THE INSTITUTION OF ENGINEERS AUSTRALIA.

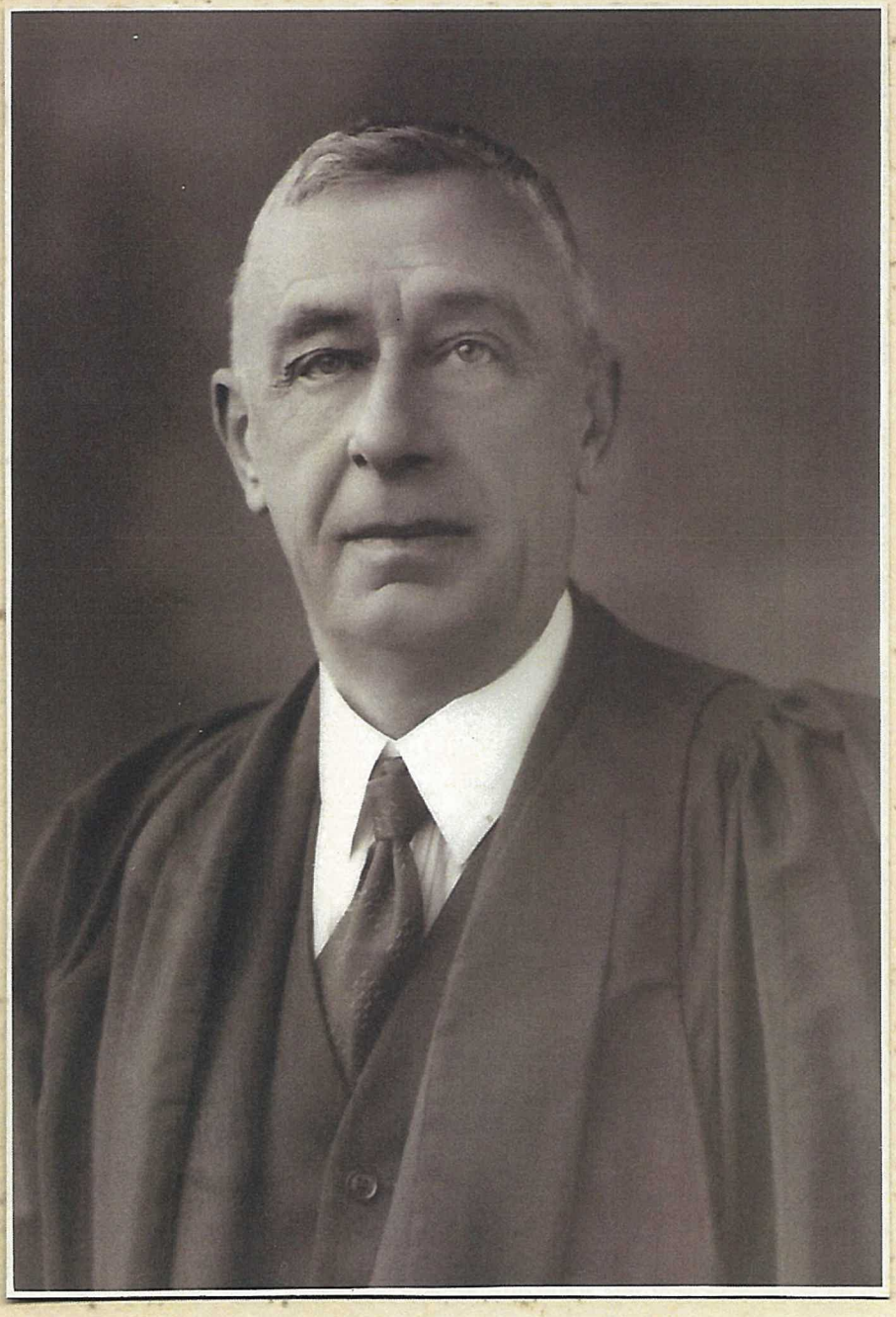
ENGINEERS AUSTRALIA.

CENTENARY LECTURE 2019

J P V MADSEN. (1879-1969)

FOUNDATION MEMBER.

Lecture by Roger Madsen, Sydney. August 26, 2019.



ENGINEERS
AUSTRALIA

Sydney Division

CERTIFICATE OF APPRECIATION

Presented to

Roger Madsen

On the occasion of his lecture

JPV Madsen

An inspiring career

Frank Johnson
Chair EHA (Syd)

26h August 2019

EHA Talk Monday 26th August, 2019.

INTRODUCTION.

By way of introduction tonight it is useful to look at the geography of where JPVM lived during his 90 years from 1879. He was born in Lochinvar in the Hunter valley not far from Gresford where his Mother's family lived & then his father moved to Queen Street Newtown in 1882 with his work as a surveyor with the NSW Lands Dept. Except for 1 year in 1890 due to the Asiatic flu epidemic when JPVM attended school in Gresford. JPVM lived in Queen St while attending Darlington primary school, High School at SBHS in Harris Street & then at Sydney university until moving to Adelaide in 1901 as Lecturer in Mathematics & Physics at the University. He was in Adelaide until he returned to Sydney at the beginning of 1909 & lived in Roseville with his family, firstly renting in Victoria St & then in his own house in Wandella Ave from 1913 until he died in 1969. Within his own family he was known as "Percy" but later adopted the name of "Sir John".

My father was an Agronomist/ Extension services administrator with the NSW Dept of Agriculture mainly in Wagga & regularly at Christmas we would visit Roseville where JPVM would usually have some project going in his workshop, preparing his fishing gear for Bawley Point or mowing his very large yard with his Victa. In his workshop he would first assess whether we had a "heavy" or "light" touch on the lathe.

On completing my LC in Wagga in 1964 I moved to Sydney & was able to stay with JPVM & Dad's sister Phyllis at Wandella Ave while doing a part time Commerce degree. JPVM was in good health for most of this time & I had the opportunity of listening to many points of interest raised by JPVM but it was not until after his death when Sir Frederick White raised the question of what was to be done with JPVM's papers (especially from the 1909-1911 period from W H Bragg & Ernest Rutherford) that I became involved in collating this material as information to be incorporated in a biography for the AAS written by Sir Frederick. It is at the AAS that JPVM's documents are archived, however this material can be accessed digitally from a reference in the John Madsen Wikipedia at the Sydney University Archives reference.(Beyond 1914).

In considering what material to present tonight for this Engineers Centenary I thought it might be useful to prepare slides which illustrate the equipment JPVM was involved with & include references to current applications of these earlier developments. The notes contain technical information which may not have been presented in the lecture.

EHA Centenary Talk on J P V Madsen-Electrical Engineer: August 26, 2019

Foundation Member of the Institution of Engineers Australia, 1919.

Delivered by R W Madsen, Chatswood. 6.00 pm.

Sir John Madsen (1879-1969) is remembered by the Institution of Engineers Australia in the Electrical College with the John Madsen Medal awarded for the best paper written by a current member of Engineers Australia & published in the Australian Journal of Electrical & Electronic Engineering. As the 1st & only Professor of Electrical Engineering in any Australian University from 1920 to 1946 he is especially remembered for his pioneering work in communications & physical standards of measurement for industry. He was based at the University of Sydney, firstly as a student then Lecturer & Professor. His career in Electrical Engineering began originally at Adelaide in 1901 when the Grenfell Street power station was erected with 2 X 50 KW DC generators & shortly after, in 1903 he became the Lecturer in Electrical Engineering at the University of Adelaide.

In June 1914, just prior to the start of WW1, JPVM in his Presidential Address to the NSW Electrical Association indicated that the time was ripe for the NSW & Victorian Associations to form an Australian Institute of Electrical Engineers & it would seem that this idea came to fruition shortly after the end of the War with the founding of the Institution of Engineers Australia in 1919 of which JPVM was a foundation member.

The information tonight is largely based on the Archive held at the Academy of Science in Canberra, but also more recent photographs & details have been obtained on the internet. A convenient source of reference for much of this material can be obtained from Wikipedia "John Madsen (Physicist)".

Slide 1. JPVM- Mathematician, Physicist & Engineer.

JPVM attended Sydney Boys High School in Ultimo & in 1896 matriculated with his best marks in mathematics obtaining A's in Arithmetic, Algebra, Trigonometry & Geometry (Sydney University Medal for Geometry).

At Sydney University he chose to concurrently complete BSc & BE degrees & was the 1st student in an Australian University to do this & in 1899 he obtained the University Medal for Mathematics on completion of his BSc degree with Class 1 Honours in Mathematics & Physics. In 1900 he obtained the University Medal for Civil Engineering.

In 1901 JPVM obtained the position of Lecturer in Mathematics & Physics at the University of Adelaide working for Prof. William Bragg who at the age of 23 in 1885 had been appointed Professor of Mathematics & Experimental Physics at the University. Between 1903-1908 JPVM lectured in Electrical Engineering at Adelaide University & in 1909 moved back to Sydney to become Lecturer in Electrical Engineering at Sydney University & in 1912 became Assistant Professor. In 1920 he obtained the full Chair which he held until his retirement in 1949.

JPVM believed that the basis of Engineering lay in Physics & although all Engineers did not necessarily agree with this, it was a theme which he pursued throughout his career. JPVM was knighted by King George VI in London In June 1941. JPVM was an expert "recycler" in using surplus materials into new

equipment of considerable benefit in the days of the Depression. Research, recycling & beach fishing were activities he followed with a passion.

Slide 2. Hans Frandsen Madsen & Annie (Bush): 19 Queen St. Newtown (1882-1937).

JPVM's father, Hans Frandsen Madsen (1843-1937), was born & educated in Denmark & came to Victoria working on fully rigged sailing ships in 1862 & then working as a miner in the Ballarat District until 1874. With good mathematical & drawing ability he was offered the position of Surveyor's Assistant in the Parkes area & in 1876 passed 3rd out of 15 in the NSW Surveyor's Exam & was offered a position with the Lands Dept. with whom he worked as a surveyor until his retirement at age 70. As a hobby & in conjunction with other like minded surveyors at the Lands Dept he built a large18 inch reflector telescope & was a member of the Royal Society of NSW at the same time as Lawrence Hargreaves & also Archibald Liversidge Dean of Science at Sydney University.

JPVM's Mother, Annie Bush (1856-1929), came from Gresford in the Hunter region, where her Father, John Bush,(originally from Bristol) was the local schoolmaster. JPVM, the eldest of the family's children, & lived at Queen St. while attending Darlington Public School, SBHS & then Sydney University, which were all fairly close by. Within his family JPVM was known as Percy. In 1890 he attended Gresford Public School to avoid the threat of the Asiatic influenza epidemic in Sydney.

Slide 3.Adelaide's new power station at Grenfell St. in 1901.(Designed by F W H Wheadon British Engineer).

On taking up his new position as Lecturer in Mathematics & Physics at Adelaide University in 1901 he also had the opportunity to watch & study the erection of a new power station in Grenfell St & subsequently to be engaged as an Assistant Engineer becoming familiar with the day to day operations.

The main plant consisted of 2 X 50KW 200Volt generators supplying Adelaide (popn. 150,000) which in 1902 had 20 miles of streets in which power was available. In 1902, 264,515 KWH was generated at a load factor of 23.76%. Steam was supplied by 3 Babcock & Wilcox (New Jersey/ London) hand fired boilers: the 2 engines were 100 hp Willans high speed single acting, made in Rugby & the dynamos (made in Edinburgh it appears) generated 50KW each at 200 Volts DC.(Apparently a 3rd 360 hp Willans engine was connected to a 400 Volt DC generator). Willans engines were apparently widely used this way & in cotton mills in England. Demand for electricity doubled every 5 years & within 20 years this plant was obsolete. Current SA generating capacity is in the order of 5MW (50% renewables & considering SMR nuclear).with approximately 250 gms CO2/KWH.

The Ultimo Power Station in Sydney was commissioned in 1899 to supply power to the electric tram network. The original equipment consisted of 4 U.S (Milwaukee) steam engines each coupled to a GE (Schenectady) 550 Volt dynamo. Each tram had less than 200 hp of electric motors. The 1st turbo alternator was installed at Ultimo in 1905 with additional Babcock & Wilcox (UK) boilers.

In 1900 global CO2 emissions were estimated at 2 billion tons pa & Atmosphere 296 ppm (2017: 36.2 billion tons & 415.39 ppm –Hawaii [May 2019]).

Slide 4. JPVM Electrical Engineering Study Tour to the UK & US c.October 1902-February 1903.

The University Council granted JPVM leave of absence in 1902 to make a trip through England & America to gain information on the most recent methods of instruction in Electrical Engineering being

adopted by the Universities & Higher Technical Colleges, & at the same time visiting as many as possible of the more important manufactories & installations. At this time he was 23 & not married to Maud Molesworth (also from Newtown) until 1904 . On his return JPVM submitted a report (24/4/03) to the University Council setting out his findings & forming the basis of his appointment as Lecturer in Electrical Engineering in 1903. This study tour had been at JPVM's own cost.

From passenger list information (Ancestry.com) it is found that JPVM arrived in New York from Liverpool on January 2, 1903 on the White Star liner SS "Teutonic" (9,984 tons) in the 2nd class saloon & he was then back in Sydney on February 22, 1903 from San Francisco on the SS "Ventura" (6,253 tons).

The next overseas voyages JPVM was to make were in 1927-1928 with wife Maud visiting the Continent, UK & America on ships including SS "Cephee", RMS "Baltic"(23,000 tons) & "Ville D Amiens". Although JPVM volunteered for AIF service in WW1 he was retained in Australia as Chief Instructor & later Officer Commanding the Engineer Officers Training School & did not go overseas at this time.

Slide 5. Research in Physics 1905-1908 with W H Bragg a Adelaide University.

In 1904 JPVM had applied to Sydney University for the position of Lecturer in Electrical Engineering as he wanted to get married & be back in Sydney, however the appointment went to an applicant from England. About this time W H Bragg had become interested in 1904 in physical research into radioactivity along the lines of work by Ernest Rutherford, then in Montreal. JPVM became a willing assistant along with his work in Electrical Engineering & lecturing in Physics & Mathematics. In this photo from 1906, WHB is to the rear & JPVM on the left, the work most likely was to investigate some aspect of ionisation.

Although WHB had started research work relatively late in life (age 42) within 10 years he had earned a Nobel prize in Physics & later became President of the Royal Society (1935-1940). Bragg & JPVM published papers jointly from 1906/07 dealing with investigations into alpha, beta & gamma rays.

Slide 6. 1906 Electrical Engineering Laboratory, Adelaide University.(Designed by JPVM in 1903).

There is no detail provided on the equipment being used here, however it is noted that a present day 100 hp induction motor has the same mounting dimensions as a 7.5 hp motor of 1897, due to significant inventions & innovations. [As a matter of current interest, on HMAS Canberra (27,000 tons), the 2 Siemens azimuth thrusters each have 15,000 HP (11 megawatts) onboard electric motors in the pods-QM2 has motors of 23,000 HP]

Slide 7. University of Adelaide DSc degree in 1907.

JPVM's DSc paper was to consider the ionisation remaining in gases after removal from the influence of the ionising agent. Two methods of experimentation were used using uranium, radium & thorium emanations. The work was supervised by WHB & the paper assessed, I believe, by the Professors of Physics at Melbourne & Sydney Universities. With his work with Radium JPVM remembered with pride that his work with W H Bragg using Radium produced good results whereas in England he said that Radium was said to be "All played out".

Slide 8. The Scattering of Beta rays of Radium (January 5, 1909).

JPVM's experiments on the scattering of beta rays of radium is referred to by Ernest Rutherford in his famous 1911 paper on the scattering of alpha & beta particles & the structure of the atom. This proposal of a nuclear atom, in due course, set off a pathway of discoveries leading to the release of atomic energy as demonstrated in 1945.

None of JPVM's apparatus or notebooks survived & this slide is taken from his published paper & shows schematically the balanced spherical chamber (Fig. II) to calibrate each foil. (There is no mention of the dimension of the apparatus, but I would guess 6 inches approx.. in diameter). The main apparatus of the experiment where beta particles (electrons) are fired from a radium source pass through foils of silver, gold, aluminium & paper (carbon) each of 10 different thicknesses which were positioned in 1 of 3 (A,B,C) positions then being scattered more & less within the hemisphere where the ionisation is measured by a quadrant electrometer. The results for each material & foil were plotted & shown in graphical form & which were all very similar.

One significant aspect of the results found was that for the thinnest foils it appeared that the beta particles were scattered only once & to Rutherford's mind that suggested that there was a great deal of empty space within the atom, as opposed to the alternate idea of a plum pudding model..In the case of aluminium it appeared that an electron had passed through over 100,000 rows of atoms & was scattered only once.

It is not clear what the further work JPVM did at Rutherford's suggestion using a fresh 30 mg supply of radium from Braunschweig, but probably involved even thinner foils , however JPVM's results did not come out as expected & he did not publish. JPVM acknowledged that it was his lack of theory in 1909 that was a block, however the single collision data did refute JJ Thomson's plum pudding model at that time. In 1912 WHB published a book on Radioactivity & included a description of JPVM's experiment which he described as a "striking experiment" which JPVM took as a high compliment.

Slide 9. The Dolezalek Quadrant Electrometer.

A few months before carrying out the Beta scattering experiment, JPVM published a paper on secondary gamma radiation in which he described the electrometer he used as being a sensitive instrument of the Dolezalek pattern, which gave a scale reading of about 4,000 divisions/volt & each division could easily be divided into 10ths. It would seem that JPVM used this same electrometer in the Beta work.

The Dolezalek quadrant electrometer was invented by the Hungarian Friedrich Dolezalek in 1896 & represented a significant improvement over earlier versions from the 1850's & quickly became a favourite of those investigating radioactive substances such as ER. It could measure to 5 microvolts (5 millionths) & was more sensitive due to its lighter material, smaller quadrants & a mirror suspended by a metal coated quartz fibre.

Slide 10. Ernest Rutherford (1908), WH & WL Bragg (1915) Nobel Prizes & early practical advances.

As a physicist ER was more than happy to be a chemist for a day to accept the 1908 prize in Chemistry for his work on radioactivity. ER was never awarded a Nobel prize for physics but I believe he well deserved it for his work on the structure of the atom. JPVM was in contact with ER subsequently on RRB (Radio Research Board) work from 1927.

In the 2nd half of 1912 father & son (WH & WL) Bragg, then back in England, became involved in X ray use for crystal structure analysis which also influenced the work of a young Henry Moseley at Manchester University, in accurately listing the elements of the periodic table by their atomic number derived from the connection between the wavelength of elements X ray spectra & the atomic number.(Mendeleyev had previously listed elements by mass). WHB by late 1912 had designed a spectrometer where X rays deflected by a crystal on a turn table could be measured in an ionisation chamber by an electrometer. The spectrometer & the theory in its use earned the 2 Braggs the Nobel Prize in Physics. X ray crystal analysis at a much later date in the early 1950's contributed to the discovery of the DNA double helix, work being carried out at the Cavendish where W L B was the Director.

During WW1 all 3 did very valuable work using sound detection for detection, of U boats (ER & WHB) & artillery shell ranging. (WLB)

Slide 11. JPVM Presidential Address to the Electrical Association of NSW-June 1914.

It seems to me that the most important aspect of JPVM's wide ranging address as it relates to our present circumstances is in relation to the generation of bulk, cheap energy to be used for the highest efficiency in our workers ie. as per the slide. Black coal at approx..900 gms CO2/kwh & "cleaner" high temperature processing is still higher than gas remains an extremely serious problem. In 1912-16 JPVM was consulting engineer for the reticulation of electricity to farms in the MIA in the area near Narrandera of the new 900 MW Yarrabee Park Solar Farm being built by 2020.& connected to the 330KV transmission line (Wagga to Darlington Point). The nearby Colleambally PV farm has a very good conversion factor of 30% using tracking technology.

This very informative address also called for standardisation laboratories in Australia, & reference to the installation of large turbine units for generation of 100,000 KW, radio telegraphy & Roentgen rays. In conclusion JPVM mentioned the passing of notable engineers Dr Rudolph Diesel & Mr George Westinghouse.

Slide 12. Engineer Officer Training School Moore Park & Roseville, WW 1.

JPVM volunteered for the AIF but was retained in Sydney as Chief Instructor of the Engineer Officer Training School to provide qualified reinforcements of Engineers sent in the 1st Convoy. At Moore Park initially & then at Roseville a camp with excellent training facilities was set up (including a generator to provide tent lighting for night study) & JPVM organised training in the same way that he taught Engineering at Sydney University. The total number of officers who completed the course was probably 300-500 but there is no official record, however each Engineer was given a certificate signed by JPVM identifying their grading in 5 categories of skill including basic infantry training, explosives/demolition, equitation & pontooning. Their service record was red stamped "EOTS." A spectacular display for the War Chest was put on at the Roseville Camp on Saturday December 2, 1917 between 3.00pm & 10.00pm demonstrating all aspects of the skills taught & learned including a display of night trench fighting. Some 3,500 members of the public attended & was very favourably reported in the SMH.

Slide 13. Australian Radio Research Board 1928-1945. (CSIR, PMG & Navy).

It would be hard to underestimate the deep interest of the Governments of many leading countries around the world in the 1920's & 30's in shortwave broadcasting, including Britain & Australia. JPVM

was the founding Chairman of the Australian Radio Research Board from July 1927 until 1956 & although it was a very small scientific body engaged in fundamental research, it obtained a significant international reputation & almost certainly was far better known overseas than in Australia. The work of the Board also included the very successful training of students at MSc level (such as Joe Pawsey) & covered the 2 separate areas of atmospherics & ionospheric propagation which was of great interest to the PMG in deciding the best wavelengths for Australian radio stations to broadcast on. At the commencement of the War in 1939 many RRB workers were recruited by JPVM into radar work in RPL (Radiophysics Laboratory) at Sydney University, but significant work continued in the RRB at Sydney Uni. led by F W Wood on ionospheric prediction services in working out the best frequencies for the Allied Services in SWPA to use 24/7 & calculated 3 months in advance.

In the Depression years from 1929 the PMG funded 70% of the RRB annual budget of 5,000 pounds. The work carried out was on fundamental problems which would not normally come within the scope of other Government Depts. or commercial organisations & that any practical applications arising from the work could be passed on to anyone interested in making use of them. Some relevant dates & information during this period are:

1905: PMG in Australia controls wireless in Australia under Act of Parliament.

1912: Australian Coastal Radio Service in operation (Balsillie & Telefunken systems).

1913: AWA formed incorporating Marconi & Telefunken interests with E. Fisk.

1922: Australian Government increases AWA capital & becomes the majority shareholder to create in .....1926 2 beam wireless stations in Victoria.

1925: 25 radio stations broadcasting entertainment in Australia.

1926: In September JPVM approached George Julius, Chairman of CSIR & fellow engineer, (of Totalisator fame & fortune) with the proposal to carry out radio research which was widely supported by T. Laby at Melbourne Uni., PMG, 2 broadcasting stations in Sydney & Melbourne, AWA (Ernest Fisk), the Wireless Institute of Australia & Military Authorities. This became the only non-primary industry activity CSIR agreed to undertake on very limited financial resources at this time.

1927: JPVM overseas in Washington & attends the URSI Congress there & on 12 December attended the 51st meeting of the British RRB in London & obtained their 1928-29 research programme.

1928: Watson-Watt of British RRB provides atmospheric recorders for use by George Munro on the voyage to Australia making observations emanating from central Africa.

1930: On June 30. Dr A L Green telegraphed JPVM from Jervis Bay that the polarisation of the downcoming waves transmitted from 2BL Sydney was right handed ie. the downcoming waves travelled in the opposite direction to the Earth's field.

1935: JPVM delivers the John Murtagh Macrossan Lecture on the Ionosphere & its Influence upon the Propagation of Radio Waves, summarising much of the work of the RRB up to that date.

JPVM remained Chairman of the RRB until 1956 & was a member of the CSIRO Council from 1943 until 1956.

Slide 14. Australian Standards-1928 Paper to Institution of Engineers.

On the same day in 1926 that JPVM made his proposal for the RRB he also made a submission for the establishment of an Australian Standards Laboratory, & although this was not adopted then, when he went overseas in July 1927 he obtained relevant information in the US, UK & Continent which he compiled into a paper presented to the Institution of Engineers in 1928. JPVM had 1st raised the question of Electrical Standards in a report to Adelaide Uni. in 1903 & also more formally in 1914 to the NSW Electrical Association. In identifying the type of work which a Laboratory could undertake, JPVM referred to the 7 Depts. existing within the National Physical Laboratory at Teddington dealing with Physics, Electricity, Metrology, Engineering, Metallurgy, Aero Dynamics & William Frounde National Tank.

The information gathered was updated a few years later, but only in a minor way, when the urgent need for manufacture in Australia was recognised as the Japanese expansionist threat in the mid 1930's became apparent. At this time JPVM was Chairman of the Government Standards Committee 1927-1945.

Slide 15. RRB investigations of the Ionosphere up to 1935.

This slide from JPVM's Macrossan Lecture is designed to show different electron densities which can arise, in the various layers in the Ionosphere & the types of reflections which can occur. Knowledge of these reflections was of crucial importance to the ionospheric prediction (wavelength) services during the War in the SWPA & with Macarthur's communications to the US in particular, initially, from Brisbane to San Francisco.

Slide 16. JPVM Flying Boat Travel 1939-1946.

Late in December 1939 JPVM, as Chairman of the Radiophysics Advisory Board, travelled to London by Qantas/Imperial Air "C" class Empire flying boat (Sydney-Singapore in "Corio"). as a matter of urgency to meet with Watson-Watt & recast the entire Australian radar programme due to the then existing war conditions in Europe & the identified requirement that Australia could become an emergency supplier of radar equipment & would be a definite sub centre to a main RDF/radar laboratory in the UK. Britain at this time was very fearful of being overrun.

Short Bros at Rochester Kent built 42 "C" class S.23 flying boats for BOAC & Qantas for the empire mail routes to Sydney & Durban & could carry 17 passengers & a crew of 5 with a range of 760 miles. Many adventures were experienced at the numerous (19) fuelling stops from Sydney with landing & taxiing on many harbours, rivers & lakes. The Corio leg to Singapore was with Qantas & then BOAC flew to Southampton via Delhi, Alexandria & Marseilles. Over 740 Sunderlands (the larger military version) were built by Shorts for the RAF & after the War the civilian version was known as the Hythe, which JPVM flew back from London in 1946.

Going to the US & UK in May 1941 involved JPVM flying with Pan Am in their Boeing 314 Clippers of which 12 were built & originally designed for luxury travel across the Pacific & elsewhere. The return trip from England (BOAC Boeing 314) leaving in November 1941 was from Foynes in Ireland to Botwood in Newfoundland & then Baltimore in Maryland. He left Honolulu for Auckland (Pan Am "Pacific Clipper") on Thursday December 4 just before Pearl Harbour & had attended a party at Hickham AFB the night before, however he had been under pressure to go straight to Singapore to discuss the supply &

installation of Australian Shore Defence Radar to control the Singapore 15 inch & 9 inch batteries. The Pan Am flight which JPVM would have travelled with to Singapore was the "Philippine Clipper" which left Honolulu on the 4th as well but it had a miraculous escape at Wake Island when shot up by Japanese aircraft around mid-day on the 7th however they missed the fully laden fuel tanks & after loading, the 5 passengers, 26 civilians & 8 crew managed to get back to Honolulu safely. (I think JPVM was unaware of this miraculous escape & always thought he would have perished if he had chosen to go straight to Singapore, rather than come back to Sydney first).The "Philippine Clipper" was one of 3 long range Martin-M 130 commercial flying boats built for Pan Am in 1937.

Slide 17. "Madsen Building"- Sydney University. Standards & Radiophysics Laboratories (1939-1977).

In late 1939 early 1940 the original plans for the NSL were doubled to accommodate the RPL for RDF/Radar work. The choice of the University site was in line with Government policy of locating research facilities within universities & in the case of RPL not to draw attention to the secret nature of the war work. JPVM at this time was Chairman of both the overseeing Boards for Standards & radar & he ran them as sister organisations, but access between the 2 Laboratories was restricted. During the War, Standards (Metrology, Physics & Electrotechnology) concentrated on urgent problems such as the manufacture of slip gauges, the electrotechnology for ShD radar, degaussing of ships (eg. Queen Mary) & glass manufacture for optics. After the War the NSL took up its originally planned role of the maintenance of standards.etc.

RPL reached a maximum staff of approx.. 500 staff by the end of the war (a 3rd building extension for RPL was carried out in 1944) consisting of scientists, engineers & administrative support such as Librarians. RPL moved to Epping in the early 1970's & Standards moved to Lindfield as the National Measurement Lab. In 1977 at which time the building was renamed the Madsen Building. It is now occupied by the School of Geoscience.

Slide 18. VT 90 Micropup Valve- 1.5 metre (200 MCS) radar transmitter tube.

1.5 metre (200 MCS) radar was very widely used by the Allies during the War. It had its origins in the 1937 developments of airborne radar in the UK by Taffy Bowen & the VT 90 was the 1st transmitter valve specifically designed for use by the military on this wavelength. Pulsed duplex radar for economy was used in the Australian Shore Defence radar controlling the 9 inch harbour batteries (such as North Head) & also in ASV airborne surface search radar initially using imported VT90 valves from the UK/US. Supply of VT90's for air warning radar became critical after December 7, 1941 & local production had to be arranged using special techniques for glass to metal seal & with thoriated tungsten filaments.

The Philips valve factory in Sydney in the mid 1930's is shown.

The Australian Air Warning radars, from December 1941, (AW & LW/AW) depended on these valves & without them, for a short while, substitutes had to be used from available stocks, before the local production became available. The Australian designed & produced radars were duplexed where the array first transmitted a short pulse & then as a receiver detected the minute returned signal.

It should be mentioned that Doppler radar for use on ships to detect enemy aircraft in hilly terrain was developed at RPL in 1943 & passed to the UK & US. I understand that civilian large aircraft today have Doppler radar to detect deadly microbursts in a timely way.

Slide 19. The Australian Lightweight Radar principle.

Soon after the initial Darwin air raid in February 1942 the value of the RPL AW set quickly became established & a small number of these early sets were produced & rushed to northern Australia & Port Moresby. By around July 1942 the AW set design was modified to make it air transportable in DC3's which involved modifying the array (carried out by Mr.Worledge of the NSWGR) & also for the components of the transmitter & receiver to be tropic proofed suitable for tropical New Guinea operations. The US forces had no radar of their own like this & Macarthur was crucially dependent in his island hopping operations on this radar to protect his airfields. The LW principle was also applied to the design & production of GCI (Ground Control Intercept) radars used in the clouded areas of New Guinea.

Over 100 LW/AW sets were supplied to the RAAF & Macarthur's Army Air Force & also to UK forces in Burma. The air transportable & tropic proofed LW/AW met a need by US forces in the SWPA for equipment which they themselves did not have available in 1942-43 in a fast moving air war. The LW/AW set was slated for operation "Olympic" in the tentative plans to invade Kyushu, Japan.

In the post war period Philips were especially interested in having JPVM as a Director from 1949 (to 1963) involved with their commercial development of radar at Hendon in Adelaide.(Philips Australia at its peak in the 1950's had 3,500 workers at Hendon manufacturing electronic equipment including TV under the leadership of Frank Leddy who in 1946 had purchased the Govt. small arms munitions factory at a bargain price & transferred Philips NSW operations to Hendon establishing an electronics industry in SA).

RAAF at Edinburgh is currently noted for Jindalee radar as well as the new MQ-4C Triton & P8A Poseidon unmanned & manned aircraft with airborne X Band surveillance radars. Inverse synthetic aperture radar for high resolution ship recognition is being used here.

Slide 20. The Randall & Boot (+Megaw) 10cm Cavity Magnetron for the Admiralty 1940.

The story of the UK 10 cm cavity magnetron invented & developed in the UK (Birmingham University & GEC Wembley) in 1940 & passed to the US in the Tizard Mission later that year is really the stuff of legend. The work done in the Physics Dept. in Birmingham under Prof. Mark Oliphant also included the feasibility of a nuclear bomb. The 1st UK set to use the 10 cm magnetron was the RN's Type 271 surface search radar which eg. was used in May 1941 by the cruiser HMS Suffolk (a sister ship of HMAS Canberra) to shadow the Bismarck for 30 hours in poor visibility.

As a follow on to the Tizard Mission, JPVM went to the US in May 1941 as the Australian Government Director of Scientific Liaison to the US & UK, to develop further contacts on 10cm work & other scientific developments as well, for the Australian war effort & to keep RPL informed of the latest developments.

HMAS Canberra which was lost at Savo Island Guadalcanal in early August 1942 was the 1st Australian ship to use the 10cm magnetron in her Type A271 set. Magnetron development (located at Melbourne University) by RPL later in the war, concentrated on wavelengths slightly higher than 10 cm to provide frequency flexibility against possible Japanese jamming, the US having developed magnetrons at shorter wavelengths down to 3 cm.

The Japanese had invented their own 10cm magnetron by 1939 but in the end had insufficient power & there were serious inter service rivalries & reliance on early night fighting tactics.

Slide 21. Australian Corvettes with 10 cm & 1.5 metre radars.

The corvettes were the work horse of the RAN & some of the 50 built are shown moored at the end of the war clearly showing the Type 271 "lantern" & also the 1.5 metre AW at the top of the mast.

Slide 22. ANRC-Aust. National Research Council-Chairman 1945-46, Nuclear Policy.

Within 2 weeks of the end of the War in August 1945 JPVM was elected Chairman of the ANRC & promptly formed a special committee of 5 Physicists including himself to prepare recommendations to the Australian Government on Nuclear Policy now that the principle of the release of nuclear energy had been demonstrated & that engineering techniques would now be required to harness it into useful applications. Early in December 1945 some 6 recommendations were made including close liaison with the UK, given that US policy was for limited disclosure even to the UK, & also the need to ascertain what resources of uranium & thorium that Aust. may have. PM J B Chifley replied in February 1946 indicating that similar recommendations had been received from CSIR & that steps with regard to the UK had already been taken. Clement Atlee was the Labor PM in England at this time who initiated their atomic bomb program at this time which was a huge commitment given that the US had decided it would not pass on any of its secret technical information even to the British.

Slide 23. NATA.

JPVM was co-opted as a Foundation member of NATA in 1947 & was Chairman in 1948-1950. Some of you may be familiar with NATA laboratories for carrying out tests on materials eg. Concrete strength etc. & the organisation has grown to a wide range of businesses requiring certification & testing including agribusiness, manufactured goods & food & Beverage. The author of a history of NATA's origins from interviews with JPVM states that "Madsen seemed to delight in hiding his considerable intellect behind a rugged exterior". NATA pioneered the accreditation concept & methodology which has been followed by other countries & is a tribute to the early work over 25 years when NZ was the 1st to follow.

Slide 24. CSIRAC & Seminal Computing Conference at Sydney University, August 1951.

JPVM was Chairman of a Computing Conference (one of the World's earliest such conferences) designed to introduce CSIRO's digital computer & also present the case for traditional analogue computing & was organised jointly by CSIRO's Radaiophysics Divn (Trevor Pearcey). & the Electrical Engineering Dept. of Sydney University.(David Myers) The Conference over 3 days was presented with many important papers & attendees had the chance to see & hear (playing music) CSIR Automatic Computer Mk 1. The Conference is regarded as the start of computing as a profession in Australia.

JPVM addressed the Conference describing the situation where producers & users of mathematical theory have closed their ranks in stimulating the progress of computing methods & techniques in very rapid advances in only a few years. In conclusion it appeared that cost, as a factor, at this time for analogue differential analysers was less than that of the digital computer.

CSIRAC Mk 1 provided service to all of CSIRO from 1951 to 1955. In 1956 the modified-improved CSIRAC MkII was dismantled & went to the University of Melbourne for service until 1964. There is an excellent History of Aust. Computing written in 2017 for the ACS which mentions that JPVM was largely responsible for arranging the funding for the Radiophysics computer development.

Currently in Sydney I understand that John Deane of the Radiophysics WI-FI team of 1996 is Chairman of the Australian Computer Museum Society & is organising a Museum in Sydney to display some 20,00 items of computer technology from the last 65 years. The John Sullivan led Radiophysics WI-Fi discovery is an excellent example of fundamental research leading to a practical application.

Slide 25. Australian URSI 1952 & the 21 cm Hydrogen Line.

JPVM was President of the Australian URSI Committee in 1952 when the International Congress, being the 1st held outside of Europe & North America, was held mainly in Sydney & was in recognition of the valuable work done in Australia over the previous 25 years in radio.

Many radio astronomy installations around Sydney run by Radiophysics & Sydney Uni. Elec. Eng were visited by important guests from overseas, in particular the Potts Hill array which had been used in 1951 by Chris Christiansen & his assistant Jim Hardman to confirm the existence of the 21 cm Hydrogen Line & also survey the Milky Way showing for the 1st time its spiral pattern.

Many leading radio research scientists from Australia & Sir Edward Appleton from the UK are included in these 2 photos.

Slide 26. Highlights of JPVM as 1st & only Professor of Electrical Engineering in Australia for 26 years.

JPVM's interest in the Engineering applications of physical principles touched on many new developments over 50+ years especially in Communications & Standards.

Slides 27 & 28. Australian Synchrotron & Parkes Ultra Wideband Receiver

The following 2 slides are examples of contemporary experimental apparatus I Australia which I believe would appeal to JPVM's way of thinking, Viz.

.The Australian Synchrotron (ANSTO) at Clayton which uses enormously powerful beams of light created by accelerating electrons (beta particles) to near the speed of light & passing them through powerful magnetic fields to create photons, to examine the molecular & atomic details of a wide range of materials in many different fields.

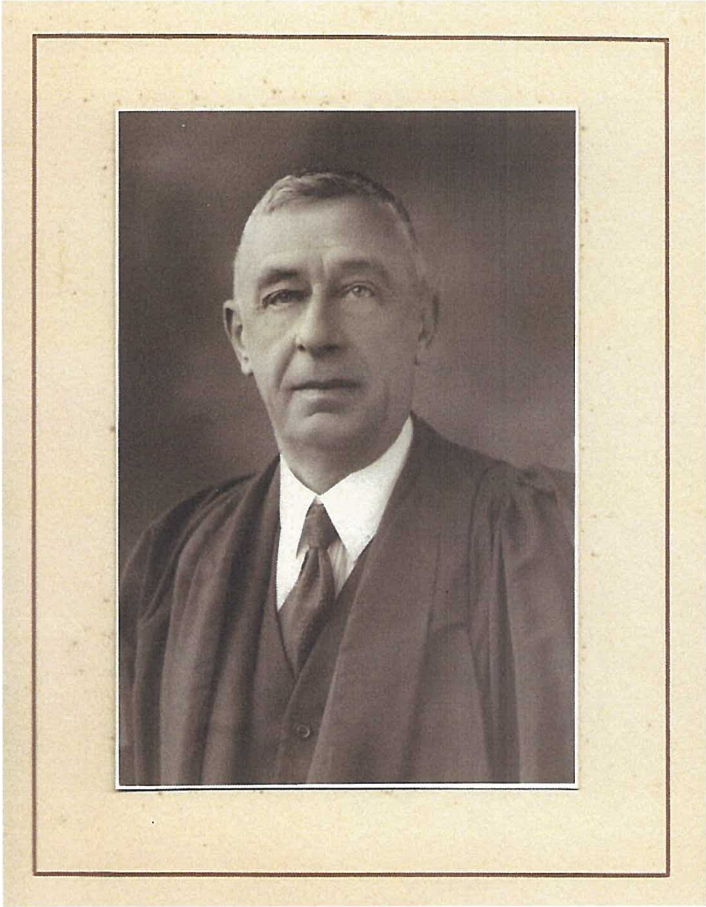
.The Parkes Ultra Wide Band receiver in 2018 to give continuous coverage of the band 0.7-4.2 Ghz. This follows the internationally leading Pulsar Survey work from the 1990's at Parkes & the discovery of the double pulsar system (PSR JO7377-3039 A/B) in 2003 which provides exceptional opportunities to test various theories on gravitation . It is noted that the intense radio beam pulses of rotating neutron stars are not well understood at this time, & there is a great deal of interest in this area.

.The SKA developments in WA & also the upgrade of the Jindalee OTH Radar system also can be mentioned currently as very significant Engineering undertakings that would appeal to JPVM.

The First Professor of Electrical Engineering in Australia

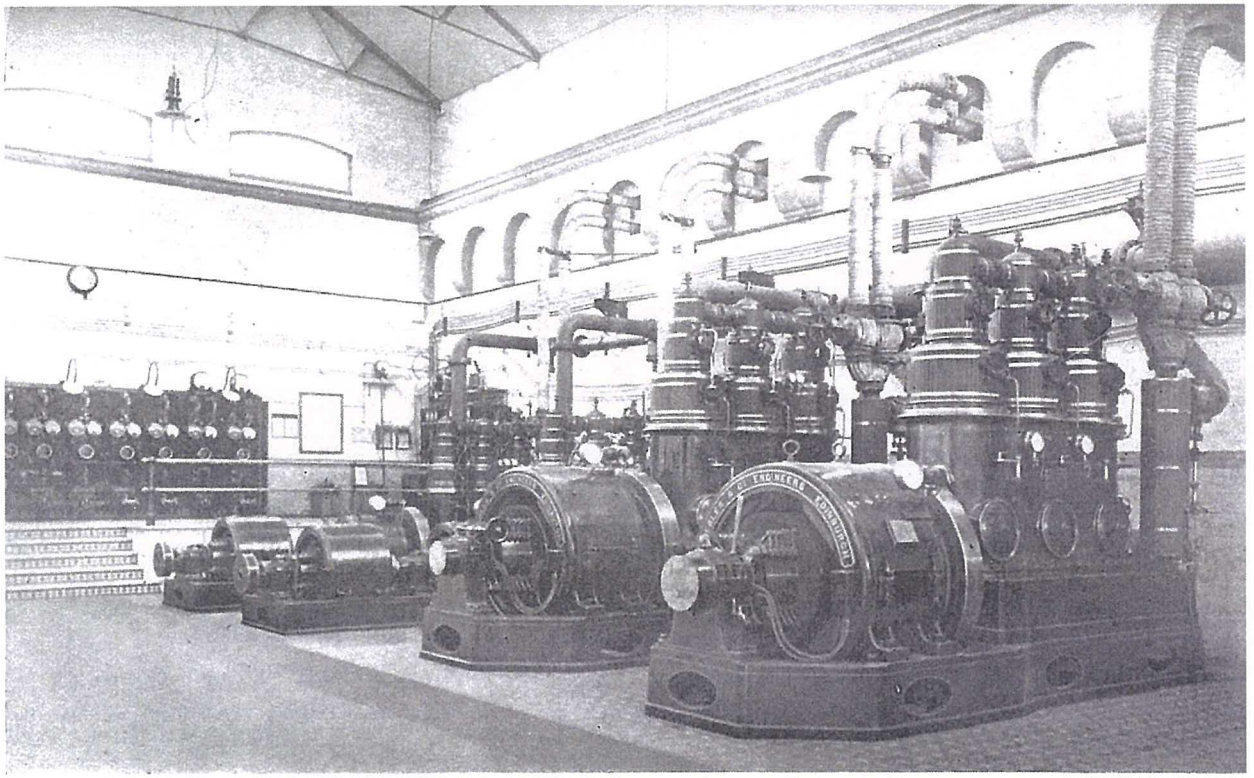
John Percival Vissing Madsen

1879-1969



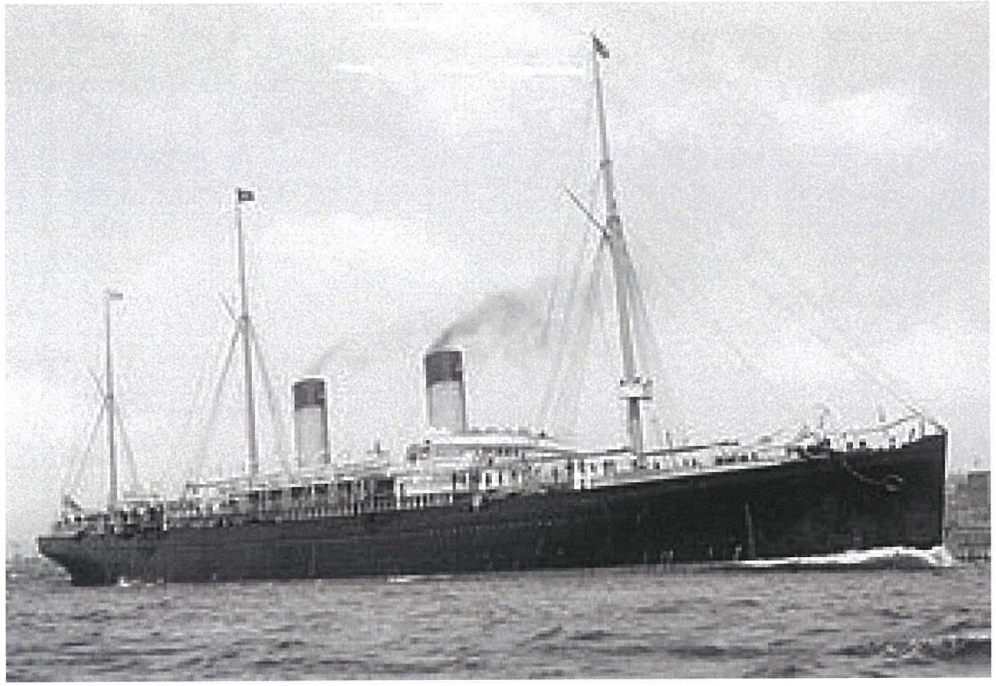
JPVM – son of a Danish Gold miner/surveyor/astronomer

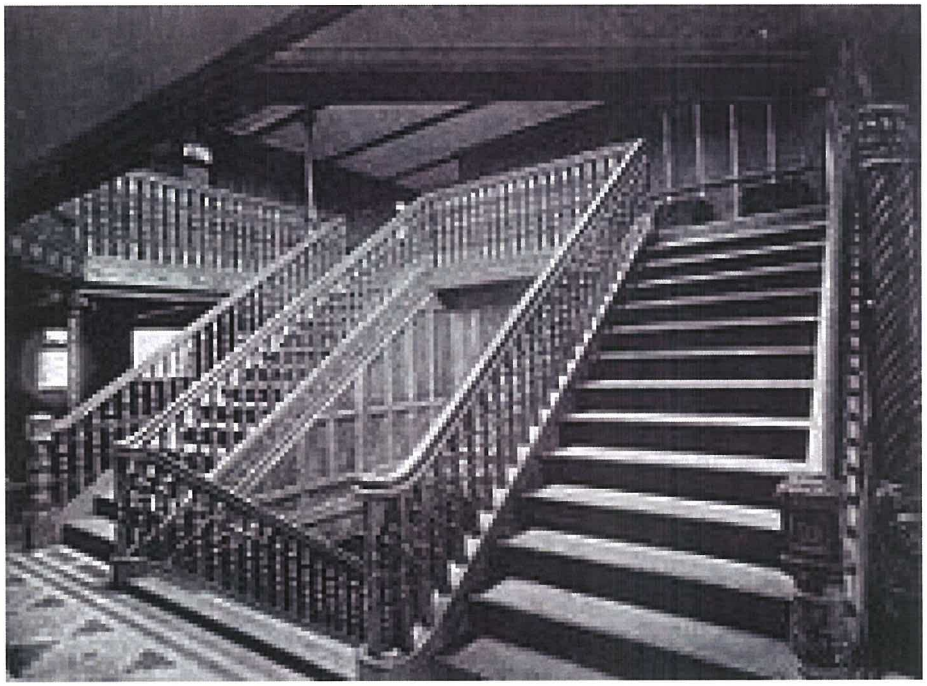
Grenfell St. 1901 2X 50 KW 200 V Generators.



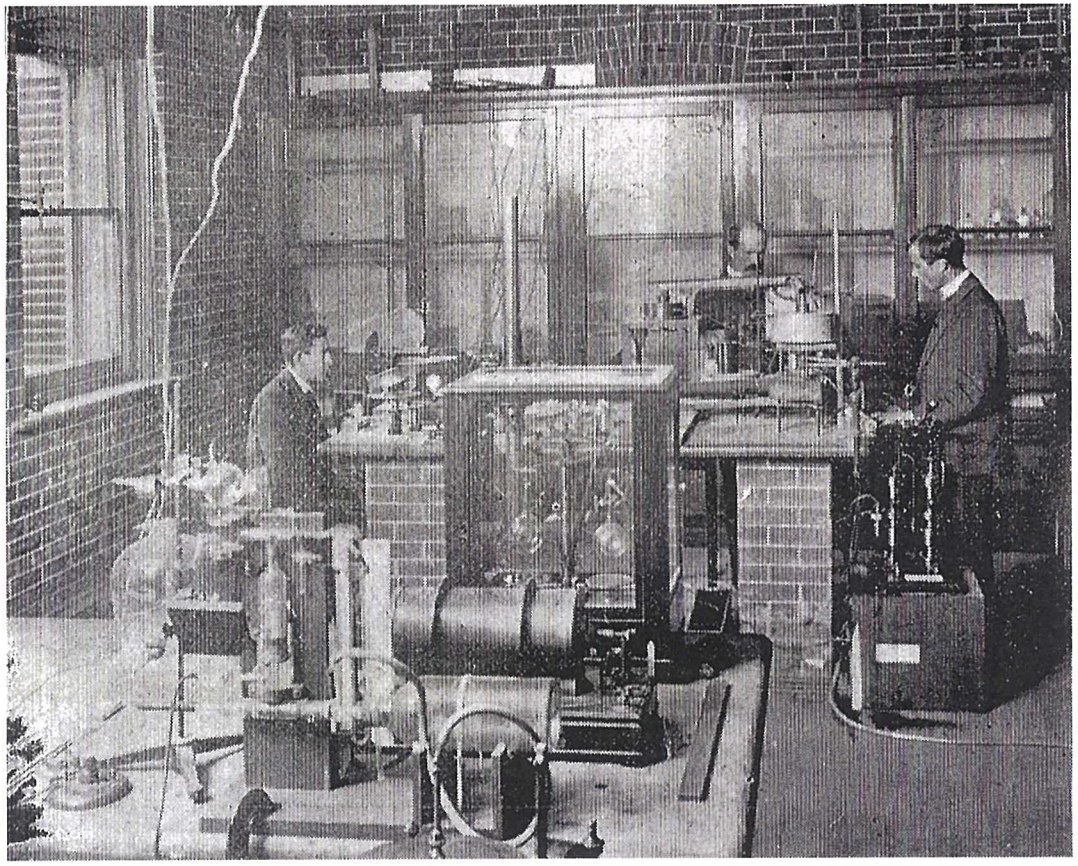
Grenfell Street Engine Room, 1901.

RMS Teutonic (1902).Liverpool to NY.

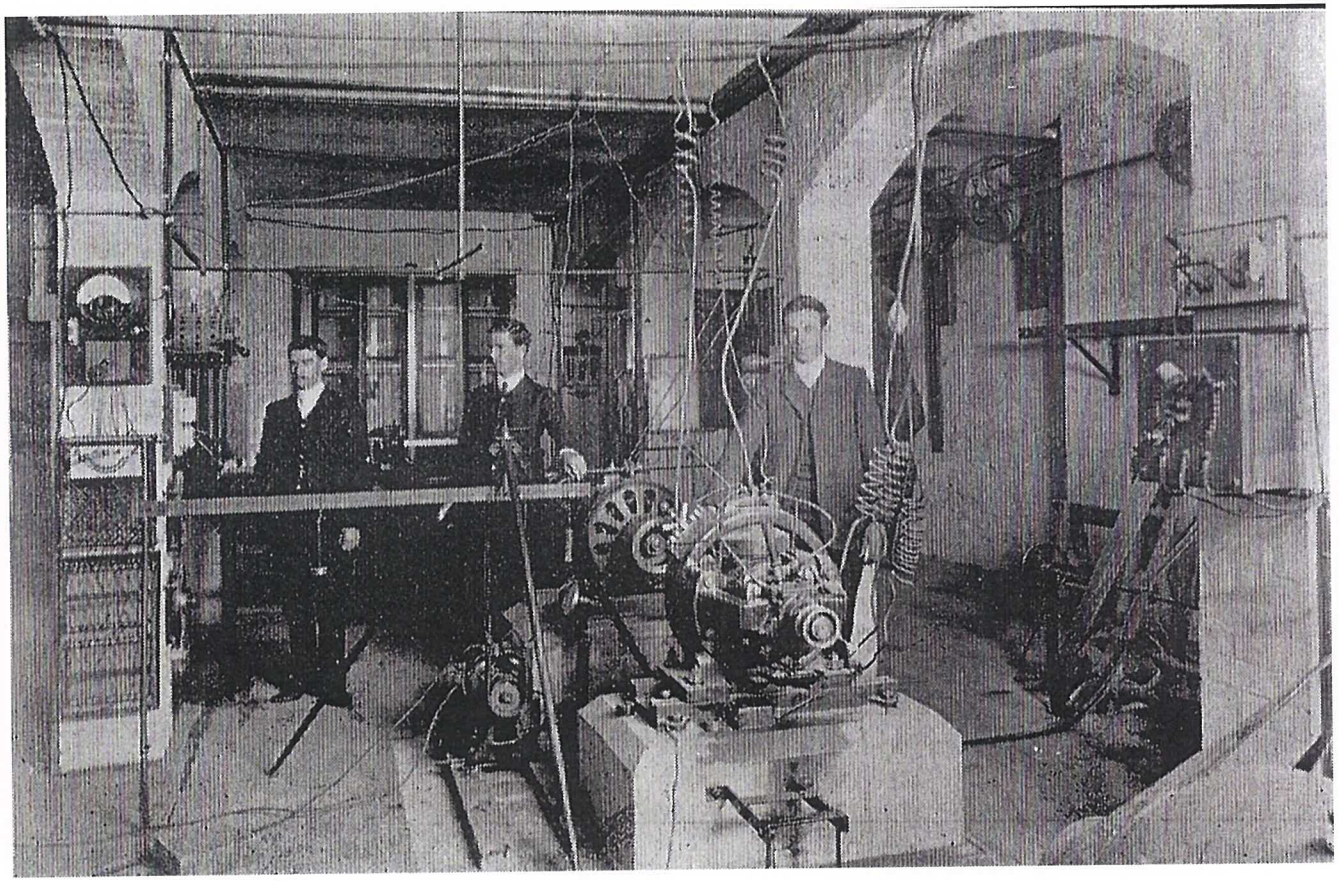




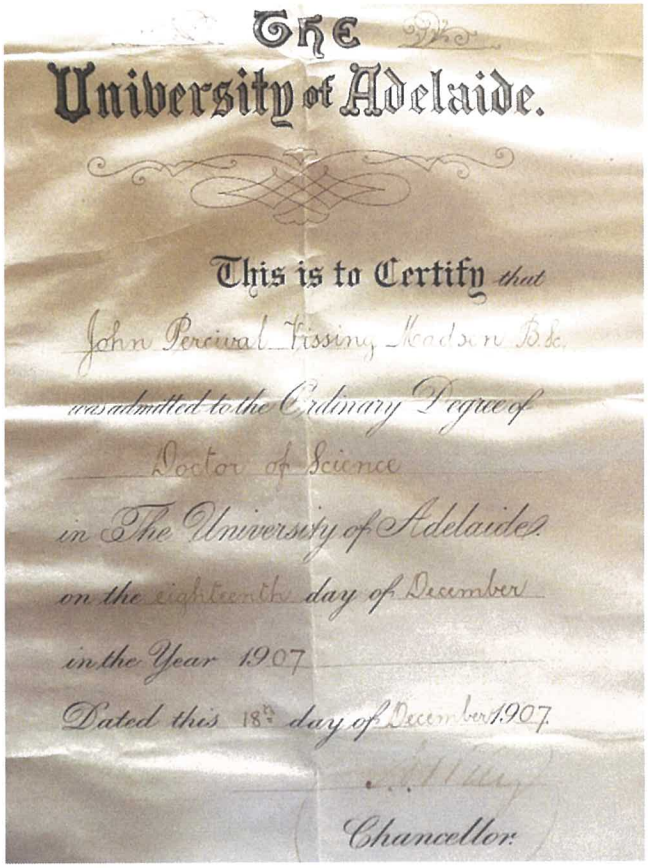
1906 W H Bragg Research Lab. Adelaide Uni.



1906 Elec. Eng. Lab. University of Adelaide.



DSc. Degree in 1907 (Ionisation).



The
University of Adelaide.

This is to Certify that
John Percival Kissing Hodson B.Sc.
was admitted to the Ordinary Degree of
Doctor of Science
in The University of Adelaide
on the eighteenth day of December
in the Year 1907
Dated this 18th day of December 1907.

Chancellor

Beta Scattering Paper 1909.

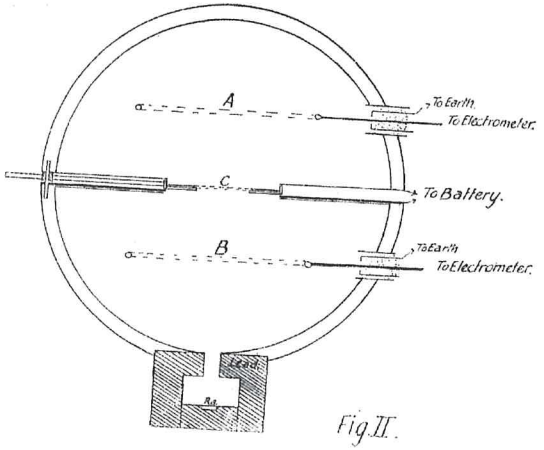


Fig. II.

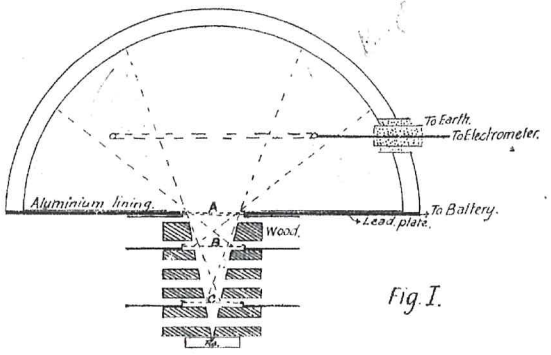
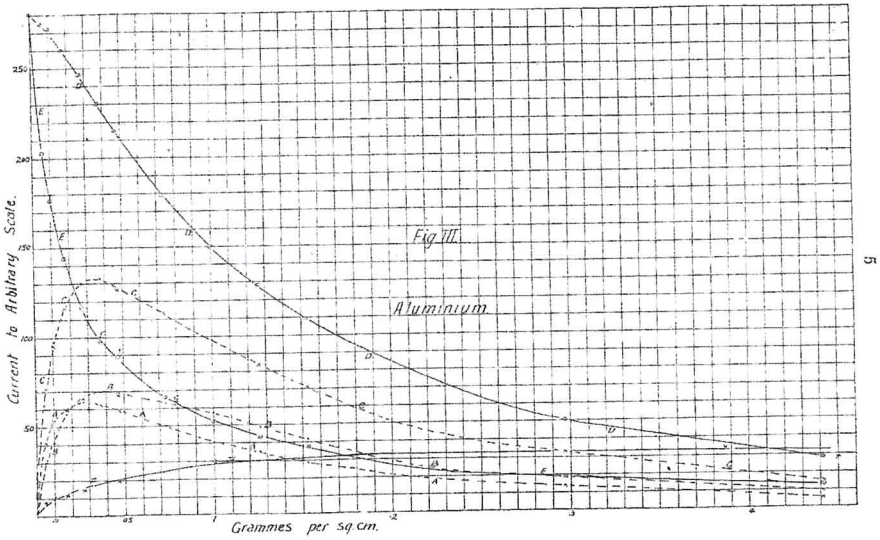
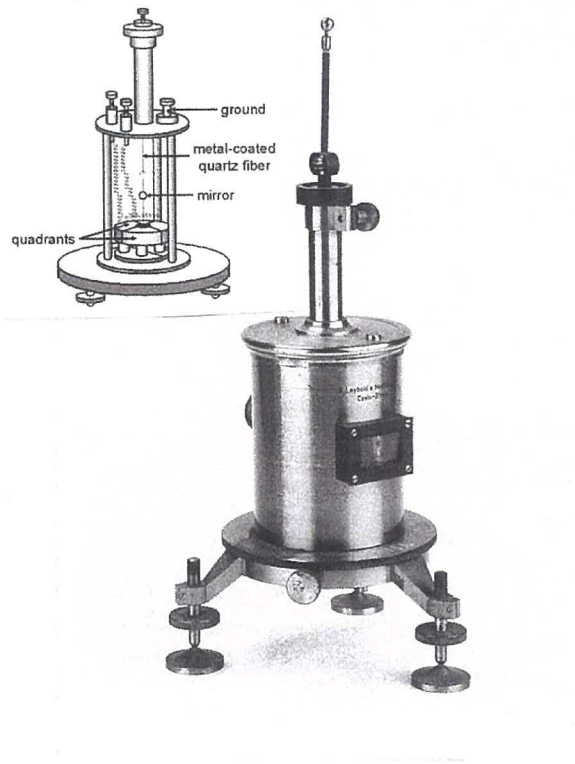


Fig. I.



5

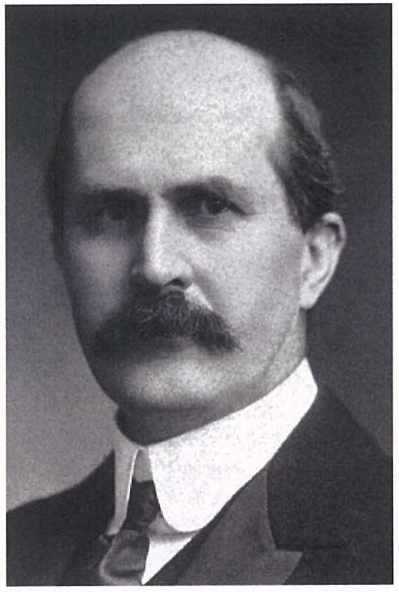
DOLEZALEK QUADRANT ELECTROMETER.

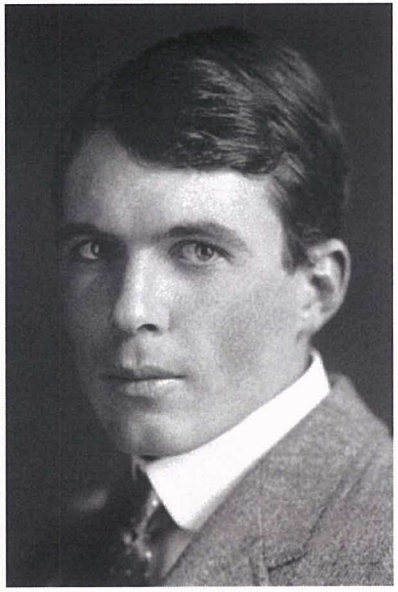


Dolezalek Quadrant Electrometer, by E. Leybold, Cologne c. 1920

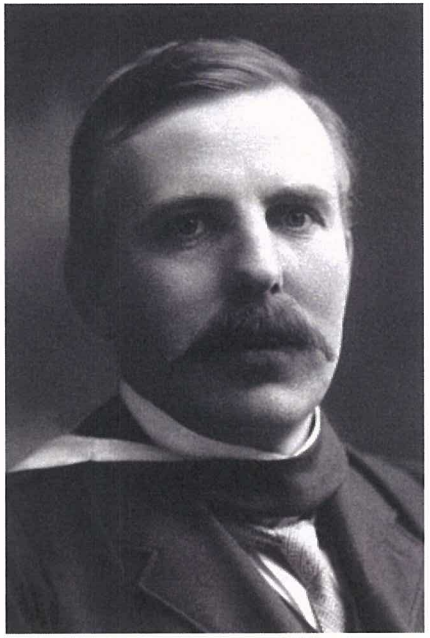
PHD in Adelaide working on radioactive scattering – leading edge

W H Bragg & W L Bragg (Nobel Foundation-1915).
Crystal Structure by X-Ray Analysis.





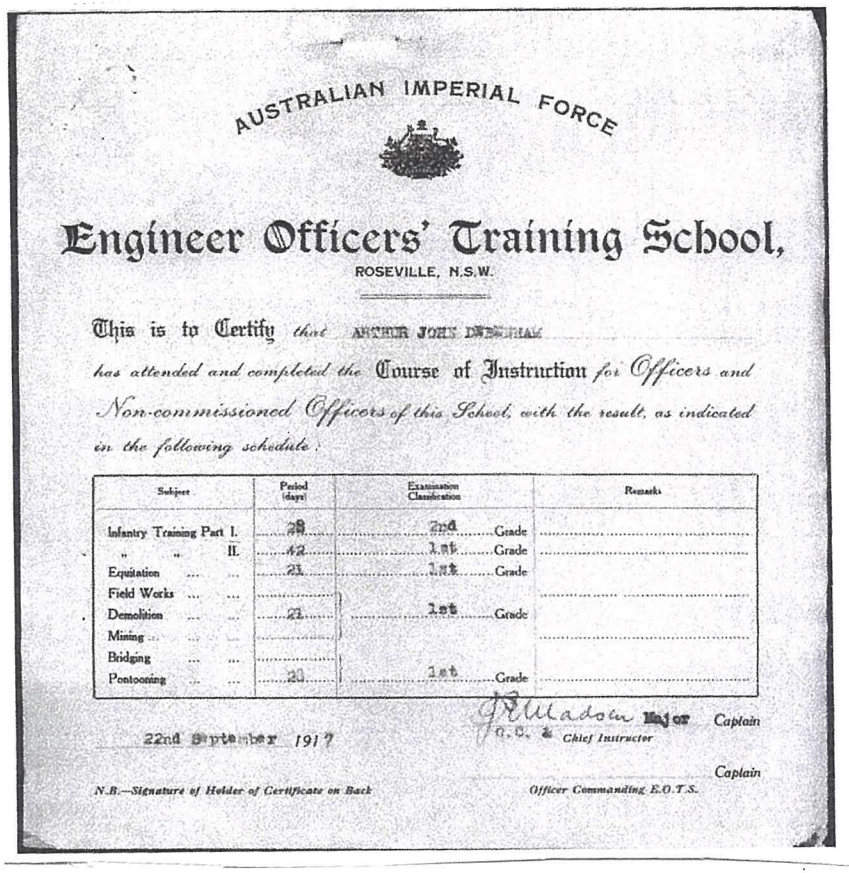
E. Rutherford (1908) Chemistry (Radioactivity).



Presidential Address to Electrical Assoc. NSW 1914.

- "We are faced with high living & high labour costs, & the only solution of this difficult problem lies in cheap production of energy, its extensive utilisation & the highest possible efficiency in our workers.
- It seems to me that one of the big electrical problems in the future in Australia will be that of the bulk production & distribution of electrical power from our coal centres. "
- Into Los Angeles at this time was 150,000 volts over 240 miles with an ultimate output of 120,000 kw.
- At this time (1914) 7:1 higher usage of electricity in the U.S. compared with Australia. (Current 2018, US average cost 3.4-4.0 Cents/Kwh).

Engineer Officer Training School in WW1.



AUSTRALIAN IMPERIAL FORCE

Engineer Officers' Training School,

ROSEVILLE, N.S.W.

This is to Certify that ARTHUR JOHN [illegible] has attended and completed the Course of Instruction for Officers and Non-commissioned Officers of this School, with the result, as indicated in the following schedule:

Subject	Period (days)	Examination Classification	Remarks
Infantry Training Part I.	28	2nd Grade	
" " II.	42	1st Grade	
Equitation	21	1st Grade	
Field Works			
Demolition	21	1st Grade	
Mining			
Bridging			
Pontooning	20	1st Grade	

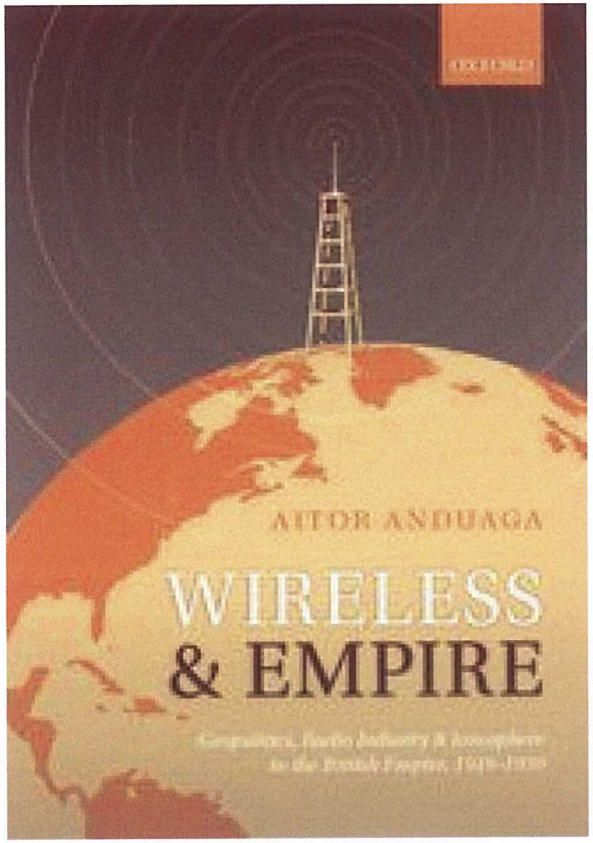
J.M. Adam Major Captain
A.D.S. & Chief Instructor

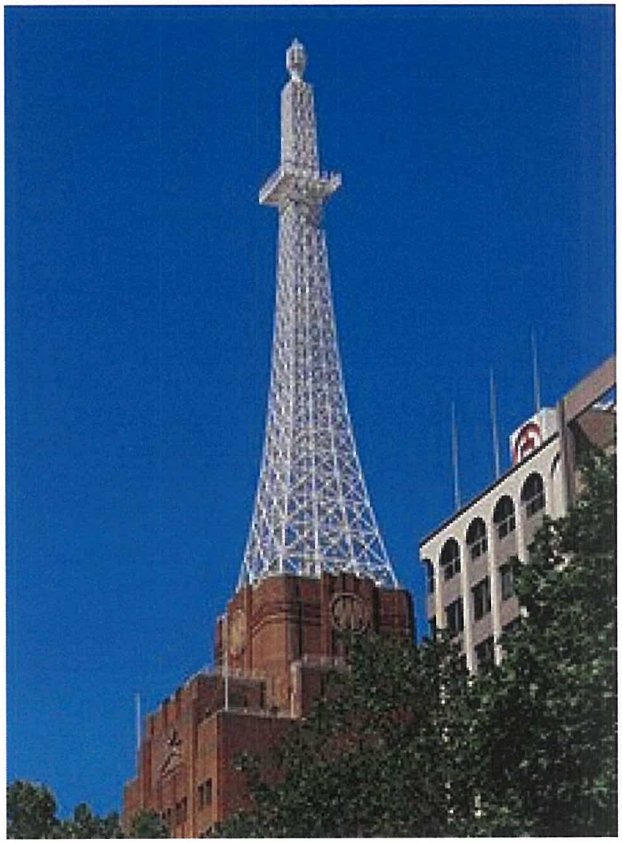
22nd September 1917

Captain
Officer Commanding E.O.T.S.

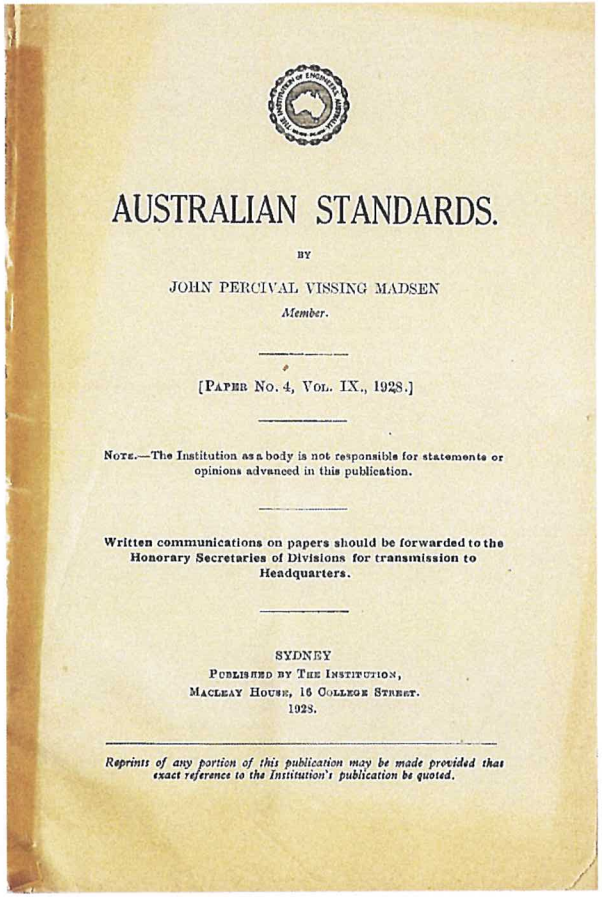
N.B.—Signature of Holder of Certificate on Back

Radio Research Board Investigations 1929-1939





Standards Paper to Institution of Engineers 1928.



AUSTRALIAN STANDARDS.

BY

JOHN PERCIVAL VISSING MADSEN

Member.

[PAPER No. 4, VOL. IX., 1928.]

NOTE.—The Institution as a body is not responsible for statements or opinions advanced in this publication.

Written communications on papers should be forwarded to the Honorary Secretaries of Divisions for transmission to Headquarters.

SYDNEY

PUBLISHED BY THE INSTITUTION,

MACLEAY HOUSE, 16 COLLEGE STREET.

1928.

Reprints of any portion of this publication may be made provided that exact reference to the Institution's publication be quoted.

Radio Research Board Ionosphere Investigations 1935.

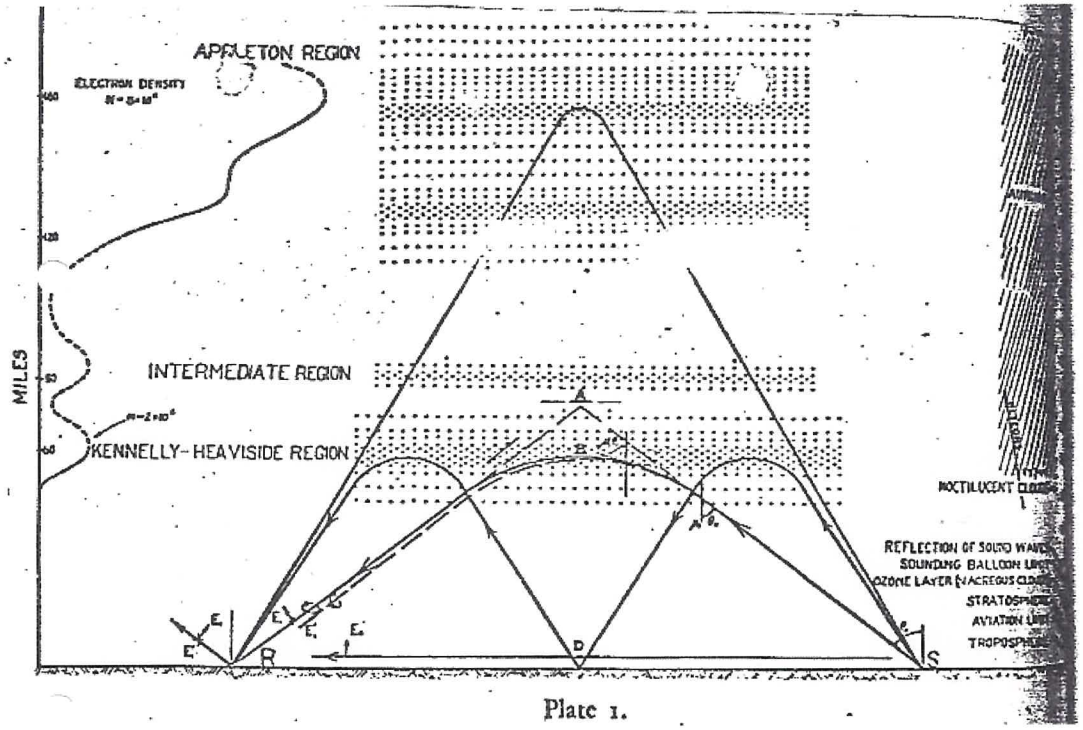
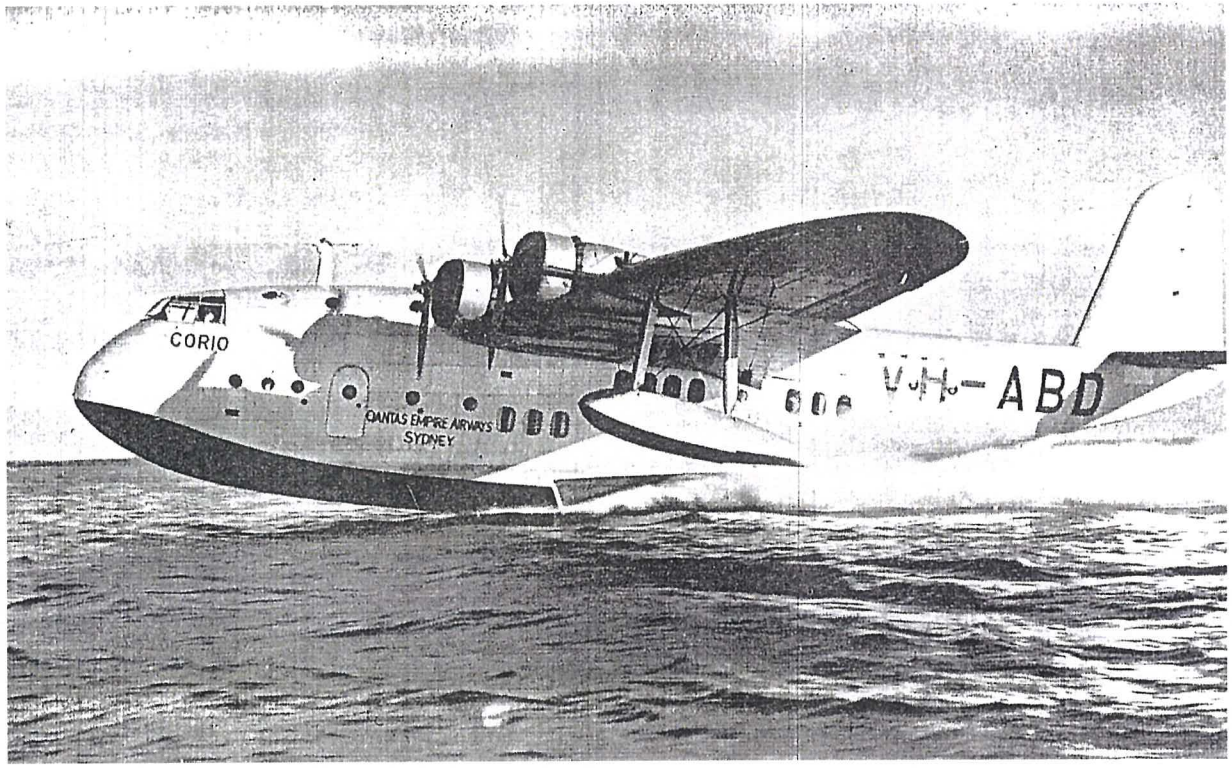


Plate 1.

Trip by “C” Class Flying Boat to London December 1939.



NSL & RPL of WW2 - Madsen Bldg Sydney Uni.

VT 90 Valve – The heart of 1.5 metre (200 MCS) radar.

6/25/2016 VT 90, Tube VT90; Röhre VT 90 ID20353, Transmitting Triode, 127.

Radiomuseum

VT90

Upload & Info » | My Tube/Semi »

ID = 20353 Help

Country: Great Britain (UK)

Brand: Common type Great Britain tube/semicond.
Tube type: Transmitting Triode, air cooled

Identical to **VT90** = 10E/97 = E1046 = REL1 = CV1090 = WL-538

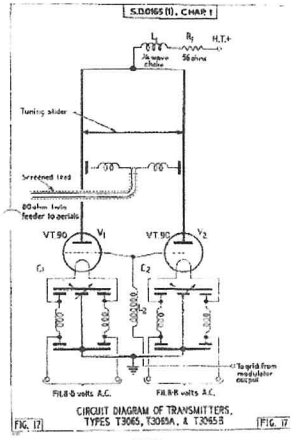
Similar Tubes
Normally replaceable-slightly different: 710A ; 8011 ; CV46
Other characteristic (electr. data): CV62

Successor Tubes D-160810 CV46

Was used by Military and/or Government

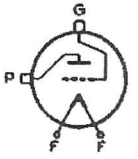
Filament Vf 8.25 Volts / If 7 Ampere / Half indirect /

Description 0KV peak anode voltage, 100W anode dissipation with forced-air cooling. Useful in pulsed operation to above 300MHz.
Used in British ASV MK2 airborne radar and in the US sets SCR-521 and ASE-1, Several British, Canadian and US manufacturers and several product codes for this British military spec.



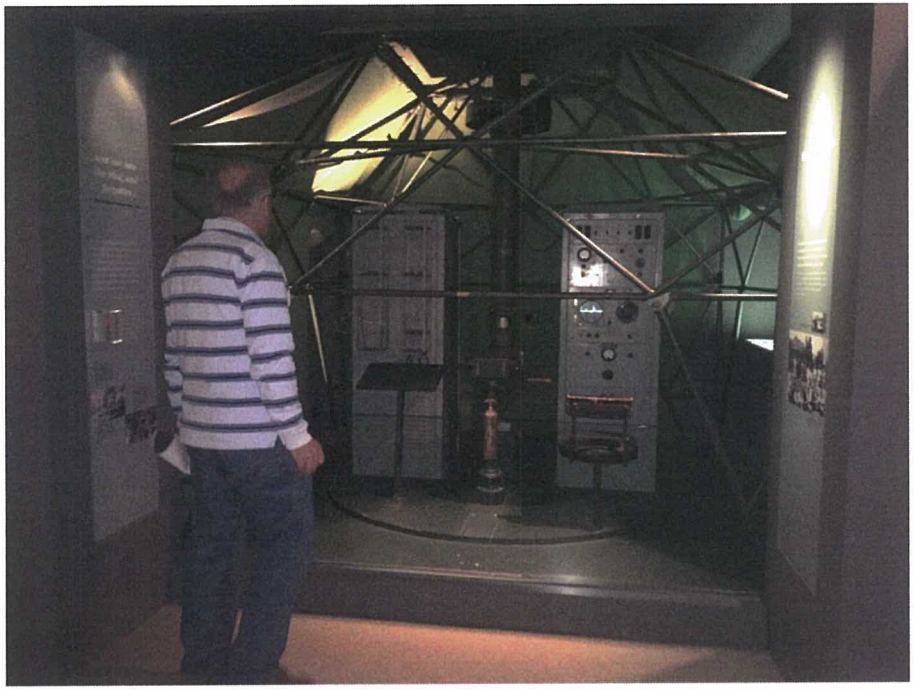
VT90
Emilio Ciardiello

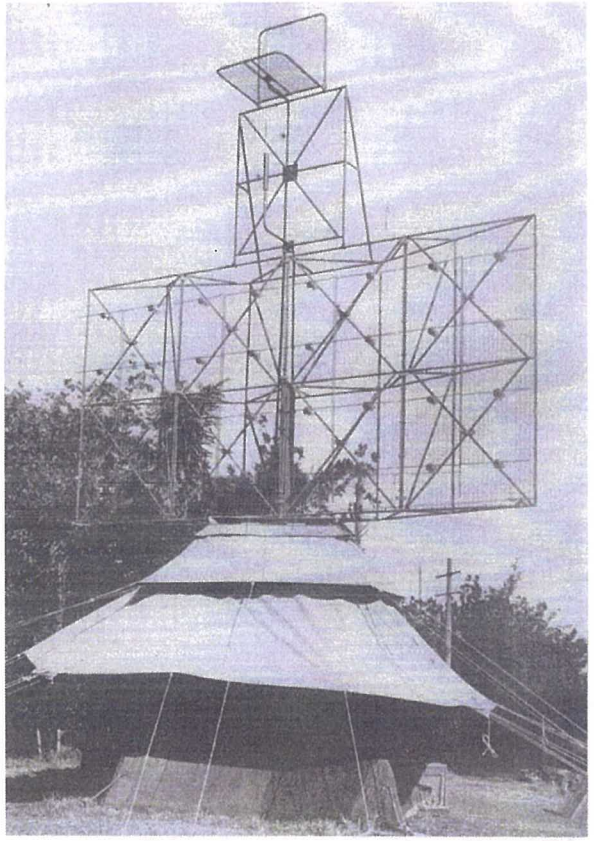
VT90
Emilio Ciardiello



VT90: Manufacturer's Literature
Emilio Ciardiello

Aust. LW/AW Radar with IFF (1.5 mtr)





Light-weight air-warning equipment. (Radiophysics Laboratory)

LW/AW & IFF.

Admiralty Drawings of 10 Cm Magnetron.

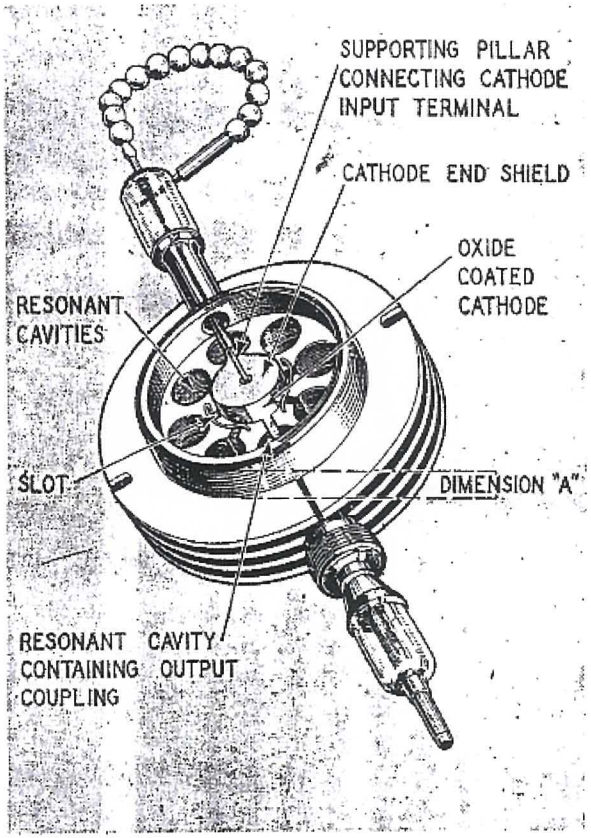


Fig. 237.—Anode block and cathode assembly of a modern magnetron (end blocks removed).
[Reproduced by courtesy of the Admiralty.

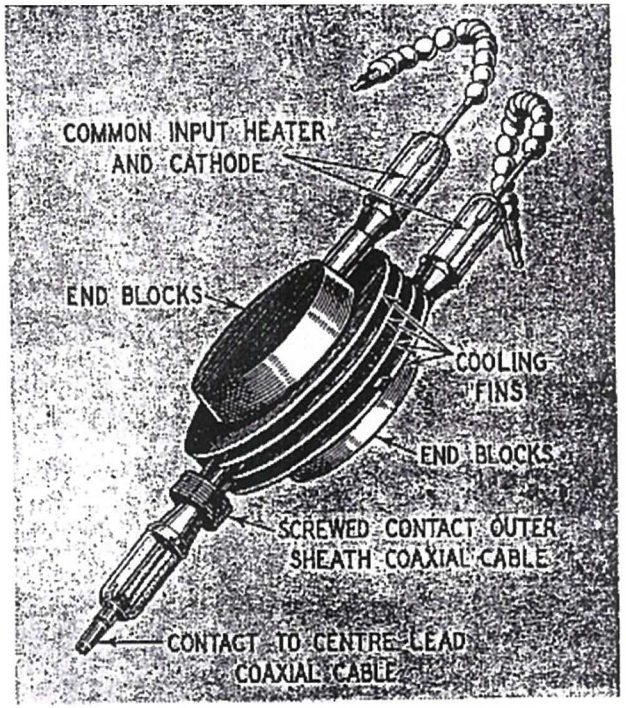
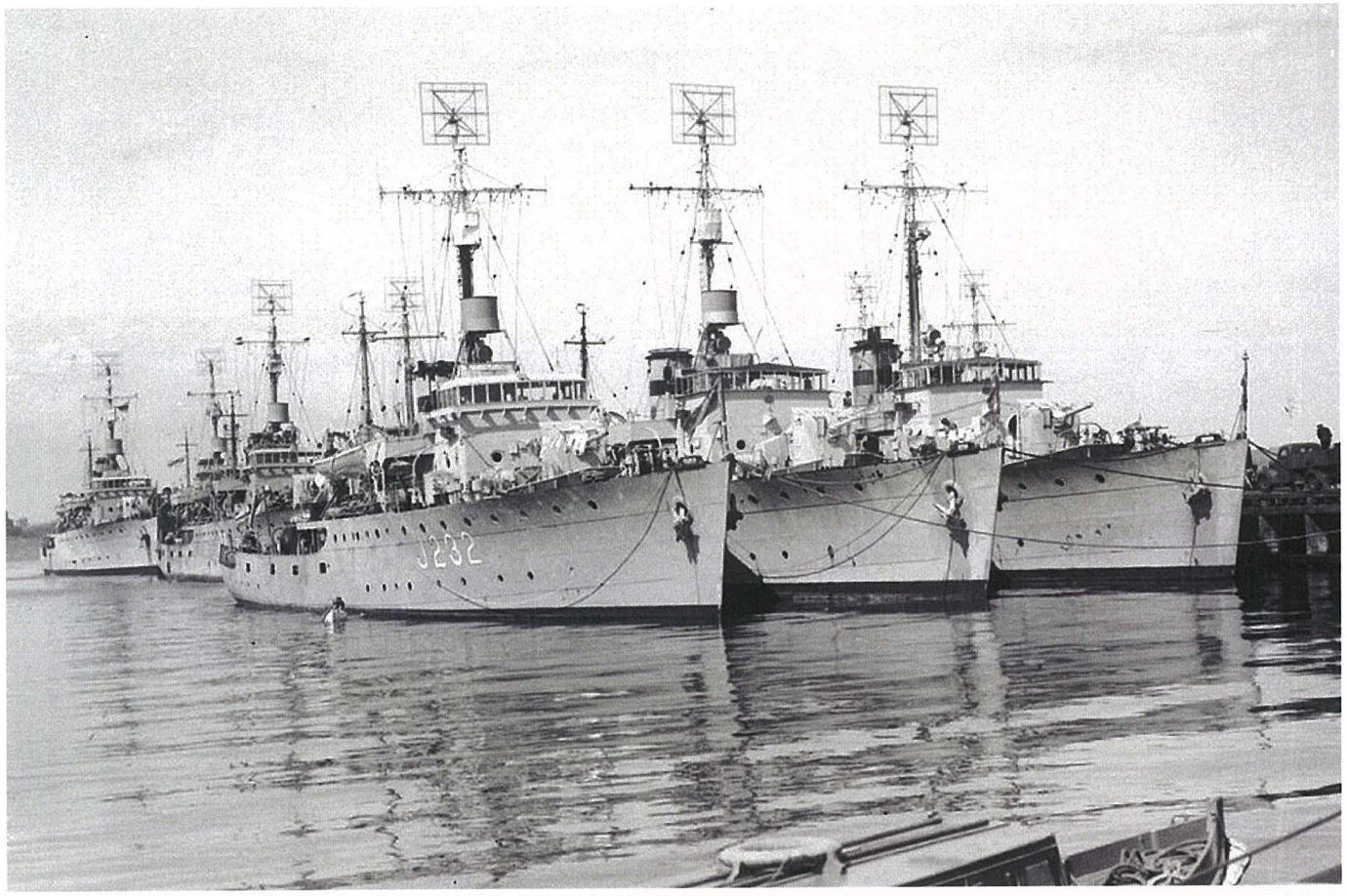
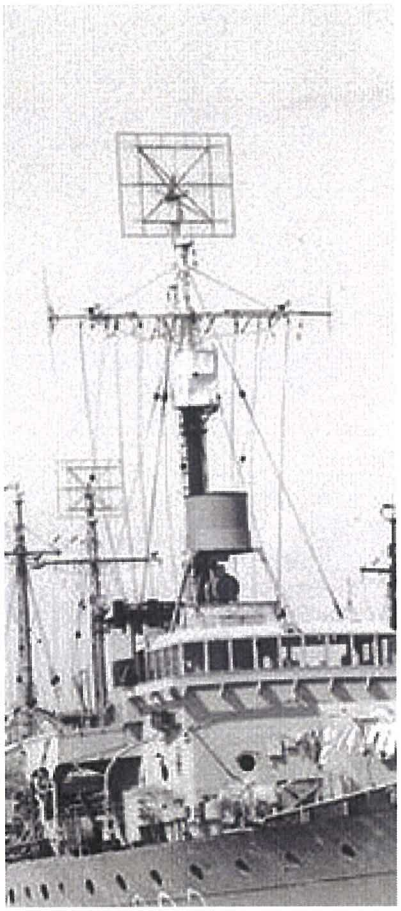


Fig. 239.—Magnetron with end blocks fitted over the anode block.
[Reproduced by courtesy of the Admiralty.

Aust. Corvettes with 10cm & 1.5 metre radars.





ANRC-Nuclear Policy Chairman1945-46.

COPY AJK:SH

P.M.'s File No. J.49/1/8

POST-WAR RECONSTRUCTION
12 FEB 1946
No. 15/626

PRIME MINISTER
CANBERRA.

J.49/1/2

14th February, 1946.

Dear Sir,

I have to refer to your letter of the 3rd December, 1945, enclosing recommendations concerning the development of nuclear physics which have been prepared by the special committee of your Council. Would you kindly convey my thanks to your Chairman, Professor Sir John Madsen, D.Sc., B.E., F. Inst.P., for arranging to submit these recommendations to the Government.

The recommendations made by your Council are substantially the same as recommendations already made to the Government by the Council for Scientific and Industrial Research, and action is already being taken on the matters referred to in your recommendations 1 and 2.

At this stage, action of a preliminary character only can be taken to formulate a research programme in this country. The release of information on this subject is, as you are aware from the reports in the press, a matter under discussion by the United Nations' Organisation. It is to be hoped, however, that before long this country, in collaboration with the United Kingdom, will be given access to modern information which will permit us to formulate a more satisfactory programme concerning the development of nuclear energy for industrial purposes in Australia.

Yours faithfully,

(SGD) J.B. CHIFLEY

Prime Minister.

Dr. H.R. Carne,
Hon. Secretary,
Australian National Research Council,
157 Gloucester Street,
SYDNEY.

COPY - C.S.I.R. (P.C.) 14/2/46

The Director-General of
Post-War Reconstruction.

Referred, by direction, in c/w my minute of 7/12/45.

COPY - P.W.R. (P.C.)
MUNS. "
E.A. "
S. & S. "

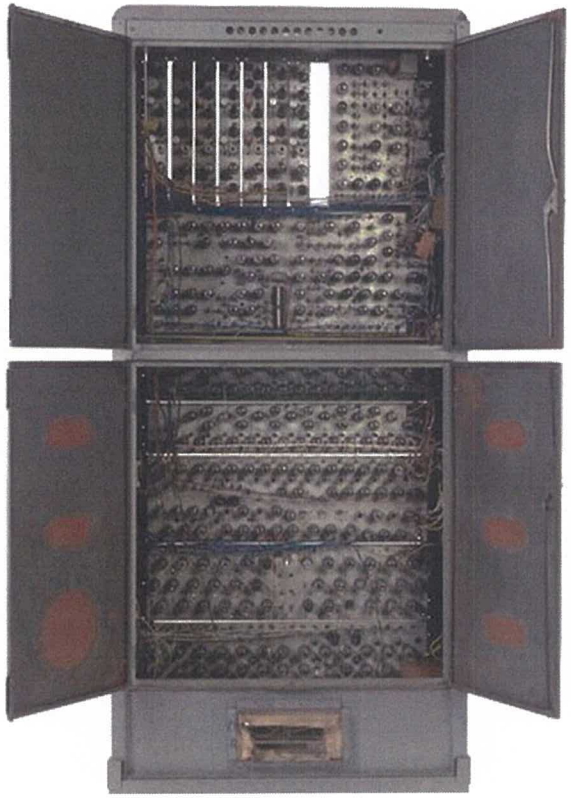
12 FEB 1946

Secretary, Prime Minister's Department.

NATA

Foundation Member 1947. (Vice Chairman, Executive Committee)
Chairman 1948-1950
(Testing includes Materials, Manufactured goods, Agribusiness, Food & Beverage, Calibration) (World Recognised Accreditation)

CSIRAC Computing Conference Aug. 1951.



University of Sydney. Digital vs. Analogue.

PRESIDENT AUST. Committee 1952 U.R.S.I.

The 1952 URSI visit to Potts Hill field station where Sir Edward Appleton (far right) discusses the E-W grating array with its designer, Chris Christiansen, who is standing on the extreme left beside one of the antennas. Third from the left is Sir Frederick White, a former wartime Chief of the Division of Radiophysics and by 1952 Chairman of the CSIRO (adapted from the original in the ATNF Historic Photographic Archive).
Source publication

JPVM – Highlights of the First Professor of Electrical Engineering

- Worked with World Leaders on the atom
- Established Standards
- Led Australian Radar work – flew out of Pearl harbour on the 4th Dec 1941
- Oversaw the growth of power/communications/radio/TV in Australia (Philips-Hendon)
- Trained many Australian Engineers from 1903-1949

AUSTRALIAN SYNCHROTRON, CLAYTON,VIC. 2007.

PARKES ULTRA WIDEBAND RECEIVER, 2018.