

CHAPTER NINE

Television Tremors

Public television services resumed in London, and began in the USA, in 1946.

There was only one BBC transmitter, serving Greater London from the Alexandra Palace. Despite technical advances with the development of radar during the war - in pulse generation, wide-band amplification, cathode ray display and VHF transmission, all of which were relevant to TV systems - the BBC decided to resume transmission on the same 405 line basic standard that they had adopted in 1937. This was because there were some 20,000 pre-war receivers in the hands of the public, serving an estimated viewing audience of 100,000 in the London area. The British Government did not wish to make these receivers obsolete by adopting a different standard, and they considered that a change involving only another 100 or 200 lines would prejudice more substantial improvements at a later date - which might include colour. Such a change would also have introduced an undesirable delay in the resumption of a service. Perhaps they were reluctant to lose the lead they had already established over America in the commencement of a public service. Alexandra Palace resumed transmissions on June 7th, 1946.

The Radio Corporation of America (RCA) began experimental TV broadcasts in New York in 1939, with a 441 line system as recommended by the RMA in 1936. But in 1940 strong objections to this were raised by rival manufacturing organisations - Du Mont and Philco - who had been experimenting with higher definition systems. All three organisations foresaw great potential profits in the manufacture of receivers, and it was essential that a national standard be adopted to ensure uniformity of transmissions. When RCA announced plans for the large scale manufacture of 441 line receivers, the regulatory FCC decided to prohibit commercial TV operation until the industry as a whole had reached agreement on standards.

This led to the formation in July 1940 of the National Television Systems Committee (NTSC) - a body of highly qualified and experienced representatives from 15 organisations (embracing manufacturers, broadcasters, producers and the Institute of Radio Engineers) which displayed scientific and engineering collaboration to a remarkable degree. In six months the NTSC reached agreement on a set of TV standards based on 525 lines with 60 fields per second, interlaced 2:1, with an aspect ratio of 4x3 - and specifying vestigial sideband transmission accompanied by frequency modulated sound in a 6Mc/s wide channel. These standards were submitted to the FCC in March 1941. As Donald G Fink said in his book "Television Standards and Practice" -

"By that time the complexion of the industry had changed from a discord of counter claims to a concord of expert opinion which left the commission no choice but to acknowledge its value and to proclaim the art open to the public."

In May the FCC officially adopted these NTSC standards and announced that commercial TV broadcasting would be permitted after July 1st, 1941. However, five months later the USA was catapulted into the war by the Japanese attack on Pearl Harbour. The resultant diversion of radio plants, to the production of military equipment, arrested TV development in the USA until the end of hostilities.

In December 1945 the FCC revised the TV standards in a few respects and American television finally began with a bang in 1946 - with 20 stations operating by 1948, 80 more partially completed and over 300 new applications pending before the FCC. The twelve RF channels which had been made available for TV in the VHF band by the FCC were obviously going to be insufficient for TV services. So, in September 1948 the FCC "froze" the granting of all further TV authorizations until more channels could be found elsewhere in the RF spectrum.

Meanwhile France was operating an experimental TV service with 819 line definition in a 10Mc/s wide RF channel - compared with 6Mc/s in the USA and Britain.

With the expansion of TV services overseas, it was

considering such a service for Australia - but the Chifley Labor Government was opposed to the commercialisation of TV, and wanted to confine any service in Australia to Government controlled National stations. At that time England had only National TV, and America only commercial. As the PMG's Department provided the technical equipment and technical staff for all the national Broadcasting Service (NBS) in Australia, it was logical for the Department to be regarded as the proper body to provide the same facilities for a National Television Service. The ABC provided only the programme staff and programmes for the NBS at that time.

At the beginning of April, 1948, I had just finished my examination of the possible relocation of the Research Laboratories in Melbourne and a final report on the conclusions of my lightning investigations which had been interrupted by my transfer to radar work in 1940. On April 5th I was called to the Commonwealth Offices in Treasury Gardens for a long interview with the Engineer-in-Chief, Mr R.V. McKay, on the subject of TV services. I told him I had maintained a comprehensive card index of articles published on television developments overseas, and left with him a copy of my TV report No. 2386 prepared for Mr Witt in 1939.

Mr McKay (RVM, as he was generally known) was soon to move to London as the PMG's first liaison officer there, while retaining the status of Engineer-in-Chief.

Television in England was one of the matters on which he would be expected to report. He rang me on April 8th and complimented me on Report No. 2386, which he said he would attach to his own report on overseas enquiries. I told him of the map I had prepared, as part of my laboratory site examinations, showing the built-up areas around Melbourne on the basis of the 1945/46 aerial survey. Mr McKay asked if he could have a copy of this map with details of population distribution added. Accordingly I had this prepared, within a 20 miles radius of the city, showing the population within increasing circles and within 450 sectors - based on the census taken in June, 1947.

The Government had agreed to the issue by the PMG's Department of an exploratory Tender Schedule for the supply of television equipment, based on a hypothetical system of one National television transmitter and associated studio in each State. The Central Office Radio Section of Jolimont was preparing to draft this Schedule.

Eric Wright then asked me to carry out a study of the desirable standards of picture definition and transmission for a television service in Australia and to develop a theoretical plan for the location of TV transmitters to serve Melbourne and the principal Victorian provincial cities. I would do this in an uncreated position of Divisional Engineer, and would be

assisted by a young West German Engineer shortly to arrive in Melbourne. This delighted me. I had been longing to do some really constructive work in television, which I knew must come to Australia eventually. I immediately began to assemble the necessary references in technical journals and text books.

On April 12th, with fellow Engineers Len Harris and Oliver Moriarty, I drove to Essendon Airport to meet the first two West German Engineers who were coming to Australia under contract to the Department of Industrial Development to work at the Research Laboratories. They were Albert Seyler and Wilhelm Otto. Seyler had been working with the American occupation forces in France. Otto had been working with the Russians. I well remember their greeting - heels clicked together and a handshake combined with a stiff bow. They both spoke excellent English. We all lunched together.

Seyler was to work with me on the television project. We had a great deal in common. When I was working on radar in Melbourne, he had worked on radar research in the Air Radio Research Institute at Oberpfaffenhofen, Germany, from 1942 to 1945. After the war he had been employed by the US Air Force in Germany as engineer for air-borne radio equipment, with some experience on American TV equipment. Albert could pun in English - a remarkable ability in a foreigner. We got on very well together and threw ourselves into the TV

project with enthusiasm. I was now in an office on the first floor overlooking Little Collins Street, with Albert just outside my door and Merle Parsons doing our shorthand and typing.

We did our best to make the newcomers feel at home in a country so recently at war with theirs. They came home to dinner with us and I enjoyed a Musica Viva concert with Albert, when Hepzibah Menuhin played in the Beethoven Archduke Trio. Albert later brought his wife Fran out to Australia, and his son Peter, and we visited them in turn.

Seyler produced two reports in the first few weeks -

No. 3102 - "A theoretical derivation of the signal-to-noise ratio for television receivers" and

No. 3111 - "Required transmitter power and permissible receiver noise figures for a television service above 200Mc/s carrier frequency".

Meanwhile I carried out a very detailed theoretical investigation into the desirable picture definition of a TV system, culminating in a report -

No. 3119- "The number of scanning lines and the video frequency band desirable in a television system".

This report considered the acuity of the human eye, the viewing distance in relation to picture size, the screen brightness, ambient illumination, movement in the

picture and flicker frequency. I tackled the problem from first principles, drawing on the work of many investigators overseas, as published in over 30 technical journals and text books - including papers by authorities on optics, physiology and psychology as well as purely engineering aspects. I considered two extremes of viewing environment - the domestic home and the picture theatre or other place of entertainment. My report of 36 pages concluded -

"The desirable numbers of lines, and the corresponding video bandwidths determined herein, exceed considerably the values at present being used for television services overseas. - - - Even at viewing distances of eight times the screen height, the video bandwidth for the desirable number of lines in home television is 8Mc/s, about twice the value now employed for standard commercial services in USA. - - - The trend of development must therefore be towards the desirable number of lines and video frequencies determined herein."

I concluded that the optimum number of active lines for home viewing at a distance of four times the picture height was 1480 - and the desirable minimum viewed at eight times the picture height was 716, requiring a video frequency bandwidth of 8Mc/s for 25 complete pictures per second ("active lines" do not include lines scanned during flyback).

However, I felt that this report was rather too abstract to convince those engaged in preparing a Tender Schedule for television equipment. I was aware that some factions in the Department were inclined to favour the English standard of 405 lines, because that would mean

purchasing transmitting and receiving equipment already developed and being manufactured in the mother country. I therefore decided to produce a shorter, more down-to-earth report to drive the point home more forcibly.

But first there were other aspects of the project still to be covered. With Seyler I had been examining the problem of the location of TV transmitters to serve Melbourne and the major provincial towns. We decided that the provincial towns we should consider were Geelong, Bendigo and Ballarat - the only cities then having populations in excess of 30,000. With greater Melbourne, these three comprised 67% of the total population of Victoria (then just over 2 million).

The main factors to be considered were population distribution and topography, and although only one service was envisaged initially (as considered by the Labor Government) it was recognised that future additional services for the same areas should share the same transmitter locations, to facilitate reception of all programmes by directional antennae.

The map showing built-up areas and population distribution within 20 miles of Melbourne, already prepared for RVM, was a good start - and my Report No. 2386 of 1939 showed topographical profiles, radiating from a hypothetical transmitter site in the Exhibition Gardens, in 14 directions covering outlying pockets of

population. To serve Melbourne within a 25 mile radius (and including Frankston) we considered alternative transmitter sites at -

The Exhibition Gardens, Melbourne (140ft above sea level)
Mount Dandenong (2078ft above sea level and 21 miles away)
Mount Macedon (3325ft above sea level and 36 miles away)

With television studios located in or near the city, these mountain sites would of course have required a relay transmission path to them.

In undulating country served by a VHF or UHF broadcast transmitter there may be receiving points from which the transmitter is hidden by an intervening rise in the terrain. Reception at such points depends on diffraction of the signal over such obstacles, and the higher the angle of arrival of the signal the better will be the benefits of diffraction. Hence, the higher the transmitting aerial the better will be the coverage in such country at a given distance. I developed a method of qualitative comparison of alternative transmitter locations, in terms of the angle of arrival of the signals at various receiving points. Then, from examination of a contour map of greater Melbourne and the plotting of topographical profiles from alternative transmitter locations, I concluded that a transmitter at Mount Dandenong would provide a better TV service (in the built up areas of Melbourne) than either one at Mount

Macedon or one on a mast at 600ft above sea level in the Exhibition Gardens.

Further, there was a reasonable prospect of providing a TV service to Geelong from Mount Dandenong, but not from the Exhibition Gardens site - Geelong being 41 miles from Melbourne and 58 miles from Mount Dandenong, largely across Port Phillip Bay.

We then looked at the possibility of serving Ballarat and Bendigo via relay links with repeaters at intervening mountain peaks, plotting profiles from contour maps. We examined several alternative routes and discussed desirable radio frequency allocations, having regard to radiation and propagation conditions, required channel width, and receiver considerations.

We concluded that frequencies between 120 and 300 Mc/s would be best for TV broadcasting, and frequencies between 500 and 6000Mc/s for relay links, but stressed the need for field measurements before making decisions on transmitter location, power and frequency, because of propagation problems and atmospheric conditions.

This report -
No.3123 - "Location of television transmitters to serve Greater Melbourne and Victorian provincial towns - a Preliminary Survey"

ran to 38 pages plus 19 sheets of drawings and was the result of three months concentrated effort by Seyler and myself.

However, on July 6th an unexpected spanner was thrown in the works. I was summoned with Jack Wilson (another Divisional Engineer at the Labs, who had worked on telephone equipment studies) to a discussion with the Engineer-in-Chief and Eric Wright in the Treasury Gardens offices. We were told that the Sydney automatic telephone network was heading for serious trouble. With the increasing rate of growth of the number of subscribers the system was rapidly approaching saturation - an urgent review of exchange boundaries and the numbering system was required. Wilson and I were instructed to visit Sydney immediately, discuss the problem with local lines and equipment-planning engineers, and report back on possible courses of action.

I pointed out that my work on the television project was incomplete, but this received scant consideration. Telephone services were most important. They were the Department's first responsibility. Television was something for the distant future.

However, an interim discussion was arranged forthwith with the Engineer-in-Chief (RVM), Ted Stewart (who had moved to the position of Supervising Engineer in the newly formed Technical Planning Section) and Horrie (H.W.) Hyett (Supervising Engineer of the Radio Section at Jolimont). I was able to report to them on the stage

reached by Seyler and myself in the television project and to give an interim verbal summary of our conclusions.

Jack Wilson was about nine years younger than I, but his experience was going to be useful. We flew to Sydney two days later on the early morning plane. I think Albert Seyler was rather taken aback by this sudden change in direction. Notwithstanding the importance placed upon the telephone equipment project, I was determined to finish the television job in my spare time. I still had to put the finishing touches to my report No. 3119 on the desirable number of scanning lines and video frequency, and I hadn't started my proposed shorter report on required definition. I knew Horrie Hyett's staff were preparing the Tender Schedule for television equipment, and I wanted my conclusions to be given full consideration. I took all my television papers to Sydney with me.

Jack and I spent eight days in Sydney, staying at the Arcadia Hotel in Elizabeth Street. We had discussions with Norman (N.W.V.) Hayes, Evan Sawkins and Stan (A.S.) Bundle and visited all the main telephone exchanges. The Sydney network was then using a six digit system, and had proposed increasing the number of main exchanges from eight to nine, but this would have involved taking over either the "A" level (reserved to absorb false dialling impulses) or the "Y" level (reserved for future trunk working). These levels corresponded to the digits one and 0. We collected a

considerable amount of relevant information on geography of the metropolitan area, population distribution, community of interest, subscriber density, exchange service boundaries and inter-exchange junctions.

I spent three weeknights and Saturday afternoon working on my television report No.3119 in the hotel, and finished the draft for typing. I found time to look up Helen Newell (who was now working in Sydney), Evelyn Connell (mother's cousin, with whom I had stayed at Coctamundra in 1931, now a widow living with her son Jim at Balgowlah) and Kath Skinner (long time Adelaide friend of Phyll and myself); I also had evening discussions with POA groups of PMG Engineers and Customs Officers concerning their classification claims to the Public Service Board. On my last night in Sydney I went to the Town Hall to hear the Sydney Symphony Orchestra with Ginette Neveu as soloist in the Sibelius violin concerto. It was a busy week, and Jack and I returned home on Friday July 16th.

I worked the whole of the following weekend and two more nights, at home, to finish my shorter television report - probably the most important in my career -

No.3122 - "Suggested Picture Definition Standards for Television Broadcasting in Australia"

In television, as in motion pictures, not only is it necessary to present a rapid succession of still pictures to give the illusion of motion, but also if the

repetition rate is too slow an objectionable flicker will be evident. Early motion pictures were shot at 16 frames per second, which produced jerky movements and flicker - hence they became known as "the flicks". If those early films are shown at the current rate of 24 frames per second, with a shutter rotating to interrupt the light beam at 48 times per second, the flicker disappears but the motion is unnaturally speeded up.

Electronic television systems use "interlaced scanning" to eliminate flicker. In one picture frame only odd lines are scanned, and in the following one only even lines - so that two such successive "fields" are required to produce a complete picture; in the USA there were 60 TV fields per second giving 30 complete pictures, and in Britain there were 50 fields giving 25 complete pictures. These field rates virtually eliminated flicker and the picture rates gave the illusion of motion.

The local electric power frequency governed the field rate chosen. America had power at 60 cycles per second and England had 50c/s. By choosing the same rate for TV field frequency, problems of power-hum interference were avoided. In Australia, with our 50c/s power supply, 50 fields per second was the obvious choice for TV.

Regarding the number of scanning lines, my report

of definition "which would provide a service sufficiently satisfactory to render any change unnecessary or unlikely". I quoted my conclusions in Report No.3119 on the requirements necessary to render the scanning line structure just not visible. Then, after demonstrating that the requirements of theatre television were too far removed from those of domestic viewing to influence the issue, I showed that current British and American standards were locked-in to decisions made 12 years earlier - the practicable number of lines in the British case and the available R.F. Channel width in the American. Since then considerable advances in technology, particularly in radar development, had made more advanced standards practicable for a television system.

I quoted overseas authorities who had recently suggested 800 and even 1000 line definition for broadcast services, and referred to the 819 line system already in use experimentally in France.

From consideration of practical methods of generating the required line scanning frequency in receivers, I deduced that the desirable number of lines for a 50 field per second broadcast system would be either 735 or 819 lines - with a preference for 819 lines.

However, as 819 line equipment was not in commercial production, I recognised that there could be considerable delay in obtaining such equipment - and that some compromise would be necessary if it was essential "to commence a television service in Australia at the earliest possible date". I then looked at the question of selecting a standard of definition which could "readily be obtained in commercial equipment now being produced".

A standard of 625 lines with 25 complete pictures per second required a line frequency of $625 \times 25 = 15,625$ per second, which was very close to the line frequency of the American system ($525 \times 30 = 15,750$ per second); and 625 lines, being the fourth power of the odd number 5, would simplify the necessary relationship of line and field frequencies. Thus, the output power required from the line scanning generator would be approximately the same as in American receivers. The chief differences between a 625/50 receiver and an existing 525/60 American receiver would lie in the field frequency, the radio frequency tuning and the video frequency band-pass. It was estimated that the wider video frequency band would increase the cost by not more than 3%.

The principal gain in the 625/50 receiver would be an increase in picture resolution - 42% more picture elements than the American system and 153% more than the

I therefore concluded that 625 line definition was the best compromise in order to obtain commercial equipment at an early date. My report suggested a hypothetical transmitter amplitude characteristic, providing for vestigial sideband transmission of the picture carrier (as in the American system) with the sound carrier located below the picture carrier within a 7Mc/s wide RF channel — as compared with the 6Mc/s channel adopted in the USA. An 819 line 50 field per second system would have required a 12Mc/s wide channel — a more extravagant use of the available RF spectrum.

My No.3122 Report recommended —

"If television is to be introduced in Australia earlier than it is possible to obtain commercial 819 line equipment, then 625 lines is the compromise definition which will give the best results from commercial equipment which should be obtainable in a relatively short time."

When the Report was issued it was stamped —

"CONFIDENTIAL
Not for publication without
permission of PMG's Department"

It was adopted as the recommendation of the Research Laboratories.

My last two reports still had to be typed, and I was worried that the TV equipment schedule might be issued calling for a 405 line system. Therefore I wrote a confidential personal memo to Horrie Hyett on July 23rd, stressing that the conclusions I had reached were of fundamental importance, arguing the case for 625 lines

but suggesting that tenders should be invited for both 625 and 819 line systems. I said "The British and American services are shackled, and we should be careful not to walk into the same trap".

PMG Tender Schedule C-5803, for the supply of television equipment for a National Service in six capital cities, was issued on August 11th. No standards were stipulated. Tenderers were invited to offer whatever equipment they were prepared to supply. The closing date for tenders was January 20th, 1949.

I then concentrated on an analytical report on the Sydney telephone network.

No.3162 - "Some general notes on the determination of exchange boundaries and grouping, and on possible forms of telephone network development".

This took me several weeks. I stressed the need for a long range plan for the ultimate network in metropolitan areas and outlined a general procedure for evolving the basic framework of such a plan. Evan Sawkins rang me from Sydney on August 4th and told me the Engineer-in-Chief had given permission for the use of the "Y" level to provide a ninth main exchange group, so the immediate crisis in the Sydney metropolitan network had been averted.

On the same day I was notified that I had been transferred to the position of Divisional Engineer,

Transmission Section (Design, Planning and Standards),
Victoria.

I had been given no prior notification of this transfer, and was most disturbed at the loss of my appointment to a radio job in Victoria at the same level, although I had not taken up duty in that position due to Central Office requirements. Two days later I wrote a formal objection to the transfer, but this was returned to me by Roy (A.J.) Attkins, Assistant Supervising Engineer in Central Office, with the suggestion that I withdraw the objection and await developments - which might not be unacceptable to me. I agreed to do this and see what happened.

In September I was invited to join Ted Stewart in an uncreated position of Divisional Engineer in the newly formed Technical Planning Section of Central Office in Treasury Gardens. Ted was the Supervising Engineer, and there was some prospect of television work. I had great respect for Ted, and enjoyed working with him. Eric Wright endeavoured to persuade me that my prospects would be better if I remained at the Laboratories, but I thought 12 years in the Labs was long enough. I took up duty with Ted with a new hope for the future. Albert Seyler remained at the Labs and was later placed in charge of a new Pulse Techniques Division.

With the Director General Mr L.B. Fanning, and the Engineer-in-Chief, Mr R.V. McKay, Ted had been a member of the Australian Delegation to the International Telecommunication and Radio Conferences at Atlantic City in 1947. The ITU had been formed to promote development of technical facilities and harmonize the actions of nations, and in particular to effect allocation of the radio frequency spectrum in order to avoid harmful radio interference between countries. Ted was a mine of information on the Radio Regulations and introduced me to the international frequency allocation table, which was to play such an important part in my future career.

The only other engineer on Ted's staff was a young recruit from England named Boraston, with whom I shared an office next to Ted - whose room was adjacent to the suite occupied by the D.G., the Deputy D.G. and the Engineer-in-Chief. We shared the typing services of their very capable secretaries - Sheila Casey and Jean Slafeststein. It was a very quiet corner of the Department, and rather isolated, after the gregarious atmosphere of the Research Laboratories. My office overlooked a light-well, and the outer window ledges were favourite resting places for Treasury Gardens pigeons. We had a rather curious office boy, and often I could see his eyes peering into the room through the clear glass border of the frosted half-pane door to the passage. One day my door burst open and this lad rushed across the room to my window, threw up the sash, and siezed a

protesting pigeon before it had time to take-off. He then apologised for his intrusion and departed with the dazed bird firmly imprisoned between his hands. No doubt he was what is commonly called a pigeon fancier. Perhaps he was training them to help with his messenger duties between departmental buildings. I was thankful it was "not my pigeon".

On August 26th a cocktail party was held at the Australia Hotel to farewell R.V. McKay who was leaving to take up his London assignment. His job in Central Office was to be filled by N.W.V. Hayes. Then on September 28th Prime Minister Chifley announced a decision to introduce legislation to provide a special board to control broadcasting, television and other like services. The relevant amendment to the Australian Broadcasting Act was passed on December 6th, creating the Australian Broadcasting Control Board (ABCB) as from March 15th, 1949. The Board was to comprise three members appointed by the Governor General. Mr L.B. Fanning was appointed Chairman, and Mr G.T. Chippindall succeeded him as Director General with Mr P.E. Vanthoff as Deputy Director of the Department. The other ABCB members were Mr R.G. Osborne and Mr Clive Ogilvy. The purpose of the ABCB was to plan the provision of broadcasting, television and facsimile stations, to establish standards for their technical equipment and operation, and to ensure that these standards were met with adequate and comprehensive

programmes provided - a far reaching set of responsibilities.

Dad came to Melbourne in October 1948 for an interview with his principals about his pending retirement. He had turned 69 and was slowing down. I took Phyll and Chris to Adelaide to spend Christmas with our families. Dad had given up playing bowls, and needed another interest. I dug up a plot in his back yard and prepared a vegetable garden for him. It was good to see Marjorie and George in their new home with young Adrian. Mother loved him.

Eleven tenders were received in response to the first television Schedule C-5803. In January 1949 Mr Hayes gave me the job of examining these with Jock (J.D.) Campbell of the Radio Section, and preparing a relevant technical report under the general supervision of Ted Stewart. Jock had been one of the engineers at the Research Labs working on microwave relay systems, and was now in the Central Office Radio Section at Jolimont under Horrie Hyett. As was to be expected the Marconi tender expressed preference for equipment largely in conformity with the BBC standards, while RCA and IGE offered equipment wholly or largely in conformity with FCC standards. The basic standards proposed by the tenderers were -

Tenderer	No. of lines	Fields /sec	Aspect ratio	Polarity of modulation
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Pye	405	50	5:4	Positive
Philips	567	50	4:3	Negative (later positive)
EMI	605	50	4:3	Negative
Marconi	625	50	4:3	Positive
			or 4:3	Negative
IGE	625	50	4:3	Negative
RCA	625	60	4:3	Negative
	625	50	4:3	Negative
La Radio Industrie	819	un-specified		Positive

This confirmed my contention that manufacturers would be prepared to offer 625 line equipment to Australia, at the state of the art then present.

I prepared a detailed comparison in tabular form, showing all the technical characteristics and video waveforms specified by the tenderers, and including the corresponding parameters of the standard American and British systems.

The analysis was a lengthy business and was not completed until May. EMI and Marconi had both suggested sites for television transmitters in the several Australian capitals. For Melbourne, EMI suggested Mount Waverley (400ft above sea level) and Marconi suggested Deepdene (250ft a.s.l.). All sites suggested were relatively close to the city centres, up to about 13 miles. It was evident that their thinking was influenced by the proximity of Alexandra Palace to London, as mine had been in my 1939 Report No.2386. My investigation with Seyler had shown the superiority of Mount Dandenong for a Melbourne service.

However, in order to make a qualitative comparison of various possible transmitter sites for Melbourne, I decided to follow a procedure I had read about in an American journal. I found there were several three-dimensional relief maps of Greater Melbourne in existence. I borrowed a suitable one from the Geology School at Melbourne University. This covered the area from Mont Albert to West Footscray in an E-W direction, and from Keonpark to Gardenvale in a N-S direction - to a scale of 1"=2500ft. horizontally and an exaggerated vertical scale of 1"=400ft. I placed a plasticine block over the city area (i.e. the so-called "golden mile") equivalent to a vertical height of 132ft (then the limit for city buildings), placed the map on the floor and gave it a fine coating of white talcum powder all over. Above this map was suspended a miniature electric lamp with a point-source filament. This filament was adjusted to heights equivalent to 100, 200, 300 and 400ft above the map surface at locations considered for a TV transmitter. For each lamp height and location, photographs were taken looking vertically down at the map. The shadowed areas in these photographs indicated areas which would not have line-of-sight to a transmitter at the location concerned, with a transmitting antenna at the corresponding height above ground.

Such photographs were taken for the suggested Mount Waverley and Deepdene sites and also for the Exhibition

Gardens site, for Jolimont (where there was an existing PMG tower for experimental FM radio), for Mont Park (where the PMG frequency measuring station was located), and at high spots in Mont Albert, Canterbury and Kew.

This method of site comparison was purely qualitative and made no allowance for large trees or structures in the suburbs, but it did suffice to give a general comparison showing up large differences in coverage of the area embraced by the map - covering the bulk of the Melbourne population. It showed the marked superiority of Mont Albert over Mount Waverley.

The tenderers suggestions were of little value in the absence of contour examination. Contours and profiles indicated that Mount Waverley and Deepdene were inferior as TV sites to the Exhibition Gardens (140ft asl) or a site near the Board of Works reservoir at the corner of Canterbury and Elgar Roads, Surrey Hills (400ft asl). The PMG microwave relay tower was eventually located near this Surrey Hills site.

In June 1949 the ABCB began to recruit technical staff and an administrative Secretary. Bruce (R.B.) Mair of the PMG Research Laboratories was appointed ABCB Director of Technical Services, J. O'Kelly (also from the Department) was appointed Secretary, and engineering staff included Alec (A.J.) McKenzie, Ross (W.R.) Baker and West (W.H.) Hatfield - all from the Research Labs.

Many of the senior engineers in the Department deeply resented this exodus, and the feeling of animosity towards the ABCB persisted for many years. Ted Stewart was not one to harbour such grievances and his cooperation with the ABCB engineers was always wholehearted and friendly.

On June 3rd, 1949, the ABCB recommended to the Government that National Television Services should be established in the six State Capitals "as soon as the necessary arrangements could be made". They recommended that the picture definition should be 625 lines with 25 pictures per second in a 7Mc/s radio frequency channel permitting "a very much clearer picture --- without increasing appreciably the cost of receivers", as stated in their first annual report.

In other words, my suggestions for standards if a service were to be established as soon as possible - as outlined nearly a year earlier in my Report No.3122 - were accepted. The aspect ratio was to be 4:3, the transmitted video signal was to be amplitude modulated with negative polarity and vestigial sideband operation, and the transmitted sound signal was to be frequency modulated. The radiated signal was to be horizontally polarized and there were to be three channels in the 178-200Mc/s band.

On June 14th the Prime Minister announced a decision to introduce television, as a National Service only, in

the six Capitals as soon as possible. The ABCB, in consultation with the PMG's Department, was to take such preliminary action as necessary to prepare for this.

The report on the tenders received in January, prepared by Jock Campbell and myself, was referred to the ABCB for comment. However, a recommendation to the Government for the acceptance of any of the tenders was delayed by two factors. First it was necessary to obtain certain additional information from some tenderers, and secondly one of the interested parties had obtained a Writ from the High Court claiming that -

"acceptance of any of the tenders for the supply of television equipment would be unlawful."

I understand that the grounds for this claim were based on the absence of a specification for television standards in the Tender Schedule C-5803 issued by the PMG's Department. I was asked to examine other PMG Tender Schedules to establish precedence for such lack of a detailed specification. I found sixteen Schedules which provided relevant examples. In a report summarising these, I stated in relation to the television Schedule -

"the specification of the equipment was deliberately left very open so that the tenders would give some indication of the commercial equipment available, of which little information from some countries had been published."

As a consequence of these delays the ABCB and the Department were unable to make definite recommendations for the acceptance of tenders until October 26th. The

net result of this was that no decision on the matter was made by the Government before the Federal Election of December 1949. At that election the Chifley Labor Government was defeated by the Liberal and Country Party coalition, and Menzies became Prime Minister once more. With the change of Government the plans for a National Television Service went into the melting pot.

Thus ended the first abortive attempt to introduce television in Australia.

In June 1949 Marjorie gave birth to a daughter. When I heard the news, being mindful of George's change from the violin to the lower pitched viola, I sent them a congratulatory telegram, saying -

"Call her viola if she's not too highly strung". But they named her Marguerite, after our dear mother.

Passing 70 in September, dad said he had entered his bonus years. The vegetable garden was paying dividends, but he had to get a neighbour to help with the digging. In November he was guest of honour at the 50th birthday celebrations of the Port Adelaide Orpheus Society and saw many old friends.

During the latter half of 1949, under Ted Stewart's direction, I prepared a report on the requirements for technical staff to operate and maintain the proposed National Television Service, and in December the Chief

Engineer nominated Ted and myself to represent the Department on a committee to investigate problems of television development with the ABCB - represented by my erstwhile colleagues Alec McKenzie and Ross Baker. The committee's chief consideration was the recommendation of parameters for the radiated signal in the proposed future Australian service. The committee met intermittently and made a detailed analysis of the types of signal being used for established services in Britain and the USA and for experimental services in Europe. There was no international standardisation of TV waveforms overseas, and the problem was to pick the best features out of all of them. Don McDonald, returned from Geneva, was appointed Assistant Director of Technical Services in the ABCB. Ted and I frequently had lunch with him after a pleasant walk down Collins Street.

During 1949 and 1950 there was intensive competition between rival American electronic organisations attempting to develop an acceptable system for colour TV. All relied on the transmission of colour in the basic components of red, green and blue hues, capable of combining to produce any other colour.

I followed these developments, in the literature, with great interest. Two types of system emerged - one using sequential colour fields, developed by the Columbia Broadcasting System (CBS) and requiring a 720rpm rotating colour disc both in originating cameras and in TV

receivers. The other, developed by RCA, used a sequence of colour dots and was all electronic.

In November 1950 the FCC adopted the CBS system as a colour standard, but this involved 72 frames per second of 405 interlaced line definition, in order to fit within the standard 6Mc/s TV channel - and so was not compatible with the existing 525/60 monochrome system.

Considerable dissention resulted, and the industry reconstituted the NTSC with the object of arriving at a colour standard that would be compatible - which meant a colour signal that would reproduce in black and white on a standard monochrome receiver, or in colour on a new colour receiver. With magnificent cooperation, especially between RCA and the Hazeltine Corporation, this objective was realized in about three years, and the FCC sequential colour standard was replaced by a compatible 525/60 colour system known as NTSC colour.

In Canberra the new L-CP Government had somewhat mixed and indeterminate views about television. Some members opposed its introduction altogether, while others considered it should be handed over to private enterprise. It appeared that the Government favoured the introduction of commercial TV, which the Labor Government had strongly opposed. In February 1950 the ABCB "submitted a report to the Minister indicating various alternative means whereby the policy of the Government in

this respect might be implemented" as stated in their second annual report.

For me, 1950 was a year of fluctuating fortune. At the end of 1949 Mr Hayes had given me the part-time job of chairing a sub-committee set up to re-write the Telecommunications Chapter of the Commonwealth War Book, with representatives of the Navy and the Department of Civil Aviation. World War II was still very fresh in the minds of everyone and it was necessary to embody the lessons learnt in that world-shattering experience, together with the expanding possibilities in the field of telecommunications, in the important reference documents. The sub-committee met at intervals in the Treasury Gardens offices.

In January I began my term as General president of the POA, and chaired a week-long inter-state conference of delegates in April. After attending the last few re-classification hearings in Canberra I withdrew from the reclassification committee that I had worked on for so long with Bert Wright. There was a limit to what I could do in my spare time. I was unable to attend the Commemoration at Adelaide University in March, but with Phyll and Chris I had a holiday in Adelaide in May, and collected my M.E. certificate then. That was the last time I was to see dad.

Colin Moodie moved to a diplomatic post in Washington D.C., and Eric Cottrell paid occasional visits to Melbourne from Broken Hill. We usually went to a show together.

I was invited to give three lecture classes in a series of five, presented by the Council of Adult Education (CAE) at the Melbourne Technical College. These provided a technical introduction to television. The other two classes were given by Max Hooper, Chief Engineer of Radio Station 3DB and John (J.H.) Reen of the Research Labs. The course was presented in 1949 and repeated in 1950, and the fee for the course was 5/- or 1/- per lecture! Good value for money!

On June 27th 1950 the Government decided that television should be developed on a gradual scale only, that initially a National TV Service should be established in Sydney and that one commercial TV licence should be issued in Sydney and Melbourne and possibly in other State Capitals - with extension of the National Service to other Capitals and larger provincial centres when appropriate. The Minister stated that -

"The whole question of television had to be approached for the time being on an experimental basis in view of the novel problems which would be encountered and the great expense which had to be incurred."

The necessary legislation amendment was under preparation and the ABCB was directed to arrange, with

the PMG's Department, for fresh tenders to be called for the proposed National Television Service in Sydney - with specifications prepared in conformity with ABCB standards set out in detail in an Appendix to the second ABCB annual report, which stated -

"After careful review of all relevant factors the Board has concluded that a system employing 625 lines is desirable for the Australian service and will give more satisfactory resolution than the British or United States system, under stringent viewing conditions, for only a small increase in cost due to the greater bandwidth required."

The question of a possible international standard for television services had been examined by a sub-committee of the International Radio Consultative Committee (CCIR), which had failed to reach agreement.

The ABCB estimated that eventually nine channels would be available for TV in the VHF band between 47.5Mc/s and 216Mc/s.

Ted Stewart asked me to make an analysis of the estimated staff requirements for the technical operation of the projected television installation in Sydney. This required a considerable amount of research and speculation, but I had recourse to the comprehensive index I had maintained of published articles on television practices overseas. It was necessary to define the functions of the technical personnel involved, to assume the initial duration of broadcast each day, to define a hypothetical programme schedule (as different

types of programme require different numbers of staff for both preparation and transmission) and to make appropriate allowances for shift work.

I divided my analysis into two cases -

(a) Requirements for a minimum assembly of equipment for a modest experimental beginning - with one large and one small (talks) studio, no provision for programme switching at the transmitter and no provision for processing of film recordings

(b) Requirements for two large and one small (talks) studios, a master control room for multiple studio switching, programme switching at the transmitter, and processing of film recordings.

In each case film transmission facilities were included and an outside broadcast unit. I assumed a broadcast service of 3 hours per day (3 to 4pm and 8 to 10pm), 7 days a week, for estimating purposes (the BBC was then broadcasting about 4 hours of TV per day in London).

I tabulated functions and suggested classifications of operators on different technical jobs, with functional layout diagrams. A hypothetical programme schedule was drawn up, comprising estimated periods of OBs, news, talks, short and long films, "live" shows on 3 nights per week for case (a) and 6 nights per week for case (b);

with estimated periods for rehearsal and preparation where relevant.

On the basis of these assumptions, with due allowance for shift work, the technical staff required was estimated at -

54 or 61 for case (a)	} Depending on the make of equipment provided (some requiring more operators)
86 or 96 for case (b)	

plus a Group Engineer in control of operations

No estimate of the programme production staff was attempted.

My report - "Tentative requirements of technical staff for the projected television installation in Sydney" - was completed in August, with 25 pages plus six diagrams. The findings, however hypothetical, were important - because no-one had really any idea of the magnitude of the staffing problem for television in Australia at that time; the numbers required are so much greater than necessary for a radio broadcast 'service'.

Ted forwarded a copy of this report to the ABC head office in Sydney.

A new Tender Schedule, No. C-6423, calling for studio, transmitter and outside broadcast equipment for a National Service in Sydney, was drafted by Jock Campbell at the Radio Section, Jolimont, and issued on September 9th, 1950. It quoted the ABCB television standards. The second attempt to introduce television in Australia had begun!

Unlike the 1948 Schedule, Schedule C-6423 specified the equipment required in great detail - perhaps too great detail, because TV equipment was still very much in a state of development overseas and we had a great deal to learn about the most effective way of using it. The scope of operations envisaged in the Schedule was very ambitious for a service "on an experimental basis" - as laid down by the Minister.

Norm Hayes had died suddenly at his work. He was a much loved and highly respected engineer, and held the office of President of the IREE in 1949 and 1950. His place as Acting Engineer-in-Chief was taken by Ralph (R.E.) Page, a transmission engineer.

I had become very concerned about my status in the Department, about my opportunities for promotion and for further work on television. It appeared that any television work was likely to be the province of the Radio Section at Jolimont.

There are two kinds of positions in the Commonwealth Public Service -

A "created" position is approved by the Public Service Board and advertised in the weekly Commonwealth Gazette, inviting applicants. The provisional appointment of a selected applicant is later published in the Gazette, but this is subject to appeal. If the

appointee withstands appeals, confirmation of the appointment is gazetted.

"Uncreated" positions are used to circumvent this lengthy procedure to meet transient or temporary requirements for particular projects. An officer may be placed in an uncreated position at the same level and salary as his confirmed classification, or at a higher level and salary. Uncreated positions are unstable and insecure.

Since 1942 I had been employed continuously in uncreated positions as Divisional Engineer, except for two years acting as Divisional Engineer Laboratory Facilities, and had seen more junior engineers appointed to higher created positions. In 1947 I was appointed to a created position of Divisional Engineer in the Victorian Branch, and had subsequently been transferred successively to two other D.E. positions in Victoria - without working in any of them. Some other engineers had acted in my place.

To resolve this unsatisfactory situation, in July 1950 I asked the Engineer-in-Chief if I could take up duty in my created position in the Transmission Planning section of the Victorian Branch, or alternatively be transferred to a position in the Radio Section at Jolimont where I might participate in television work. His reaction was to instruct me to give assistance to the Supervising Engineer, Long Line Equipment (again in an

created position) as soon as my work on the War Book sub-committee permitted.

Ralph Page had no interest in TV. He could not understand why I wanted to do TV work. He considered TV to be nothing but a waste of time.

I reported to Norm (N.J.) McCay, Supervising Engineer Long Line Equipment at "Grong Grong" in Toorak on August 22nd. Grong Grong (probably an Aboriginal name) was an old two storey mansion which had been occupied by personnel of the Netherlands Air Force during World War II. In its day it must have been a palatial building, with an extensive garden and tennis courts. The Netherlands personnel had left their mark by painting over the flamboyant murals viewed from the elaborate staircase. Grong Grong was not a popular workplace with PMB personnel. It was too far from the other departmental buildings in the city, and not close to shops. It was commonly referred to as "The Snake Pit". I assumed that this was a case where two grongs did not make a right!

Having had no experience with long line equipment since my Cadet training days in Adelaide in the mid 1930s, I was not told why I was to work at Grong Grong and Norm McCay seemed equally uninformed.

I prepared a lengthy formal appeal, under Regulation 33, against my continued employment in uncreated positions, claiming it to be "prejudicial to my departmental career and not in the best interests of departmental administration". I supported this with a comprehensive case history and referred to assurances by Mr R.V. McKay in 1948 and by Mr G.T. Chippindall in 1949 that I would be used by the Department on television work when the requirement arose, because of my experience in that field. I submitted this to the Engineer-in-Chief on August 28th.

The Director General advised me on September 26th that approval had been given for my transfer to a position of Divisional Engineer in the Radio Section at Jolimont with effect from September 20th.

So my stay at Grong Grong was shortlived, but on September 21st, before I received this advice, Ralph Page instructed me by memorandum to report immediately to Mr R.L. Edwards, Assistant Director-General (Buildings) to provide assistance for two months in the preparation of plans for standardised exchange, repeater and carrier buildings, etc. I was to cooperate with the Supervising Engineers in the Telephone Equipment, Long Line Equipment and Lines Section. "Here we go again!" I thought - another uncreated position - but arrival of the advice from the D.G. a few days later mollified me. At least there was light at the end of the tunnel!

Two months was quite inadequate for the work involved. I spent four months, working chiefly with Jack (J.C.) Sloss in Parliament Place, on the design of a standard layout for branch automatic exchange buildings - particularly in relation to the entry of the complicated system of underground cables.

I had a sad letter from dad at the end of October. He had written to Smith Mitchell telling them he could carry on no further, and they had advertised for a replacement manager in Adelaide. he had served them well for some 30 years, but his health was failing. His main interest now was the welfare of his grandchildren and the vegetable garden.

In November Ted Stewart received comments on my TV staffing report from Mr R.G.F. Boyer, Chairman of the ABC. This was highly critical of my estimates concerning the requirements of programme production. At this stage the Government had made no decision as to what authority would be responsible for either the technical or programme operation of the proposed National Television Service, but it appeared that the ABC regarded their responsibility for the Service as a foregone conclusion, and they desired responsibility for both technical and programme staff. Further, they considered that radio and television studios should be adjacent to one another. They also considered that when a second TV programme unit

became necessary this should also be in Sydney, rather than Melbourne.

Ted asked me to prepare a diplomatic reply, which was forwarded.

On August 28th the Minister had established a Television Advisory Committee, comprising -

Mr G.T. Chippendall, Director General of the PMG
Department
Mr L.B. Fanning, Chairman of the ABCB
Mr R.G.F. Boyer, Chairman of the ABC

Their responsibility was to keep the Government informed of the progress of measures being taken and to provide relevant advice. They made a recommendation which was adopted by the Minister for Posts and Telegraphs in December

"That a small committee of officers should investigate television developments overseas, particularly in Canada, the United States and Great Britain, the primary purpose of the mission being to obtain information on matters relating to the establishment of the proposed national television station in Sydney and its operation during the experimental period".

On November 29th Mr Chippendall told me I would be required to represent the Department on this "small committee of officers", the other members of which were to be Charles (C.J.A.) Moses General Manager of the ABC, and Jack (J.M.) Donovan Assistant Secretary of the ABCB. We were to report back to the Television Advisory Committee. I applied myself to the Buildings Branch project with renewed vigour, determined to leave this in

a satisfactory condition, and I spent Christmas with Phyll and Chris in an atmosphere of suppressed excitement.

On January 3rd, Mr Vanthoff, the Deputy D.G., told me the overseas visit was to begin on February 17th and would probably be of two months duration. I had to obtain taxation clearance, a passport, USA visa, dollar advance, necessary vaccination and inoculations and health clearance from the Commonwealth Medical Officer. I believe it was Ted Stewart who nominated me for the delegation, and he recommended that I be given the status and salary of Supervising Engineer for the duration of the trip. This was approved, and the temporary classification was subsequently extended to cover the consequent writing of the report to the Television Advisory Committee.

I could not have wished for a more exciting outcome to all my television preparations. I was actually going to see this marvel in operation overseas! In an interview with Mr Edwards about the winding up of the Building Branch project, Mr Page told me I would not go back to the Building Branch on my return from overseas. I discussed the desirable itinerary for the trip with Ted and Jack Donovan, and we met Charles Moses for the first time on January 5th.

Jack was short, a pipe smoker with an Irish charm, a sense of humour and a twinkle in his eye. We got on famously. Charles was large and impressive, with a great love of music, an eye for the ladies and an undeniable charm. He was a law unto himself. His favourite expression was "Oh, Lordy!" In his Sydney office he had two secretaries - one was my second cousin Helen Newell, as I was to discover later.

In those days, overseas trips for departmental officers were a rarity, and I considered myself fortunate to be chosen at the age of 39 on a project that was to fulfil my fondest ambitions. I intended to do justice to it! My constant perusal of overseas technical journals meant that I knew what to look for and, to a large extent, where to find it on our travels. Charles Moses had been overseas many times before and had contacts with programme personnel all over the world - a great advantage in opening doors for us. For Jack and myself it was the first trip outside Australia.

A sub-committee of the Television Advisory Committee, comprising Ted Stewart, Bruce Mair and an ABC officer, had been examining possible TV studio sites in Sydney. The ABCB preferred Gore Hill on the Pacific Highway, four miles north of Sydney, for transmitter and studios. The ABC wanted TV studios to be adjacent to their radio studios in Forbes Street, Darlinghurst, two miles east of Sydney. I spent two days examining the

The investigations to be made overseas might well have been expected to have a considerable influence on the determination of this question.

The approved terms of reference for the delegation issued in February included two pages of "Matters to be Investigated", under the headings of Administration, Studios, Programmes, Technical and General. The Director General advised me -

"The Minister is particularly anxious that no publicity should be given to this visit, that no member of the delegation should express any views concerning present or prospective television or sound broadcasting policy in Australia".

The delegation was required, as far as possible, to act jointly. The tentative travel schedule covered two and a half weeks in the USA, two weeks in Canada and three weeks in Britain.

Jack Donovan and I had a farewell interview with Mr Chippindall on February 15th and flew to Sydney next day. I rang Phyll, Marjorie, mother and dad from the Sydney GPO to say goodbye. Dad sounded rather frail. He had written to me at the end of January, giving me details of his assets and a copy of his income tax return. I thought this sounded a little ominous. Mother was well. Their house was in their joint names. Dad said he was very proud of me. I was touched. Whatever I had achieved was the result of his early guidance and his hard working example. I was very fortunate.

We attended a farewell function at the ABC offices in Pitt Street that evening. In a few well-chosen words, I said that in this trinity Charles must be regarded as the father, myself (being youngest) as the son, and Jack (with his strong religious background) as the spirit. Helen was there to wish us well, with "Bon Voyage" from everyone.

Next morning the three of us met at Mascot Airport, heading for San Francisco.

The great adventure had begun!