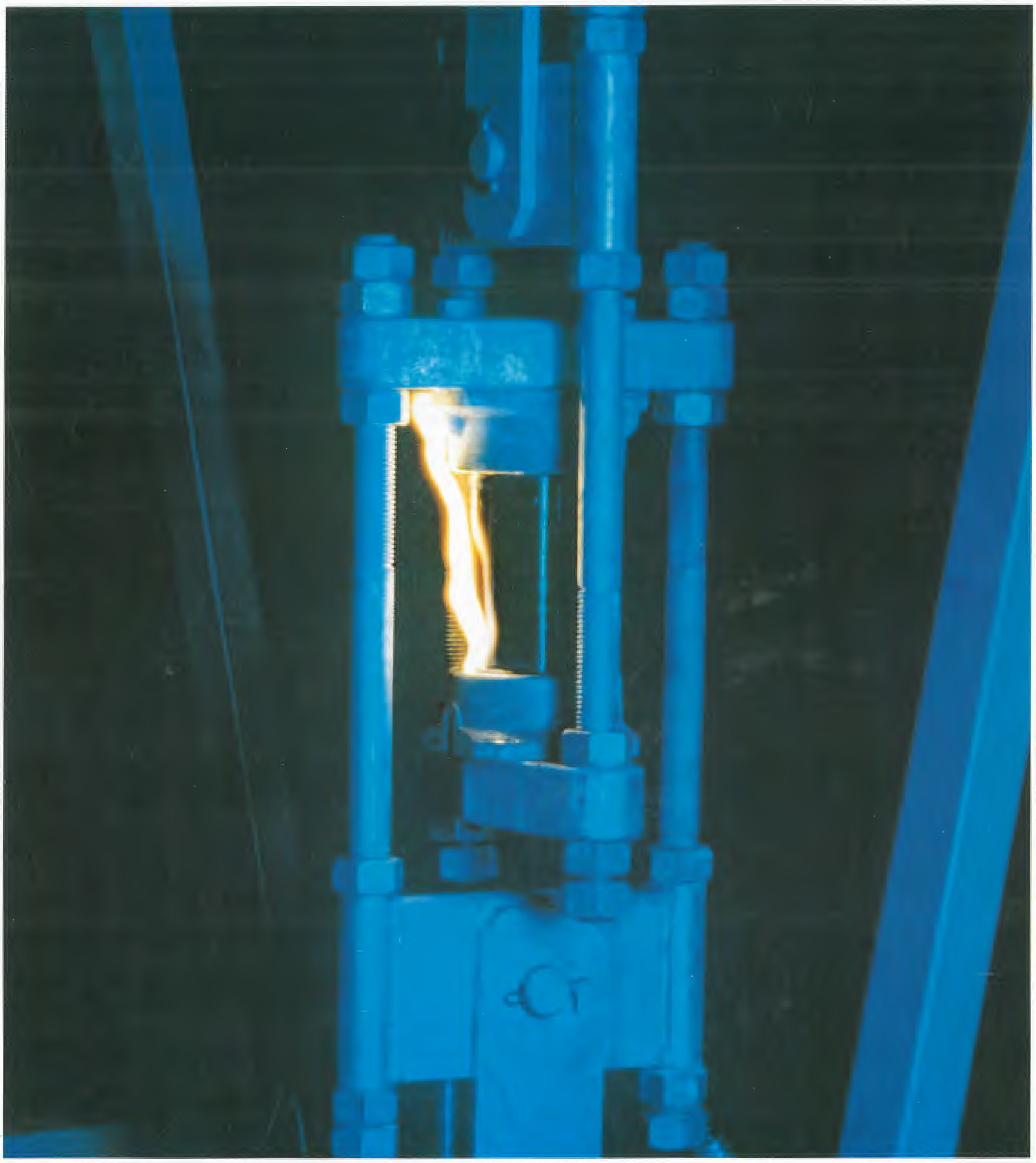
The BROADCASTER

Newsletter of the Broadcasting Division

No. 22 March 1992



HIGH VOLTAGE TEST ON GUY INSULATOR

THE BROADCASTER

The Broadcaster is the in-house newsletter of the Broadcasting Division and is published three times a year to inform and recognise the people who make up this organisation.

Articles appearing in *The Broadcaster* do not necessarily reflect the views of the management of Telecom Australia.

Written and photographic contributions are welcome. All material should bear the contributor's name and location and be directed to:

The Editor,
The Broadcaster,
Telecom Australia
GPO Box 1621,
ADELAIDE, SA 5001

Editor: Jack Ross

Publication Co-ordinator: Mel Pressley.

Design and Layout: Brian Turner.

Co-ordinators:

National Office:	Terry Said Sandra Mannings
Queensland:	Paul Hayden
New South Wales:	Ron Johnson
Victoria:	Ray Weeks
Tasmania:	Glen Clements
South Australia/NT:	Mel Pressley
Western Australia:	Jeff Keith
Published by:	Broadcasting Division, 11th Floor, 484 St Kilda Rd, MELBOURNE, VIC 3004 Australian and Overseas Telecommunications Corporation Limited A.C.N. 051 775 556

National Library Card No. ISSN 0816-3235

EDITORIAL

Although a great deal is known today about ceramic insulator design for broadcasting application, basic developmental work was undertaken during the wireless telegraphy era. One project which paved the way for the use of base insulators for broadcast radiators was the 500 kW low frequency wireless telegraphy Rugby Radio Station in England erected in 1925. Although eight 244 m lattice steel masts were erected to support the cage aerial system, the designers decided to insulate the masts from earth. Research was undertaken to find an insulating material capable of withstanding the simultaneous application of high power radio frequency and high mechanical stresses. The studies concentrated on granite and porcelain with the final solution being a combination of porcelain insulators mounted on a large granite block.

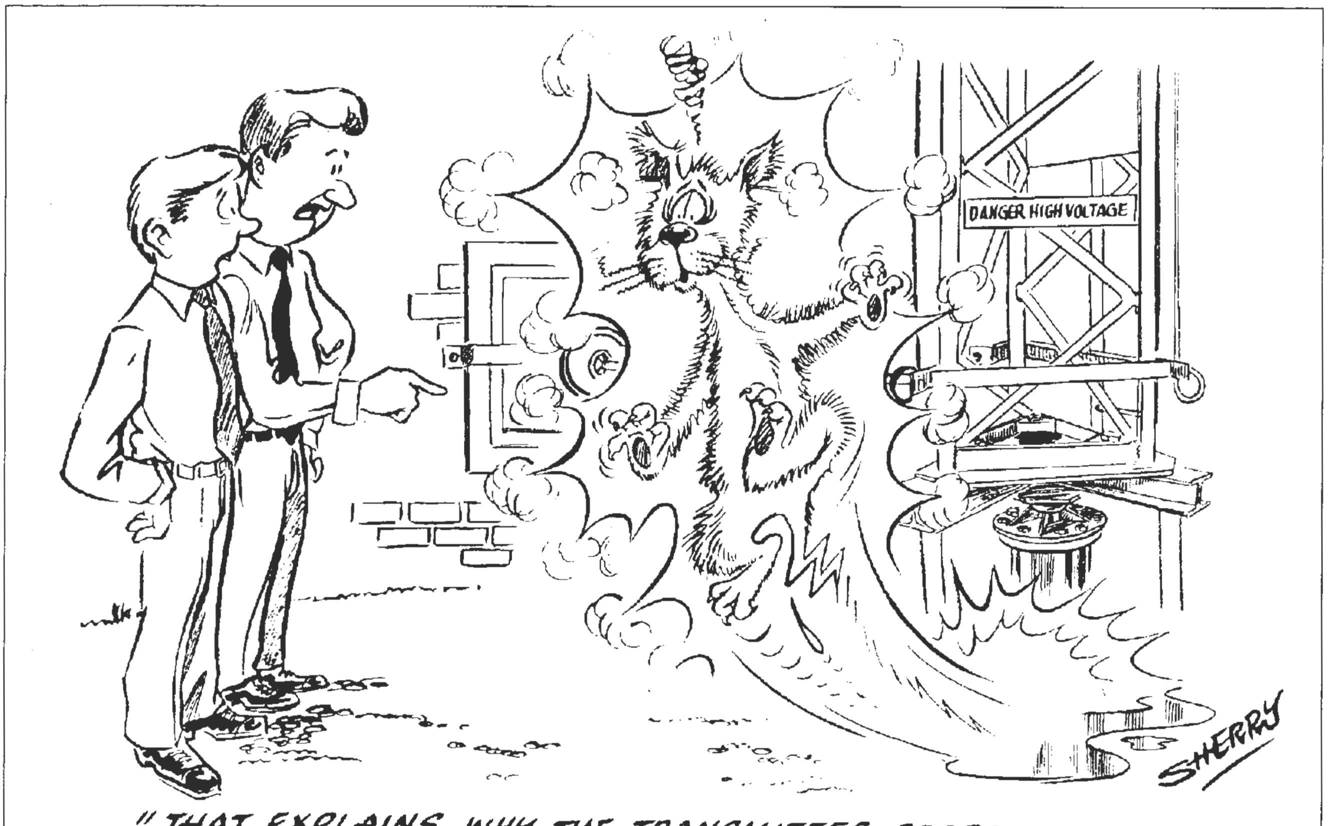
The porcelain insulator design known as a 'Cheese' type, was cylindrical in shape with a 50 mm hole through the middle to give satisfactory vitrification of the material. Individual insulators were 225 mm diameter and 87 mm thick. Twelve columns each consisting of three insulators supported the mast. From this developmental work, hollow cylindrical porcelain insulators later became the standard method of insulating broadcast radiators.

JACK ROSS

Front Cover: Guy insulator being tested at Telecom Research Laboratories.

Contributors to this issue:

Leon Sebire
Jeff Laidlaw
Leo Moloney
Ken Smith
Mychelle Vanderburg
John Bray
Neil Deer
Terry McManus
Graham Smith
John Swarbrick
Andy Fisher
Ray Jackson
Ted McGrath
Graham Ward
George Moss
Jack Ross



"THAT EXPLAINS WHY THE TRANSMITTER DROPS OUT EVERY MORNING AT THIS TIME!"

Leon Sebire.

FROM MY DESK

This year we will begin to see some fundamental changes to the way we have traditionally operated and to the regulation of the Australian broadcasting situation.

A National Transmission Agency (NTA) is to replace the National Broadcasting Branch of the Department of Transport and Communications, the body to whom we have acted as contractor in recent years.

The NTA is expected to come into being on 1 July 1992 and will take over and manage all of the transmission assets of the National Broadcasting Service. At the same time it will be responsible for the upgrading and extension of the facilities used for the transmission of the programs of the ABC and SBS.

The most important difference is that the Telecom Broadcasting Division will no longer have exclusive rights to design, construct and maintain these facilities. The NTA will introduce competition and these activities will, for the first time in the history of the National Broadcasting Service, be put out to tender on a commercial businesslike basis. Furthermore, the NTA will operate as a discrete cost centre on a commercial accounting basis providing public visibility and accountability in all its activities.

Initially it seems likely that the introduction of competition will be in the area of construction or project work. Because of the very complex arrangements which exist in relation to our current maintenance activities it can be expected that competitive tendering for this work will not be feasible at the outset but will need a much longer timeframe for its introduction.

Clearly retention by us of a substantial proportion of our current work activities will present great challenge and we will need to look closely at methods and practices throughout our organisation if we are to succeed.

LEON SEBIRE
General Manager, Broadcasting

STATION ROLL CALL

ABWQ-6 WIDE BAY

The ABWQ-6 television transmitter is situated on Mount Goonaneman which is part of the Woowoonga Range at an elevation of 617 metres located 35 kilometres by road, West of Childers.

The building is of Phase 4 design being of two storey brick construction which now houses a National and three Commercial television transmitters, two 20 kW ABC FM transmitters and associated equipment. It is also a major repeater site for Telecom bearer equipment and other services.

The station serves the Wide Bay area and surrounding Hinterland and cities of note in the primary service area include Bundaberg, Maryborough and Hervey Bay.

Sugar cane is the principal crop grown in the coastal region but the area supports a broad range of industries from small crops right through to machinery manufacturing and ship building. Another very important industry to the area is that of tourism.

The station was commissioned in October 1965 using two 5 kW AWA TVH5 transmitters operating in parallel. These transmitters remained in service until their replacement by two solid state 5 kW NEC PCN-1405SSH/I transmitters in parallel in October 1990.

The original Commercial service was commissioned in April 1965 using a single 10 kW TVH10 transmitter without a standby transmitter.

The original antenna system was mounted on a 150 metre self supporting lattice steel tower. However, this has since been modified extensively during the TV Equalisation project. The resultant structure is now 130 metres supporting new UHF, VHF and FM antenna panels.

KEN SMITH.

4GM GYMPIE.

There are not many broadcasting stations built on site of a former gold mine, but 4GM Gympie is one such case. Although there is an old partly filled shaft on the property and some corroded Chinese coins were found, the installation staff who toiled on the site in 1951, found no loose nuggets. The whole area adjoining the station site is now residential or light industrial.

The station was officially opened on 17 August 1951 by a recorded speech by Postmaster General, H.L. Anthony and local and State dignitaries attending a ceremony in the local Town Hall.

The transmitting facilities were housed in a small timber building and included a pair of AWA type 2J51316 200 watt transmitters using conventional high level anode modulation with a pair of 828 pentodes modulating an 810 triode. The high tension rectifiers were 872A mercury vapour diodes but were later replaced by solid state diode stacks.

The radiator comprised a 36 m lattice steel guyed mast erected by Deeco Steel Construction Co. The 120 copper earth mat radials were laid to a nominal depth of 150 mm but even though the workmen tried hard to root out gold bearing ore, their luck was out.

The station was operated by a staff of two. One man staffed the station during the morning and another in the late afternoon and evening. During the middle of the day, the transmitter was unattended - a bold move at the time.

LEO MOLONEY.

ABU MEETING

The twenty-eighth annual meeting of the Asia-Pacific Broadcasting Union (ABU) was held in Kuala Lumpur during October 1991. Consisting of about 60 members from some 45 countries such as China, India, Iran, Japan, Korea, Malaysia, New Zealand, Thailand and Turkey, the ABU meets every year to discuss programming and engineering issues in the Broadcasting arena. One of the founder members is the ABC, represented this year by John Bigeni from ABCTV Sydney who chaired the Engineering Committee, and General Manager Leon Sebire and Graham Smith from the Broadcasting Division.

The engineering meetings, which ran for seven consecutive days, covered a wide range of topics, including frequency allocations for Satellite Digital Sound Broadcasting. The meetings also included the presentation of technical papers, with the Broadcasting Division submitting papers on VHF antenna shielding, high power UHF-TV combiners, VSWR monitoring systems and Mini-ACTTS. The MiniACTTS paper presentation, which included the distribution of the Mini-ACTTS brochure, generated significant interest amongst delegates.

The conference, which is held in a different city each year, returned to Kuala Lumpur, the home of the ABU secretariat, for the first time in fifteen years. The Malaysians are extremely generous and hospitable people and took great delight in showing off their country. It wasn't until later in the conference, however, that delegates were able to see Kuala Lumpur at its best, due to the presence of a large haze over most of the region limiting visibility to a few kilometres. The haze was caused by major bushfires in Sumatra, which took many weeks to extinguish. As well as the daily conference meetings, delegates attended a number of functions at night hosted by dignitaries such as the Minister of Information and the Mayor of Kuala Lumpur. Every function included a show displaying traditional Malaysian costume, singing and dancing. The host broadcaster, Radio Television Malaysia's function included a live TV broadcast of its variety show, with viewers across the country treated to an exhibition of Malaysian dancing by the Australian delegates.

Another highlight of the conference was a day trip, complete with police escort, to Malacca, one of the more historical cities of Malaysia.

GRAHAM SMITH

UPGRADING AT THE BLUFF

On Wednesday 25 September 1991, new transmitters were commissioned for ABNS1 at The Bluff. The station provides the ABC program for the Spencer Gulf region in the mid-north of South Australia. Major towns serviced in the area, known as the "Iron Triangle" include Port Pirie, Port Augusta and Whyalla with a number of translators being dependent upon The Bluff to serve many outlying areas. The original transmitters were manufactured by Marconi, England and had been operational since 10 April 1965. The service underwent a number of changes since that time including colour conversion in 1975 and the program source derived from AUSSAT satellite in 1985. Initially, program arrived via a Siemens television bearer from Adelaide but this was subsequently removed from service. The new television transmitters were supplied by NEC Australia Pty Ltd, and consist of two PCN-1410AL/I units operating in parallel via automatic coaxial combining equipment. Each transmitter provides 10 kW of peak vision power giving a total of 20 kW split into two antenna stacks. Separate sound and vision RF amplifiers are used. The sound transmitter consists of two 600 watt solid state amplifiers in parallel wheras the vision transmitter utilises a 600 watt solid state amplifier driving a tetrode PA stage. The ABC program is now provided in stereo sound format. Program input equipment was redesigned and rational-

Some of the original staff and Engineers on site during the 25th Anniversary celebrations April 1990.

Back Row (L to R) Brian Roberts, Brian Beyer, Max Chadwick, Ross Faggoter, Graham Ward.

Front Row (L to R) Richard Kruger, Wes Graham, Brian Hammond

ised as most of the old equipment was no longer required or had exceeded its life expectancy. As the NEC transmitters incorporate all the necessary colour and transmitter correction in their exciters, the correction and equalisation units used with the Marconi transmitters became redundant. Staff associated with

The new NEC transmitter with original Marconi units in background.

the original Marconi installation and operation included Ted McGrath, Brian Hammond, Max Chadwick, Brian Roberts (first station OIC), Brian Beyer, Murray Penifold, Ross Faggoter, Graham Ward and Richard Kruger. Installation staff of the new NEC facility included Tom Pascoe, Norm Scott, Ray Jackson, Paul Pyatt, Alan Mattiske, Rod Poole and station staff.

RAY JACKSON

BROADCAST AUTOMATED TESTING SYSTEM

Test Equipment is the prime 'tool' of most engineering and technical work groups within Broadcasting Division. While most work requires some test instrumentation, it is probably transmitter commissioning and periodic testing which create the greatest demands.

The network of 763 stations that Broadcasting operates throughout Australia for the transmission of ABC and SBS programs, is by far the largest in the country and is substantial by world standards. It provides a variety of AM, FM and TV services to even the most remote areas.

Since contracting to DOTAC to maintain these Broadcasting systems, Telecom has been required to undertake an annual technical audit on each station. The diversity of the transmitter types and their isolation makes this a formidable exercise.

It was an appreciation of the size of this job and the desire to establish a standard test and reporting procedure that prompted the search for a better way of testing transmitters and associated equipment.

In July 1990, National Office approved the development of an automated testing system, primarily to service the requirements of MSS (Maintenance Support Specification) reporting, but capable of wider application.

A selection of test equipment from several manufacturers was evaluated before a final choice was made. Most of the equipment ultimately chosen is state-of the-art, and some so new that assessment was carried out on pre-production models. This "newness" did create delivery delays, but by May 1991, the initial set of automated TV/AM/FM transmitter test equipment was assembled.

The Broadcast Automated Testing System (BATS) has been housed in five aluminium transit cases, designed so test equipment need not be removed for operation. Some cases contain up to three items of equipment permanently interconnected to simplify set-up on site.

The system is buss controlled from a 386SX laptop computer. The computer has been loaded with BORIS site data and will ultimately include the ORACLE asset database.

In this configuration, the system performs the following functions:-

* Automatically presets test equipment to suit the frequency and power of the transmitter being tested, by interrogating the BORIS site file.
* Automatically completes a comprehensive set of tests on the transmitter (taking about five minutes).

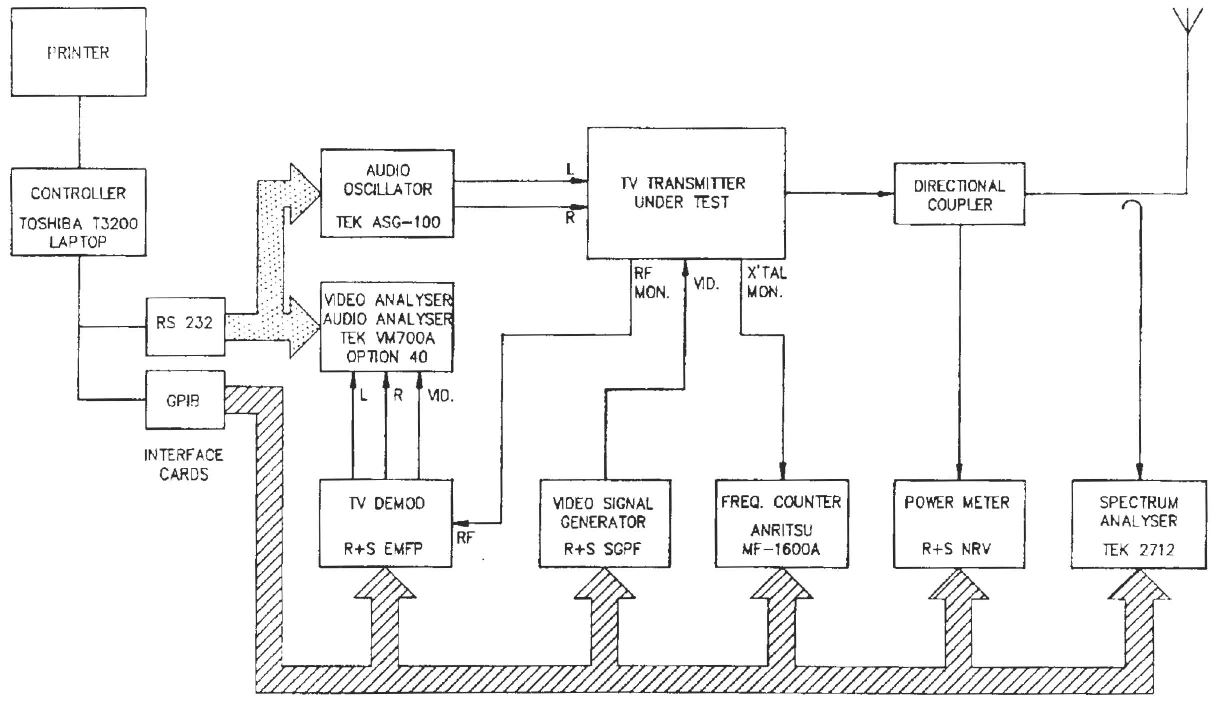
  In transmitter adjustment mode it enables an operator to step through each test manually, allowing unlimited time for adjustment. It should be noted that most TV vision adjustments, even frequency and group delay responses, can be done whilst still transmitting normal program.
* Highlights any test result that does not meet prescribed specification.
* Presents test results either in MSS test report format ("before" and "after" tests), or as a comprehensive report for engineering records.
* Completes a site asset report, ultimately accepting the barcode entry of assets and checking against the ORACLE database.

In its prime roles as an MSS test system, the BATS will produce a complete printed test and asset check report ready for submission to DOTAC.

The BATS system was conceived and developed at the Brisbane Broadcast Service Centre and has been field proven within the district on a variety of transmitters.

Many people have been associated with the project including Mike Dallimore, National Office; Ian McFarlane and Dominic McKay, Brisbane BSC; Mike Francis WA and Peter Tsoulos SA.

JEFF LAIDLAW



BROADCAST AUTOMATED TESTING SYSTEM
TV TRANSMITTER

NOTED ARTIST

J A (JACK) HARGREAVES

Many readers of *The Broadcaster* will remember Jack Hargreaves as the first Officer-in-Charge of Radio Australia, Shepparton, known initially as the International HF Transmitting Station when it began operation in 1944. Jack remained at the station until retirement from the Postmaster General's Department in 1962.

What is not generally known is that he was an artist of significant stature, producing some 400 water-colours, mainly of Victorian scenes. One of the paintings produced in 1936, and which now hangs in the Shepparton station building, is of the original Lyndhurst Transmitting Station building where he worked for many years, becoming Officer-in-Charge in 1938.

John Alfred Hargreaves was born in Horsham, Victoria in 1897 and joined the Postmaster General's Department just prior to the outbreak of the First World War. When he turned 18 years of age he enlisted in the Australian Imperial Forces and saw service in the Middle East and on the European Western Front. After the Battle of the Somme where the total casualties for both sides in the conflict exceeded 1.3 million during the short campaign, he was invalided home in 1916. Jack turned to painting during his convalescence and rehabilitation, and Post War studies under Frederick McCubbin were to have a major influence on his artistic style in capturing impressions of the Victorian landscape and seascape. After the War, he resumed duty with the Department and after working in the suburbs of Melbourne, transferred to Portland in 1930 where he was able to combine his interests in painting with his work as a Telephone Mechanic. His mode of transport to distant telephone subscribers up to 50 km from his office was by horse and cart. Long slow journeys gave plenty of opportunities for painting landmarks and vistas. In 1934, he made a change in direction in his career when he moved to Melbourne to take up a position in the 3LO/3AR studios with outside broadcast activities being amongst his many duties.

In the 1930s, Jack transferred to Lyndhurst where VK3LR had been commissioned to provide ABC programs by short wave transmissions to remote areas not served by the MF station network. This involvement with short wave technology was to continue until retirement some 26 years later. Jack was awarded the Imperial Service Medal, for contributions to the development of short wave radiocommunications, when he retired. He died in 1978.

Included in his 400 paintings are some 80 works of Portland and surrounding areas, of particular interest to local historians. Grandson Steve Markham presented History House, Portland with an album of photographs of Jack Hargreaves' painting scenes, with the local newspaper marking the occasion with articles on the life of Jack and his work in July 1991 issues of the paper.

I am indebted to Bernard Wallace, Portland history teacher and Observer columnist; Dave Reynolds, Chief of Staff of the Portland Observer; Bob Brown former Senior Engineer, Radio Australia and now a Portland resident; Bruce Wilson current OIC Radio Australia, Shepparton and to Steve Markham for much of the material contained in this article.

JACK ROSS

Painting of original Lyndhurst Transmitting Station by J A Hargreaves, 1936.

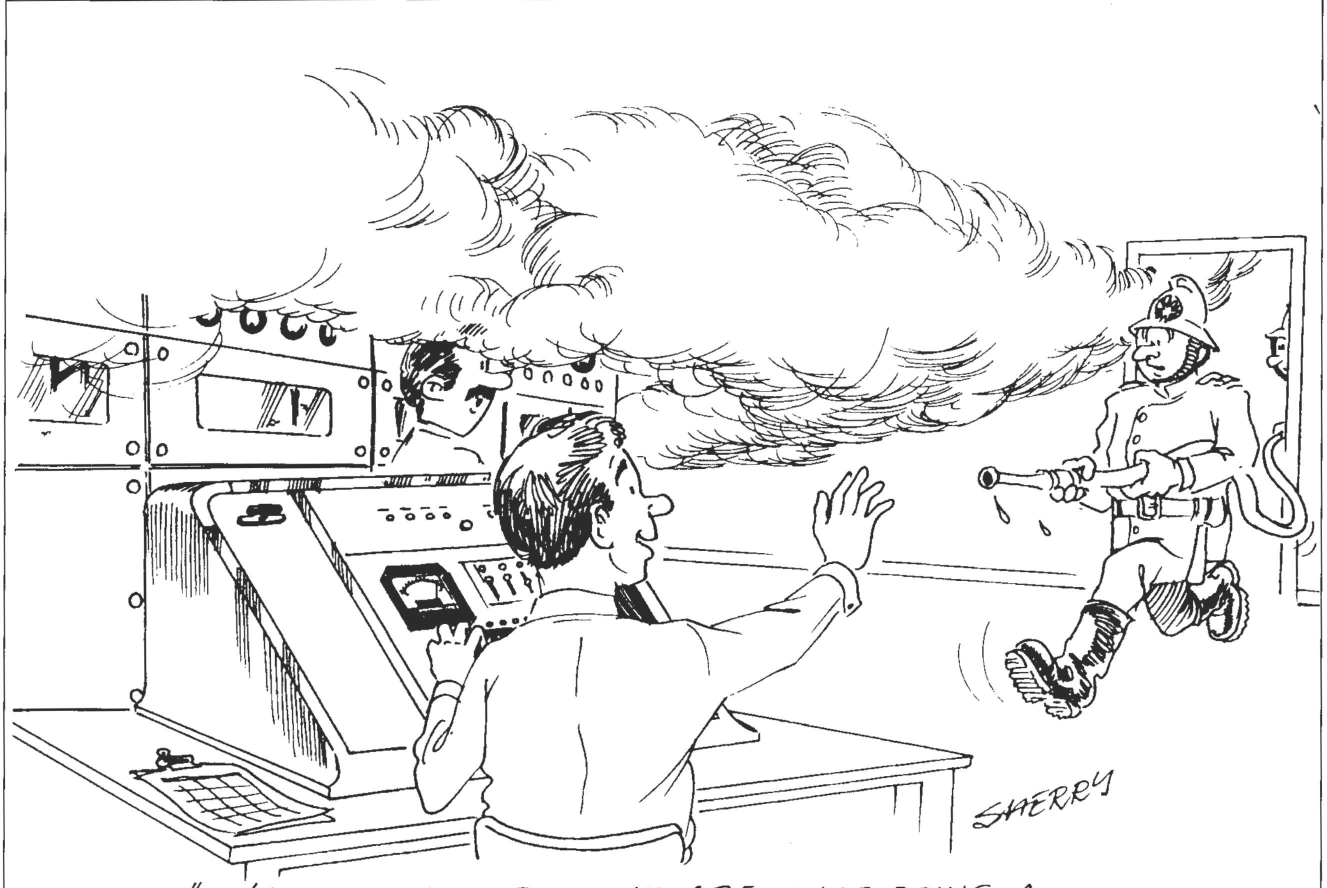
REMOTE MONITORING AND CONTROL SYSTEM

The development of a remote monitoring and control system for the Broadcasting Division dates back many years. Work began as early as 1975 with the development of the TETRA, followed by the ADAM and then finally the ACTTS. The ACTTS, first field-trialled in 1985, proved to be very successful and approximately 130 units have been installed at major sites around Australia. In addition, considerable resources have been devoted to the production of MIC software and hardware facilities for communication with the ACTTS. One of the ACTTS' major limitations, however, was its size, making it inappropriate for smaller translator installations. The Queensland Region, having many of these small stations, undertook the task of redesigning the ACTTS into a smaller package, now known as the Mini-ACTTS. The Mini-ACTTS used much of the same hardware and software of the ACTTS, with fewer expansion capabilities, but additional features such as built-in input display cards, output relay cards and front panel attendance controls for maintenance staff. Approximately 400 Mini-ACTTS have now been manufactured and most of the network is now -monitored by either the ACTTS or Mini-ACTTS.

With its own market saturated, the Division decided to investigate the potential of Mini-ACTTS in external markets. Although the Mini-ACTTS was designed for monitoring and control of broadcast stations, it is also suitable for non-broadcast applications requiring remote monitoring of a number of unattended sites. The Queensland Region commissioned a marketing survey report from "Marketshare", a market research company based in Brisbane. The initial part of the study found that a significant market existed for a product with the Mini-ACTTS' capabilities. However, there were a number of competitive products and it was not clear whether Mini-ACTTS had the attributes (capability, pricing etc.) to give it a competitive advantage in the target market segment. A competitive product audit comparing Mini-ACTTS with its competition is currently underway. If our product proves to have competitive advantages, marketing strategies appropriate for the segments targeted will be prepared. As part of the initial research, the Mini-ACTTS was exhibited controlling water pumps at an international public works trade show in Brisbane in order to test interest to one potential market. It was also exhibited at the IREECON Exhibition held recently in Sydney.

The Mini-ACTTS also has potential offshore, with major national broadcasters in the Asia-Pacific region. The Asia-Pacific Broadcasting Union conference, held recently in Kuala Lumpur, provided the perfect opportunity to exploit this potential. National Office produced a colour brochure as part of the promotion. A professional printing company undertook the production with the design subcontracted to a graphic artist. National Office staff spent many hours negotiating with art-directors, but in the end achieved a result which pleased everyone concerned. At the conference, the Divisional delegates actively promoted the unit by presenting a technical paper and widely distributing the brochure. Many of the broadcasters were very interested. We are now awaiting a flood of orders.

GRAHAM SMITH



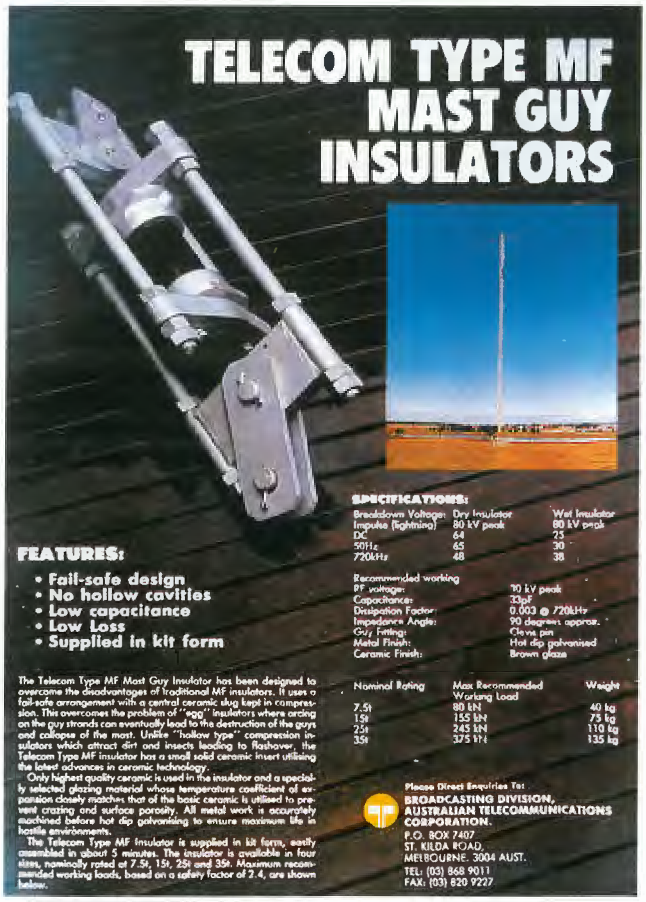
"IT'S O.K. OFFICER — WE ARE JUST DOING A HEAT RUN TEST!"

GUY INSULATOR

NEW DESIGN BY NATIONAL OFFICE

Over the last few years we have been steadily implementing a program of replacing the older MF equipment in the network. This program includes the replacement of the main guys which are showing signs of corrosion on the transmitting mast at a number of sites including Liverpool, Pimpala, Sydenham and Wagin. The insulators also need to be replaced as they are likely to be damaged during the guy removal process, and very few spares are available.

Unfortunately, insulators of the size required with rated loads in the range 15 - 35 tonne had not been needed for many years and the traditional suppliers were no longer in this business. We therefore undertook a survey of the world market, including North America, Europe and Japan but found that the few remaining manufacturers were charging very high prices, and that the units offered were not compatible with our standard range of guy swages.



Brochure prepared to commercialise the insulator.

We finally decided that we could design a range of insulators ourselves, at a reasonable price and which would meet our technical requirements, and started negotiations with Morlynn Ceramics Pty Ltd for the manufacture of the porcelain. The metalwork was to be designed by our own structural engineers.

The advantages of this approach were that we could eventually standardise on a range of guy attachment and adjusting steelwork for all our structures, including the main TV masts. Dealing with a local supplier also offered many advantages in developing the designs.

Having established that Morlynn were interested in the manufacture of the insulators we set about preparing a detailed design and specification. This work was under the guidance of Gary France, but with the increasing workload due to Equalisation commitments we also engaged Dave Fuller on a contract basis to help Gary.

Unfortunately the Equalisation demands continued to increase and very soon we also had to divert Dave onto other projects. It was therefore not until early 1991 that we were able to devote significant time to the project.

Our first design was for a cast iron frame to hold the porcelain. The design was based largely on the concepts of the existing insulators manufactured by Johns & Waygood and using the specifications prepared by our present General Manager, Leon Sebire, many years ago. In fact Leon still acted as a technical consultant during the development of the units. However, with improvements in the manufacture of porcelain and with care in the detailing of the steelwork, we were able to produce a lighter, yet stronger unit.

We sought a quotation from Morlynn to manufacture the units but found that the cost was heavily dependant on the iron casting process, which was not under the control of Morlynn, and the final result was still too expensive for us. However, by working closely with the manufacturer we were able to use a readily available standard casting for the end caps, with a common porcelain slug, and to redesign the remainder of the steelwork to use easily fabricated components.

Guy insulator at 3LO/3RN Sydenham installed 1938.

The final pricing on this was acceptable and we then proceeded to the manufacture of a prototype 15 tonne insulator. This unit was tested to 35 tonne before elongation of the rods, whilst the porcelain slug was separately tested to an amazing 500 tonne without failure. Electrical tests were also conducted at the Telecom Research Laboratories at Clayton, under the guidance of Ed Bondarenko, to confirm the rated flashover voltages.

Guy insulators are now being manufactured in the 15, 25 and 35 tonne sizes and designs are under way for a 7.5t unit to be used on the smaller standby masts.

The results show the advantages of developing equipment to meet our needs in close cooperation with the supplier.

JOHN BRAY

RADIO FREQUENCY MANAGEMENT

International high frequency broadcasting from Australian based stations gained impetus with the expansion of World War 2 into the Pacific region. This led to the establishment of a high power station at Shepparton. Previous to that time, the only Government owned high frequency transmitters were broadcasting from sites at Perth (VLW) and Lyndhurst (VLR) using powers of 2 kW. In Germany, Italy and Japan there had been an appreciation of the fact that international high frequency broadcasting was the most effective way of disseminating news and information to mass audiences at a distance, and had committed considerable investment in high power transmitting facilities. With the outbreak of the War, these stations became important propaganda tools, and were countered by broadcasts by the BBC and "Australia Calling"' which later became "Radio Australia".

The International Telecommunications Union was set up after a Telegraph and Radiotelegraph Conference in Madrid in 1932 which brought together some 73 Government and other interested representatives. One achievement of this Conference was the establishment of internationally agreed Radio Regulations which allocated specific spectrum to HF broadcasting. From that time, spectrum allocation has been set by World Administrative Radio Conferences (WARC) which to date have allocated eight bands for broadcasting in the 3-30 MHz range. A 1979, WARC paved the way for additional spectrum to be opened up for broadcasting as a reaction to the congestion problem being experienced by broadcasters. In 1991, there is a general agreement that there needs to be an increase of three to four times the amount of spectrum currently available if all requirements of users of the HF bands are to be adequately satisfied. Even with the introduction of Reduced Carrier Single Sideband proposed for 2015, estimates are that two to three times the available spectrum is required.

Australian frequency management is the responsibility of the Department of Transport and Communications, although the choice of operating frequencies within the HF bands for Radio Australia had, until 1990 been handled by Telecom's Broadcasting Division. In 1990, that function passed to the end user of the frequencies, Radio Australia which set up its own Frequency Management Unit by recruiting from within the ABC, Assistant Frequency Manager Nigel Holmes and seconding Hugh Murray from the Broadcasting Division as first Frequency Manager. After the interim establishment period, Hugh Murray returned to Telecom and Nigel Holmes has now taken over as Frequency Manager.

It is interesting to compare how Radio Australia's program output has developed over the past 50 years, as it gives some dimension to the complexities of frequency management in the l990s. In the 1940s, the Department of Information's Shortwave Broadcasting Division employed six transmitters to transmit seven hours of program to the Pacific, South-East Asia, China, North and Central America and the Middle East daily. By 1991, Radio Australia transmitted 304 hours daily from 14 transmitters to North Asia, South East Asia and the Pacific in competition with over 30 other broadcasters who also target audiences in the region. This requires considerable effort by the Frequency Management Unit in determining, not only the most appropriate frequencies to use, but also which frequencies are not being used by other broadcasters and then watching these frequencies to ensure that their reception is possible by the listeners in the target area.

The key to international HF broadcasting is that the outer layer of the earth's atmosphere reflects the band of frequencies from 3-30 MHz back to earth. Using this phenomenon, it is possible to reflect signals to targets about 3000km away – the transmission beyond this distance is achieved by the signal bouncing off the earth's surface to the ionosphere and then back to earth again. This effect was used for transmissions from Cox Peninsula to the Gulf Hostages with the signal bouncing from the earth in South Asia before arriving in the Gulf Region.

The difficulty of determining a transmission path is complicated by the variations in the ionosphere whose reflection of radio signals-or more accurately, refraction of radio signals-is determined by the position of the sun and solar activity of the sun. The condition of the ionosphere changes with the day-night cycle, the seasons of the year and sunspot activity. Fortunately, considerable work has been done over the years on investigating and determining ionospheric conditions. In Australia, the Ionospheric Prediction Service (IPS) has produced a transmission path calculation program that allows fairly accurate determination of the most suitable path between transmitter site and target for time of day, time within sunspot cycle and season.

By international agreement, broadcasting schedules are produced four times a year and notified to the International Frequency Registration Board (IFRB) which examines them and publishes them for the information of all HF users. Where there are conflicting requirements, the IFRB notifies the broadcasters and stands available to help arbitrate in any dispute that may develop. In recent years, the Board has been attempting to develop a computer based system to allocate frequencies on an equitable basis but has found some difficulty in doing so. After Radio Australia begins transmitting a new schedule, a network of 18 professional monitors are asked to report on signal conditions in the target regions and if necessary, some frequency changes may be made. Listener's letters are another important source of information and their reports are entered into a data base for future reference in frequency selection.

Recently, Radio Australia began to establish Listener's Panels of several hundred people in a number of countries and these groups will be used to recruit additional monitors and also to provide information for the Frequency Management Unit as to which short wave receivers are available locally and with what frequency range. This type of data is invaluable in choosing appropriate frequencies for a given target area.

Effective frequency management requires the co-operation and interaction from a number of groups. They include the International Section and National Broadcasting Branch of Department of Transport and Communications, the Broadcasting Division National Office and OIC's and staff at the transmitting stations. Without their co-operation and assistance Radio Australia would not be as effective as it is today.

What of the future? Some predictions are that the new technologies of satellite broadcasting and others, will result in short wave listening being abandoned. However, the facts speak otherwise, with world audiences continuing to tune to International HF Broadcasters at times of crisis or to be better informed about the world around them using simple , cheap and easy to operate receivers. The recent broadcasts to the Gulf War Hostages is a good example. HF broadcasting will continue to be the central core of Radio Australia's operations even though there will also be a move to exploit the capabilities offered by new technologies where they may be advantageous or appropriate.

NEIL DEER


Glazing insulators.


Photoscope lathe.


De-airing extruder.

PORCELAIN INSULATORS

MANUFACTURE BY MORLYNN CERAMICS PTY LTD

The most common electrical porcelain used for the manufacture of porcelain insulators from low voltage 440 volt to extra high voltage 500kV is soft triaxial porcelain. Soft refers to the relatively low temperature used for firing, approximately 1200°C relative to hard about 1400°C Triaxial refers to the three main constituents; clay, quartz (which acts as a filler), and feldspar (which acts as a fluxing agent).

The various clays are weighed out in accordance with the formula or recipe. The hard materials, the quartz and feldspar, are separately weighed out, these are loaded into a ball mill together with water and sufficient clay to facilitate the grinding process and the ball mill is rotated for about six hours. The clays are then added and the mill again rotated for a further 30 minutes to ensure adequate mixing. The clay particles being fine do not require grinding, just thorough mixing. The grinding process reduces the particle size to less than 150 micron for 99% of the body and, to ensure that no coarse particles are included in the body which is now called slip, the contents of the ball mill are sieved through a vibrating double layer sieve fitted with 200 mesh stainless steel gauze to ensure that no particles greater than 100 micron are present.

During this process the slip passes through both permanent and electro-magnetic separators to ensure that no ferreous particles are present in the slip.

The new slip is then pumped into a storage tank which is continuously stirred, called an ark. Returned clay from the turning process for insulators is collected and blunged, a process of stirring with water to make slip, and this is also sieved and passed through electric magnets similar to the new body.

The return slip is mixed in a fixed proportion with the new slip to form the body which is stored in an ark ready for the next stage of the process. At this stage the viscosity is that of cream and for further processing it is necessary to remove a large amount of the water content. This is done by pumping the slip into a filter press which dewaters the slip and reduces the moisture content to approximately 20%. The slip is pumped into a closed filter press containing filter cloths capable of retaining the clays but allowing the water to pass through.

The filter cakes of plastic clay are loaded into the deairing pugmill or extruder which cuts up the clay, mixes it, deaires it with a very strong vacuum and then consolidates it in a final auger through a nozzle of the correct size to suit the particular insulator being manufactured.

The design of the extruder and in particular the final stages of nozzle design are very important to even out the stresses within the plastic clay. The extrusions are cut to the appropriate length for the insulator being manufactured, allowance being made for the shrinkage which takes place. These cylinders of clay are referred to in the industry as 'dumps'. The dumps are placed on racks and allowed to cool and mature in a curing room which further reduces the moisture content to about 18%.

The dumps with about 1% moisture are then turned on mainly vertical turning lathes Two types of lathes are used. One a carousel type lathe which indexes around six stations. At each station a form tool similar to the final shape required is used to turn the insulator.

A photoscope lathe is used for smaller runs where the turning tool follows the outline of the insulator drawn on a template by using a light following servo mechanism. The template, which is a white card with the outline of the insulator drawn on it in black ink, is normally produced using the CAD drawing system which allows for the 14% longitudinal and 12% diametrical shrinkage which takes place between the turned and fired insulators. The turned insulators are then placed on racks in drying rooms and the drying cycle is commenced to carefully remove the moisture content to the critical level of 13%. Below this no further shrinkage or dimensional change takes place.

The dried insulators are checked for surface finish and then glazed. Glaze is a glassy ceramic, which is usually coloured munsell grey or brown for electrical porcelains, providing a smooth surface so that dirt and particles can be easily washed or wiped off.

The glaze is formulated by the Ceramic Engineer to be in compression during the cooling part of the firing cycle so that an increase in mechanical strength occurs. The dried insulators are dipped into tanks of glaze and then allowed to dry. If metal parts are to be attached at a later stage, the insulators are prepared to provide a rough surface to enable a satisfactory bond to take place.

Particles of ceramic body, which have been sieved to a specific size are attached to the glazed insulator with a mixture of organic binders and glaze to cover the surface area which will be in contact with cement.

It is essential that the surface which will be supporting the insulator in the kiln is free from all glaze. If this is not done then the insulator becomes firmly attached to the kiln support plate during firing and has to be broken free.

The glazed insulators are placed on the kiln and the firing cycle, usually a programmed cycle taking about 48 hours, is commenced. When the firing is complete and the kiln has cooled down sufficiently, it is opened and the ware is removed.

All insulators are then temperature cycled in hot and cold water baths with a temperature difference of 70°C and then hit with a controlled impact to propagate any internal cracks which may have developed. The temperature cycle test is required to be carried out as a batch or sample test by Australian Standard 2947, however Morlynn test each insulator, as part of the internal Quality Control procedure, to ensure that any insulators with internal defects are eliminated.

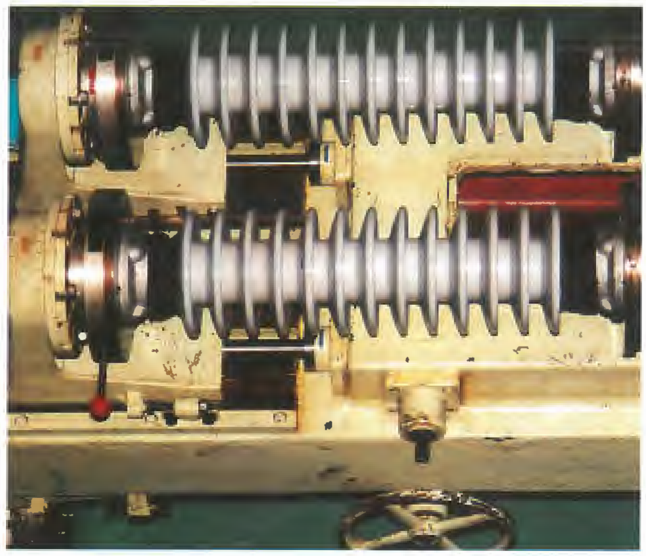
Both the sanded surface of the porcelain insulator and the mating surfaces of the metal work to be attached are coated with a thin layer of bitumen. A carefully weighed and controlled portland cement, silica sand and water mix is prepared and this cement is the bonding agent between the porcelain and the metalwork.

It is very important that only freshly mixed cement is used and so a cement mix is limited to a 20 minute use after which it is discarded. The exposed surface of the cement is protected with damp cloths for a period of four hours before steam curing for about 16 hours. Most metalwork for attachment is galvanised to prevent corrosion as the insulator is expected to have a life in excess of 50 years.

The final insulator is subjected to various electrical and mechanical tests as required by the relevant Standards and customers requirements.

JOHN SWARBRICK

Preparing an insulator for mechanical tests.



Insulator assembly fixture.

Filter press.

THE DEVELOPMENT OF RADIO CERAMIC INSULATORS

When the early wireless telegraphy engineers began to design transmitters and aerial systems, they relied on the technology that had been developed for ceramic insulators over a long period of time by a succession of electric power, telegraph and telephone engineers. The techniques for manufacturing porcelain insulators to a wide variety of shapes and sizes had reached a high level of development, and a great deal was known of the physical and electrical properties of the material. However, the engineers soon ran into trouble when they began commissioning high power wireless telegraph transmitting stations. Insulators became excessively hot, resulting in cracking, and in some cases explosion, with disastrous consequences. To add to their troubles, little was known about corona control at high voltages. It soon became evident that insulators of much higher quality and performance than those used with power station, telegraph and telephone networks were required to meet the more stringent demands of wireless station installations. Not only were the voltages much higher but they operated at higher frequencies and in a steep fronted pulsing mode, resulting in high heat losses in the insulator material due to poor power factor characteristics and blemishes, not considered significant in other applications. The very high peak voltages caused a major problem with flashover due to corona and other factors. The shunt capacitance introduced by the insulator and its associated hardware also became significant in system design.

The radio engineers also posed other challenges for the ceramic chemists and designers for the production of insulators required for the aerial systems. In particular, these included strain types for aerial wires and cables, sectionalising insulators for steel guy ropes and thrust or base insulators to support tall radiators. Guyed tubular, base insulated radiators as high as 200 ft (61 m) were in service as early as 1906 in USA and Scotland.

By 1925, there were at least 50 high power long wave stations in service throughout the world, some of which employed powers in excess of 500 kW with several 1000 kW designs on the drawing board. However, with development in short wave technology and the greatly improved traffic handling capability of these stations, there was a rapid expansion in station numbers. By 1928, there were at least 300 major radiocommunications stations in service and this brought further problems for the radio engineer in insulator design. The higher frequencies required material of even lower loss characteristics and new end cap designs that would not only handle high voltages but also reduce insulator capacitance. To meet the special needs of radio engineering, the term Radio Rating (RR) was introduced for ceramic insulators. The RR was the 1 MHz sine wave RMS voltage that would produce a 50°F rise in temperature in the ceramic at the hottest spot. Engineers had a number of formulae available which were reasonably accurate for design purposes up to at least 10 MHz. The formulae enabled the designer to change the insulator RR rating to any other frequency, to change the insulator RR rating to any modulation factor (M), to change the insulator RR rating from a 50°F rise to a 70°F rise, to obtain the temperature rise at any frequency and voltage and to obtain the temperature rise when modulated, if the temperature rise unmodulated, was known. By this stage, steatite became available as an insulating material. The loss factor of an insulator made of steatite was less than 25% that of porcelain so that the RR of a steatite insulator was twice that of porcelain. For a typical 150 mm stand-off insulator, a steatite type had an RR of 36 kV compared with 18 kV for an equivalent porcelain type. For the same voltage and frequency, the temperature rise of a steatite insulator was generally less than 25% that of a porcelain type of the same dimensions. Design data available at the time shows that the average dielectric constant of a porcelain insulator manufactured by the wet process method was 6.3 with a power factor of 2% at 50 Hz and 0.6% at 1 MHz giving a loss factor at 1 MHz of approximately 3.8. Commercial steatite with an average dielectric constant of 6.1 had a power factor of 0.2% at 50 Hz and 0.2% at l MHz giving a loss factor at 1 MHz of 1.2. Even at l00 MHz – well above the short wave band 1 – 1the loss factor was less than 3. Low-loss steatite used mainly in valve sockets and plug inserts had even better characteristics.

The transmitter in particular, employed a large range of ceramic components. Designs in the early 1930s included valve sockets, mounts for forced air cooled valves, water coils for water cooled valves, stand-off insulators of various designs, as well as plug and receptacle assemblies. At the time, transmitter designers were devoting much time to the production of equipment, the appearance of which was in keeping with its high quality. Construction had reached the stage where transmitters were neat, orderly, well finished and giving the impression of sturdiness and high reliability. The designers demanded the same high standard from insulator manufacturers as other component manufacturers and this led to the production of high quality, blemish free ceramic, and hardware carefully designed and finished to provide an assembly of top performance and pleasing proportions in harmony with other components making up the transmitter. Stand-off insulators were available in a range of sizes with uniform or tapered cross section or with corrugated sides suitable for heavy or moderate duty application. The tapered design had the same cantilever strength plus lower loss and lower capacitance than one of uniform side with diameter equal to the maximum diameter of the tapered unit. Up to about 1930, there had been no suitable stand-off ceramic insulators for radio frequency application. Ordinary power pin types had been used for supporting copper tubing or cables within the transmitter but they had high loss and high capacitance. Hot air from the valves and components added to the heat generated within the insulator and cracked insulators were a major problem with the operation of some early transmitters. In designing improved insulators for transmitter application, metal inserts which had been a feature of insulators of the 1920's were eliminated. Measurements showed that the internal temperature rise of an insulator fitted with a metal insert was approximately twice that of an insulator fitted with an end cap with rounded edges. With good end cap design, the operating voltage was limited by heating of the ceramic, with corona rarely being a problem.

The design of insulators for external purposes such as lead-out, transmission line, aerial array, vertical radiator base and guy sectionalising insulators required great care. In addition to the need to meet the necessary voltage and frequency requirements they had to meet stringent mechanical and environmental conditions. Silicon aluminium end caps were introduced during the early 1930's as they had superior characteristics for service in an aggressive salt laden environment. Corona rings of large diameter were employed on aerial systems where high voltages were employed but when station operating frequencies moved up to the short wave band the high capacitance across the insulator due to the corona rings introduced problems necessitating a revised design of insulators end caps. Today, end caps used in short wave installations are very small compared with those used 50 to 60 years ago yet they can handle the highest voltages without excessive power loss due to corona. Egg type insulators were widely employed for aerial conductor insulation and in guy ropes at broadcasting stations in the 1920's when T and L type aerials were in service. With the introduction of tall lattice steel radiators in the 1930's, cast metal assemblies were used to break up guy ropes with the porcelain being in compression. The principle is still employed today with variations being made to the metal assembly design to take account of increasing voltages resulting from the high powers of some modern transmitters. At some stations, particularly where transmitter powers have been increased to 50 kW, opportunity is being taken to upgrade the guy insulator assemblies when steel ropes need replacement because of maintenance considerations.

Base insulators were introduced in the form of a push-pull design for insertion at the base of legs of self supporting towers and as tubular designs for guyed masts. Although practice in the USA almost from the start of broadcasting, was to use a design known as a 'compression cone', the Australian practice when the first tall armature top radiators were designed for the NBS stations at 2NR Grafton, 3WV Dooen, 6WA Wagin and 2CR Cumnock in the mid 1930's, was to stand the base of the mast on a group of tubular insulators 312 mm high, 225 mm diameter and 44 mm wall thickness. Much larger insulators were designed for the armature and inductor cable lead-in insulators. All these insulators were manufactured to PMG Department designs by Sunshine Porcelain Potteries Pty Ltd in Victoria. At the time, the production was considered to be a significant achievement in ceramic insulator technology.

Base insulator with 214m 3LO/3RN Sydenham radiator installed 1938.

When tall radiators were constructed without armature tops for 3LO/3AR, 2BL/2FC and 4QS, large single tubular insulators were installed at the bases. In the early 1960's when 5CL/5AN and 5CK were erected, multiple base insulators were again used together with multiple insulators at the sectionalising points. These assemblies were oil filled and were manufactured in the USA. The guy insulators for these stations were imported from Japan.

During the Second World War years, considerable work was undertaken in Australia on the development of ceramics to meet the radio needs of the Armed Services. In particular, the advent of radar with its exacting insulator requirements and the need to develop the production of steatite insulators involved participation by many local industries. Some of those involved included Nilcrom Porcelain (Aust) Pty Ltd, Sunshine Potteries, Ducon Condenser Pty Ltd and Kosters Premier Pottery and others. Nilcrom Porcelains (Aust) Pty Ltd provided much of the specialised insulators required for the Royal Australian Navy 200 kW low frequency transmitter commissioned in 1942. Such items as

Raised base insulator with 169m 2KP Kempsey radiator installed 1959.

Guy insulator 3LO/3RN.

pedestal insulators 1 m high, insulators for the 5 m high aerial loading coil former, cable rest insulators and aerial switch gear insulators were all produced using local resources. In Post War years, the company produced insulators for NBS installations.

Kosters Premier Pottery of Adelaide provided many of the large strain insulators used in the development of insulator designs for the Radio Australia, Cox Peninsula project in which a great deal of work was undertaken in designing low capacity end cap assemblies. In more recent times, manufacturing and developmental work to meet the needs of the NBS has been undertaken by Morlynn Ceramics Pty Ltd Victoria in conjunction with National Office staff.

JACK ROSS

RADIO AUSTRALIA

TWO NEW 250 KW TRANSMITTERS FOR COX PENINSULA

The Radio Australia transmitting station at Cox Peninsula, near Darwin, became fully operational in 1971 with three 250 kW Collins 821A-2 transmitters. The station was planned for a total of five transmitters and so the building and infrastructure were constructed accordingly. Following the destruction of the station by Cyclone Tracy on Christmas Day 1974, the station was recommissioned in 1984 with a new complement of eight curtain antenna arrays.

However, it was not until 1991, that the Government decided to provide the two additional transmitters. The project resulting from this decision is now well underway, involving the purchase of two 250 kW transmitters, a 2 x 10 extension of the Brown Boveri matrix switch, revision of the matrix switch control software, construction of transmission lines, rearrangement of the program input equipment, extension to the mains power supply system and replacement of the main station computer control system. The work will heavily involve Telecom Broadcasting SA/NT and National Office staff until well into 1993.

Central to the project are the two transmitters. The transmitter contract was issued on 18 October 1991 to Thomson CSF of Paris,

The transmitters being purchased are the most modern types available and incorporate the following features:

- Both DSB and SSB capability.
- Very high power conversion efficiency.
- Dynamic Adaptive Carrier Modulation mode (DACM) capability.
- Full remote computer control.
- Internal fault diagnostic capability.

The transmitters are the first large short wave transmitters to employ only one tube, which is used in the RF output stage. The modulator is a solid state "Multi Parameter Modulator" in which a micro processor controlled Management Unit commands a number of series connected chopper modules to produce the 0-30kV modulating voltage which is applied to the final RF tube. The Management Unit ensures the correct operation of the MPM in conjunction with the transmitter control management unit and ensures:

- Correct signal treatment associated with the relevant operating mode: conventional double sideband, DACM, or single sideband.
- Continuous power output adjustments.
- Continuous monitoring of Chopper Module status and by-passing of faulty modules.
- Management of chopper module operation for optimum efficiency and signal distortion.

Cooling for the transmitter is a combination of closed cycle water and air. The air system includes special provision for minimising the high humidity problems common in the Darwin area during the "wet" season,

The Management Unit provides the means for controlling, monitoring and protection of the transmitter. It has been designed for automatic operation of the transmitter and to minimise and ease the operator's intervention.

The Management Unit includes on its front panel, a video colour display monitor permanently showing the transmitter operational state. The central unit accounts and correlates faults occurring during operation. This information is sequenced on the colour monitor screen which allows the central unit to display a statistical analysis of the faults, correlation between the faults, as well as a list of the verification and sequential interventions to be performed.

TERRY McMANUS

"HOW CAN I MEASURE DISTORTION WHEN I CAN'T UNDERSTAND A WORD OF CHINESE ?!"

SERVING RURAL AUSTRALIA

THE RADIATA PINE FORESTS – 5PA

Station 5PA was commissioned on 14 December 1956 at Penola in the South Eastern portion of South Australia. The station was provided with main and standby 2kW Philips transmitters manufactured in Adelaide. The radiator was a 94m high sectionalised type and was the first antifading radiator installed in the State.

In 1970, a new station with twin STC 5kW transmitters and a 130m directional antenna system was erected at Naracoorte to take account of a shift in the population density. In September 1991, the STC units were replaced by a pair of Nautel 5 kW solid state transmitters.

Major towns served by the transmitter include Mt. Gambier,

5PA directional antenna.

Penola, Naracoorte, Bordertown and Keith. The main industry in the area is associated with the Radiata Pine Forests.

Because South Australia had very little natural forest, the Government formed the Woods and Forest Department in 1875 with the primary aim of establishing State Forests for wood production. A nursery was established in 1876 and the first experimental plantation of radiata pine was commenced in 1879 at Mt. Gambier.

The species is said to have been introduced to Australia by the Californian gold miners who settled in Ballarat and Bendigo during the gold rush days of the 1850s.

In 1931, a sawmill was established at Mt. Burr and it ushered in a new era of modern high volume sawmilling in Australia. Mills were later established at Nangwarry and Mount Gambier.

The Mt. Burr mill was a Scandinavian gangsaw type and is believed to be the first of its kind installed in the southern hemisphere. It created widespread interest and influenced the use in later years of this type of equipment elsewhere in Australia.

Some 100 years later, the area has been transformed into more than 60 000 hectares of softwood plantations. From the forests flow logs for wood processing industries at an annual sustainable rate of 750,000 cubic metres.

It has been estimated that the forests are growing at the rate of 150 tonnes per hour or 2 1/2 tonnes per minute. The Mt. Gambier sawmill which is the largest in the area, converts 320 tonnes of pine logs every day into enough kiln dried timber to build 35 modest size timber frame houses.

GRAHAM WARD

Road through the forest.

Logs being transported to the mill.

Logs at the mill.

PROFILES

BRIAN HEY

Brian Hey has been with Broadcasting Division as State Broadcasting Manager in Tasmania since October 1989. He joined the PMG's Department in 1957 as a Technician-in-training and participated in the installation and maintenance of the Mount Wellington (ABT2 Hobart) and Mt Barrow (ABNT3 Launceston) transmitters from 1959 to 1965. After qualifying as a Senior Technician in 1964, Brian became involved at the field technical level with radiocommunications and broadcasting systems throughout the State. In 1980, he was appointed as officed-based group Manager for radiocommunications, broadcasting and television systems installation and maintenance in Tasmania. With the formation of the State Broadcasting Branch in 1983, Brian temporarily parted company with the broadcasting functions and diversified into a functions Manager in charge of all Telecom transmission systems. After six years in this role he rejoined the broadcasting area as State Broadcasting Manager, Tasmania. Brian's outside interests are mechanical engineering, Jaguar cars, vintage boatcraft and the enjoyment of the quality of Tasmanian food, wine and the environment with wife Wendy, the children and the grandchildren. He is currently a member of a syndicate restoring a veteran Derwent River passenger steamer.

JOHN O'MARA

John O'Mara is Senior Engineer in the Tasmanian Broadcasting Branch where he took up duty in July 1989. Following graduation with an Honours Degree in Engineering and a Degree in Mathematics from Trinity College, Dublin he emigrated to Australia and joined Telecom in 1981 in Western Australia. After working in a number of areas in the State and sampling various engineering activities John came to the conclusion that broadcasting technology was the most interesting and challenging field. He soon became involved in the design of aerial coupling units; TV, FM and MF transmitter testing; evaluation of ITS analysers and the design of the first digital two hop link in WA linking Wanneroo with Yanchep. John then took a two year break to return to further University studies and to pursue a career in music. He then returned to Telecom and worked on many projects including RUCS, TV aerial designs and the development of a wideband portable MF radiator for emergency broadcasting purposes.

Since taking up duty in Hobart, John has been busily engaged in a range of projects including establishment of station 7JJJ, a 500 kVA power plant at Mt Wellington and refurbishing the Mt Barrow antenna following damage by lightning. When time permits he likes to engage in squash, golf, chess and yoga.

Brian Hey

Noel Brown

John O'Mara

Bruce Berwick

NOEL BROWN

Noel Brown has been OIC at the Tasmanian Monitoring Centre and Mt Wellington operations and maintenance activities since December 1987. He commenced duties with the PMG's Department in 1954 as an Exempt Technician's Assistant and for a period was the second half of the two-man Radio and Broadcast Installation staff, engaged mainly in broadcast studio installation. Noel qualified as a Technician at the Open Technician's Examination in 1958, and two years later qualified as a Senior Technician. His period of time as a Technician involved assistance with the installation of the transmitter at Ralphs Bay, shift operational duties at both transmitters and studios, and assistance to the Broadcast Inspections Officer. On gaining his Senior Technician qualification in 1960, Noel was promoted to shift leader at the ABC studios and occupied that position for three years. In 1963, an application for transfer resulted in Noel obtaining the position of shift leader at ABT2 Mt Wellington, a position he was to occupy for some 24 years.

Outside interests include sailing and fly fishing. He is a qualified glider pilot and licensed for glider inspections and maintenance. With wife Bev, Noel enjoys travelling when opportunity permits.

BRUCE BERWICK

Bruce Berwick has been OIC of the Southern Tasmanian Broadcast District since September 1989. He joined the PMG's Department in 1961 as a Technician-in-training where he worked and trained at such places as the ABC studios in Hobart and Launceston, TV and radio broadcast transmitters at Mt Wellington and Kelso as well as radio telephone sites at Stanley and Mt Arthur. Since 1965, Bruce has been involved in a number of interesting projects including replacement of the ABT2 and 7QN transmitters, Mt Barrow colour conversion, radio telephone bearers across Bass Strait, the 140 Mb digital system linking Burnie to Hobart via Launceston and the installation of cellular mobile telephone services. Other activities include factory testing at NEC and Siemens works and contractor supervision of Telecom antenna installation on King Island. Bruce is a member of the Friends of the Museum and Art Gallery and the Tasmanian Sail Training Association which built the square rigger "Lady Nelson", the original of which was the proud little mainstay of early settlement in New South Wales and Van Diemen's Land. He likes travelling to distant places and one memorable tour was to Cape York Peninsula with wife Jill on an extended camping holiday.

BROADCASTING 1919 STYLE

During the 1914-18 War, wireless came of age as a medium of point-to-point communication. However, it was not seen as a means of home entertainment or of educating and informing the general public.

Those operating the system had to be conversant with the Morse Code. Technology had not reached the stage where the transmission of speech and music were reliable and of sufficiently high quality.

After the War, thousands of ex-servicemen and others who had been trained in the science of wireless telegraphy snapped up War surplus parts and equipment and began experimenting. The Postmaster General's Department and private enterprises like Amalgamated Wireless (Australasia) Ltd., became heavily involved.

Australia's first public demonstration of radio broadcasting took place in Sydney on 13 August 1919. Ernest Fisk of AWA was lecturing the Royal Society of New South Wales on the potentialities of wireless at the Society's rooms in Elizabeth Street and arranged for a recording of the National Anthem to be transmitted over a distance of five city blocks from AWA's office in Clarence Street.

Typical "jam tin" speaker.

The transmitter employed a single Marconi Q tube.

The Q tube was developed in 1916 by Captain H.J. Round of the Marconi Company and was basically a high frequency receiving tube. The widely used R tube was not satisfactory in a multistage amplifying system due to the high interelectrode capacity of the tube plus the holder. Round developed a tube called the V24 which attempted to overcome the problem by using a cylindrical bulb and bringing out the axial filament leads at opposite ends while the plate and grid connections were brought out on small caps and placed at opposite ends of a diameter. Filament voltage was 5 volts and the plate required a voltage of 20 to 60 volts. The Q tube was a companion of the V24 and was designed as a detector usually in a gird leak circuit. It had a higher amplification than the V24 and operated with plate voltage of up to 150 volts for good operation.

In order to obtain the maximum possible output from the Q tube Fisk ran the tube with a plate voltage of 240 volts. The plate glowed a bright cherry red colour but the little tube gave its all, and the transmission was a success.

The normal method of listening to wireless signals at the time was with headphones. However, these were not satisfactory for a public demonstration of broadcasting so Fisk had a tinsmith build up 20 tin horns to surround the headphone receivers. They were then strung along the ceiling of the Society's rooms.

Marconi Q tube.

The headphone receivers were Baldwin types using a mica diaphragm and at the time were the best available. They were originally designed by Nathaniel Baldwin, a Mormon in Salt Lake City. He built the first headphones on his kitchen table and sent them to the US Navy for test. They were found to be twice as sensitive as any other make. Baldwin had discovered an entirely new method of moving the diaphragm with a driving rod. He made the diaphragms of mica. Later models used a corrugated aluminium diaphragm.

The following year, 1920, when members of the Federal Parliament were given their first taste of broadcasting at the historic demonstration in Queen's Hall, Melbourne on 13 October 1920, the same tin loudspeakers and Baldwin receivers were used.

However, the Government was not keen to rush into approving the new technology and the public had to wait until the end of 1923 before the first broadcasting stations 2BL and 2FC began transmissions

JACK ROSS

Baldwin mica diaphragm headphones.

HI-FI TECHNOLOGY

HOME MUSIC SYSTEM

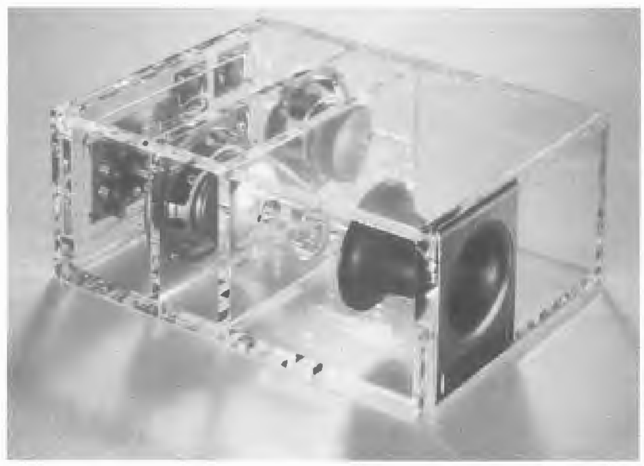
Since the establishment of broadcasting in Australia in 1923, designers and engineers have devoted considerable effort to improving the quality of transmission. From the 1930's in particular, great strides were made in improving the performance of the transmitter by development of high performance valves, modulation transformers and power supply filtering, the application of negative feedback, over-modulation control devices and other techniques which resulted in wide frequency response, reduced distortion and improved signal-to-noise ratio. Similarly, tremendous improvements were made in the performance of pick-ups, turntables, microphones, amplifiers, monitoring loudspeakers and recording equipment in studios and also program circuits used to convey the program between studio and transmitter.

However, in comparison, the home radio receiver was a poor relation, falling behind in technological development. Even home entertainment facilities such as record players combined with the radio receiver to produce the radiogram made little technical progress considering the phonograph and gramophone had been in widespread use for more than 20 years before broadcasting became a reality.

Although a number of feeble attempts were made over the years to encourage the concept of the 'radio home' whereby broadcast programs and music from records were distributed throughout the home from centrally located equipment, it was never accepted by the general public. The cost of wiring a home was expensive; the equipment was bulky, expensive and unreliable; it generated a lot of heat and some of the equipment available was so complex that the owner had to be almost a radio mechanic to operate it. The position has been somewhat rectified in recent years by designers taking advantage of technological development in many areas to produce what has become known as 'home music systems' incorporating built-in CD,AM and FM tuners, radio frequency remote control systems and miniature high performance loudspeaker systems. At the same time it brings superb sound to television while seeming virtually invisible.

There are currently a number of organisations throughout the world backed up by extensive research facilities producing this type of home equipment. One such facility being widely accepted in Australian homes is known as The Lifestyle Music Centre manufactured by the BOSE Corporation in the USA. The firm was founded by Professor Dr. Amar Bose of the Massachusetts Institute of Technology.

The Bose Lifestyle Music System showing four 6.5 cm wide-range cube speaker array, remote control and the compact music centre, including CD player, AM and FM tuners.



Plexiglass model of Bose Acoustimass bass speaker which launches sound into room by an air mass, rather than directly from a vibrating surface.

The main features include:

- An AM/FM tuner featuring high sensitivity and immunity from interference combined with low distortion and wide dynamic range. The tuner can be operated by remote control and any combination of 30 AM or FM stations can be stored for instant access with all 30 stations being capable of being scanned with a single button.
- High performance CD player with D to A converters and sophisticated filters with a triple beam laser system ensuring optimal tracking. A full array of programming and search functions are accessible with the hand held remote control device.
- Power amplifiers are placed inside the loudspeaker, enabling the control centre to be made very small while at the same time incorporating a compact disc player.
- The dual-zone design permits the playing of two different program sources at the same time. This means for example, that a CD can be listened to in one room while someone else can listen to the radio in another.
- The hand held remote control unit uses a new radio frequency technology so that the unit can be used anywhere inside or outside the house to control the Music Centre. The remote control functions include activation of the system with a single button, selection of up to six sources, adjustment of volume, muting the system, controlling each of two zones independently, accessing 30 AM or FM presets, scanning of programmed stations, selection of any CD track, movement rapidly forward or backwards through a track, selection of random play, repetition of one track or the entire CD, preview 1 to 59 seconds of each track automatic program turn-off and others.

The Acoustimass loudspeakers employ three built-in amplifiers delivering 200 watts. Unlike conventional loudspeakers which radiate bass sound from a vibrating cone, the Acoustimass launches sound into the room using two air masses. Built-in active equalisers automatically balance the entire frequency range for accurate reproduction of instrumental timbre and greater clarity, thereby eliminating user adjustable equaliser controls. Another feature is that dynamic equalisation automatically adjusts the system's bass to match the volume level so the listener hears deep, clear bass even at low volume.

MYCHELLE VANDERBURG

LETTERS TO THE EDITOR

Contributors to Letters to the Editor are reminded that full names and addresses must be supplied. Letters should be brief and to the point. Long letters may be edited. The Editor's decision in respect of the suitability of letters for publication in *The Broadcaster* is final and no correspondence on the Editor's decision will be entered into.

Sir ,

Prior to taking up a position with the Postmaster General's Department Transmission Laboratories in Adelaide in 1938, I was on the technical staff of local broadcasting station 5DN which was the first B Class station to be established in South Australia when it went to air in 1924. One of my interesting activities whilst working at 5DN during the 1930's was the operation of the Hill-and-Dale or Vertical Cut Disc Recording Equipment. Readers of *The Broadcaster* may be interested in some aspects of this particular method of recording. I am not aware of vertical cut equipment having being employed in the National Broadcasting Service studios but it was certainly popular at a number of Commercial stations during the 1930's. Readers will know that the phonograph as invented by Thomas Edison in 1877 used the vertical cut principle in transferring sound signals to a cylinder. It was Emile Berliner who departed from Edison's invention and worked on a lateral cut principle on a flat disc. In Berliner's system, sound vibrations moved from side-to-side in the record groove. He called his apparatus a gramophone and was granted a patent in 1887. The vertical cut method of recording had a number of important advantages compared with the lateral cut system. They included the following:

- an extended frequency range, typically 50 to 10000 Hz due largely to the reduction in mass of the vibrating section of the reproducing head. With lateral recording the range was typically 50 to 7000 Hz.
- the reproducing stylus could follow a vertically modulated groove better than a lateral one. There was no riding up on the shoulder of the groove as with lateral recordings as the groove changed direction.
- a long life, estimated to be up to 1000 playings without deleterious effects due to the light weight reproducing head and a reduction of the mechanical impedance of the vibrating system.
- closer groove spacing gave greater playing time per unit area of recorded surface.

To take advantage of the extended frequency range, special methods of reducing the background noise were adopted. The most important included:

- the adoption of a non-abrasive disc material.
- a permanently pointed diamond reproducing stylus.
- gold sputtering method of metalising the wax coating.

The recording industry developed a unique method of preparing the wax before cutting. It was called "wax flowing" and consisted of flowing molten wax to a specified thickness onto a perfectly flat metal disc which was maintained hot by electrical or steam heating. After the film of wax has assumed a uniform level,it was chilled, leaving a perfectly flat and smooth surface. Prior to the development of this technique, a wax blank was shaved to give the necessary flat surface. However, the process caused residual strains in the wax surface which normalised after cutting, resulting in distortion of the grooves. In the early Edison discs, double thickness laminated material was employed to ensure an absolutely plane surface. Thin discs had a tendency to warp. The technology of recording vertically modulated discs was similar to that of lateral recording except that the equipment had to be more accurate if the advantages of the vertically cut system were to be realised. After cutting the disc, it was sent away for processing which involved a number of treatments including gold sputtering, preplating, copper forming, chromium plating and pressing. Following chromium plating, the master was placed in a test pressing machine which was manually controlled and high pressure applied to press the master onto Vinylite stock. The test pressing was then passed to the test room where it was inspected and reproduced. If it was satisfactory in every respect, it was forwarded to the customer for approval. If the customer required additional pressings, a stamper which was really a duplicate of the master was made. The finished recordings were pressed from Vinylite, a synthetic resin of the vinyl ester type which gave remarkably low background noise level.

Controversy between lateral cut and vertical cut records raged on for years. Each technology had its dedicated school of supporters but in terms of numbers of discs produced, the lateral cut system was the winner. It had a 10:1 advantage over the vertical technique in record numbers.

Andy Fisher operating the Vertical Cut Disc Recorder.

ANDY FISHER.

Sir,

Readers of *The Broadcaster* may be interested to learn that there was a magazine published in Perth by West Australian Newspapers as a stand-alone illustrated weekly journal also called "The Broadcaster".

The first issue was published on 7 April 1934 and comprised 64 pages at a cost of three pence.

The contents comprised complete radio programs for the whole State and snippets of sport, racing, technical matters, comic sketches and articles of general interest. The principal article in the first issue concerned survey work being undertaken prior to the establishment of 6WA Wagin.

Advertisers in the first issue included many businesses well known in Perth in the 1930's but, unfortunately some no longer exist today. Major advertisers were Nicholsons Ltd., Craig & Co., W.A. Atkins Ltd., Boans Ltd., Harringtons (WA) Ltd., C.S. Baty & Co., Thomsons Ltd., Stott and Hoare, The Bairds Co. Ltd., W.J. Lucas, G.F. Kearns, AWA Ltd., Shell Oil Co., and Norman Burnell & Co.

Publication of the magazine continued until the last issue on 15 January 1955 and comprised 40 pages at a cost of four pence. The following week it reappeared as a give-away supplement to the Weekend Mail, another publication of West Australian Newspapers. The last issue appeared to have been published on 30 January 1955.

GEORGE MOSS.

5AN ADELAIDE.

Until 1937, only Sydney and Melbourne listeners had a choice of two ABC programs. Between October 1937 and October 1938, the situation was rectified with the commissioning of 5AN Adelaide, 4QR Brisbane, 7ZR Hobart and 6WN Perth.

By 1939, the ABC programs consisted of the Australian National Program over 2FC, 3AR, 4QG, 5AN, 6WF and 7ZL and the State National Program over 2BL, 3LO, 4QR, 5CL, 6WN and 7ZR. The ABC followed the BBC practice by offering listeners a wide range of programs 'serious' to 'light'.

Original 5AN transmitter (left) and standby (right).

The 5AN station, the first of the new group to be commissioned employed a 500 watt STC transmitter located in an annexe of the Adelaide Trunk Test Room. It was commissioned on 15 October 1937. The transmitter employed 4242A valves in the modulator, buffer and modulated amplifier stages with two 4279A valves in the final amplifier. The radiator, a self-supporting insulated tower 62 m high was located on top a 24 m high building adjacent to the building housing the transmitter. A counterpoise system formed part of the radiator earth system. The feeder was an 80 ohm concentric type using an outer tube of diameter 25 mm diameter and an inner tube of 6 mm diameter.

In 1944, the transmitter and radiator were removed to Brooklyn Park and the transmitter power output increased to 2000 watts by operating with four valves in parallel in the final amplifier. A locally built 200 watt transmitter was provided as standby. In 1948, the height of the radiator was reduced to meet Civil Aviation requirements.

In 1946, the Australian Broadcasting Commissioners made a bold move. For the first time, listeners in the main centres of Australia could choose between quite different ABC programs, designated Interstate and National programs. The Interstate program provided light music, variety, talk sessions like Guest of Honour, while the National program carried the more serious material such as Country Hour, Childrens Session, weather reports and considerable periods of classical music. This was one of the most significant program policy decisions made by the ABC since its inception in 1932.

With the establishment of a new Metropolitan Transmitting Centre at Pimpala in 1961, 5AN was provided with a 10 kW main and a 2 kW standby STC combination sharing a 172 m radiator with 5CL. The service was subsequently upgraded and the transmitter now operates with 50 kW main and 10 kW STC standby units.

Today, 5AN is part of the ABC Regional/Metro Radio Network while 5CL (now 5RN) is part of the Radio National Network.

TED McGRATH

Current 5AN 50kW transmitter.