Michael, 196
- Nizwa, Oman, 291
- Norfolk Island, 95
- Nouméa
  - brothel in, 95
- NSW University of Technology,
  - 197
- nuclear engineering
  - course in, 200, 205
- Nuffield Research Professor, 200,
  - 214
- NZ Scientific Defence Corps, 168,
  - 177
- Ockendon, Hilary, 286
- Ockendon, John, 259, 286
- octopus, 2, 36
- Officers' Training School, 69
- Oliphant, Mark, 208
- operational flying, 100, 113
- Orange, Freddie, 41
- Oxford Centre for Industrial and
  - Applied Mathematics, 286
- Oxford City, 151, 152, 214
- Oxford Technical College, 160
- Oxford University
  - colleges, 217–220
  - engineering, 222, 224, 229
    - attitude towards, 213
  - Mathematical Institute, 283

- tutorial system in, 218
- Oxford University Air Squadron,
  - 157, 162, 165
  - Hack trophy, 167
- Pacific War, 91
- Packard, Bill, 143, 171
- Pease, Bas, 211, 265
- Peierls, Rudolf, 231
- Penrose, Roger, 285
- philosophy, 94, 120, 127, 300
  - logical positivism, 254
  - of science, 253, 299
  - realism, 254
  - thermodynamics and, 260
- Pierard, Tony, 121
- Pillow, Fenton, 188, 191, 207, 298
- Pilot Officer, 79
- plasma confinement
  - failure of, 247, 274
- plasma physics, 206
  - in Oxford, 231
  - research in, 230
- plasma physicists
  - plasma pressure, 264–265, 300
- politics, 39, 138, 179
- Potts, Ren, 148
- Prigogine, Ilya, 253
- Prior, Arthur, 227
- Professorship of Mathematics (Theory of Plasma), 232
- publish-or-perish, 161, 189, 205
- Purangi River, 2, 4, 6, 13
- Rabaul, 56, 109, 122, 123
  - bombing of, 101, 106
- railguns, 303
- Rationalist Association, 88, 110
- rationing, 144, 155, 171
- Reese, Jason, 301
- Reeves, Paul, 18, 301
- religious faith, 7, 30, 39, 149
  - changing, 55, 88, 90
  - communism and, 88
  - declaring, 55
  - proselytizing, 110
- Rhodes House, 144, 152
- Rhodes Scholars, 140, 157, 171, 196, 213, 224, 227, 297
- Rhodes Scholarship, 140–144, 143, 281
- RNZAF, 45, 48, 88, 128, 129
- Robinson, Derek, 296
- Robinson, Robbie, 269
- Romania, visit to, 256
- Room, T G, 186
- Rosenblat, Simon, 196, 242
- Rotorua, 4
- Royal Society, 228, 266, 281
- rugby, 28, 34, 40, 69
- scholarship, 32–36, 37
- Scholfield, Nick, 267
- Seddon Memorial Technical College, 23
- Sedov, L I, 204, 235
- Segedin, Cecil, 46, 80, 120, 135, 194
- Serbia, hospitality in, 181
- Sheldonian Theatre, 170
- shock waves, 160
- Sievers, Alan, 101, 102
- Singapore, fall of, 82, 87
- sister *see* Willis
- Smith-White, Bill, 194
- Smithyman, Kendrick, 29, 40, 89, 111
- snooker, 43
- socialism, 40, 51, 87, 146
- solar physics
  - prominences, 308
- solar wind, 239
- solo flights (first on type), 92, 113
- Solomon Islands, 91, 93, 97
- South Africa
  - visit to, 241

- Southern, Richard, 226  
 Southwell, Richard, 158, 160, 186  
 Soweto, SA, 241  
 Spence, David, 230  
 spins in planes, 59  
 Squire, H Brian, 177  
 St George, Douglas, 91  
 Starnes, Keith, 112, 114, 118  
 Stevenson, Cliff, 136, 169  
 Stuart, J Trevor, 177  
 student politics, 136, 139  
 submarines, 101, 115  
 subsonic flow  
   book on, 204  
 Sultan Qaboos University, 287, 290  
 Swaziland, 242  
 Sydney, 147, 209  
 Sydney University, 188, 192, 197, 198
- Taieri, Dunedin, 56  
 Taupo, 4, 5, 11, 18  
 Tauranga, 69  
 Tayler, Alan, 238, 239, 259  
 Taylor, Brian, 232, 233, 275  
 Taylor, Geoffrey ('GI'), 183  
 Tbilisi, 235  
 Te Kanawa, Kiri, 281  
 Technion, Haifa, 242  
 Tel Aviv, 242  
 Temple, George, 161, 186, 228, 229, 266, 281  
 thermodynamics, 195  
 thermonuclear fusion, 206  
 Thom, Alex, 145, 158, 160, 222  
 Thompson, Bill, 231  
 Thoneman, Peter, 211  
 Thornton, Barry, 270, 307  
 Tiger Moth, 57, 69, 73, 77, 163  
   aerobatics in, 62  
   at sea in, 63  
   crashing, 81  
   engine cleaning, 79  
   in a haystack, 80  
   instructing, 67  
 tokamaks, 247–252, 272–280  
   ALCATOR, 294  
   economics of, 277  
   failure of, 266  
   instability of, 251, 276, 303  
   Joint European Torus (JET), 247  
   politics of, 275–276  
   radioactivity in, 249  
   transport of heat in, 265  
   vast cost of, 249, 272  
   why they failed, 273–275  
 Torokina airstrip, 98, 101, 118  
 transonic flow, 159  
 Troughton, Helen, 259, 269, 291  
 Truesdell, Clifford, 235  
   rational mechanics and, 260  
 Tsavo National Park, 237  
 Tucker, Freddie, 96, 114  
 Turner, David, 246  
 tutorial system  
   (Oxford), 173, 218–220
- University  
   of California (Berkeley), 237  
   of Iasi, Romania, 258  
   of Maryland, 241  
   of NSW, 200, 307  
   of NZ, 32, 90  
   of Tel Aviv, 242  
   of Texas at Austin, 239  
   of Witswatersrand, 241  
 university politics, 202
- Vancouver, 258  
 Vickers Vincent a/c, 66, 82, 84  
 von Engel, Hans, 231
- Ware, Alan, 277–280  
 Watson, Philip, 172  
 Watson-Munro, Charles, 200

Westfold, Kevin, 189, 196  
 Whale, Harry, 39, 41  
 Whenuapai airfield, 95  
 Whitianga, 2, 3, 4, 6, 13  
 Williams, Bill, 213, 246  
 Williams, Robyn, 310

Willis, Al, 198, 201, 214  
 Willis, Beverley, 28, 48, 192, 237,  
 298, 306

Woodhead  
 Alex (brother), 48, 192  
 Ambler (grandfather), 5  
 Beverley (sister) *see* Willis  
 Binny (father), 4, 11, 19, 50,  
 269, 282  
 Florence (aunt) *see* Harsant  
 Gwen (mother), 4, 5, 11, 94,  
 269

Trevor (brother), 3  
 Woods  
 Betty, 79  
 daughters  
 Coral, 118, 128, 136, 160,  
 171, 230, 240, 267  
 Diane, 160, 239, 267  
 Jill, 139, 240, 267  
 Liz, 169, 268, 310  
 Pat, 169, 268

wives  
 Betty (1), 269, 87, 94  
 Helen (2) *see* Troughton  
 Suzanne (3), 297, 298, 304

Yugoslavia, 181, 182

ZETA, 248  
 Zirin, Harold, 310

