

CHAPTER SIX

Lightning Changes

After spending Christmas with our families, Phyll and I were married by Pat MacLaren in the St Peters College Chapel on Wednesday December 30th, 1936. Cuth Bammann was my best man and his fiancée Berenice Bailey was Phyll's bridesmaid. We had two other bridesmaids, Phyll's friends Keturah Lean and Joan Beams, and two groomsmen - my fellow engineering graduates Gordon Allen and Sid Smith. George Gardner, my old singing master at Saints, played the organ. My only worry was whether he would turn up, but he arrived at the last minute. Phyll and her bridesmaids all looked magnificent.

The reception was at the Maple Leaf Cafe in King William Street, and we drove to the Bridgewater Hotel in the Adelaide hills for our wedding night. Next evening we caught the Melbourne Express at Bridgewater station, but I was somewhat taken aback when Phyll's parents and two sisters arrived to escort us to the station at 8 p.m. It seemed they were not prepared to let her go easily! We saw the new year "in" on the train.

We relaxed for two days at "The Victoria" in Little Collins Street. I took Phyll to see our new home. She was happy with my choice. We were paying two weeks rent before taking possession, and we spent the next week at Marysville, a lovely mountain resort in the Dandenongs. There we enjoyed walks through beautiful Mountain Ash

timber country, with waterfalls and tree-fern gullies. On the day we returned our furniture was delivered, gas, telephone and electricity were connected and my income tax assessment arrived. The home was established!

In the next few days we washed clothes, shopped for household odds and ends, bought carpets, kitchen furniture, crockery and cutlery and called at Yalcowinna to see Bob Moodie and John Macvean. The Regal Cinema was under construction at the corner of Camberwell and Toorak Roads, Hartwell, only a stone's throw from our home. We would not have to travel far for entertainment! I laid linoleum on the kitchen floor, assisted by the son-in-law of our landlady who lived opposite us in Toorak Road.

Two days after I resumed work at the Research Laboratories I was instructed to travel to northern New South Wales and southern Queensland to investigate trouble on the Sydney-Brisbane broadcast carrier relay route due to interference from lightning. This route passed through one of the worst lightning districts in the world, and January and February were the worst months for the incidence of thunderstorms. I was to collaborate with Alan Chisholm, an engineer in the Sydney Branch. The prospect of some real research work excited me.

However, I could hardly leave alone in Melbourne my bride of three weeks, knowing hardly a soul and feeling

with me. I was to be provided with first class train fares and accommodation for the duration of the trip, but I could not afford to pay the same amount for my wife. I suggested to Mr Witt that they pay me the first class fare, which I would use to buy two second class tickets. This was accepted, and we left by train for Sydney on Sunday January 24th, after insuring our household goods for L600.

Alan Chisholm joined us at Albury, where we changed trains. He briefed me on the nature of the trouble being experienced, which sometimes made unacceptable the relays of radio programmes between Sydney and Brisbane.

It was customary for an officer from Central Office to pay a courtesy call to the "top brass" in a State Branch, before undertaking any work in the State concerned. Therefore I had interviews with the Deputy Director Mr Duncan and the Superintending Engineer Mr Hipsley in Sydney before catching an excursion train for Grafton on Monday evening. We passed through a thunderstorm en route and spent five nights taking measurements and observations at the Grafton Repeater Station, joined by Harry Little, another NSW engineer. Overnight work was necessary, as the lines could not be taken out of service until the broadcast relays finished about 11 pm. A thunderstorm occurred somewhere along the route on Sunday, giving some interesting results. Our

Although direct lightning strikes to overhead telephone lines are rare, the proximity of a charged thundercloud induces electrostatic charges on the lines, and lightning strikes in the vicinity cause electromagnetic interference - which is heard as thumps, bumps, scratches and clicks in the line communication. Severe thunderstorm activity can render a broadcast carrier channel unusable, if suitable technical protection is not provided to mitigate the effect. Furthermore, the discharge of lightning-induced electrical charges (by some types of protective devices connected to the lines) can result in a residual current-leakage which produces sustained "static" noise.

We moved on to Brisbane on Monday February 1st, to be met by Sam Ross, the Brisbane Transmission Engineer. I spent three nights making observations there, without finding any more lightning interference. Alan Chisholm returned to Sydney and Phyll and I caught the train back to Grafton. We stayed six days at Grafton during which there were thunderstorms on three days at Kempsey, Chatswood and again at Kempsey. These gave more useful information. Then back to Sydney for discussions with Harry Little and Dick Knuckey. I collected much statistical data.

I had some free time in Sydney, and took Phyll to

Colonel de Basil at the Theatre Royal, where we saw "Carnaval" and "Scheherazade" danced with Helene Kirsova and Tamara Tchinarova. Also the great Charles Laughton in the film "Rembrandt". Returning to Melbourne on Saturday night I reported back at the Laboratory on Monday after an absence of three weeks. Phyll was a bit sick of staying at hotels and having to amuse herself - being married to an engineer can make life difficult. It was good to be home again.

A week later we received a communication from the estate agent, headed -

"NOTICE TO QUIT"

This was a bombshell!! Although we had paid rent for eight weeks, we had actually occupied the house for only three, and now we had one month's notice to move out! It transpired that our landlady was selling the house to her son-in-law, and we had merely been "keeping it warm" while he was arranging finance. He had kindly helped me lay the kitchen lino in the house he was about to purchase! One such experience with a real estate "shark" was enough. I decided we would use the small amount of capital at our disposal to purchase a house of our own. No more renting for us!

In our brief stay at the Hartwell house Phyll had managed the cooking very well and we had visits from several of our friends who sympathised with our

We spent the next three weeks looking at houses for sale. About a mile away there were 22 all-brick houses under construction in a new street in Burwood. One of these was available and it suited us fine - on a hill, close to the tram with a pleasing view across to Camberwell Junction at the rear. It had six rooms, a gas hot water service, tiled roof, a garage with a concrete driveway, for a purchase price of £1250 - with a deposit of £150 and two mortgages. The weekly payments of interest plus reduction of principal amounted to only £2 per week - little more than the rent we had been paying. This was marvellous. I had the remains of a small legacy from my grandmother which was just sufficient for the deposit. From there the electric tram fare to the city was still only sixpence for the eight mile journey of 35 minutes.

Bob Moodie gave me some friendly advice regarding the legal aspects of the transaction and we bought the house. Don Burnard with "Albert" helped us move our books and personal belongings when we took up residence in March. Our home was very comfortable, but of course there was no garden - just a pile of rubble left by the builders. I had to begin a new hobby - gardening! Torchy Thomas lent me a mattock and Mari lent Phyll her sewing machine.

We had visits from Marjorie, Phyll's parents, dad, and then mother with Marjorie, from Adelaide during the year. Mr Williams helped me in the garden and Hilda and Helen Newell often called in with flowers and plants on Saturdays, on their way home to Wantinna from their Camberwell shop. Ned was a great help with supplies of seedlings and bulbs. Often I brought home specimens from my laboratory colleagues. The front lawn was sown in October, when it rained incessantly for three days and I had to dig a drain round the house - thankful that we lived on a hill. All our friends came to see us. Don and Doone had their first baby, Robin, in August. Colin Moodie passed through on his way to Canberra and Eric Cottrell went to South Africa to work for six months. Eric became engaged to Maxine Wicks of Broken Hill in November.

During the year we saw productions of Wild Violets, Lilac Time and Balalaika and the G and S Opera "Utopia Ltd" for the first time. We saw the film "Mr Deeds Comes to Town" at the newly opened Regal Cinema at Hartwell in May and listened to the coronation of George VI at Westminster Abbey by radio. It was a year full of changes, but the United Australia Party under Joe Lyons was returned to power in the Federal Elections of October.

At work I spent a considerable time researching

interference from lightning and accidental contact with, or interference from, aerial power lines. I devised laboratory methods of testing various systems of protection and instituted a series of tests at the Repeater Stations of Katoomba and Glen Innes in NSW and Stanthorpe, Chantres Towers and Atherton in Queensland to determine the relative energy level of longitudinal surges produced by lightning during the thunderstorm seasons of 1938/39 and 1939/40. In 1937 the only protective devices on the Sydney-Brisbane line were air-gap carbon-body arresters and, at some places, two electrode gaseous discharge tubes, and the breakdown voltages of these were undesirably high.

I had concluded that the chief cause of "static" noises on trunk lines, resulting from lightning, was asymmetric breakdown of the arresters on the two wires of a line pair - due to the unequal breakdown voltages of the two arresters concerned. I developed and tested the relative merits of several alternative systems of protection, designed to assist symmetrical breakdown. The findings of these investigations were published in three issues of The Telecommunication Journal of Australia in 1939 and 1940, under the heading "The Characteristics and Applications of Protection Equipment for Telecommunication Services in Australia".

In early 1940 I made a second trip from Sydney to

travelling by train on the inland route through Tamworth, Glen Innes, Stanthorpe and Toowoomba. This involved catching trains at unearthly hours, sometimes in the middle of the night. I heard some fascinating stories about lightning strikes. One fellow told me that if lightning struck a tree in a cow pasture, any cows standing along lines radiating from the tree would be more likely to be killed than those standing at right angles to such lines - because there would be a greater earth-potential difference between their front and back legs than there would be between the left and right legs of the other cows. Another story concerned a fireball, which entered the open front doorway of a motor service station, rolled through and disappeared through the open rear doorway - accompanied by a strong smell of brimstone.

On reaching Brisbane I waited several days, with no sign of thunderstorms. Brisbane in summer is a humid, coatless city. I was having a shower in my hotel when I heard a celestial "BOOM". Dressing hurriedly I phoned for a taxi to the Trunk Terminal. On completing my measurements I ventured on to the flat roof to see where the storm was coming from. It was everywhere! Great flashes of lightning streaked across the sky above, as though all Hell was let loose. My shirt was saturated just crossing from the building to a taxi.

The Brisbane War Memorial has a flat masonry drum supported by a ring of columns, with an eternal flame burning at its centre. I read in the newspaper that a "sundowner" had been arrested for cooking sausages over the flame. Nothing is sacred in the north!

Returning to Sydney by the coastal route, I stopped at Murwillumbah, Grafton, Kempsey and Taree. The local PMG mechanic at Taree invited me to fish for flathead with him in the shallows of the beach. I wore a hat and coat over my trunks, and the sun was very warm. When I boarded the tram for Sydney my ankles felt sore, and the train was so full I had to sit on my suitcase in the corridor. Arriving in Sydney next morning I realized I had a case of sunburn - my ankles were red and swollen.

Fortunately I had a pair of sandshoes, and I wore these while I made my necessary engineering contacts. I had booked a room on the eleventh floor of the Morris Hotel, and on returning in the late afternoon I flopped on the bed and fell fast asleep - dog tired. Awakening about 11pm I was hungry. Cafes in the city were closed at that hour, so I took a taxi to Kings Cross - where you can find a meal at any hour. I returned to Morris at 1am to find that the lift had stopped running at midnight! I had to climb those eleven floors with burning feet. When I returned to Melbourne I had to take a week's sick leave to allow my feet to recover. I have reason to remember

My findings on the subject of lightning interference were summarized in the comprehensive Research Laboratory Report No. 3098, titled "Systems of Protection against Excessive Voltages on Trunk Lines and for the Reduction of "Static" Interference from Lightning".

I had some respite from lightning research, in the form of participation in various technical exhibitions. In April 1936 "The Argus", then one of Melbourne's three morning papers, organised a Modern World Exhibition at Earl's Court, St Kilda (when I first came to Melbourne I was intrigued by the cry of the newsboys in the city streets - who called "Sunayganargus", which, being interpreted, was "Sun, Age and Argus"). I was asked to arrange an exhibit for the Laboratories, and canvassed the various research groups for suitable material. One of the subjects chosen was the use of ultra-violet light in material testing. We displayed an array of postage stamps which fluoresced under UV radiation.

In the following September the Labs were asked to take part in a PMG exhibit at the annual Royal Agricultural Show at Flemington, and I was detailed to organise this. I developed two exhibits - one using UV light and the other using a cathode ray oscilloscope. I designed a small stage, about 6 ft long and 18" high, labelled "Fluorescent Revue". Within this, before a

were moved from right to left by a hidden motor-driven belt. The figures illustrated seven current Post Office slogans, with a touch of humour, such as -

"Say it by telephone" - (a young man proposing to a girl)
 "Telegraph your congratulations" - (a telegraph boy with the bride and groom)
 "A Telephone for the family" - (dad and mother with three children)
 "Post early each day" - (a pajama-clad figure posting a letter).

I enlisted the services of a clever artist in an advertising firm to draw, cut out and colour these figures. They were painted with special paints which I supplied, to fluoresce brightly in different colours under ultra violet light. They were beautifully made, with just the light-hearted approach I needed.

The right half of the stage was illuminated by ordinary incandescent light, and the left half by UV light - with black louvres placed to prevent cross-illumination. As the figures moved from right to left the colours changed dramatically when they entered the UV zone. A caption read -

"WATCH THE COLOURS CHANGE!"

The oscillograph exhibit comprised a microphone, gramophone turntable and pick-up, and an audio oscillator - all arranged to feed into the oscilloscope to show speech, music and tone waveforms, with a loudspeaker to make them audible. Spectators were invited to speak into the microphone, and a caption read -

I enjoyed this project greatly, because it involved "show business", and it attracted considerable attention.

The Labs were asked to participate again in the 1939 Royal Show. This time I used the same "Fluorescent Revue" but re-designed the "See your voice" exhibit, housing the equipment in a tall cylinder placed within a squat cylindrical enclosure for the operator. Both exhibits were finished in sky-blue with pillarbox red trimmings and looked very striking. They were awarded first prize in the Hall of Industry.

Two doors from our Burwood home lived a young couple about the same age as Phyll and myself - Jane and Fred Jones. Fred was a banker and a great tennis player. Jane had a wide circle of friends, mostly from her schooldays at Tintern Grammar, and they loved throwing parties. We became great friends, with many happy evenings at Jane's home and the homes of her friends - and they visited us in turn.

The Dramatic Club of the Tintern Old Girls Association presented the A.A. Milne musical play "Toad of Toad Hall", adapted from Kenneth Graham's "Wind in the Willows", at Central Hall, Little Collins Street in September 1939. Several of Jane's friends and their husbands took part and it was quite a creditable production. The same group were to present "The Ghost Train" by Arnold Ridley in the same hall in November 1940

- in aid of the "Soldiers Hut" which had been established in the grounds of St Pauls Cathedral for troops in Melbourne. I was asked to give some backstage assistance.

Now the whole action of "The Ghost Train" takes place at night in the waiting room of an English country railway station. A door, centre stage, leading to the platform, is flanked by frosted glass windows on either side. My job was to produce the effect of lighted carriage windows passing these frosted panes as the train pulled in to stop at the station, and then departed after some passengers had alighted. I borrowed an effects record of train noises - approaching, stopping and leaving - from the ABC, and prepared two light-boxes with sliding tabs perforated with a row of rectangular holes. These were mounted on two tables behind the waiting room windows, so that they could project "lighted carriage window" images on the frosted glass panes. The two light-boxes were several feet apart and their sliding tabs were joined by a string, so that when one was pulled the other followed in synchronism.

All went well at rehearsal. The amplified sound of the approaching train was followed by "window lights" flashing past the frosted panes of the waiting room, slowing to a stop as the train halted with hissing steam and doors banging. It was all very realistic and I was

proud of our efforts. I pulled the front tab and an assistant guided the rear one to ensure smooth movement.

On the production night the effects record started on cue and, as the "train" entered the station, I began to pull the tab and the lights flashed by. Unfortunately my tab suddenly jammed and my assistant, thinking the string must have broken, continued to feed his tab past his light box. The effect was that the front carriages had come to a sudden halt, and the rear carriages with continuing train noises were telescoping somewhere behind the waiting room door! The audience was convulsed, and the remainder of the play was treated as slapstick-comedy rather than the thriller it was intended to be.

It took me a long time to recover from the humiliation of this breakdown. There was only one performance, so I had no opportunity to redeem my reputation. My assistant and I appeared on the programme as "technicians". Wreckers, would have been more appropriate. It was a lesson I have never forgotten. That was my first and only part in an amateur dramatic production, but our friendship with Jane and Fred Jones and their circle of friends continued for many years.

In contrast, my sister Marjorie took part in amateur theatrical productions in Adelaide with conspicuous success. She already had some experience acting in plays produced by the students of the S.A. School of Arts and

Crafts, but in 1938 and 1939 she worked with The Playbox Theatre, an amateur group producing plays at the "Australia Hall" in Angas Street. On three nights in November 1938 they produced a musical comedy "His Royal Highness", adapted from an old play. The producer was Lloyd Prider. Marjorie wrote the lyrics to music composed by Maurice Sheard, and also painted the scenery for the first act, assisted by her friend Madge Searcy. There were fourteen musical numbers!

In November 1939, again for three nights, they produced an original musical play "Tropical Trouble". Marjorie collaborated with Lloyd Prider in writing the book and lyrics, to music by Maurice Sheard for twelve musical numbers. Marjorie and I enjoyed exchanging verse. I sent her a telegram on the closing night ("Fish" was her nickname to friends) -

"May Tropical Trouble Fish Sheard delight
Prove Prider the Playbox this Saturday night
May production accomplish most ambitious aims
With attendance in spirit
love
Phyllis and James"

I received Marjorie's reply next day -

"Thanks for your telegrammatical rhyme
Tropical Trouble lived up to its nine
Marjorie"

With typical bureaucratic lack of humour, the Post Office confirmed the words telegrammatical and nine at the foot of the telegram - they just couldn't believe

there could be such words! The play, with proceeds going to the Red Cross, received excellent reviews.

In 1940 Marjorie became involved in productions by a ballet group known as "Les Ballets Contemporains", directed by Joe Siebert in North Adelaide. She painted scenery, designed costumes, acted miming parts and gave spoken commentaries. They developed a repertoire of some 20 ballets, produced to recorded music, with four or five seasons a year.

I was very proud of my sister's activities in the art world, the amateur theatre and in the many facets of ballet. It was sad that we had to live in different cities for the rest of our lives.

It was in 1937 that I really began to see a future in television development. One of the *greatest* advantages of working in the Research laboratories was the access it gave me to a wide range of technical periodicals from England, America, Europe and Japan. About 24 of these journals published articles about developments in television equipment overseas, and in particular the Journal of the Society of Motion Picture Engineers from the U.S.A. and Wireless World from England kept me abreast of the work being done in those two countries on an experimental basis. I began a card index system of my own, giving references to relevant articles and extracts from them.

On November 2nd, 1936, the BBC had inaugurated the world's first broadcast TV service for a few hours each day. On alternate weeks they used the Baird system, which was mechanical with 240 picture scanning lines, and the Marconi-EMI all electronic system with 405 lines - both transmitting 25 complete pictures per second. This arrangement was to continue for three months to enable the relative merits of the two systems to be evaluated. I awaited the outcome of these trials with great interest.

At the end of January 1937 the BBC ceased using the Baird system and adopted the Marconi-EMI system for all transmissions. In the USA there was still no public television service but several firms were experimenting with systems, and in 1936 the Radio Manufacturers Association (RMA) had recommended a 441 line picture standard with 30 complete pictures per second, interlaced in two fields per frame. The Federal Communications Commission (FCC) had not ratified these standards, but allocated certain radio frequency channels above 42 Mc/s for experimental TV transmissions.

The broadcast transmission of such television picture signals required radio frequencies above about 40 megacycles per second, because of the very high video modulation frequencies involved. Such radio frequencies are subject to propagation limitations, and this and the possible effective radiated power of the transmitter

determined the service area of a television station. Therefore I was particularly interested in papers published on the propagation characteristics of such high frequency radio waves. I was interested also in experiments being carried out in the USA to determine what types of television programme material would be acceptable to the public, and whether a service providing such material would be commercially viable - because television in the USA, like radio broadcasting, was destined to be a commercially funded service.

Mr Witt was intensely interested in television, and he once said to me

"This is the first time in history that mankind has perfected a complex engineering system before he knows what to do with it!"

Sometimes I wonder if mankind has even now arrived at a proper use for TV. Mr Witt also said -

"I am sure that a use will be found for it, because it is an extension of the human senses."

The more I read about TV the more enthusiastic I became about it - as a system and as a future source of entertainment and information to the public. Here we had something that involved all the things that interested me - electronics, mechanics, photography, artwork, design, acting, music, dancing, writing, or as one writer has said -

"All the arts that God has given to man."

I was convinced that TV would eventually come to Australia, and I wanted to be involved in it.

I decided to write a paper for presentation at a meeting at the Juniors and Students Section of the IEA. It was to be called simply --

"Recent Developments in Television"

At this stage most Australian engineers knew nothing about television. Therefore my paper began by discussing the concept of a television system, describing the scanning process and early mechanical systems such as those developed by Baird in England in the late 1920s and by Jenkins in the USA. Then I went on to examine photo electric devices, methods of picture reproduction and the requirement for synchronizing scanning at the originating and receiving points. I discussed the requirements for picture definition and repetition rates, transmitter modulation frequencies and broadcast radiation frequencies, the use of the cathode ray tube for picture reproduction and the electron cameras currently in use. I dealt with the problem of film scanning and finally reported on current TV developments in Britain, the USA, Germany, France and other countries, with a reference to the experimental 30 line, 12 and a half pictures per second transmissions made from the Observatory Tower at Brisbane on radio broadcast frequencies.

Realising that understanding of the operation of a TV system would be assisted by an experimental demonstration of the basic principles involved, I designed a 30 line Nipkow disc and had it manufactured in the Laboratory model shop. It followed the original design of Dr Nipkow in Germany in 1884. The sheet steel disc, 16" in diameter, had a spiral of $1/32$ " holes drilled at radial distances increasing from 5" to 6" from the centre at angular intervals of 12° . The periphery of the disc was slotted at 120° intervals with 30 equal slots 1" deep, aligned radially with the $1/32$ " diameter holes. It was expertly constructed by George West of the model shop, and mounted on the shaft of a 1500 rpm (ie. 25 revs per second) electric motor.

A lens system was arranged to throw an image of a letter, cut out of an opaque card in a 1" square, on to the spiral of holes, with a photo-electric cell on the other side of the disc - so that when the disc rotated the holes scanned the letter image and the photo-electric cell received the resulting light pulses.

The signals from the photo-electric cell were amplified and used to control the intensity of the electron beam in the 5" cathode ray tube of an oscillograph. The electron beam was made to scan the CRT screen vertically at 750 times per second (ie 30×25)

and horizontally at 25 times per second, corresponding to the scanning rates of the holes in the Nipkow disc.

The slots in the periphery of the disc were used to produce a series of signal pulses by chopping another light beam feeding another photo-electric cell. These pulses, at $30 \times 25 = 750$ times per second, were amplified and used to keep the CRO scanning beam running in synchronism with the scanning of the Nipkow disc.

The whole assembly of equipment was put together in the laboratory dark room. When operated with the room lights out, crude but satisfactory images of the cut-out letters were reproduced on the CRO screen. Crude it may have been, but it served to demonstrate the principles of television transmission. This work was all done after hours in my own time, and the Laboratories asked me to emphasise that "The demonstration was included merely to demonstrate television principles, and not in any way as an example of serious experimental work".

My paper was presented at a meeting of the IEA Juniors and Students Section in Kelvin Hall, Collins Place (now Exhibition Street) on the evening of Tuesday September 14th 1937. It was well received, and at the conclusion of the paper members were invited to walk across to the Laboratories (only a block away) and see the demonstration.

This was possibly the first production of a television "image" on a cathode ray tube screen in Australia, as other experimental demonstrations had employed mechanical scanning for reproduction. It is interesting to note that in the report of the meeting in the IEA Journal of November 1937 it was stated -

"After refreshments had been served, members visited the Research Laboratories, Postmaster General's Department, Melbourne, for a demonstration of cathode ray oscillography."

This was in keeping with the desire of the Laboratories that there should be no suggestion that the Department was preparing for television in Australia. In February 1938 I repeated this paper to the Postal Electrical Society of Victoria at the Melbourne Technical College, but without the demonstration - which by then had been dismantled.

However, Mr Witt was interested in my activities, and in December 1938 he asked me to prepare a detailed estimate of the necessary characteristics and probable cost of a television service in an Australian capital city, with a standard equivalent to that provided in Greater London by the BBC station then operating at Alexandra Palace. Because of the ready availability of local information I chose Melbourne as the test case. This study took me three months and the results were

embodied in the confidential Research Laboratory Report No. 2386 of March 1939, entitled -

"Study of overseas developments in Television in relation to possible future services in Australia".

The Report examined population distribution, desirable transmitter location, topography within the service area, desirable radio frequency, required field strength, radiator height and transmitter power. It examined the published characteristics of established high-power TV transmitters overseas (all of which were experimental except in the BBC service) and speculated on tentative standards for Australia. The Report then estimated probable costs of transmitter and studio installations and running costs - based on published information from overseas - discussed possible licence fees and the cost of domestic receivers.

It was suggested that this work could form a skeleton on which future calculations and estimates might be based, although the results arrived at were largely hypothetical and the costs estimated were very approximate.

About this time Colin Moodie was released from External Affairs to serve as Private Secretary to the Treasurer, Richard Casey for several months. In April 1939, Prime Minister Lyons died while still in office. Earl Page then acted as caretaker P.M. for 19 days, until

Bob Menzies was elected P.M. he had a hard task ahead of him.

On Sunday September 3rd, 1939, the half-expected and dreaded declaration of war against Germany was broadcast to the nation at 9.15pm. Next day the laboratory staff, assembled for morning tea in the lunch room, listened in stunned silence to a rebroadcast of the announcement. Then the immediate reaction was "What will we have to do?" and "How long is it likely to last?"

For some months it had no appreciable effect on Australian life, and the effect on Britain was just as uncertain. The BBC television service had ceased abruptly at 12 noon on September 1st, when the outbreak of war seemed imminent. They feared that German bombers might "home-in" on Alexandra Palace as a target for London. BBC television was to remain dormant for nearly seven years.

The initial period from September 1939 to May 1940 was referred to by both Neville Chamberlain and Winston Churchill as the "Twilight War" - hostilities being confined chiefly to German submarine attacks on Allied shipping. The newspapers called it a "phony" war.

During this period I was given the job of collaborating with Australian Associated Press in experiments with portable equipment for the transmission

of photographs and diagrams over telephone lines. It was intended for use by reporters, who would place a standard full-plate photographic print round a rotating drum, go to the nearest telephone, dial their newspaper office number and transmit the photograph by sitting the telephone receiver on a coupling device which fed the picture signals electro-magnetically into the telephone lines. These experiments were carried out at the Herald Office in Flinders Street.

I had one further opportunity for television work. The Australian agents for the British General Electric Company had imported two English television receivers as a publicity stunt, displaying them (but of course not operating) in shop windows in the capital cities - one had a 9" screen and the other 15". With the outbreak of war and cessation of BBC television there was no point in returning these to England, so they presented them to our Laboratories. Extensive repair work was required, as they had been roughly handled in transport around Australia. With the assistance of Harry Terns, one of our laboratory technicians, the receivers were restored to working condition. The Lab had recently imported a Du Mont "Phasmajector" tube from the USA. This was a type of cathode ray tube in which the usual fluorescent screen was replaced by a plate carrying an engraved head of Abraham Lincoln. When this plate was scanned by the electron beam the output signal could be used to

reproduce the Abraham Lincoln image on a television receiver, when fed into the video amplifier.

As our source of these picture signals had no synchronizing pulses, we had to adjust the sweep frequencies of the Phasmajector tube to bring them into synchronism with the sweeps of the TV receivers - which operated at the BBC standard of 405 lines and 25 pictures per second. As the Phasmajector sweep frequencies were progressively lowered to the right value we derived some amusement, with multiple images of Abraham Lincoln all over the TV screen, starting with the size of postage stamps! It was good experience.

At this time, cathode ray oscillographs were still regarded more as laboratory equipment than as tools to be used in the field. I had been making considerable use of them and wanted to advertise their practical value. Therefore I wrote a paper entitled -

"Some practical applications of cathode ray tubes" which was presented at a meeting of the Electrical Engineering Branch of the IEA on June 4th, 1940. This paper discussed the development of the cathode ray tube and described twelve different applications for its use in measurement, analysis, detection and comparison of engineering parameters ending with the function of TV picture display. I assembled equipment in the lecture room which demonstrated all these applications, including the picture of Abraham Lincoln on the G.E.C. 9"

television receiver. The demonstration worked perfectly and created considerable interest. I was asked to repeat this paper and demonstration before the Institution of Radio Engineers in the same year, and again in 1943 before science undergraduates at Melbourne University. It was published, in amplified form in The Telecommunication Journal of Australia of October 1946.

With fellow engineer Bob Warnock, I collaborated in the presentation of a joint paper on "Gaseous Discharge Tube Lighting" at a meeting of the IEA Juniors and Students Section in September 1939. Bob's part dealt with highway lighting, and mine with UV and industrial fluorescent tubes - which were then just being introduced. Our paper was awarded the Edward Noyes Prize for 1939.

In May 1940 Neville Chamberlain resigned as Prime Minister of Britain, to be replaced by Winston Churchill. The end of May saw the momentous evacuation of some 100,000 British and French troops from Dunkirk by 850 vessels of all kinds, including even small private boats, across the English Channel. This was followed soon after by the onset of the horrific Battle of Britain, which continued for months with the demolition of cities and tragic losses of air crews on both sides. It was in the second half of 1940 that the realisation of being a country at war with Germany really hit us.

The Research Laboratories were to play their part in the war effort. The time had come for some more lightning changes.