AVAILABLE (Cont.)

AVO Valve Characteristic Meter Mk II in good working order, offers. Trio type 9R59 Communications receiver - $100 ONO. Columbus model 19 tablegram with original RCNZ gram unit; offers.
Cheap to good home, Cabinets for Philco 620 tombstone, Ultimate BCU (rect. dial), BDU (sq. dial), all in need of some work. . Arthur Williams, 26 Centre St., Invercargill. Ph. 03/2168985

EKCO SW86 BC/SW 1937 vintage receiver; black cabinet, fully restored, original excellent condition, complete with circuit & data. On behalf of estate ZL1TIN. Enquiries or offers to ph. 06/7656361, Stratford.

WANTED

To complete an Atwater Kent 20C I require the 3 position aerial tapping switch that fits between the first two tuning capacitors. Condition immaterial. Also require any information on GEC-O-PHONE 1 valve amplifier, circa 1924. Phone Ian Greaves at 0800 390187 evenings.

One MD7 ARC5 modulator unit complete; used 2x1625 valves, pushpull transformer with separate plate and screen windings, mu-metal core used. Will swap for 80m ARC5 receiver in good going order.
Dial scale for Philips 525. Wooden cabinet for Philips 597 - have chassis and dial scale. Six Philco plastic 6 sided knobs as used on models 60, 84E and 144(MGA p166). D.J.Smith, 156 Rangitoto Rd, Papatoetoe, Auckland 1701. Ph 09/2783541.

For display in Southland Museum. Any radio equipment from the wartime coastwatchers stations - see article - or even a couple of National type N Velvet Vernier dials or knobs for same. Arthur Williams, 26 Centre St., Invercargill. Ph. 03/2168985.

Valves, 25Y5, 25Z5 or 1D6 rectifiers and a 43 pentode. Also a Silvertone 60W chassis. Bill Meiklejohn, 56 Kokich Cres., Onerahi, Whangarei. Ph 09/4361922.

New 10 ufd, 450V electrolytic caps. EM34 magic eye, wkg. Dial glass for Pye 79RG. Mike Edwards, 47 Martyn St., Waiuku. Ph 09/2356903.

Two 6AR7/EBF35 valves. Doug Fairbank, 5 Richardson Ave., Gisborne. Ph.06/8671592

Atwater Kent power transformers, interstage transformers, speakers, valve shields and any chassis for models 55, 60 & 70 - OK if speakers and transformers not working.
10" Magnavox speaker for Patterson Model 106, 5 pin connection with pushpull output. Pat Robb, ph. 09/6207347

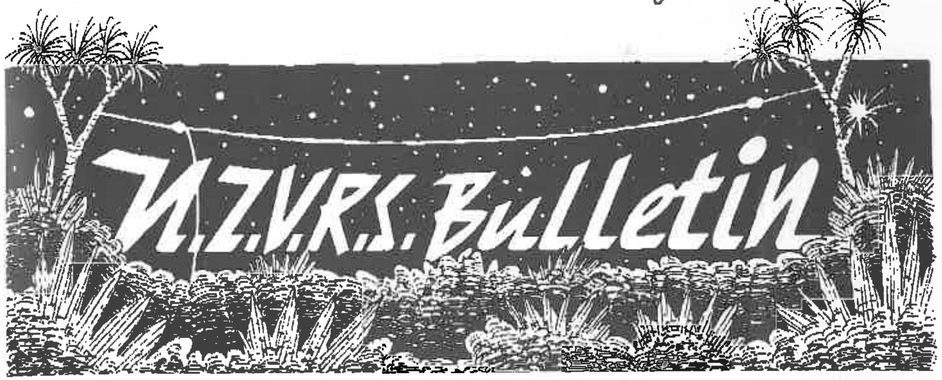
Knobs for HRO receiver labelled "AUDIO GAIN" and :SELECTIVITY".
Phil McGechie, 2/10 Elizabeth St, Orewa. Ph. 09/4266661.

An SME type arm that would suit a restored Garrard 301 turntable: would also consider any of the following types; Rega RB300, Grace Mk II, Ortophon, Mayware, Lustre etc. that would accept a Shure M75 cartridge. Graeme Lea, 73 Wallace Place, New Plymouth. Ph 06/7585344 after 6pm.

Old valves or valve collections as I would like to extend my vintage valve shelf: also any old lamp bulbs with tips. Pay cash or swap nice old radios or audio triodes.
Early Pacific radio (pre Akrad Radio), also Victor Victrola XVIII gramophone. Rod Osborne, Tauranga. Ph. 07-5442887.

Radiola 64 chassis - any condition. Gerry Bilman, Auckland. Ph. 09/6256568.

Loan (or copy) of operating manual for GR 821A Twin-T RF Bridge. Reg Motion, 2A Hazel Tce, Tauranga. Ph. 07/5768733.



NEW ZEALAND VINTAGE RADIO SOCIETY

Vol. 18 No.3 November 1997

RDL PERSONNEL IN NEW CALEDONIA - JANUARY, 1944.

From left: S.E.Slatter, R.S.Unwin, E.R.Collins, C.N.Watson-Munro.

NEW ZEALAND VINTAGE RADIO SOCIETY

A non-profit organisation devoted to the preservation of early radio equipment and associated historical information

PRESIDENT: Ian Sangster, 75 Anawata Rd, Piha Rural Delivery, New Lynn, 1250. Ph 09-8149597.

SECRETARY: Grahame Lindsey, 110 Sylvan Ave, Northcote, Auckland. Ph 09-4192033. General correspondence as well as requests for purchase of books, badges and power cable are handled by the Secretary.

TREASURER: David Crozier, 154 Grey St, Onehunga. Ph 09-6365954 or 0800-187161. Financial matters as well as membership applications are handled by the Treasurer. A **MEMBERSHIP DATA BASE** is maintained by Graeme Lea, 73 Wallace Ave, New Plymouth.

NZVRS BULLETIN is published quarterly in the months of February, May, August and November. Opinions expressed by writers are not necessarily those of the society. Contributions should be sent to the **EDITOR**, Reg Motion, 2A Hazel Terrace, Tauranga. Ph 07-5768733. Bulletin distribution is arranged by Chris Hollis, 13A Princes St, Cambridge. Back numbers of most issues are still available from the **FOUNDING EDITOR**, John Stokes, 281C Hillsborough Rd, Mt Roskill, Auckland. Price is $1 each for numbers up to volume 10 and $2 for issues from Volume 10 onwards. Cheques to be made out to NZVRS.

NZVRS LIBRARY. Requests for circuit diagrams, books and magazines from our library should be made to the **LIBRARIAN**, Ernie Hakanson, 17 Williamson Ave, Grey Lynn, Auckland. A small charge will be made for copies of items supplied.

AUCKLAND MEETINGS are held on the third Monday of each month at 7.30pm in the meeting room at the rear of the Methodist Church, 426 Dominion Rd, Mt Eden. Sales of vintage items are held at these meetings in the months of March, June, September and December.

WAIKATO AREA. Next meeting will be held at 13A Princes St, Cambridge on the 7th of December commencing at 1.30 pm.

WELLINGTON MEETINGS are held typically from 1pm on the second Sunday of every month at Tireti Hall, Te Pene Ave, Titahi Bay. For further details contact Bob Hatton, 40 Rose St, Wadestown. Ph 04-4728788.

CHRISTCHURCH AREA. Contact Russ McKee, 39 Halliwell Ave, Christchurch for details. Ph 03-3525778.

CONTENTS

FROM THE EDITOR

In this bulletin we have taken the unusual step of republishing an article from another source. It was felt that the late Robert ("Bob") Unwin's story of the development of radar in New Zealand during World War II would interest many of our readers who were unlikely to have viewed it in the original publication ("Radioscientist," March 1992, journal of the International Union of Radio Scientists). We are indebted to the Editor of the Radioscientist at the time of the article, Professor R.L.Dowden of Otago University and to Mrs Unwin for permission to reproduce the article and for supply of the copy as well as the original photos.

During the war and for some time afterwards the subject of radar development in NZ was shrouded in necessary secrecy. But 50 years is a long time to wait and the details could have been lost forever if Robert Unwin hadn't taken on the task and produced this short but excellent history of a New Zealand success story. "Bob" graduated from Canterbury College of the University of New Zealand in 1940 and worked in the New Zealand Post Office and Scientific and Industrial Research Department on radar development until 1946/47 when he headed a joint NZ/UK investigation on meteorological effects on radio wave propagation. From mid 1957 he headed a DSIR and university team in studies of the aurora australis and related phenomena. His research interests remained in this field (particularly auroral radar) which he studied first at Invercargill and later when he set up the PEL Auroral Station at Lauder(now a branch of the National Institute of Water and Atmospheric Research). In 1971 he became Superintendent of the Geophysical Observatory in Christchurch. He was awarded a D.Sc. in 1982.

As a scientist who was deeply involved in the developments of the time "Bob" was well qualified for the task which, of course, he has written from the angle of a practical scientist with due acknowledgment of the assistance given by other government departments, the Defence Forces and industry generally. One of our members has kindly shown me some details of historical records prepared by ex-RNZAF personnel including a booklet "Radar Stories" by I.M.Sexton, but records of industry efforts are very scarce. Such details undoubtedly still exist in the memories of some of our readers who perhaps may find the time to place them on record with an article which would be welcomed.

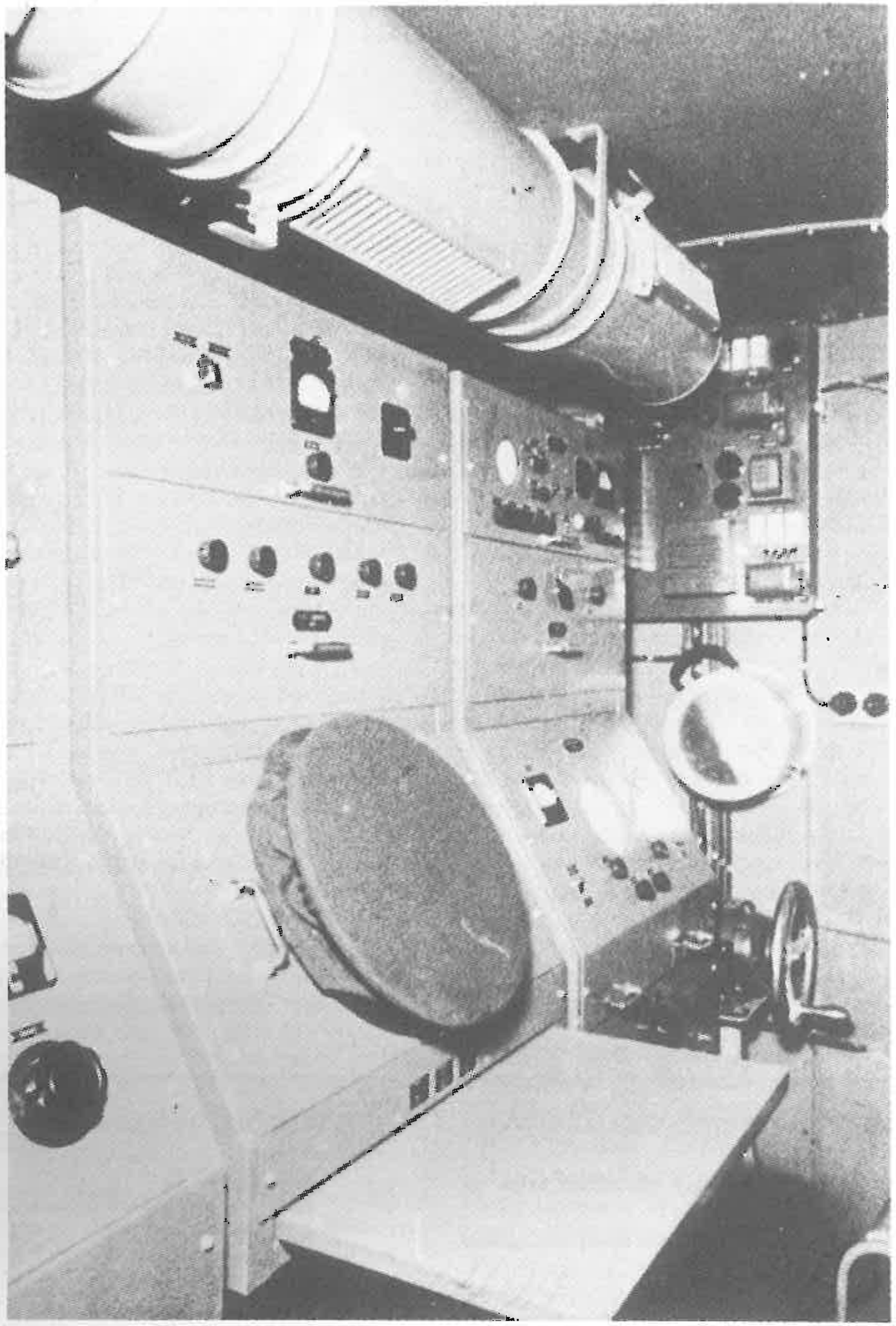
Your attention is drawn to the Treasurer's warning note on page 30. It also seems opportune at this point to remind members that the Antiquities Act 1990 requires anyone exporting items (or parts of) which are over 60 years old to obtain a certificate of permission from the Secretary of Internal Affairs.

AUCKLAND MEETING CALENDAR

17th November: Phil McGechie talks on quartz crystals.
15th December: Sale of radios and related equipment.
19th January: Bring and tell "Headphones and microphones"

NEW MEMBERS WELCOMED

Kenneth BATE
Philip BROWN
Ian DRABBLE
Trevor BROWN
Peter LEWIS
Gary JONES
Tony HULL



Interior of NZ radar truck used in the Pacific in WWII (see Figure 5)

THE DEVELOPMENT OF RADAR IN NEW ZEALAND IN WORLD WAR II

Robert S Unwin

EARLY DEVELOPMENTS

In the 1990's radar as an essential aid to navigation in the air and on the sea is so commonplace that it is difficult to realise that in the mid 1930s it was a completely new technique that was being hastily developed in the greatest secrecy by the chief combatants of World War II - Great Britain, Germany, the United States, Japan, France, Italy and the Soviet Union.

Although the concept of detecting the presence of an aircraft or ship through measuring the delay of a radio signal reflected back from it to the position of the transmitter was not new, it was only in the mid-thirties that research and development began in these countries in earnest. Considering the effort that was being put into the development of radar in the three or four years immediately prior to the outbreak of World War II it is amusing to realise that a German inventor had been granted a patent covering the basic idea of radar in 1904, and that Marconi in a speech to the American Institute of Engineers in 1922 said "..I have noticed reflections of these (radio) waves by metallic objects miles away....it should be possible to design apparatus by means of which a ship could radiate... in any desired direction, which rays, if coming across...another ship, would be reflected back to a receiver screened from the local transmitter...and thereby immediately reveal the presence and bearing of the other ship in fog or thick weather". The Americans Breit and Tuve in 1926 first used pulse radio transmissions to determine the source of a distant object, in their case the ionosphere, while in 1928 a patent for "... methods and means for determining the position. direction and distances of objects by wireless waves, applicable to navigation and for the location of dangerous objects or enemy craft" had been granted to Salmon and Alder of the Royal Naval Signal School in England. Had these ideas been followed at the time, the history of radar would have been vastly different from what actually occurred.

It is not the purpose of this article to say anything about the development of radar in different countries apart from those that had a direct effect on the work in New Zealand as the topic has been covered in numerous publications. Not surprisingly, since New Zealand was a member of the British Commonwealth, it was from Great Britain that the initial information on radar development came. It arose in the following way:

Early in 1939 when it was recognised that war was imminent, the British Secretary of State for Air asked that a physicist be sent to England (along with other Commonwealth representatives) for training "in an entirely new scientific technique of a defence nature". The reasoning behind this was that Great Britain in 1939 was putting all its effort into building radar for its own needs, so it would be necessary for Commonwealth countries to devise their own, at least initially, and each build up a team who could in due course assist in the introduction of radar systems as and when they became available. Thus did one physicist in each of a number of Commonwealth countries learn the basics of radar as it had been developed in Great Britain up to the time of the outbreak of WWII. The New Zealand representative was Dr (later Sir) Ernest Marsden (who with Geiger had performed the crucial experiments in Rutherford's laboratory at Manchester that led to the discovery of atomic structure).

New Zealand was lucky to have had a person of the calibre of Dr Marsden to send to Great Britain. As head of the New Zealand Department of Scientific and Industrial Research (DSIR) he had the authority to establish a research and development team immediately on his return from overseas. In England he was able to secure a number of critical components, virtually unobtainable in NZ such as coaxial cable, oscilloscopes, a Pye television receiver (actually two) and an incomplete 1.5 metre ASV (Air to Surface Vessel) radar which had just been developed for the British Royal Air Force. He was able to establish a permanent arrangement in England for a continuous flow of highly classified technical data on radar development and operations and a fund which ensured that a supply of components otherwise unobtainable in NZ were available (when they could be spared) for radar development

New Zealand, then as now, was a small country in a vast ocean, isolated from the rest of the world, with a long coastline. It was clear that the chief danger would be from enemy submarines and raiders, and possibly warships. The need was therefore to detect surface vessels from land, sea and air, and provide gunnery and searchlight control for the cruisers of the New Zealand Navy and coastal batteries guarding the main ports. By early 1940 developments were under way for all these purposes.

The highly secret programme was begun in two locations. One was the Radio Section of the NZ Post Office (in Wellington), at that time the organisation in the Civil Service most advanced in electronic techniques. Two Post Office engineers were allocated part time to the work and two or three technicians. The other location was a high security laboratory in Canterbury University, Christchurch, under physics professor F.W.G.White (later Sir Frederick White, head of the Australian CSIRO). To both these laboratories DSIR scientists were seconded in slowly increasing numbers - initially D.M.Hall in Christchurch and C.N.M. Watson-Munro (later Director of the Australian Atomic Energy Commission and professor of plasma physics, University of Sydney).

The two teams were given different objectives by Dr Marsden. That in Christchurch was given a self-squegging transmitter, an IF strip from a Pye television receiver and some high frequency valves and was asked to develop ship borne radar for the detection of both aircraft and ships, and to direct gunfire. The Wellington team were to develop sets for coastal locations to detect shipping, an airborne set for the same purpose (ASV) and to provide precision radar for the fire direction of the 150mm batteries guarding New Zealand's main ports.

Also in late 1939 it was arranged that a special one-year course in radio physics be established at the Universities of Auckland and Canterbury, open to recent physics graduates or those taking their final year in a Batchelor of Science course (the author of this article was one of the 1940 class at Canterbury). By this means the number of physicists and engineers actively working on radar in Wellington had risen from three in January to nine in December 1940, although the Christchurch group remained at two physicists, an engineer and two technicians.

Both the teams in Wellington and Christchurch faced daunting technical problems in developing novel techniques far from the help of their more advanced colleagues overseas, and with minimal library backup restricted to the small amount of information that Dr Marsden had been able to bring with him from Great Britain and the trickle of new information that spasmodically appeared.

However, in spite of these disadvantages and the small number of people involved, the work achieved in the first year was remarkable. The first radar echoes were seen by Watson-Munro from the top floor of the Wellington Post Office building at the end of 1939. The receiver used an IF strip from a Pye television receiver and the transmitter was a self squegging oscillator on 183 MHz using a pair of RCA 834 valves in push-pull with separate receiving and transmitting antennas each consisting of a centre fed dipole and reflector. The transmitter produced 2 microsecond pulses at about 1 kW peak power and was the basis of all the land based CW(Coastal Watching) and gunnery control CD(Coast Defence) radars until around mid 1941 when the more powerful VT90 "micropup" tubes became available.

Between January and June 1940 the staff in Wellington had increased by four (E.R.Collins, later professor of physics at Auckland University, K.D.George, I.K.Walker, subsequently Assistant Director General of the NZ DSIR, and C.H.Vincent). The main effort was put into designing receivers, broadside antennas and displays for the various radar systems. The task was simplified by the fact that all of them, except for naval gunnery (see below), operated close to 200 MHz so only one design of transmitter and receiver , and antenna to some extent, served all needs. By the middle of 1940 a CW set was operating for the Navy at Auckland, an airborne ASV was under trial, and an experimental air and surface warning set was operating on the cruiser HMS Achilles. By the end of the year CD sets were operating for the Army at coastal batteries at Auckland and Wellington, three CW sets for the Navy on the approaches to Auckland and Lyttleton, and an experimental early warning and gunnery control set on HMS Achilles.

Further development and refinement of these early sets continued through 1941, but in the second half of that year there was a major change in administration. Whereas the DSIR staff had been primarily responsible for research and development and the Post Office for construction of radar sets, the whole of the programme was now put under the control of the DSIR. The Radio Development Laboratory (RDL) with Watson-Munro as director was formed as a branch of DSIR to carry out the programme. Professor White had at this time been loaned (subsequently permanently) to Australia and his Christchurch unit was put under the control of RDL. Dr.O.O.Pulley (on loan from Australia for a year in exchange for Professor White) took over as director until October 1942 while Watson-Munro was in USA (see below). In June 1944 Watson-Munro was replaced as Director by I.D.Stevenson, who was in turn replaced by J.B.C.Taylor in September 1945 until RDL was wound up in 1946. Early in 1942 RDL moved from Post Office quarters to its own premises and staff members increased rapidly, reaching 100 of all ranks by the end of 1943, including 29 physicists and 11 engineers.

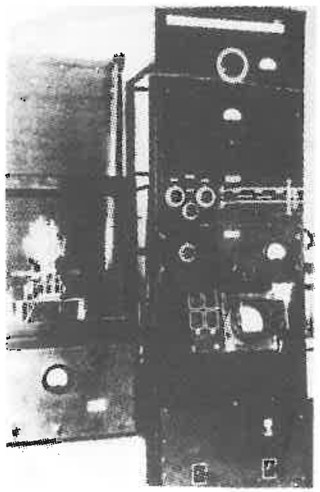


Fig. 1A. CW Radar - transmitter on left, receiver and display on right.

COAST WATCHING (CW)

The New Zealand Navy with its responsibility for coast watching, required a number of simple radar sets, capable of being installed on remote hilltops (often without road access) and offshore islands, and powered by small generators. This requirement resulted in the sets shown in figure 1A.

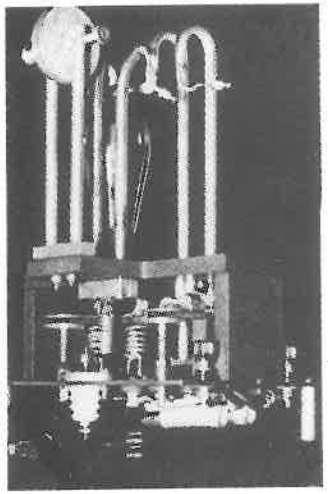


Fig. 1B. Early CW transmitter (one RCA 834 tube removed).

As mentioned above, the transmitter (figure 1B) consisted of a squegging oscillator using a pair of RCA 834 tubes in pushpull and generating a 2 microsecond pulse at around 1kW. The pulse triggered a simple time base on a 15 cm CRT and echoes deflected the spot at right angles to the trace. The transmitter pulse also kicked into operation a critically damped oscillator on 82 kHz, from which, after amplification and differentiation, range "pips" were provided at 2000 yard intervals which deflected the spot in opposite direction to the echoes. This "A" display was universal on radars in service in all countries at this time. The antenna consisted of stacked horizontal dipoles backed by a mesh reflector, with the centre two of four stacks used for transmitting and the outer pair for receiving. The original CW set was powered by petrol engines charging 24 volt batteries with a rotary convertor to 230 volts AC. The petrol driven 230 volt alternators that followed proved unsatisfactory for continuous service and were later replaced by diesels.

The CW sets were capable of being transported by sledge dragged by a bulldozer. Accommodation for the Naval crew was built close to the radars, so the total amount of construction required to set up even a simple CW station was considerable. It was carried out by the Public Works Department and there are hair-raising tales of getting machinery and equipment ashore on some of the islands or remote capes on the mainland. Subsequent fuel supplies were at times brought in by packhorse. The first CW sets had the broadside antenna mounted on the side of the radar hut and the hut itself was rotated to scan in azimuth. Control was manual and in a high wind the operator had to call for assistance to achieve an azimuth scan! Later sets had a separate antenna and control was electromechanical, but the antenna was fed by flexible coaxial cable, which meant there were strict limits to the range of azimuths that could be scanned. Wear and tear on the gearboxes and the operator's nerves in the frequent gales was severe and the occasional disaster occurred. The total area of a broadside antenna approached 20 square metres, and the reflector was 50mm wire netting, so the loading in a high wind was considerable.

The radars were initially set up on site by physicists and engineers involved in the design and the Navy crew trained in operation and maintenance. The latter was helped by the fact that they had been given a special course on radar (initially by an ex-science teacher recruited by DSIR) at the Naval Radio Training School in Auckland.

With the RCA 834 transmitting tubes ranges up to 25 to 30 km on a 10,000 ton freighter were achieved. With the more powerful GEC VT90 "micropup" tubes installed from mid-1941 ranges over 40 km and sometimes approaching 50 km were obtained from the higher elevation sites. Early in 1942 a CW set was installed on Mbengga Island covering the approaches to Suva, ,Fiji's capital and main port. (The radar site was on the 360m summit of the trackless jungle-covered island, and *everything* had to be hand-carried from where it was landed on the beach - quite an operation!). Overall the simple CW radar sets did great service, and the programme was fully justified by the audacious activity of German raiders around the New Zealand coast.

In 1943/44 these simple CW sets were phased out, and replaced by more sophisticated microwave sets (see below).

COASTAL DEFENCE (CD)

Range-finding for the guns defending the main ports of Auckland, Wellington and Lyttelton was by "depression range-finders" (effectively an optical base equivalent to the height above sea level) which were, of course, valueless in fog or darkness. The development of a radar for fire control was urgent, and started at Wellington early in 1940. The transmitter/receiver/display combination of the first set was identical to the CW, except that the time-base was displayed on a 30 cm cathode ray tube. In order to obtain good directivity the first CD set (installed at the Motutapu battery near Auckland) had separate 4-stack broadside antennas for transmitting and receiving. They were mounted on the sides of two manually rotated huts which were turned in synchronism by the operators communicating with each other by telephone! In 1941 the transmitter ,of this set was moved into the receiving hut and connected to a Yagi antenna, simplifying the operation enormously,.

The first CD set for Wellington's Palmer Head battery was installed without significant trials, in a tiny enclosed space at the fort and after a few days continuous operation it over-heated to the extent it became unusable! The design team had to devise better cooling, and learnt the bitter lesson of the need for robustness in military equipment, and the (not unreasonable) unforgiving attitude of military personnel to defects in equipment they are expected to use in action.

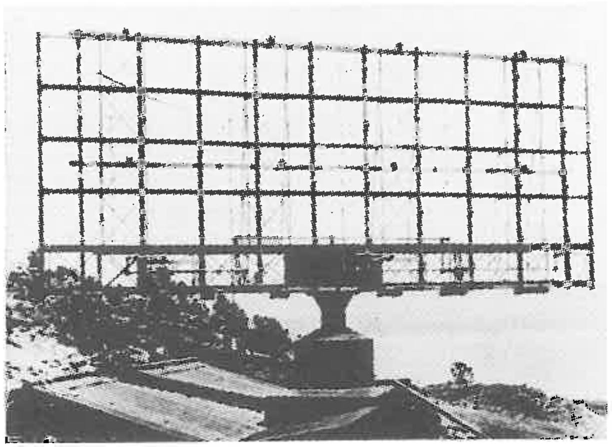
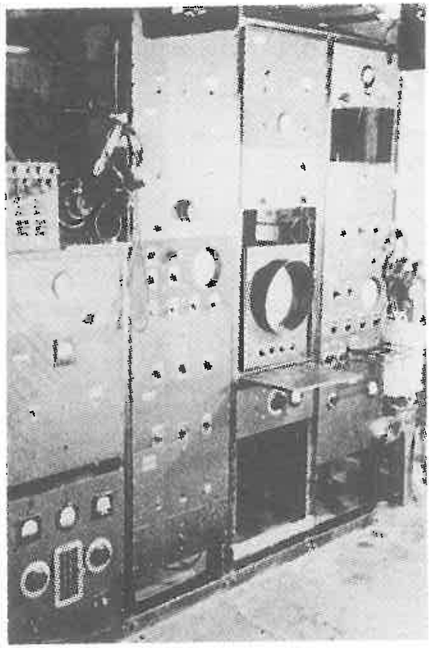


Fig 2. 5 stack broadside array

The closeness of the Palmer Head battery to the Post Office laboratory in Wellington allowed more thorough experimentation with antennas than had been possible at Auckland. In both places this had to be confined to daytime to allow radar operation at night, which did not help matters. The ultimate design reached by late 1940 had the three centre stacks of a five-stack broadside array for transmitting and the outer pair for receiving (Figure .2). The relative phasing of the latter was alternately switched between two different values causing the antenna beam to swing backwards and forwardas in azimuth by 6 or 7 degrees. On the display the timebase was moved a small amount laterally in synchronism, so a pair of target echoes appeared side by side, and then the antenna azimuth was adjusted until they were of equal amplitude. With an effective horizontal beam width of 10 degrees an operator could thus read azimuths to better than a quarter of a degree under good conditions.

During 1941 a number of improvements were made to the CD radars. The VT90 transmitter and a much improved receiver with coaxial resonator tuning on the RF and local oscillator stages became available, and two 15 cm CRTs were added to the display. One had a selectable expanded section of the timebase for accurate ranging and the other displayed the split target echo while beam switching. A much sturdier and more powerful antenna rotating system, designed by the Christchurch branch of RDL and the Public Works Department, also became available and allowed satisfactory operation even in a considerable gale.



The improved set was installed in stages at Palmer Head through the middle of 1941, while a second (originally intended for Motutapu) went to a coastal battery guarding Suva in Fiji after Japan entered the war. Further sets were made by industry (Fig. 3) largely in Wellington, but not without problems as the experienced radio-engineers discovered the wide differences between so many circuits in radar and those in radio communications. In all eight CD radars were supplied to the Army, the remainder of New Zealand's needs being met by the purchase from Australia of ShD (Shore Defence) gunnery controlled radars which also operated at about 200 Mhz. Eventually these sets were replaced in 1944 and 1945 by the CD Mark 3 microwave radar manufactured in Great Britain.

Unlike the Navy, the Army initially relied on the DSIR to train personnel to operate and maintain the sets. After recruiting to cover the needs of established technical services the Army then selected those they thought might be suitable to handle what was to them a new-fangled device of uncertain capability. The author of this article had the experience of training two such far from ideal groups at Palmer Head; it was noticeable that the second was of better quality than a the first as the Army got more faith in the "hurdy-gurdy"! The training problem eased substantially from the middle of 1941 when the first Service graduates,

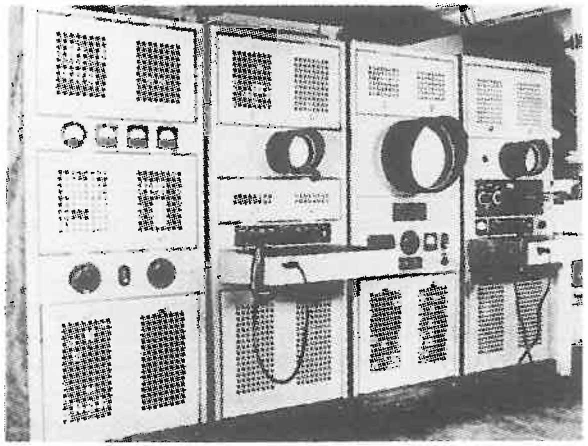


Fig. 3. CD Radar - Laboratory model (upper) and final version below.

who had been through the special university radio physics course, appeared on the scene.

SHIP WARNING GUNNERY (SWG).

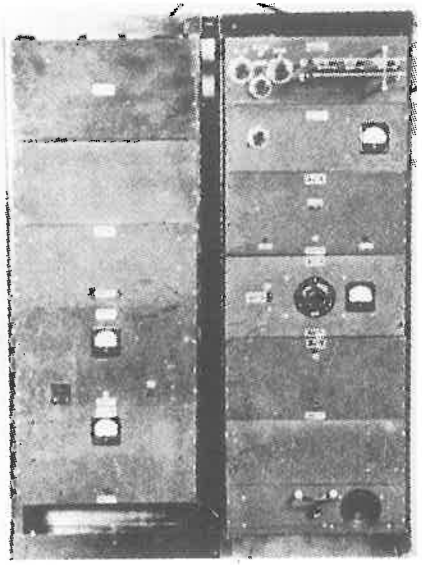
When the pocket battleship Graf Spee was scuttled in the River Plate estuary in December 1939, the aerials of the radar set designed to direct the fire of the ship's guns were plain to see. It turned out later that a lucky hit had disabled the radar early in the action, which had enabled the New Zealand cruiser Achilles and HMS Ajax, with no radar themselves, to manoeuvre safely hidden by smoke screens between brief appearances to fire on the battleship. A young RNVR lieutenant on Achilles, S.D.Harper (in peacetime a research worker at the British Post Office electronics laboratory), realised how narrow had been the cruiser's escape, and resolved that his ship would not fight the next action blind. He prevailed on the Wellington Navy Office to send him to Professor White's team in Christchurch to design and build a radar set capable of directing the fire of the ship's main armament.

As an interim measure an experimental radar was hastily assembled in Christchurch and Wellington and installed on Achilles in July 1940 while Harper started his own design. With experience in both electronics and servicing ships at sea he rejected the"rack and panel" construction used by the Post Office and adopted a filing cabinet principle with sliding drawers that pulled out on trailing leads. By putting wiring on top and valves underneath inspection and servicing could be carried out with the equipment operating. This revolutionary design was highly successful, and was adopted as standard by all wartime radars subsequently built in New Zealand. To ensure accurate ranging he used a crystal controlled oscillator at 164 kHz (providing 1000 yard range markers) and divided down to 2050 Hz to trigger the transmitter pulse and generate a timebase. The frequency was 430 MHz (wavelength 70 cm), the highest that could be practically attained with components available in New Zealand at the time, and the antennas a pair of multi-element Yagis mounted on robust shafts of galvanised water pipe. Two sets of this design were built in Christchurch and installed on the NZ cruisers Achilles and Leander in 1941 with the antennas on the fire-control tower. With a ship range of 7000 yards (against less than 5000 yards on the experimental model), range accuracy of 50 yards (500 yards) and quoted azimuth accuracy of 1 degree they were a vast improvement on the experimental model. Both sets operated successfully until they were replaced by production models (see below).

In 1941 as the Japanese threat developed, the British Admiralty inquired of New Zealand whether radar sets could be manufactured for the Eastern Fleet based in Singapore. Five air warning (SW) based on the CW design and five SWG based on the Harper design were promised. Later the SW order was cancelled, but the SWG order increased to 30, although only 24 were ultimately delivered, including eight to the New Zealand Navy. To attempt such production on an urgent basis required vast effort, which was based at a subsidiary RDL laboratory at Auckland and local industry engaged to manufacture. Improvements included increased transmitter power using VT 90 "micropup" tubes, a display with range "pips" in a "ruler-type" arrangement less prone to reading errors, and capability to show a selected portion of the time base on an expanded scale for accurate ranging. In spite of delay in supplies, the first set was delivered in February 1942 and the remainder by the end of the year. Of those dispatched first to Singapore and later to Tricomalee in the Indian Ocean, there is reason to think that one at least fell into Japanese hands, complete with its manuals; sadly, there seems to be no record of any of them being installed.

WORK FOR THE ROYAL NZ AIR FORCE

On his return from England in October 1939, Dr Marsden had with him an incomplete ASV (Air to Surface Vessel) radar. A receiver was added by the group in Wellington, and early in 1940 New Zealand's first airborne radar was flown in a Waco aircraft. It had a range of 20km on the 5,000-tonne inter-island ferry Rangatira.. Subsequent development was based in Christchurch with Professor White's group and a special Air Force unit, and a set produced along the lines of the British ASV Mark 1. This used the squegging oscillator principle for the transmitter at about 200 MHz and B-scope display. The transmitting antenna gave a fan-shaped forward-looking beam and two receiving antennas were arranged so the echos from each would be of equal amplitude only when the target was dead ahead of the aircraft. A rotary switch connected the two antennas alternately and the echoes deflected the CRT spot to the left and right of the vertical time-base.



The transmitter and receiver of the CW and CD radars were adapted for use in aircraft and the first set installed in an Oxford gave ranges approaching 30km on the Rangatira. About 20 ASV sets were produced by the Post Office workshops in Wellington and Christchurch and installed in Vincent and Oxford aircraft up to October 1941. Further development ceased when the better-performing British ASV Mark II became available from July 1941.

The wide use of the ASV Mark II in New Zealand and the Pacific necessitated the provisiion of ASV beacons to assist aircraft to return to their home or allied base. These were designed by the RDL and RNZAF units in Christchurch, and transmitted a coded response via an all-round-looking antenna after triggering by an ASV signal (figure 4). The beacons for the Pacific Islands were "tropicalised" to ensure that the electronics would stand up to the humidity and moulds that would be encountered. Their performance over average ranges of 100 miles was equal to that of the US sets bought later .

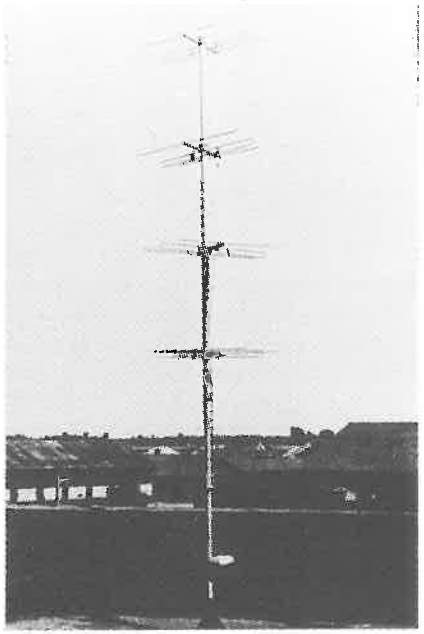


Fig. 4. ASV Beacon. Responder (upper) antenna (below)

Whereas in Britain defence from air attack was the top priority, in New Zealand it was of less importance than coast defence until late 1941 when Japan entered the war. However, by this time ground radar for RNZAF needs had already been ordered from Great Britain, and RDL involvement was limited to assistance in the installation where necessary, and sometimes the supply of alternatives to missing parts. An overseas version of CH (Chain Home), COL (Chain Overseas Low) and GCI (Ground Controlled Interception) were involved. An old COL, previously used for training purposes by the Air Force, was installed on Malolo Island off Nandi aerodrome in Fiji in February 1942, and several COLs by the Air Force in the Solomons in 1943.

Of particular interest was the fitting of the first successful T-R (Transmit-Receive) system in New Zealand to a CH radar on the Coromandel Peninsula. In this system a single antenna is connected to both the transmitter and receiver. A spark gap at an appropriate point across the transmission line protects the receiver when the gap fires during a transmitter pulse. The system used a locally made spark gap, and did away with the necessity of providing a receiving antenna on a separate mast.

In early 1943, as the Allied operation in the South Pacific turned more to the offensive, RDL gave further assistance in setting up a GCI radar in Guadalcanal in the Solomons. As a result of this experience it was recommended that the set would be much more useful if mobile. Following a request by Admiral Halsey, the Allied Commander in the South Pacific, two sets were each put in a 6-truck convoy by RDL. The first was set up at Munda in the Solomons by the RNZAF in September 1943, and the second on Bougainville. The pressure ventilation incorporated in the operating trucks proved to be a real boon in the Tropics.

MICROWAVE RADARS

In 1939 it had been appreciated in Britain that metre wavelength radars would never be satisfactory for night fighter aircraft to engage an enemy bomber, both because of the extra drag and the lack of precision in azimuth that was achievable by practicable antennas. Research into methods of producing useful power at a wavelength of 10cm, and of detecting such waves, was started late in 1939. By the middle of 1940 the cavity magnetron was producing powers of several kilowatts at this wavelength and the klystron, used as a local oscillator, enabled their successful reception. Microwave radar was possible and within months its enormous potential on land, sea and in the air was being realised. It is now history that the secret of microwave radar was taken to the USA in October 1940. In a far-seeing move the US authorities set up the Radiation Laboratoriy of the Massachusetts Institute of Technology (MIT) to develop and exploit the new technique, and at the same time to gear industry to manufacture on a large scale. Another important device that had been invented in Great Britain in May 1940 was the Plan Position Indicator (PPI) display, originally developed for the GCI radar which had a "rotating coupler" in the transmission line to the antenna allowing it to rotate continuously. In the PPI display a radial time-base rotates (in synchronism with the rotation of the antenna) from the centre of a CRT and is brightness modulated by the echo signal and, when required, range markers. In this way a map of the area surrounding the radar is presented, from which the azimuth and range of the desired target, appearing as a short arc, may be pinpointed. The PPI display enabled the full potentialities of microwave radar to be realised, and, with its derivatives, is at the heart of every modern radar alongside the cavity magnetron.

Late in 1941 Watson-Munro was appointed "Scientific Liaison Officer" (SLO) at the New Zealand legation in Washington DC with the prime objective of learning microwave techniques at MIT and obtaining a supply of critical components. He returned in May 1942 with magnetrons, klystrons, parabolic aerial dishes etc. supplied by the USA and Canada under "lend lease". With the subsequent permanent appointment of a Washington SLO (one also in London) the continued availability of these critical components in New Zealand was assured, and enabled a vigorous programme of development and construction of microwave radars to be maintained. Almost as important, the subsequent flow of technical literature, originating in Great Britain, the USA and Canada was ensured, relieving the semi-vacuum in library facilities that had existed in the early days at RDL. The magnetrons originally brought to NZ by Watson-Munro were designed to operate at 9.2cm, a wavelength that was maintained in all microwave sets built in New Zealand in World War II. To help build up the nucleus of a team two RDL physicists spent a few months in Australia where microwave work had already begun.

In a far-seeing move it was decided very early in the microwave programme that a mobile coast-watching and surface fire control radar be designed for service anywhere in the Pacific, and be operational within a few minutes upon a chosen site. Even with the critical components available the amount of design and development work involved for the first microwave radar was enormous - all the RF components such as coaxial transmission lines(there was no experience in waveguide theory and practice in New Zealand at the time), rotating coupler, T-R system etc., spark gap modulator, a PPI display and so on. In the middle of 1942 the state of war in the Pacific demanded the greatest urgency and with the recruitment of local industry in Wellington and Christchurch and the Electrical Engineering School at the University of Canterbury, the first microwave radars were in full production early in 1943 following the firing up of the first pre-production model at RDL on Christmas Day 1942. Because the radars were to operate as mobile units in the Pacific the normal standard component and chassis assembly was modified to increase robustness and resistance to vibration, and all the electronics were "tropicalised".

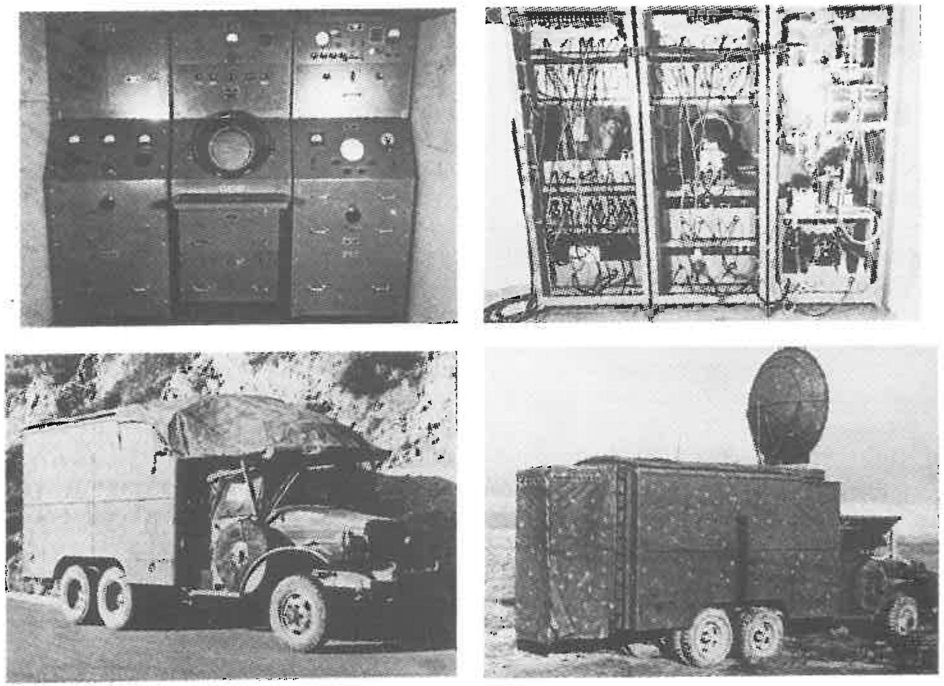


Fig. 5. **Truck-mounted Microwave Radar** Top Left - Front view of radar equipment Top right - Rear View of equipment showing trailing leads Bottom left - Radar truck with dish antenna stowed for transport. Bottom right - Truck with antenna in operating position. (An interior view of the truck is shown on page 4).

The radar itself was mounted in a ten-wheeler truck with the antenna dish on a rear platform initially, but in later models on the roof of the cab to allow a larger radar cabin with room for a plotting table and communications (Figure 5). A second truck contained three petrol generators (later two Lister diesels) with a workshop bench and tools. A supply of hand tools to enable first or even second-line servicing in the field was considered essential and, to ensure that the initial production run of 12 sets was fully supplied, late in 1942 two of the office staff of RDL visited every hardware shop in New Zealand and virtually exhausted their stocks of these items! Plenty of spare parts and essential electronic test gear such as oscilloscopes, standing wave detectors, test oscillators, vacuum tube voltmeters etc., designed at RDL, were also sent with each radar set.

After assembly and installation in the trucks by RDL staff the radars were fully tested in rough conditions by driving up river beds, and setting up and operating on various coastal sites. Results were highly satisfactory, well repaying the hard work that had gone into their production. After arriving at a level site the radar could become operational in no more than ten minutes, but up to 30 minutes if significant jacking up of the trucks to level them was required.

There is no doubt that, in the first half of 1943 the mobile microwave sets produced in New Zealand were well ahead of contemporary efforts by the USA and Australia in the South Pacific.

Early in 1943 the first truck-mounted microwave radar saw service in the Russell Islands in the Solomons, in the defence of a US motor torpedo boat base. An RDL scientist and a NZ Navy lieutenant were seconded to serve with the US 3rd Raider Marines, controlling the fire of a battery of 155mm mobile guns ("Long Toms"). Further mobile microwave sets, manned by the NZ Navy were sent to other points in the Solomons in April and June in support of both the US and NZ forces operating in the area. Other RDL scientists visited some of these radars in operation, ensuring that lessons learned in the field and improvements and adaptations foreseen as desirable were incorporated where possible in later models.

As well as seeing service in the Pacific, the microwave radars gradually replaced a number of the 200 MHz CW sets in New Zealand from late 1943. Four sets were constructed for minesweepers operating in the Pacific Islands, their design and fitting requiring detailed planning because of space limitations. A bridge-mounted PPI display (now standard practice on virtually every radar-equipped vessel afloat) allowed the navigator to have ready access to the screen. Several of the CW microwave sets were re-modelled for detection of low-flying aircraft and truck-mounted for mobile operation by the British operating from India, but never saw service before the war's end. The last microwave radar designed at RDL was for height finding, and used for tracking radiosonde balloons by the Meteorological Service. Six of these sets were built and continued in operation until the early 1960s.

LONG-RANGE AIR WARNING (LRAW)

Following the landings of US Marines in the Solomon Islands in the middle of 1942 it became apparent that there was a need for a long-range air warning set that could be quickly deployed after a landing. The transportable US air warning radar (SCR270) took up to three days to bring into operation, whereas air warning was required virtually immediately following a landing.

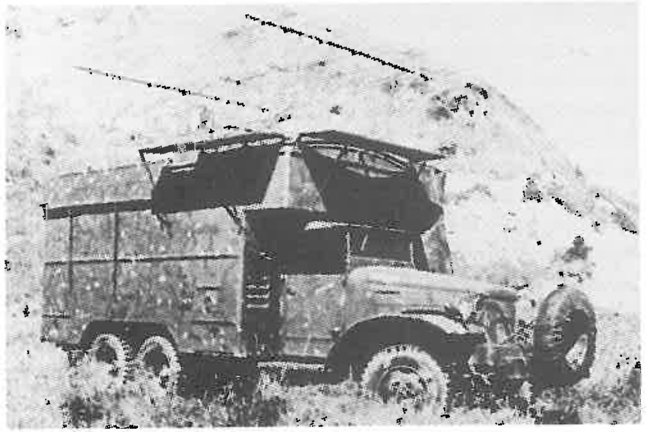


Fig. 6. LRAW radar truck with Yagis erected

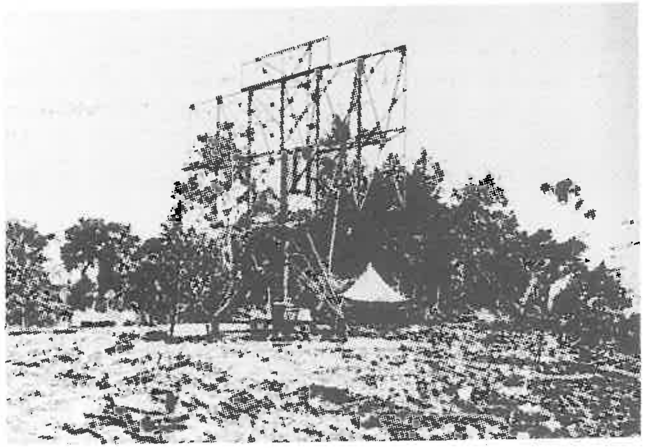


Fig. 7. LRAW Broadside array in operation

In 1943 a radar operating at 100MHz was designed and again with the help of industry, the Public Works Department and Canterbury University Engineering School, six were produced in a remarkably short time. As with the microwave equipment the sets were truck mounted - the first of three trucks contained the radar equipment and a demountable moderate gain Yagi on the roof, the second contained two diesel powered generators and workshop facilities and the third contained components for a high gain broadside array and its mounting tower.

Following coming ashore in a landing craft and being driven to the site, the radar could be brought into action (Figure 6) in about half an hour. It took about a day to erect the broadside array (Figure 7). Ranges of about 150 to 200 km on aircraft flying at 3000m were normal.

The LRAW sets were assigned to US Navy "Argus" units with an RDL physicist (temporarily seconded to the NZ Army), who had been closely involved in the assembly and testing, accompanying each one to train the Argus personnel in operation and maintenance and take part in its use in military operations. The first LRAW was dispatched from New Zealand in December 1943 and took part in the landing on Nissan Island in the Solomons in February 1944. It performed extremely well and received much favourable comment from the US command. Other sets went to Enirau Island (Bismark Archipelago), Peleliu (Palau Islands) and Ulithi (Pacific Islands Trust Territories). In all cases the performance was good, allowing for deficiencies in siting in some cases, and the decision to have an RDL expert in charge, who was determined to get the best out of the set, was amply justified.

ASSISTANCE TO ALLIED OPERATIONS IN THE PACIFIC

Although not strictly within the topic of this article, the development of radar in New Zealand, another important activity of RDL scientists in 1942 and 1943 particularly, was the fitting of US manufactured radar sets on to so-called attack transport. These sets, in ex-factory packaging, were hoisted aboard as these ships left USA shores, the intention being to fit them at the earliest opportunity, which in some cases turned out to be a short stopover in New Zealand. At the time there were very few US radar experts in the South Pacific, whereas the RDL scientists with experience of designing and building radars from first principles and installing them in ships, were ideally suited to undertake the installations. It was not unusual to be faced with a previously unseen radar set, complete with manuals, and to be asked to install it in five days while the ship was in dry dock! It was demanding and exhausting work, but of great value to the US forces. For example, all the attack transports for the landing at Tarawa in the Marshall Islands (now Kiribati) were fitted with radar in this way at the Wellington floating dock. There were installations on many other US vessels and a T-R system was devised for the antennas of a Dutch cruiser operating with the Allied navies in the South Pacific.

Until late 1943 little was known of Japanese radar in the Pacific, but in November of that year much evidence came in that they had a variety of both land-based and seaborne equipment. An active countermeasures programme was needed and a new headquarters unit to coordinate Allied countermeasure activities in the area was formed, which included personnel from all the Allied countries operating in the Pacific theatre of war. Two RDL scientists were seconded to this group in December 1943, operating from New Caledonia and the Solomon Islands and subsequently from New Guinea, Morotai and the Philipines. Their activities included intelligence, accompanying missions for radar search and destroy, and jamming enemy radar on raids to major targets, and continued until the war's end in August 1945.

SUMMARY

From small beginnings late in 1939 New Zealand was able to develop radar sets of increasing sophistication throughout World War II and put them in the field in New Zealand and the Pacific sometimes well before sets of similar capability could be made available from elsewhere. Because of limited facilities mass production was not attempted but, with the very full cooperation of local industry, small numbers of radars incorporating new applications were produced in a very short time between concept and placement in the field. This achievement was all the more meritorious as there was no television industry as a basis and no one, at least in the outset, trained in any way in what was an entirely new invention. In all 117 sets of different types were delivered to the Armed services, including 76 to the Navy and 7 to the US Forces in the Pacific.

It should be stressed here that no equipment put into the field was complete without detailed operational and maintenance manuals. The writing and printing of these was a demanding job and in many cases the only people who could supply the basic information were already heavily committed to furthering other urgent work. This sort of thing is only one example of the dedication of staff to the radar development programme and their willingness to work long hours when necessary under conditions which were often far from ideal. Even so, the job had its lighter moments - examples of these could fill a book. like the operator at Motutapu who missed reporting the liner Quenn Elizabeth anchored 2000 yards from the front door - "Sorry Sir, I thought it was an island", or the pilot's comments about a radar operator whose ASV set had the left/right antennas connected right/left to the display, or interference from a microwave transmitter under test causing an irate citizen from next door to the RDL building to complain that he was nearly blasted out of the room when he was listening to Christmas carols on the radio, on Christmas Day too! The list is endless but unfortunately not for this article.

It would be appropriate to end this brief account of the development of radar in New Zealand with an acknowledgement to the late Sir Ernest Marsden, who launched the programme in 1939 and by his continued enthusiasm and encouragement did a great deal to ensure its success. Sir Ernest believed that "all an administrator could really do was to create an atmosphere in which research could take place, to stimulate his officers with ideas and to see that they had adequate facilities". He did this to great effect in the radar development programme in New Zealand. His contribution to this development, and through it to the war in the Pacific, was very great and should always be remembered.

ACKNOWLEDGEMENTS
In the preparation of this article I am indebted to a number of my former colleagues in the Radio Development Laboratory who have provided information on their personal experiences, refreshed my memory on many aspects of the programme that had escaped me after a lapse of fifty years, and provided comments and criticism on the draft manuscript. I.K.Walker provided an excellent report on the CW, CD and SWG programmes, while E.R.Collins covered a great deal of the earliest days in 1939 and 1940. Others who should be mentioned include, in alphabetical order. I.D. Dick. A.D.Gifkins, C.G.Liddell, Prof. A.G.McLellan, N.B.Manssen, S.E.Slatter and Dr. R.M.Williams. I would also like to thank Bruce McMillan of Eclipse Radio and Computers in Dunedin, whose recent research into the history of the World War II radars guarding that port has turned up much useful information from the wartime records of the Public Works Department and the Services, and which he has made freely available to me.

Editors note - To conserve space the bibliography of 16 references has been omitted from this reprint of the original article.

NEW MEMBERS

The NEW ZEALAND VINTAGE RADIO SOCIETY was formed in 1979 with the object of encouraging the preservation of all types of early radio equipment together with associated documentary material. In particular the Society is concerned to see that as much as possible is done to preserve for posterity anything connected with the history of radio in NZ.

While the membership is reasonably strong there is always room for new members. As a present member you will be aware of the benefits to be gained from membership of the Society. Do you have a friend who is also interested but is not yet a member?

Enclosed with this issue is a membership form just in case your friend might be keen to join.

FROM THE WHITE SHED

Ian Sangster

Recently I have had the luxury of a little time to get into my shed of largely unrestored radios. Over time I seem to have accumulated a few of the Bush look-a-like, Ultimate EA and FA sets.

I was asked to repair an FA by one of the painters at my work. This was his garage radio, thus it wasn't in the most immaculate order. I replaced all the paper capacitors plus electolytics and was quite impressed by the the way that the set performed. Some time after returning the set to its owner, he reported that it had stopped operating. I asked him to bring it back. I found that the oscillator had stopped oscillating. This turned out to be one of the small mica capacitors in the oscillator circuit.

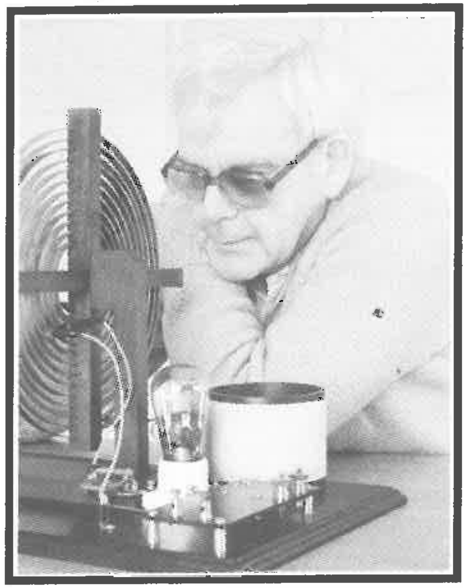
Lessons learnt in this exercise were. Don't rush to get the set back to its owner, run it for several days after getting it going, other components may fail with full high tension voltage supplied to them for the first time in years. When working on the Ultimate FA's and EA's one has to remove the speaker from the cabinet to run the set as they seem to be cursed with very short speaker leads. In the case of repeated speaker removal for sets with intermittent problems, the wood screws holding the speaker tend to loose their grip. Thinking about this problem, and the number of my own FA's and EA's in the pending stack, I hit on the idea of making a pair of speaker plug and socket extension leads.

Searching through my plug and socket draw I found 4 pin and 5 pin plug and socket sets, the sockets were wafer type valve socket but the plugs were ones with insulated rear covers. Selecting some of my finest teflon insulated wire I made up a couple of looms and laced them neatly. The looms were 3 or 4 feet long. The plugs and sockets were soldered at either end and a pin to socket continuity and insulation check was carried out. A boot was made up to insulate the rear of the socket using heavy tape or sleeving attached to to the wafer socket with small cable ties through the valve socket mounting holes and holes punched in the sleeving. The sleeving was then graduated down in size to the diameter of the loom and tied firmly there. Heat shrink would be ideal here, though large diameter heat shrink can be very expensive.

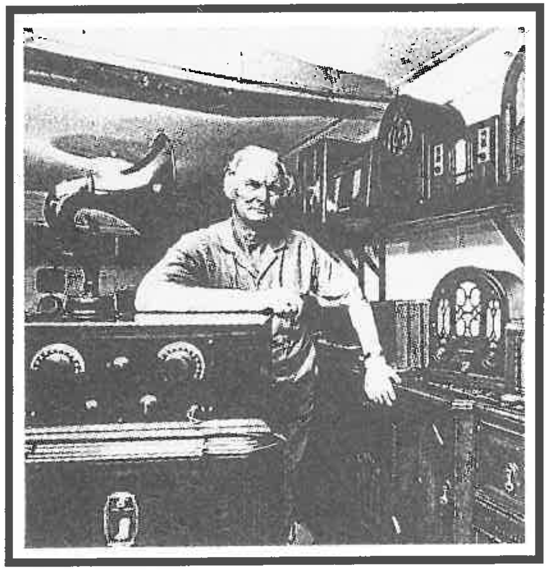
I have used these leads a couple of times now and find them convenient, one needs a clear shelf above or near the workbench on which to sit the empty cabinet,which can be a problem in some crowded work areas. Cabinet rattles and resonances can be picked up more easily as, without the chassis in the cabinet, the possibility of valve microphonics can be eliminated. These leads were probably used by people in the heyday of valve radio servicing, though many of the better equiped areas would have had test speakers, which include selectable choke impedances for various differing sets.

Any of our members who have been lucky enough to attend NZVRS exhibitions have experienced the hospitality of **KIT FARMER**, her cooking and baking skills were evident in the food supplied to them Many members also experienced her hospitality when they visited Bill's workshop. Kit died on September the 20th. Our feelings are with you, Bill.

It is with regret that we note the death of two outstanding members.



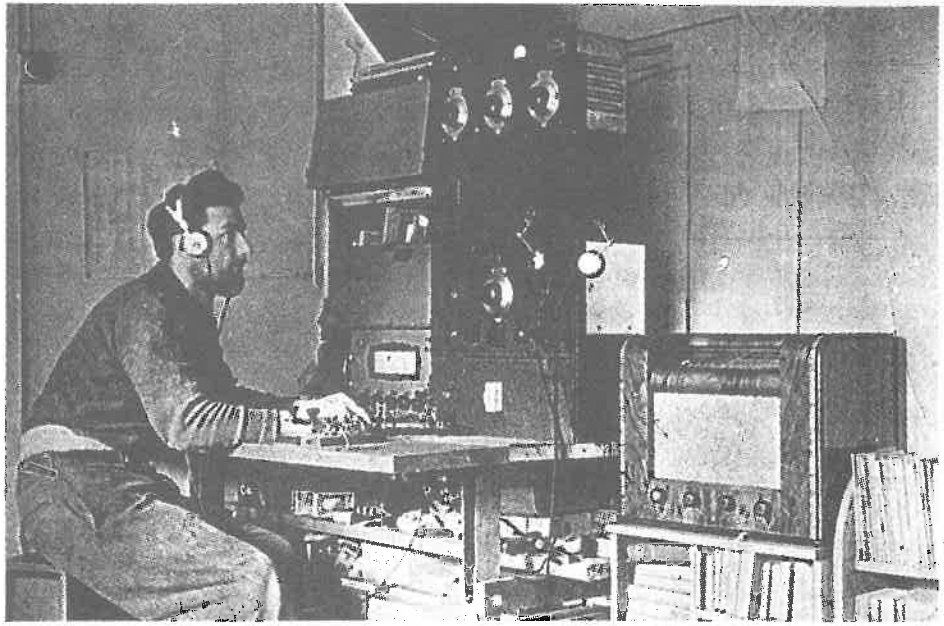
ERIC GEORGE KIRBY, was born in Wairoa and early on developed a hobby interest in radio which he maintained throughout a life largely spent as a Public Hospital administrator. In 1960 he visited England and worked for a time on radio with the Marconi Company which started his intense interest in Marconi himself and his early discoveries. Eric became a foundation member of the NZVRS being its first Treasurer and was very interested in the history of radio in New Zealand, a subject on which he contributed a number of articles to this journal. He was a man of many abilities including activities as diverse as antenna design, clock repair and painting in oils. He is sadly missed by his wife, Marie and his many friends.



FREDERICK CHARLES JOHANNES WILLEMSEN

Fritz Willemsen was born in Holland and came to New Zealand following a period in the military in the Dutch East Indies (now Indonesia). His occupations here included, farming and building before he retired to Hamilton and took up vintage radio collecting and wooden toymaking. Fritz's radio collection is one of the most impressive and certainly one of the best displayed of any in this country. His residence has been the venue for meeting of Waikato collectors for a number of years now and the hospitality afforded by Fritz and Leah was one of the main attractions at these meetings. To Leah and family we offer our sincere condolences. Fritz will be missed by many in the radio collecting field.

COASTWATCHING IN THE SUB-ANTARCTIC 1941-45



Photograph courtesy Southland Museum and Art Gallery

Codenamed the Cape Expedition, the object of this secret mission was to watch for and report on any enemy shipping that may try to make use of New Zealand's sub-Antarctic islands.

There were two camps on the Auckland Islands and one on the Campbell Islands. Five civilian volunteers were stationed at each camp and many had no idea where they were being sent when they left NZ. They were stationed on the island for a year or more at a time with little contact with home.

The need for secrecy meant that the radio transmitter could only be used to send the most essential personal messages back to NZ. However they could receive official information about supply ship movements and, as conditions allowed, receive news and entertainment from broadcast stations including news of the Normandy landings in June 1944.

The Southland museum has set-up one of the original coastwatcher's huts in its "Roaring 40s" gallery and they are keen to locate any of the original radio equipment to complete the display. We could also look at a mock-up of the transmitter panel as shown in the photo if an original transmitter cannot be found - anyone got any spare National Velvet Vernier dials?

If anyone can help identify or provide more information on the equipment shown or even identify the receivers in the photo (believed to be of the Campbell Island station) the writer would be pleased to hear from them. The radio gear could be of Collier & Beale manufacture.

Arthur Williams, 26 Centre St., Invercargill. Ph. 03/2168985

A RANDOM REMINISCENCE

George Newlands.

South Canterbury plains. February. HOT! On the shady side of an old shed a motley collection of rams listlessly contemplate heat haze, brown paddocks and a clear blue sky, doubtless wishing for greener feed and looking forward to April. Somewhere roofing iron squeaks in an apology for a breeze and the place smells of old straw, dry grease and age. Some things are the same the whole world over. Shafting, gears and broad-belt pulleys that once made sheep uneasy now lie in partially dismantled disarray, still for years, rusted and bleached with bird droppings. Dry and weathered wood decorated with old cobwebs and windblown straw. Age-furrowed hardwood and lichen. An engine block, oil stain keeping the weeds at bay, slowly losing the battle to stay above ground. I stand and contemplate the once that was and never will be again - a time when such places were all action and wool guaranteed an income.

But now it's just a dumping ground for the unwanted and forgotten, disappearing into the landscape by slow degrees. Grey iron turning brown, standing in the weather until only the weather remains. Car doors, removed from the family car when it became the farm hack and the rest of it somewhere out there under the macrocarpas, layed to rest in traditional fashion and slowly mouldering into the ground. The untidy nests of numerous sparrows spill their tendrils of wheat straw over an amazing accumulation of bric-a-brac, some recognisable but much now gone from mind and memory. Rusty hooks, fencing wire and gear wheels on rusty nails, all essential to some part of the operation or to the whims and passions of men long gone. I find such places both sad and fascinating.

Above my head is a shelf of old tins and boxes, fragile, rusted and faded. A contents check turns up nothing but old nails and a shapeless lump of rust which proves to be a collection of old shearing cutters. Now a wooden box with the faded emblem of Laurel Kerosene on the end. It's awkward to get at but I get a hand inside it and pull. Ouch! A sharp pain and dark blood wells from a finger. Transferring injured digit to mouth stifles a string of curses while I try to remember when I last had a Tetanus booster. Never mind, we all have to die of something. The box contains straw, bird droppings, a collection of perished vee belts and an old paint tin full of rusty chain. But wait - there's something else here. No, surely my mind must be going. It must be the heat; tetanus doesn't work that fast. Can I really be looking at the top of one of the more memorable efforts of Collier and Beale?

Actually, gentle reader, I was. It was a 518N, complete but dirty and now restored and working. How it came to be where it was will forever remain a mystery and, curiously enough, I had tried very hard to get one not long before. So it just goes to show, you never know where these things will turn up.

On Call. Brad's work requires him to drive frequently so he has a mobile phone in his utility. One evening when his friend called the mobile number, he heard a recorded message: "Hi! This is Brad. I'm sorry I can't talk to you now because I'm **home,** but I promise to call you back as soon as I'm out"

THIS BUSINESS OF SOLDERING.

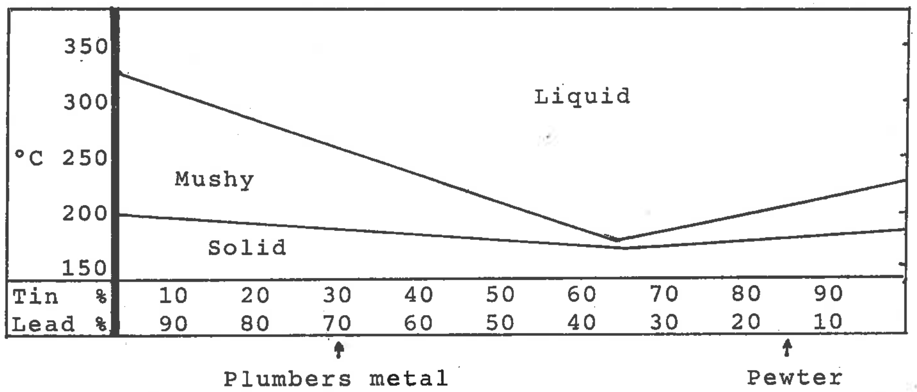
George Newlands

The following article is the result of finding a most unusual fault in a mantle set. A Cromwell 5151 (C&B) was given to me with the fault that the output faded in and out intermittently. Faded was right. The audio came and went slowly and intermittent faults are always difficult. It turned out to be a dry joint on a heater connection of the IF valve socket; the heating and cooling of the cathode causing the slow fades and the joint itself causing the intermittency. (Not an easy one to find with the valve (6BA6) cathode invisible with the valve in place and testing 100% out of it.) The joint looked perfectly OK and even had the customary lacquer dab.

Solder, as a part of radio, is familiar to us all. It is as common as resistors and capacitors but, to many people I suspect, rather more mysterious in actual action. I wonder how many people actually know what they are doing when they make a soldered joint.

Soldering is the process of joining two metals mechanically, and thus electrically, by the use of a third. How good a joint is depends on the type of solder used and how well it adheres to the metals being joined.

Electrical solder is an alloy of lead and tin, in proportions suitable for its application, and is softer than either of these metals. Lead and tin have crystalline structures which when melted together attack each other to form a eutectic mix, the resulting alloy having a lower melting point than the constituent metals. (It is this action which allowed the ancients to cast bronze, an alloy of copper and tin, rather than trying to work with the impossibly high melting point of copper.) The melting temperature of the alloy depends on the percentages of the two metals as shown in the figure.



Note that the lowest melting point occurs with 63% tin and 37% lead, giving a liquefaction temperature of 183 degrees C. It is for this reason that "60/40" is the common solder used in electrical work although other mixes can be found and an increased tin content can be an advantage if the higher melting point can be tolerated. Difficulties with tinning or "wetting" a joint will be found if the lead percentage is increased. (This writer well remembers a consignment of solder purchased from India by the old NZPO We ordered 60/40 and that's what we got- 60% lead and 40% tin! If I recall correctly it got made into fishing sinkers.)

Electrical soldered joints are made with a soldering iron unless it is a mass production operation where bath techniques are used. The purpose of the iron is to bring the materials being joined to a temperature that will allow solder to run easily into the joint. This is the sole purpose of the iron- it should never be used as a plastering tool. The temperature of a soldering iron must be well in excess of the melting point of the solder as the iron tip temperature drops sharply when it is applied to a joint and heat flows into the parts being soldered. This means that the iron must have sufficient size or reserve of heat to maintain itself and the joint above the melting point of the solder for however long it takes to complete the operation.

When making a solder joint cleanliness is absolutely essential, both for the tools and all the materials involved with no scale, oxide coating or grease present. The iron tip must be clean, bright and well tinned in order to ensure efficient heat transfer to the joint. Some form of flux is desirable, if not essential, to assist solder flow and to prevent oxidation of the parts as the joint heats up. Flux (from the Latin Fluxus, describing the action of flowing) takes various forms in soldering and serves several purposes. Electrical soldering fluxes must be non-acidic, non-contaminating and set hard when cold. They are generally resin based and contained within the solder. Acidic fluxes have their uses but they should never be used in radio work. Flux serves the purposes of keeping air away from the joint, breaking the surface tension of the solder and assisting the fusion of the solder to the parts involved.

I can well remember some liquid flux supplied by the American Western Electric company for use in installation work in the old "Rotary" telephone exchanges. It came in a (US) gallon tin and you could always tell how much there was left - it formed a line on the outside of the tin at the level of the liquid where it was attempting to eat its way through. We never knew what it was made of but always considered that it was designed to solder enamelled wire without scraping the insulation. It was vicious stuff which we were very wary of using.

It has been the experience of this writer that most of the soldering irons used in electrical work do not run hot enough. Six to seven hundred degrees Celsius is common and probably adequate for most work as long as the bit is large enough but it is always an advantage to be able to make a joint quickly and this requires a very hot iron. It can be noted that, ideally, a solder joint should be made hot enough to vapourize any flux used in the operation and many irons are not capable of this. Still, this requirement is not important in vintage radio work. This writer uses a temperature controlled iron set for 800 degrees C and this meets all the requirements of speed, efficiency and flux vapourization.

Radiola Model 66

WORTH THE WAIT

Rod Osborne

On a trip to an American radio meet a couple of years ago I became friendly with a local collector who showed me his collection of vintage Radiolas and Atwater Kents. It was one of the nicest collections I have seen with all the models very well presented and he had some really impressive radios. Sadly for me none were for sale. We kept in touch swapping service information. A few months ago he said he would sell a couple of models I had coveted - a Radiola 46 and 66. He had bought a vintage Volkswagen and his wife "suggested" that he sell some radios.

The US freight bill was, as usual, quite frightening but the radios duly arrived and what a packing job he had done. The cabinets, chassis and speakers were all bubble wrapped and packed in separate boxes, each box made out of 12mm ply screwed every 100mm. Each valve and knob had been removed and wrapped separately with little labels to tell me where everything went.

Both sets were as good as I remembered them. The tapestry on the 66 and the grill cloth on the 46 were original and unmarked, the cabinets were original with no borer or bubbled veneer, all the knobs were original and the chassi and speakers were in top condition with no rust or corrosion. The chassis and cabinets are so large, about 1300mm high and seem to weigh about half a tonne. Testing will have to wait until I have checked the critical bits.

When these sets are compared with my usual acquisitions - borer to be treated, veneer to be replaced or repaired, polish to be redone, grill cloth to be replaced, knobs to be found, rat's poo and rust to be removed from the chassis, speaker and transformers to be rewound etc, that they were most welcome. Being classical Radiolas also helped. The birds eye maple around the top of the 46 and the tapestry on the 66 are particularly nice and I hope they show in the photos.

I wonder why these old sets keep so well in America and usually so poorly here. I keep looking and wondering what I can do th them and, except for a good waxing, I can't find anything - makes me feel a little unwanted.

Footnote: since writing this my friend has contacted me again and will sell another two radios which I had wanted even more than these - apparently the Volkswagen needs a lot of work - any offers for two classic sets........

Radiola model 46

LETTERS TO THE EDITOR

The Editor

Through you I would like to pay a tribute to the late Fritz Willemsen.

With fellow members, Ian Sangster and Bob Cook I attended most of the Waikato area meetings held at Fritz and Leah's residence in Hamilton on Sunday afternoons. I think it was the hospitality that was bestowed upon us by Fritz and Leah that had us returning to those meetings.

Fritz's magnificent radio display was certainly a credit to him.

I found Fritz quite a character to deal with. When I would make fritz an offer for an article I would look for the expression on his face to determine whether the offer insulted or pleased him. I did not do many "deals" with Fritz but the atmosphere that was created at those meetings will be a pleasant memory with me and, I am sure, with other members who had the pleasure of attending those meetings.

I met many interesting NZVRS members at those meetings, many of whom had travelled great distances to be there and I know that those Sunday meetings at Fritz and Leah's place will be sadly missed by them.

Finally I would like to convey my condolences to Leah and her family.

E.J. (Ned) Matich.

The Editor,

Just two years ago Bruce Jensen gave several talks to members of the Wellington Group on cabinet veneers, resurfacing and colouring and he was then in good health. Thus his recent sudden death in Wellington Hospice was unexpected

His father founded the firm A.C.JENSEN Ltd, Adelaide Rd., Wellington about 1930 and was responsible for the excellence of all Columbus. Courtenay, Collier and Beale and many other cabinets. Staff up to 100 were employed and total units over the years must have reached a million.

Bruce, however began in 1937 in the toolroom of Radio Corp NZ - as he said "to obtain precision in tool construction". This he applied when he took over as Managing Director of his late father's firm in 1958 and continued the family tradition. A friend of mine and a pioneer of NZ vintage radio and TV cabinets has departed.

Alan Stanley.

The Editor,

Came across a small bit of information recently in a Smithsonian Institution publication about the George H. Clark Radioana Collection that I thought might interest the Bulletin readership.

An announcement from the RCA board of directors

"Recognising the importance of providing a museum for the Radio Art to house the rapidly disappearing relics of earlier days, and the desirability of collecting for it without further delay examples of apparatus in use since the inception of radio, the Board of Directors of RCA has made an initial appropriation of $100,000 as the nucleus of a fund for the establishment of a National Radio Museum."

The sum was impressive, but what caused me to do a "double take" was the date - 1928!!!! Seems that radio collecting has been around for some time.

Peter Lankshear.

70 YEARS OF RADIO TUBES AND VALVES by John. W. Stokes
Second edition, Sonoran Publishing, USA, 1977

Even if they cannot identify any other component, everybody *knows* that valves are a vital component of vintage radios and many enthusiasts, the writer included, find that these are fascinating devices and very collectable in their own right. The development of radio is closely linked with that of valves, and a major demarcation point in the chronology of electronics was the transition during the 1960s to solid state technology. In fact, modern electronic engineering dates from the advent of the transistor which was the genesis of the silicon chip.

We are fortunate in having three widely respected and definitive books dealing with valve history. Gerald Tyne's 1977 *Saga of the Vacuum Tube* sponsored by the Antique Wireless Association and the Smithsonian Institution, was the first of these reference standards. Tyne deals with valve history only up to 1930 and, while it does cover world developments, its real strengths are in US valve history. In 1992, Keith R. Thrower produced his excellent and geographically specific *History of the British Radio Valve to 1940*, in some ways the Saga's counterpart.

Meanwhile in 1982, Vestal Press in Upstate New York had published a much wider ranging and extensive work covering the history of the valve. The creation of our own John Stokes, *70 Years of Radio Tubes and Valves* quickly gained international recognition and it is a measure of its status that it is frequently acknowledged as a reference source for vintage radio articles. Its strengths are the wide range of topics covered , the enormous number of valve types referred to and the lavish illustrations, advertisements and photographs.

70 Years is an essential work for any radio history library and many readers will already possess a copy of the first edition which I reviewed in the February 1983 Bulletin. Then I pointed out that in recognition of John's effort, the US Antique Wireless Association had awarded him the Prestigious Tyne Award, an honour not lightly conferred. On rereading my enthusiastic 1983 review I see no need to revise any of my comments. It is still the widest ranging, most fact filled and readable work on the electronic valve.

With any opus of the breadth and quality of material covered by *70 Years*, it is inevitable that errors will occur and later information will emerge. The first edition is no exception and John subsequently issued an errata list. Also, a minor problem arose when information about a specific valve type was sought as there was no index of valve types and sometime a bit of hunting was necessary to locate the required reference.

Now the Sonoran Publishing Company of Chandler, Arizona has published a second, revised edition. The majority of the first edition's errors and amendments have been attended to but very importantly there is now a valve type index. But wait! as they say in the commercials, there is more. One omission from the first edition was a section dealing specifically with audio output valves. John has now written a new chapter covering in depth all the favourites, including the big triodes like the 2A3 and 300B and the legendary KT66 and KT88 tetrodes.

This new section will appeal especially to a group of enthusiasts which has emerged since the publication of the first edition. These are the audio enthusiasts who have kept alive the cult of valve audio equipment. When John wrote originally the valve was considered extinct and the term "70 Years" could imply finality. But few could have foreseen the stubborn fanaticism of the audiophiles who have not only kept alive the tradition of the valve but who have created such a demand that manufacturing plants have reopened. Perhaps this second edition should have the subtitle "Now 90 years and Still Alive!"

Every vintage radio enthusiast's bookshelf should have a copy of *70 Years*. If you already own the first edition, I recommend adding number two, if only for the new information provided and the revisions.

THE OLDEST RADIO BROADCASTING ORGANISATION IN THE BRITISH EMPIRE

This year marks the 75th anniversary of the formation of the Otago Radio Association, a group of Dunedin enthusiasts intent on setting up a broadcasting station back in 1922. However the O.R.A. was not alone in this move as at much the same time two other Dunedinites had the same idea.

That these early pioneers should have centred in Dunedin was undoubtedly due to the pioneering work of Dr Jack of Otago University who is now generally credited with being the first person to transmit speech and music in this country, an event which first took place on 17th November 1921.

The Otago Radio Association began transmitting in October 1922, some four months before any form of licensing had been introduced and thus no callsigns had been issued. The station received a Grade 1 license with the callsign 4AB in August 1923 but this was really an amateur grade and not until September 1926 was a 'broadcasting' callsign, 4ZB, issued. In 1937 this call was requisitioned by the National Commercial Broadcasting Service who wanted it to complete their chain of 'ZB' callsigns, and in its place the O.R.A was allocated 4ZD. This became 4XD in 1948 when a big wavelength shuffle occurred.

When in 1937 the remaining privately owned stations were bought up and closed by the government of the day, the O.R.A's 4XD was one of the only two allowed to continue broadcasting (the other was 2ZM, later 2XM, Gisborne which closed in 1963). After 50 years of unbroken service the Association could claim to be "The Oldest Radio Broadcasting Organisation in the British Empire" and in 1970 station 4XD was recognised by the NZ Broadcasting Authority as being the oldest established broadcasting station in New Zealand and issued with a warrant, MF1, to mark the occasion. (JWS)

see also - Book Review by Reg Hotton of Jim Sullivan's book Bulletin ~~19/2~~ 19-1-29

DC MAINS AND A TRUE STORY

John W. Stokes

Because this story hinges around DC mains operation of radio receivers, a little background concerning DC supplies should help to set the scene and provide some idea of the way things were in those far off days. As is generally known, New Zealand had by the early 1920s adopted the British 230/240 volt 50 Hz AC system as a national standard for domestic supplies of electricity, though it may not be generally realised that initially only DC power was generated. Why? Well, this country like others too, was following a well trodden pathway laid down by Mr Edison a DC-only man to his dying day.

Although the first public supply of electricity was originally introduced for the purpose of street lighting it was a matter of record that, in some New Zealand cities at least, the first public use of mains power was to supply electric tramcars. In Auckland this happened in 1902, some years before electric lighting was installed on this city's streets. DC was, of course, essential for the operation of the trams traction motors, and it was also needed to supply the electric arc lights used briefly on some Auckland streets in 1910. Not that Auckland is being cited as a pioneer in the use of electric lighting because it wasn't. Incandescent lamps, on the other hand, could operate equally well from either AC or DC supplies, though such lamps used on DC had a longer running life.

Although it was a only matter of time before DC was eventually superseded by AC, not surprisingly, the changeover was a long drawn out process. In central Auckland during the 1930s it was quite common to find both AC and DC supplies in the same street. It was also quite common to find houses without a single power point (wall socket) in the place, electricity being used solely for lighting. As a matter of interest, if a radio receiver is regarded as being an electrical appliance, then it was often the first of such devices used in the home.

In houses without a power point the only way of connecting up a set was by means of a bayonet (BC) adaptor inserted into the lampholder of a lighting pendant, this procedure often resulting in 'nuisance' service calls caused by accidental reversal of polarity when the adaptor was inserted the wrong way round. But even the existence of a power point did not always guarantee immunity from polarity problems as it was not unknown to find two wall sockets wired differently by an 'inexperienced' electrician. "The radio works all right in one room but not in another" was a common complaint in those days. As though a serviceman didn't have enough to worry about already!

Because most living radio/electronics technicians will not have had 'hands on' experience with DC working, the foregoing is likely to be of academic interest only, but just think how long it might have been before the thermionic valve was invented had Mr Edison not had cause to investigate that molecular shadow!

We come now to the true story. It started with a service call from the owner of a DC radio whose electrical supply was shortly to be changed to AC. In such cases the owner could arrange to have his set converted to AC/DC operation and continue to use it after the changeover, which was what happened in this case. Incidentally, the cost of a conversion job was only a fraction of the price of a new AC radio, an important consideration in those days. After the conversion had been completed, the set was duly returned to its owner and demonstrated to be working satisfactorily, an assurance being given that it would work just as well after the mains supply had been changed to AC in a few day's time. However, on the following day we received a call to say the set had not worked on the evening I had left the house and was still not working. Expecting that some fault had developed in the receiver, I armed myself with a set of valves and sallied forth to investigate.

On arrival I found the radio to be lighting up but otherwise completely dead, the trouble being quickly traced to the polarity of the DC supply voltage being incorrect at the set's input. But how could this be? I had left the set running on the previous day. A quick swap round of the red and black wires at the plug got the set going again, but the mystery remained. The owner swore that no one had touched the plug on the flexible cord but mentioned that the electrical contractor who had been rewiring the house in readiness for the changeover had been working on the wall socket supplying the radio just before leaving on the previous day. So that was it!, the electrician, apparently not realising that any radio running on DC was polarity sensitive, had wired up the wall socket as would have been correct for an AC installation but in this case the DC was still connected which meant that his action had reversed the polarity of the supply at the wall socket. Oh well, no further trouble now, or so I thought. But more was in store.

A few days later we received yet another call for help. Yes, the set was not working again. Unbelievably, the trouble was found to be reversed polarity, but this time not at the wall socket; the red and black wires of the two-core flex were found to have been changed over. Once again the owner denied having touched the plug but remembered that on the previous day a Power Board inspector had called to check the new wiring and while chatting to the owner had noticed a slight fraying of the radio flex where it entered the plug and as it was such a trivial matter offered to tidy it up on the spot. Unfortunately in doing so he found the two wires to be "wrongly" connected, not realising that they had to be this way while the set was still running on DC. Once again I had to reconnect the flex, this time knowing that when the AC was connected this trouble could not occur again.

WARNING

who was he?

Dear members,

With concern, I mention that an Aucklander and former member of this Society, is internationally advertising vintage and rare valves for sale, entering into agreement and accepting payment but either not dispatching them or sending inferior items.

This practice has cast suspicion on all New Zealanders who 'deal' in valves or vintage radios as the marketing of these "pre-loved" items is built on a certain amount of trust, especially in International deals and, to preserve our members good name, the Committee is taking action to stop this fraud and to assist the offshore aggrieved in resolving the matter.

I strongly suggest that all members considering any (valve) sales satisfy themselves as to the relative integrity of the purchaser and take particular care when purchasing. Generally the rule of "let the buyer beware" still applies but the law of commerce for "pre-loved " items appears more difficult to uphold than retails sales - especially in International sales.

I would appreciate any additional information, comments or concerns that members may have in this matter.

David Crozier, Treasurer.

FROM THE LIBRARY

The following are extracts of articles from vintage radio magazines received by the NZVRS library. Photocopies of these articles are available at $1 each plus postage from the librarian - Ernie Hakanson, 17 Williamson Ave, Grey Lynn, Auckland. Phone 09/3766059

74. Radios of convenience - chairside and remote control devices. photos and descriptions, Zenith, General Motors, Stromberg -Carlson 55, Kadette tunemaster, RCA type RAE-68 & Philco 39-116 console. Antique Radio Classified, vol 14/5, p10, May 97.

75. book review of "Shortwave receivers past and Present - communications receivers 1945 to 1996." Fred Osterman. includes price and availability. Antique Radio Classified, vol 14/5, p20, May 97.

76. The DeForest gang hits Colorado - history of Dr Lee DeForest's business dealings. Old Timers Bulletin, Vol 38, no 2, p22, May 1997.

77. King AM-PLI-TONE horn speakers. photos, description. Old Timers Bulletin, Vol 38, no 2, p26, May 1997

78. German WW2 military transmitter-receiver type 30W.S.a. photos, description. Old Timers Bulletin, Vol 38, no 2, p30, May 1997.

79 Forgotten pioneers of Wireless - Nathan Stubblefield. Photo, history. Old Timers Bulletin, Vol 38, no 2, p32, May 1997.

80. Restoration of an RCA model 9Y7 radio-recordplayer. detailed description of methods. Old Timers Bulletin, Vol 38, no 2, p35, May 1997.

MARKETPLACE

Advertisements for the next issue must reach the editor by the 17th January 1998. Ads should be either hand printed or typed on a separate page. Note that no verbal or phone ads will be accepted. Remember to include your name, address and phone number. There is no charge for ads but the NZVRS is not responsible for transactions between members. Address ads to:
Reg Motion, 2A Hazel Terrace, Tauranga, New Zealand.

AVAILABLE

Gulbransen telephone dial chassis, no cabinet or speaker - offers. "Utah 12" EM speaker ex Midwest 16 valve console set - offers. The following early postwar AC/Batt. valve portables in "as found" condition are available free to anyone interested and willing to pay freight costs: Cases OK - Pacemaker 517AB, Courtenay 414, HMV 495, Courier FB, Mullard 681, Columbus 402Z: Front cover missing - Courier RJ: Damaged cases or covers - 2 of Pacemaker 5155AB, Pacemaker 5755AB. Doug Fairbank, 5 Richardson Ave., Gisborne. Ph 06/8671592.

Limited quantity of German Telefunken type octal base valves types EF12(Valvo, metal case), EF14(Telefunken metal case) & ECH11(Funkwert Erfurt metal sprayed glass) as used in some imported German radios from 1938 on. $15 each including postage (discount for orders of more than one). Note - not common octal base but have 5 pins on one side and 3 on other.
One spare copy each of Volumes 3,5 & 9 of A.O.R.S.M. at $40 each inclusive economy air postage. Ray Kelly, 49 Sharon Rd., Springvale 3172, Victoria, Australia.