The BROADCASTER

NEWSLETTER OF THE BROADCASTING DIRECTORATE

No. 11 July 1988

50 KW SOLID STATE TRANSMITTER

NEW BUILDING – 3WV DOOEN

The Broadcaster

The Broadcaster is the in-house newsletter of the Broadcasting Directorate 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:

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Editorial

When news of the invention of the transistor by John Bardeen, Walter H. Brattain and William Shockley of the Bell Telephone Laboratories was announced forty years ago in the press it created a sensation. Unlike some inventions, it was not a seven day wonder.

With the chip which was invented ten years later, it resulted in tremendous advancement being made in broadcasting technology. Had the vacuum tube remained supreme, it is unlikely that equipment would have reached the present level of sophistication, reliability and efficiency. Microelectronics is now accepted as part of every day life for the broadcaster.

Although tubes were quickly ousted from receivers and other low power equipment it has taken much longer for the high power stages of transmitters to be replaced by solid state components.

However, that milestone has now been reached with transmitters up to 50kW output with the commissioning of a fully solid state transmitter at 3WV Dooen.

Perhaps one day we will see the Radio Australia short wave transmitters replaced with solid state units and transmitting tubes, like receiving tubes, will then become museum pieces.

JACK ROSS
Editor

Front cover:
First 50kW fully solid state transmitter. Installed 3WV 1988.

Contributors to this issue:
Leon Sebire, Max Chadwick, Roy Badrock, Terry Murphy, Arthur Naylor, Doug Sanderson, Raoul Pelham, Bill Roy, Doug Smith, Simon Moorehead, Rod Thompson, Ray Weeks, Glen Clements, Brian McKenzie, Alan Holland, Jack Ross, Kevin Buckland, Alastair Gellatly, Geoff Jones, and Bill Smallgange.

Leon Sebire

From the Director's Desk

"Public Broadcasting" is a term widely used throughout the world to describe what we do. It provides a broadcasting service, generally free from advertisements, is funded by Government and, in most cases, is free-to air. All true public broadcasters must give value for money to the people they serve because public broadcasting is funded by the taxpayers.

Governments everywhere will periodically review the performance of their public broadcasters with a view to ensuring that the public receives satisfaction. In some countries, the reviews seem to occur with monotonous regularity. The CBC (Canada), BCNZ (New Zealand) and BBC (UK) could be said to have received more than their fair share of attention.

The ABC is currently receiving attention under the Department of Transport and Communications "Review of National Broadcasting Policy" following the issue in February of Discussion Papers on the Corporation's activities. It will obviously be some time before an outcome materialises because the announced aim of the release of the papers is to stimulate "public debate" on the role and function of the ABC. As we all know, "public debate" is generally anything but that, because regrettably, as so often happens in this country, public apathy is likely to leave the debating to minority pressure groups and vested interests.

To those close to the scene, it seems curious that the publication is consistently critical of the inadequacies of legislation and particularly the lack therein of an appropriate and clearly defined "charter" for the ABC. We are conscious that it is only quite recently (1983) that the seemingly deficient legislation in the form of the ABC Act was framed by the very people who are now decrying its inadequacy.

Perhaps public admission of a past default could be regarded as a unique technique for stimulating true public interest. Whatever the subtleties of intent it is hoped that the real public will suitably respond to this important review. Those of us who have been fortunate to experience broadcasting in countries where broadcasting is wholly commercial will no doubt share the view "thank God for the ABC" whether it really costs 8 cents a day, 5 cents a day or even 12 cents a day.

LEON SEBIRE

Station Roll Call

ABGN-7 MT BINGAR

National television station ABGN-7 is situated on Mt Bingar in the Cocoparra National Park just north of Griffith and serves the Murrumbidgee Irrigation Area. The station was commissioned in July 1966 and was the 31st National transmitter to be placed in service.

The Murrumbidgee Irrigation Area in the Riverina district of New South Wales is the most important irrigation development in that State. The area produces rice and other cereals, fruits, vegetables, wool, livestock and cotton. The MIA covers about 183,000 hectares of which about 108,000 hectares are under irrigation. It extends north west from Narrandera and is centred on the towns of Griffith and Leeton. It is of interest that Griffith which was named after Arthur Griffith who opened the Burrinjuck Dam in 1912 was designed by the American architect Walter Burley Griffin who also designed Canberra.

The original installation comprised ASTOR transmitters manufactured in Melbourne, but in late 1986 new Thomson LGT transmitters replaced the ASTOR models.

In December 1965, commercial station MTN9 transmitters began service sharing the building and the 168 m high tower.

Until 1986, programs were carried by a microwave radio relay system. The system became redundant with the installation of AUSSAT satellite receiving facilities.

The station is also centre for a 2ABC FM stereo transmitter which went to air in December 1982 on frequency 107.5 MHz and effective radiated power of 50 kW.

Access to the station site some 622 m above sea level was not easy for the nine staff in the early days. Four wheel drive vehicles were necessary, but in later years the road on the mountain was sealed and access by more conventional cars is now possible. Snow has fallen on the mountain in some years, but has not been in sufficient quantity to cause an access problem.

RAOUL PELHAM

2CY CANBERRA

The first National Broadcasting Service transmitter to be established in the national capital of Australia was 2CY Canberra. It began transmission on 23rd December, 1938 in a building which it now shares with 2CN.

Canberra is 306 km by road from Sydney and 655 km by road from Melbourne.

The development and construction of Canberra as Australia's national capital is the responsibility of the national Capital Development Commission, a statutory authority created in 1957 by an Act of Parliament. It employs a staff of 400 persons and includes architects, engineers, town planners, journalists, draftsmen and administrative personnel.

The first transmitter was a 10 kW model of modular construction manufactured by Standard Telephones and Cables Sydney. At the time, the construction was unique in that it was put together on a production line with a number of others for the NBS. Prior to that time transmitters had been built individually by a group of specialist workers.

The period was one of considerable development in transmitter technology and one of the important features of the transmitter was the incorporation of negative feedback. This produced a high degree of stability, improved the frequency response characteristics, reduced distortion and improved the signal-to-noise ratio.

It employed low level modulation with linear amplifying stages. The final stage comprised twin 5 kW stages each employing two 4220B water cooled tubes. A spare socket enabled rapid changeover should one tube fail during operation.

EHT supply was provided by six 4078A hot cathode mercury vapour tubes in a three phase full-wave rectifier circuit.

The transmission line was an 80 ohm coaxial tube type but this has since been replaced by an open wire coaxial type.

The present STC 10 kW transmitter was installed in 1964 and shares a 193 m radiator with 2CN.

BILL ROY

News Round Up

JACK CARNELL – RETIREMENT

As reported in the March 1988 issue of The Broadcaster, Jack Carnell Broadcasting Operations Manager Victoria retired on 10th February after 41 years service.

A function was later held in the Collins Tower Dining Room Melbourne where Jack was able to renew acquaintances with many of the 75 guests including retired staff who attended.

Master of Ceremonies for the function was Bruce Wilson, OIC Radio Australia Shepparton and guest speakers were Leon Sebire Director Broadcasting, Les Rodgers State Broadcasting Manager and Geoff Helstroom ex OIC Mt. Dandenong TV station.

RAY WEEKS.

State Broadcasting Manager Les Rodgers (left) presenting Jack Carnell with Telecom Medallion.

TOM HARRISON – RETIREMENT

Tom Harrison, Manager Administration, Central Office and one of the inaugural staff members of the Directorate, retired on 18 March 1988 after more than 40 years service.

A farewell luncheon to mark the occasion was well attended by friends throughout Telecom. Also present were Tom's wife Eileen, daughter Joanna, and son John. In appreciation of his long and considerable contributions to the Postmaster General's Department and Telecom Australia, Tom was presented with a long service medallion and a compact disc player by Director Leon Sebire on behalf of Tom's many colleagues throughout Australia.

The Director also extended to Tom, the Broadcasting Directorate's sincere best wishes for a long and happy retirement.

TERRY MURPHY.

Director Leon Sebire (left) making presentation to Tom Harrison.

LOGO CAKE

The State Broadcasting Manager Tasmania, Brian Hall and staff at the Ralph's Bay 7ZL/7ZR metropolitan transmitting station celebrated the last Christmas – New Year period with a function where the centrepiece amongst the refreshments was a Directorate Logo Cake.

The design on the icing was magnificent and all agreed the cake tasted delicious.

Acting STO1 Jim Darling who won the prize for the design of the Directorate's logo during last year's competition was joined by Brian Hall in the cutting ceremony.

GLEN CLEMENTS.

State Broadcasting Manager Brian Hall (left) helping Jim Darling to cut the cake

THE BROADCASTER GOES TO USSR

Requests are received from time to time from overseas organisations for copies of The Broadcaster. The most recent request has come from the prestigious USSR NATIONAL PUBLIC LIBRARY FOR SCIENCE AND TECHNOLOGY in MOSCOW.

The Library is at the head of the technical library network in the USSR set up in 1958 by Soviet government decree.

The Library covers all fields of science and technology except medicine. It's role is to act as a diversified scientific and technical library of state importance, to serve as an All Union source of information on engineering and related sciences, to act as a co-ordinating point for technical translations and to acquire foreign technical literature.

Current holdings of the Library total some seven million books and periodicals housed in six buildings.

The Library is open only to suitably qualified researchers e.g. engineers, technicians and students of higher technical education.

JACK ROSS.

REVIEWS, AUDITS AND INQUISITIONS

Elsewhere in this issue, reference has been made to the current review of the ABC. In the same time-scale several other reviews of direct relevance to the Broadcasting Directorate are proceeding.

Of greatest significance is the "Efficiency Audit of the Administration of National Broadcasting Transmitting Facilities" which is being conducted by the Australian Audit Office, Canberra. This audit is taking place under the Audit Act 1901 and is focused on the efficiency with which the National transmitting stations are managed and operated. It will assess both technical and financial performance and will report its findings directly to Parliament. It is the first such formal examination of efficiency of the national broadcasting transmitting service in more than 50 years of the service's operation and will involve field investigations in most States and Central Office. Additionally, input to the audit will be obtained from the ABC, the SBS and the Department of Transport and Communications.

The Department of Transport and Communications late last year commissioned a consultancy with Independent Broadcasting Authority Consultancy Services of UK to establish performance standards for the National Broadcasting Network in Australia. The consultants visited Australia earlier this year and spent almost three months visiting National transmitter sites and holding discussion with Departmental and Directorate staff as part of their investigations. This work led to the Department receiving a comprehensive report and recommendations on performance standards, maintenance and organisational arrangements considered by the consultants to be appropriate in the Australian scene. The Directorate has received extracts of the report for comment and the Department is currently considering the outcome before promulgating any decisions that might be reached. It is still too early to say what effect the consultancy and subsequent decisions will have on our future operations. However, it seems unlikely that the workload for Telecom Broadcasting maintenance staff will be significantly diminished as a result of the study.

LEON SEBIRE.

SCHOOL ON AIRWAVES

The mining based township of Laverton in WA at the western edge of the Great Victorian Desert certainly makes every effort to overcome its isolation with a strong community spirit.

WA Broadcasting Branch was recently caught up in the high powered enthusiams of the locals led by the effervescent principal of the High School, Mr. Andrew Hart. Andrew involved the whole community in a fund raising weekend to provide funds for school facilities. Any organiser knows of the value of advertising using a mix of visiting identities and the local people. Add the mystique of "The electronic media" and the crowds are assured. The High School set about establishing a Radio Station for the weekend that would service many needs including filling the coffers and providing the school pupils with a valuable experience in communication with others.

Help from the ABC quickly organised the visiting celebrities, however, the technical facilities and expertise were not available locally. WA Broadcasting Branch was approached and offered to assist. The Branch people freely provided their time and talents to borrow the equipment needed, get it interconnected and assist the High School staff and students set it up.

The community weekend was a huge success and the radio station played a real role in the triumph. The High School has issued Honour Awards to those notably involved in the weekend. The Broadcasting Branch of WA is now the holder of a Laverton District High School Honour Certificate.

GEOFF JONES.

WOLLONGONG TV TRANSMITTER

The first national television station to be rebuilt as part of the Government's equalisation initiatives, is at Wollongong in NSW. The station (ABWN-5A) will change channel from VHF 5A to channel 56 UHF, in mid 1988.

The new UHF transmitter for this station will be an all solid state NEC 30kW unit. This will be the first fully solid state high power television transmitter to be installed at a National television station.

The transmitter comprises two identical 15 kW transmitters combined in parallel to give a total output power of 30kW. Each 15kW transmitter has its own exciter (although only one is used at any one time, the other being held in reserve), three nominal 6 kW video RF power amplifiers and one nominal 1.8kW aural RF power amplifier.

Each 6kW video RF power amplifier is made up of eight 800W P.A. modules. The 800 watt modules are combined in parallel by the use of 8-way input and output combiners. The aural power amplifier is similar in concept but uses three 600 watt modules combined to give approximately 1.8kW output. It is necessary to generate slightly higher powers in the various modules in order to offset the losses incurred in the multiple combiner stages used throughout the transmitter.

The power transistors in each 600W or 800W P.A. module are mounted on an aluminium plate on one side of the module housing and not on a large heat sink, as is the normal constructional practice in equipment of this type. Cooling is achieved by applying an air jet to each individual transistor from an accurately positioned air nozzle.

Each pair of P.A. modules has its own individual switch-mode power supply. P.A. modules or power supply modules may be removed for repair while the transmitter is in service by simply turning off the requisite power supply.

As a result of this design, each 15kW transmitter has a very high level of inbuilt redundancy and this is increased even further when the transmitters are combined to give the full 30kW output. The failure of a P.A. module or power supply does not affect the operation of the transmitter other than to slightly reduce the overall output power, and a failed exciter is automatically replaced by the reserve unit.

ROY BADROCK

3WV DOOEN UPGRADE

Station 3WV Dooen near Horsham was recently upgraded with the construction of a new building and installation of a solid state 50kW Nautel transmitter. The original building was built in the late 1930's by the Department of Works. It features 300 mm thick solid brick and masonry walls and a concrete bond beam around the top of the walls to support the wooden king post trusses and corrugated asbestos cement roof.

The original strip footings were unsuitable for the local elastic clay soils, allowing the foundations to move causing the masonry to crack. The building's deterioration was rapidly accelerated by recent drought conditions such that cracks in the wall up to 100mm wide appeared. Several attempts over the years were made to stabilize the footings, however these have been unsuccessful. The new building features a reinforced raft slab.

The station was visited by the Canadian Consul General (Mr. Bob Dawson) and his aide (Mr Leon Stryker) during the final commissioning tests. These gentlemen were accompanied by Mr. John Stannard (JNS), Les Rodgers State Broadcasting Manager Victoria and Brian Rowland Engineering and Construction Manager Victoria.

SIMON MOOREHEAD

4QA – SUGAR

Station 4QA is located at Mackay in North Queensland and was commissioned in January 1951 to serve the Mackay area extending along the coast north to Whitsunday Island and south beyond Sarina. Inland, it serves the Pioneer River valley settlements.

The original twin 2 kW transmitters STC type 4SU-14C are still in operation and feed a 52 m high omnidirectional radiator.

The station was staffed until 1971 but maintenance work is now the responsibility of the Mackay Broadcasting District.

Mackay is the centre of one of the major sugar growing districts in Queensland. The others are at Bundaberg, Ayr and Cairns.

Sugar cane was brought to Australia by the First Fleet in 1788, with cane loaded on at South Africa, and the first refinery began production in Sydney in 1842.

4QA mast with bulk sugar storage building in background.

A plantation was established at Ormiston near Brisbane in 1862 and plantations soon spread to North Queensland. By 1880 there were 16 mills in operation in the Mackay district.

During this early period most sugar was grown with the use of Kanaka (Polynesian) labour. As the plantations expanded, so blackbirding (forced recruitment) from the South Pacific Islands was increased. Finally the Government intervened to ensure fair treatment of the Kanakas. At the time it was considered that European labourers did not have the necessary stamina to work in cane fields in the tropics.

During the growing season the dense green cane fields are almost deserted but during harvest time the night sky is lurid with burning-off fires as the dry leaves are removed in preparation for the mechanical harvesters which eat their way across the fields. Australia was the first country to have a completely mechanised sugar industry.

View of cane fields from ABMQ-4, Mt. Blackwood

Burning Cane.

Then the cane trains come out and the tiny diesels haul long rattling rakes and loaded trucks on the network of narrow gauge rails leading to the mills.

When the cane enters the mill, shredding machines chop the cane and feed it into a series of heavy rollers which squeeze out the juice. Lime is added to the juice and it is boiled under reduced pressure. This process causes impurities to separate

Racecourse Mill.

from the juice. The purified juice is boiled a number of times in vacuum pans and raw sugar crystals are formed. Spinning separates the crystals from the remaining syrup. The crystals are dried in revolving drums through which hot air passes.

The crystals are sent to one of six refineries in Australia where further treatment is carried out and the refined sugar crystals are then graded and packed for sale.

DOUG SANDERSON/ARTHUR NAYLOR.

Toft cane harvester.

REDUNDANCY CONCEPTS

Since the inception of broadcasting, it has been common practice at most national broadcasting stations to provide redundant plant to minimize program outage time, due to transmitter failure.

For many years it was normal to use a main and standby transmitter configuration in which the standby transmitter output power was a fraction of the main transmitter. Typical combinations were 10/2kW or 50/10kW.

The advantages of this arrangement, other than the obvious maintenance of transmission, were that it was possible to work on either transmitter without interrupting program and the cost of the standby unit was relatively low. The chief disadvantages were that there was a break in transmission, albeit short, when the transmitters changed over and there was a quite severe reduction in station service area coverage, when operating on low power.

In an endeavour to improve on this situation, parallel operation in which two transmitters, each of which was half the output power of the service, was introduced. This form of operation retained the advantage of staff being able to work on one transmitter while the other kept the service operational and in addition eliminated the break in transmission when a transmitter failed or was taken out of service for maintenance.

The disadvantages of this system were that unless special arrangements were made to bypass the combining equipment, the transmitter power output fell by 6dB each time one transmitter closed down. This was little better from a service area coverage viewpoint, than the previous high/low power transmitter configuration. In addition, the cost of providing two equal power transmitters and a highly complex combiner was much greater than the earlier main and standby arrangement.

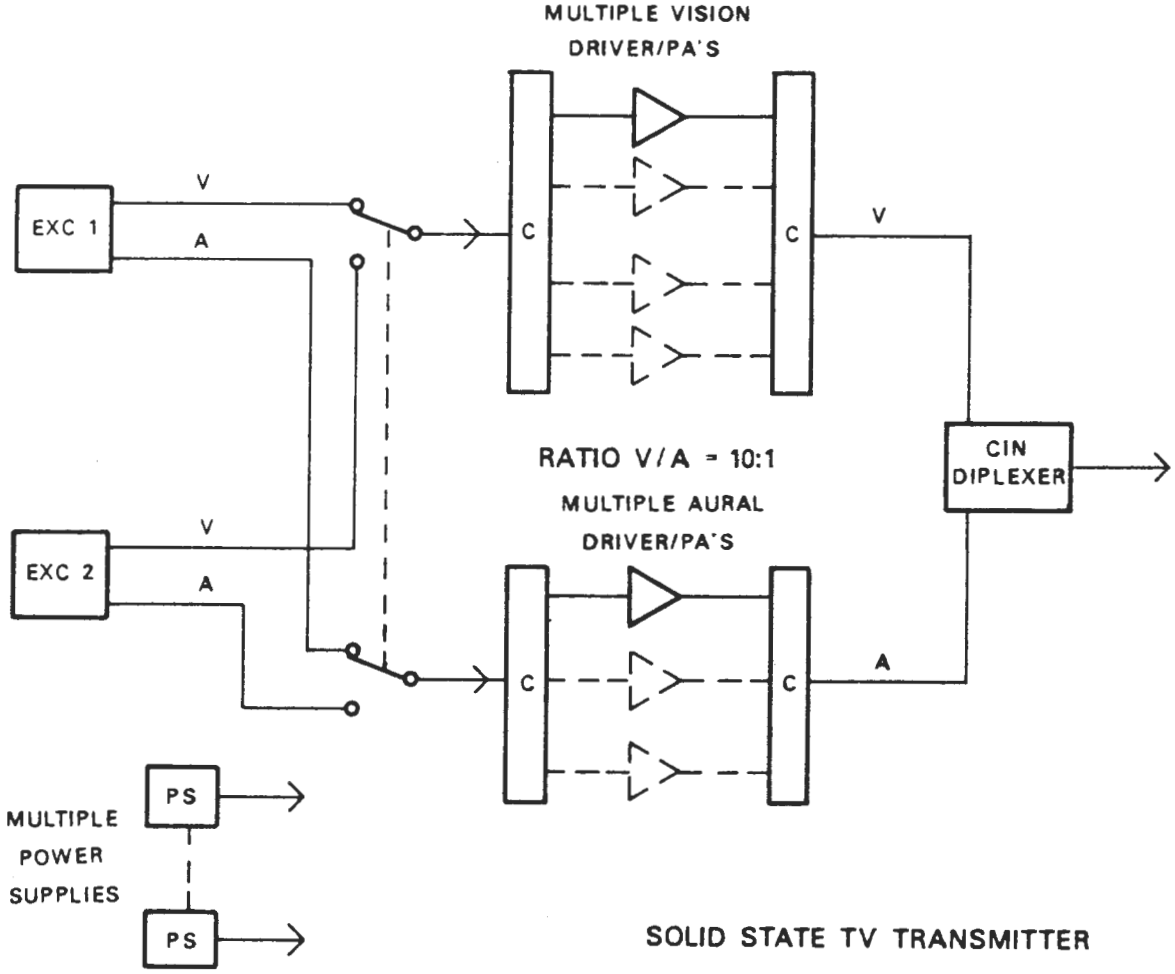
As a consequence, in recent years the trend in redundancy planning has moved towards the provision of high power main and standby transmitters with instantaneous automatic changeover. This equipment arrangement provides all of the best features of the previous two and maintains the stations service area coverage when one transmitter fails or is withdrawn from service. However, it is still expensive and requires a high power transmitter to stand idle for much of its service life.

In the last year or so, with the advent of fully solid state transmitters, it has become evident that the need to duplicate transmitters, is in many cases, unnecessary. This is due fundamentally, to the inability of transistors to produce high RF output powers thus necessitating in a high power transmitter, large numbers of highly reliable low power amplifiers combined in parallel to obtain the required power output.

In consequence, all high power (i.e. 10-50kW) National MF stations installed over the last two years have employed single fully redundant transmitters. These transmitters employ duplicated exciters with automatic changeover facilities, multiple driver and power amplifier modules as well as multiple power supplies. The failure of any one of these individual units has no effect on the transmission, other than to slightly reduce transmitter power output.

Consideration is now being given to extending this concept to high power television transmitters and a tender schedule seeking offers to provide such a transmitter has recently been released to the industry. The type of transmitter sought is illustrated in the sketch and it can be seen that all items are duplicated except the CIN diplexer. As this is a passive device and therefore highly reliable, it would not be unreasonable to expect an extended mean time between failures.

ROY BADROCK



SOLID STATE TV TRANSMITTER

Holiday in Nepal

Himalaya Country

Kevin Buckland Manager Management Services Western Australia, late last year visited Nepal with his daughter Karen, on a school vacation trip organised by the Governor Stirling Senior High School. Kevin and Karen were with a party of 13 students and seven adults who went on the trip. Kevin tells of his impressions of this fascinating country in this article.

Nepal is a kingdom in south-central Asia. The world's highest mountain range, the Himalaya, covers more than nine-tenths of Nepal. Mount Everest, the tallest mountain in the world, rises along Nepal's border with Tibet.

Nepal has a population of about 17 million and patches of farmland lie among the mountains. These cultivated areas account for only 10% of the country's total area, but more than 90% of the people live there. The country is poor and undeveloped, and has a high rate of disease and illiteracy.

The population is made up of different races and tribes, living in regions, wearing different costumes and speaking different languages and dialects. Hinduism and Buddhism are the two major religions.

Street Scene in Thamel District of Kathmandu the capital of Nepal

The rich cultural heritage of Nepal can be seen in the diverse social customs and frequent socio-religious festivals which spill into the streets and squares of the cities and villages. Dasain, also known as Durga Puja for the worship of Mother Goddess Durga, is Nepal's longest and most lavishly celebrated Hindu festival. Like the Western world's Christmas, it is the holiday during which families unite to exchange blessings and gifts, to spread goodwill, and to forget feuds and quarrels.

Herds of slowly moving water buffalo, bleating sheep and goats are ushered to market for sale and eventual slaughter in the name of Goddess Durga. Government offices, schools, and many businesses close for ten to fifteen days. The entire Kingdom officially comes to a near halt. On Asthami, the eighth day of Dasain, orthodox Hindus fast in preparation for Kala Ratri, the Black Night, when hundreds of buffalo, goats, sheep, chickens and ducks are sacrificed at Durga temples. The following dawns sees mass sacrifices performed publicly and it is not a sight for the softhearted. Blood from the slain animals is sprinkled at sites of Mother Goddess Durga, and on vehicles – cars, trucks, buses and even aeroplanes – to prevent accident.

Sheep grazing high up in the Annapurna Mountain range.

Tools of trade – shovels, axes, soldering irons, ploughs, etc – are likewise initiated in hopes of professional success.

Nepal is a trekker's paradise. One can trek along beaten trails or virgin tracks. There is something for everyone; the magnificent spectacle of great snow summits, the highest in the world, or mountain ridges carpeted in alpine flowers, or forests of rhododendron.

Trekkers are well looked after by the Sherpas – they treat you like royalty. Every morning you are awakened to a cup of hot tea and a bowl of hot water delivered to your tent.

The most striking aspect of Nepal that I encountered was the friendliness of its people and the lack of concern at foreigners trooping through their rice fields and walking past their backdoors. English is taught in the schools, and most children can talk good English and continually ask for your pens. However, one thing that was hard to get used to was being stared at by the villagers, particularly the young children who crowded around at every available opportunity. In fact they crowded around our tents until we went to sleep, and then next morning they were there again.

KEVIN BUCKLAND.

Rice fields.

New MF Transmitters

10 KW SOLID STATE TRANSMITTER

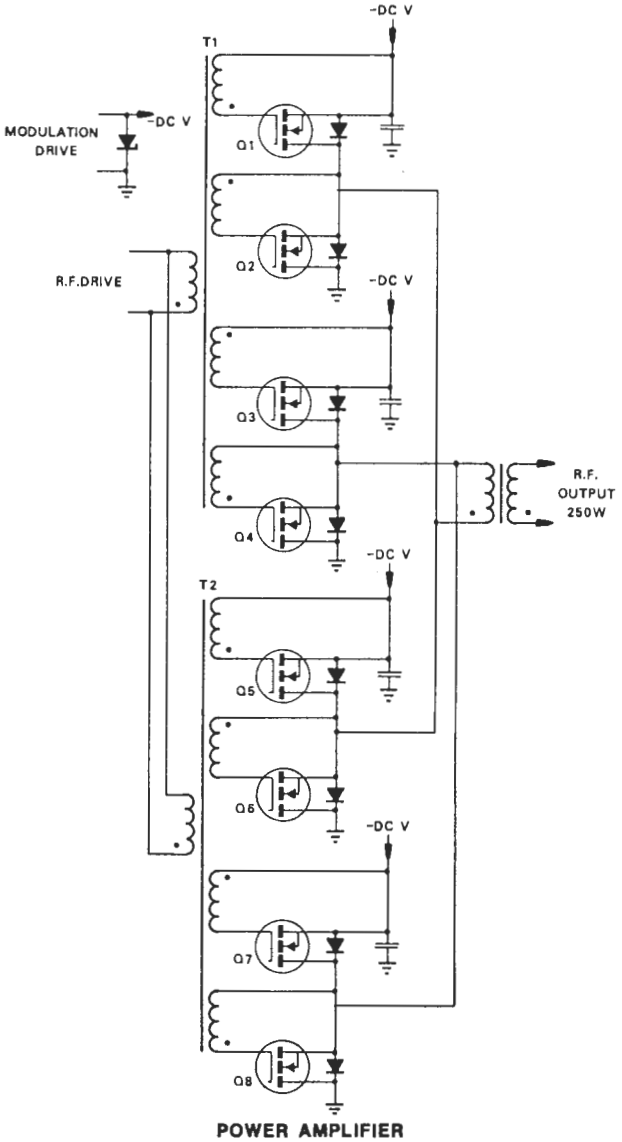
Solid state transmitters are now replacing tube types in the National Broadcasting Service for all powers up to 50kW.

Transmitters of 10kW output have recently been installed in the MF network and this article outlines the basic technical features of the Nautel unit.

The overall simplicity of the transmitter design is readily apparent from the block diagram. It basically consists of three main sections, the RF driver, the modulation driver and the power amplifier stage.

The RF driver module generates a square wave at carrier frequency and the modulator driver module accepts the audio input and generates a pulse width modulated drive signal for the modulators of the power amplifier stage.

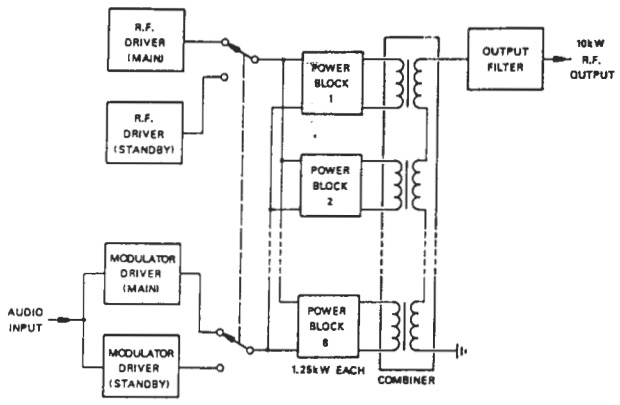
The RF drivers and the modulator driver functions are duplicated with automatic switchover in the event of a failure.



POWER AMPLIFIER

The power amplifier stage consists of eight 1.25 kW power blocks that combine in the output transformer to give the total 10kW output power. Each power block has three pairs of 250 W power amplifier modules, a modulator module and a rectifier/regulator module.

RF drive is fed to each pair of PA modules via a failure sensing circuit which automatically shuts down its pair of PA modules in the event of a failure in either module. The output of each PA module, in each block, is connected in series with the other



SIMPLIFIED BLOCK DIAGRAM

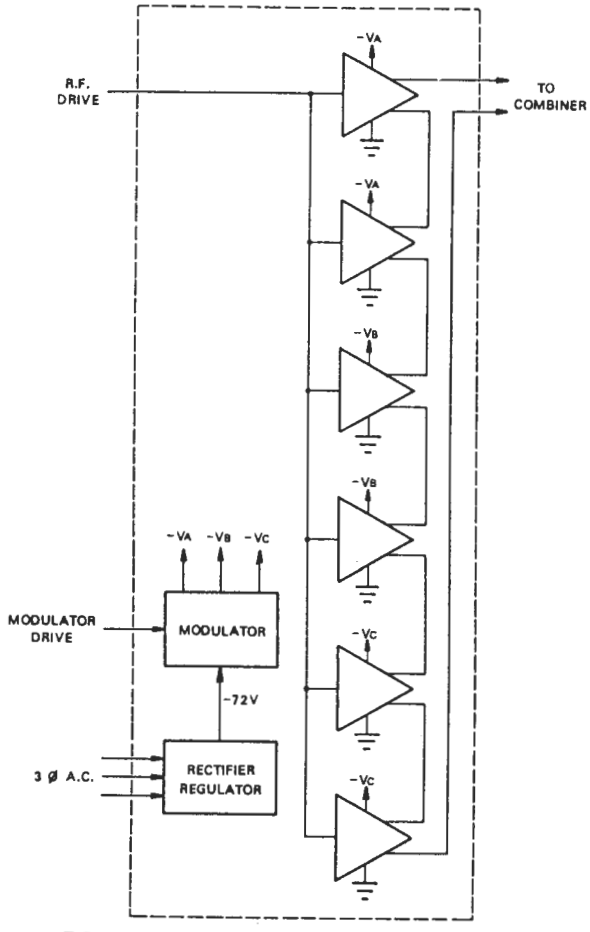
five PA modules of that block. A non-operational PA module (either failed or switched off via the modulator drive) appears as a short circuit at its output terminals, and hence the continuity of the output circuit is maintained, although the RF output will be reduced by 500 W.

The modulator module of each power block accepts the pulse width modulated audio signal from the modulator driver and provides a modulated – DC supply voltage to the six PA modules.

The PA modules are class D switch mode RF power amplifiers using power MOSFETS. The RF drive square wave is applied to the gates of the MOSFETS through step down transformers. Pairs of MOSFETS are connected in a series push-pull arrangement, and the phasing of their inputs determine which pairs are turned on. Pairs with the same phasing are connected to the module's output transformer in parallel.

The high level of redundancy lessens the need for a standby transmitter, and as operation with faulty modules places no stress on other modules, replacement of modules can wait until the next scheduled maintenance visit.

ALASTAIR GELLATLY



POWER BLOCK BLOCK DIAGRAM

Nautel plant Hackett's Cove.

Light assembly area.

Heavy assembly area.

Solid State Technology

NAUTEL MF TRANSMITTERS

Medium frequency broadcasting is one of the few remaining domains still using classical, double sideband, amplitude modulation.

However, transmitter designs have not remained static and the long entrenched vacuum tube designs have at last yielded to wholly solid state technology with power outputs up to 50kW. Even 100 kW models are under development.

The majority of AM transmitters have utilised high level modulation for efficiency, and consist essentially of an r.f. power amplifier, a power modulator, low level excitation circuitry, power supplies and control/monitor circuitry.

The solid state designs have basically the same subsystems but the details of the amplifier and modulator designs are very different, utilising digital switching rather than analogue techniques. Such techniques are not new and have been known for many years, but their application has been given considerable impetus by the introduction of power FET devices.

The r.f power amplifiers are, in essence, converters of incoming d.c. power into r.f. power at the desired carrier frequency. A class D amplifier is commonly employed with solid state designs for this conversion process. The direct coupled bridge version of this amplifier has several practical advantages with power FET switches being used as the active switching elements.

Digital technique solid state AM transmitters offer a number of advantages compared with analogue techniques, particularly in regard to intrinsic linearity. For a typical 50kW transmitter, overall efficiency is better than 75%, audio harmonic distortion over the range 30 to 10000 Hz is less that 2% at 95%modulation and hum and noise (unweighted) is 60dB or better, relative to 100% modulation.

One of the leading organisations in the development and production of solid state MF transmitters is Nautical Electronic Laboratories Ltd of Canada. The company has transmitters operating throughout the world with over 40 being operational in Australia ranging in power from 400 watts to 50 kW. The transmitters are marketed under the name NAUTEL.

The company was founded in 1969 to operate an electronic research and development organisation, but its launch into the production of solid state transmitters came when it was awarded a major contract for radio beacon transmitters. Entry into the MF transmitter field came with the installation of a 10 kW transmitter for a station in Canada.

Despite their proven record, acceptance of NAUTEL solid state transmitters in Australia was initially slow but has now become almost the accepted standard. The first NAUTEL transmitter was installed and put in service for a commercial station late 1983. National Broadcasting stations which use NAUTEL equipment include 2GU Goulburn 400 W, 8KN Katherine 2 kW, 3 WA Wangaratta 10kW, 6KP Karratha 10kW, 4CH Charleville 10kW, 2NT Tomerong 10kW, and 3WV Dooen 50kW.

The 3 WV installation employs an AMPFET 50 model transmitter and consists of 48 identical 1.25 kW power subsystems combined into 5 kW groups. The twelve 5 kW blocks are combined in the final harmonic filter/combiner unit to provide 60 kW output capability. Subsystem failure will not result in an off-air condition. The integral modular reserve design provides for continued operation at slightly reduced power without additional stress on the remaining subsystems.

The benefits of modular redundancy are optimised by the provision of isolation switches for each 5 kW power block. A 1.25 kW subsystem module may be safely removed for servicing while most of the transmitter remains on air. Shorting switches are provided at the back of each quad combiner so that once a PA subsystem has been removed, the other three in the group may be returned to service by reclosing the isolation switch.

A fast acting output protection circuit senses the amplitude and phase of the r.f. current to protect the transmitter against unacceptable loads and antenna arcing.

ROD THOMPSON.

Test room.

Final assembly.

Module inspection.

Solid State Modulator

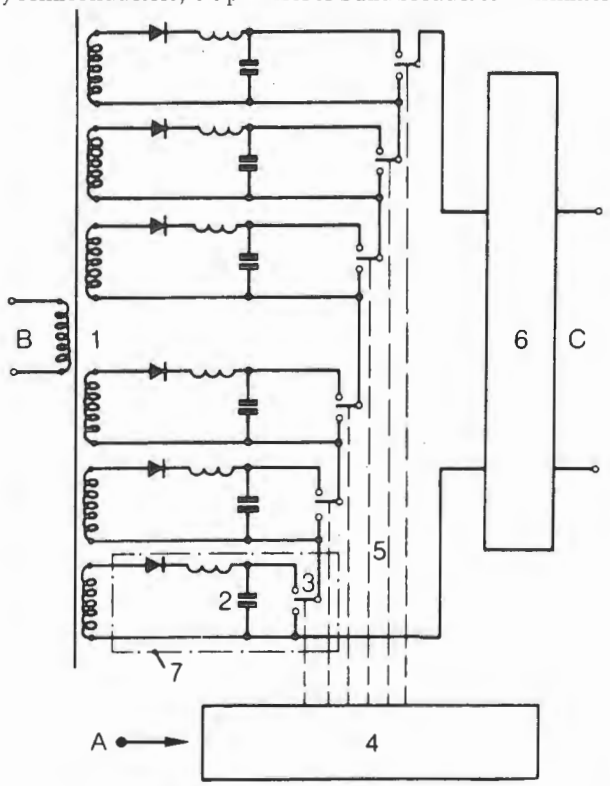
HIGH POWER TRANSMITTER DEVELOPMENT

Improvement in efficiency of transmitters, particularly high power types, is of vital concern in view of the rising cost of primary power.

Important technical progress has been made since the introduction of solid state technology to broadcasting but the break through really came with the replacement of the traditional Class B modulator by a switching amplifier.

Most major transmitter manufacturers are now producing designs employing switching amplifiers of various types. Models manufactured by Brown Boveri and Co. are typical of the new technology and employ a pulse step modulator (PSM) so called on account of the principle it employs to generate voltage.

Since the formerly used modulator tubes can now be replaced by semiconductors, it is possible to build broadcast transmitters



Brown Boveri's pulse step modulator

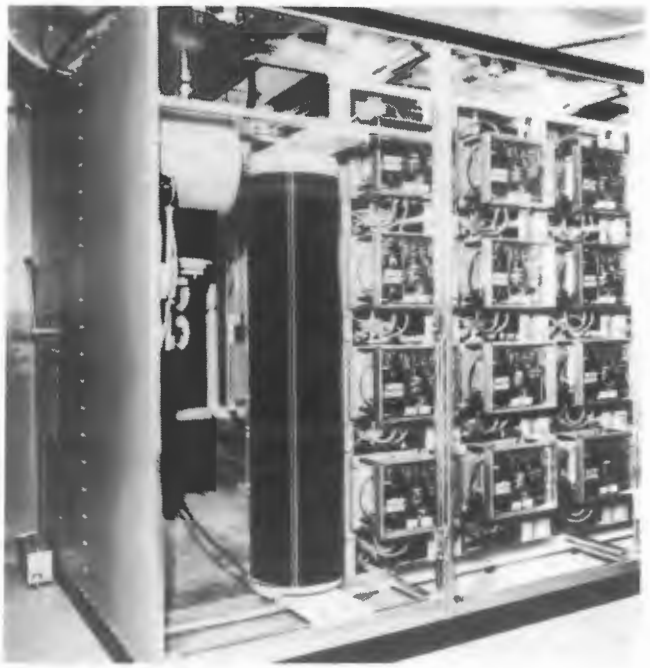
A – AF input signal
B – Medium-voltage system (3-24 kV)
C – Anode voltage to RF final stage
1 – Transformers
2 – Capacitor bank as voltage source
3 – Solidstate switches
4 – Central control system
5 – Fibre optic links
6 – PDM/PSM Filter
7 – Switching stage

even in power ranges of 250 kW and above employing a single tetrode tube.

This development applies to high power transmitters for long-wave, medium wave and short wave broadcasting.

The tetrode tube is capable of delivering both the carrier power and the peak modulation power without control grid modulation and with practically no grid current.

In contrast to a push-pull Class B modulator, which only amplifies the a.f. information signals and superimposes them upon the d.c. voltage of the high voltage rectifier the PSM switching modulator is a d.c. voltage amplifier which amplifies voltages from 0 to 28 kVp and currents up to 100A in the 50 to 4500 Hz frequency range.



Switching module showing some of the water cooled switching elements.
(Courtesy Brown Boveri & Co.)

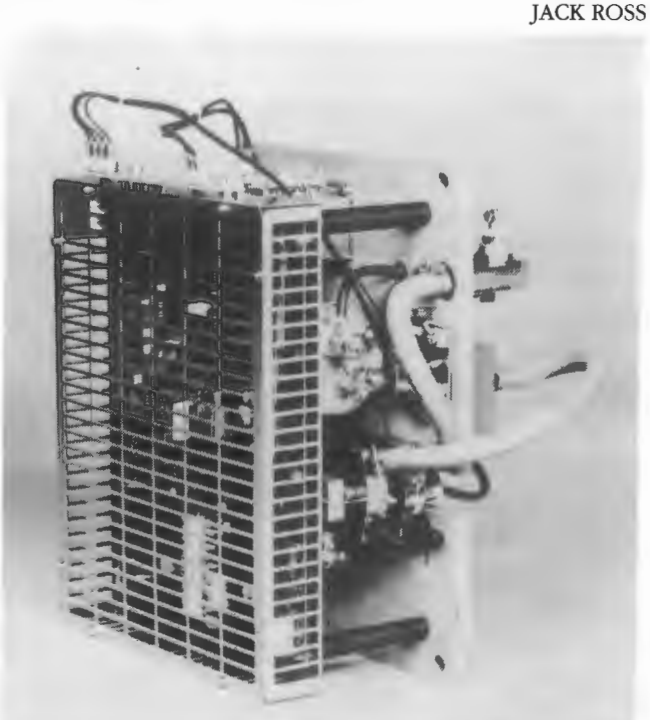
This means that the high voltage rectifiers and the massive heavy modulation components are no longer required. Their place is taken by 32 identical voltage sources which are switched on and off to achieve the above mentioned values in the a.f. range.

Pulse duration modulation can be used for close matching of the switching steps to the analog signal.

The modulated d.c. voltage is applied to the r.f. final stage. Efficiencies of 97% in the PSM section are achieved with the 32 switching modules. These modules include a rectification device, energy storage unit and switching unit with associated control electronics.

The pulse step modulation system and new tube developments have resulted in energy-saving installation with overall efficiencies in excess of 76% for medium wave and short wave transmitters.

JACK ROSS



Partial front view PSM amplifier showing pulse frequency filter and some switching stages.
(Courtesy Brown Boveri & Co.)

Wireless Telegraphy 1901

PRESENTATION OF PLAQUE

The November 1987 issue of The Broadcaster contained an article on early wireless telegraphy experiments in Victoria including work by Mr. H. W. (Walter) Jenvey Electrical Engineer of the Victorian Post Office.

One of Mr. Jenvey's major achievements was the establishment of communication with one of the warships which brought the Duke and Duchess of Cornwall and York to Melbourne for the opening of the first Federal Parliament after Federation.

For some time, a dedicated group of citizens of the Borough of Queenscliffe spearheaded by Ray Raison worked towards the provision of a plaque to commemorate this important event which took place on 6 May 1901.

On 24 May 1988 at a ceremony at the southern entrance of Citizens Park, Gellibrand Street, Queenscliff near Fort Queenscliff, Director Leon Sebire presented to the people of Queenscliff a commemorative plaque. The Mayor of the Borough of Queenscliffe Cr. I. R. Curtis J. P., accepted the plaque on behalf of the citizens.

Queenscliff was selected as the site of the transmission because it had a town gas supply needed to inflate the balloon with which it was intended to raise the antenna.

Mr. Jenvey installed his equipment probably in the Signal House near the lighthouse and began tests on 3 May when the use of balloons proved to be impractical to raise the antenna. A

Wording of the plaque.

kite was tried but it was found to be unsatisfactory. As a last resort, the antenna was hauled up the signal mast which stood nearby.

Walter Jenvey was a leading telegraph Engineer and was author of the book PRACTICAL TELEGRAPHY which by 1904 had reached the fourth edition stage. Following the erection of the first telegraph circuit in Victoria in 1854 between Melbourne and Williamstown, the service expanded rapidly and soon included links to the neighbouring colonies of South Australia and Victoria.

It became evident to Jenvey and others that there was a need for a society within the Post Office to promote the knowledge of electricity, especially as it applied to telegraphy. In 1874 officers of the Post and Telegraph Department formed a society called The Telegraph Electrical Society with Walter Jenvey being a member of the Committee of Management.

After the later inventions of the telephone and wireless telegraphy 'Telegraph' was no longer appropriate to describe the Society and in 1908 a new society called The Postal Electrical Society of Victoria was formed with Mr. Jenvey as the inaugural Chairman. Today, it is called the Telecommunications Society of Australia.

Walter Jenvey was one of our foremost pioneers in the practical application of line telegraphy and wireless telegraphy and without his like, it is doubtful whether we would have the sophisticated communications systems we have today.

JACK ROSS

Cr. Curtis, Mayor Borough of Queenscliffe and Director Leon Sebire at the plaque.

The Signal House

Staff News

CENTRAL OFFICE

Several people have left the office including Administrative Manager Tom Harrison who retired after 42 years service with the Postmaster General's Department and Telecom, Nirmala Clements and Greg Farrell who transferred to Network Engineering and Julie Hood who resigned from the service.

Two staff members Denise Honan and Victoria Ridgeway commenced maternity leave while new arrivals include Engineers Tom Glass and George Wielicki who have taken up duty with Engineering Services Section.

VICTORIA

Best wishes are extended to Max Fowler and Alan Dobson, OIC's of Mt Major TV station and Lyndhurst Radio respectively, on their retirements after a combined service of over 72 years with Broadcasting.

Several staff have resigned recently to seek work elsewhere. Good luck and best wishes go to David Rofe and Sussan Loucopoulos from the Management Services Section, Elizabeth Li, Secretary and Mario Castillo, Drafting Assistant.

Welcome to John Bouros who has commenced as OIC Registry and congratulations go to Con Giovas Clerk Class 4 and Irene Petalas on their recent marriage.

TASMANIA

Milton Cunningham BOM recently attended an Army Reserve exercise at Puckapunyal and Glen Clements, Branch AO, attended a TEWT in Queensland. Both returned unharmed.

Welcome back Brian McKenzie SLO who has once again resumed from mainland duties, this time from a radiation measurement course in Adelaide.

Personnel Officer Ruth Virth used her recreation leave to assist her husband build the family fence and Sonia McKay acted as Personnel Officer during Ruth's absence.

Karen Paice transferred over to Support Services Branch and Tania Bishop joined the office as replacement.

A number of movements and retirements have taken place in the technical area. Graeme Wilmot previously OIC Ralphs Bay transferred to Radio Australia Cox Peninsula NT to become OIC there. John McIntyre OIC Mt Wellington retired after a long association with the station. He had previously worked with the British Merchant Navy and with Marconi Co. in Egypt. Mel Ferguson Labourer at Mt Barrow resigned to take up a position with Comalco aluminium smelter at Bell Bay.

Tony Lohrey previously OIC Broadcast Service Centre joined private enterprise in the management technology field. Peter Hirst Technician Broadcasting District South, is another industrious staff member who left Telecom. Best wishes to all these people.

WESTERN AUSTRALIA

Merran Barrett Clerical Assistant Broadcast Technical Centre recently gave birth to daughter Chirsty. Congratulations Merran. Heather Stevens is now filling the vacancy during Merran's absence.

Natalie Garbin Clerical Assistant commenced six months leave from 6 May to undertake an extensive holiday in Europe.

Office bearers for API Broadcasting Branch committee were recently elected with Ian Gibbs Senior Draftsman taking over the role of President from Kevin Buckland, John Gregory OIC Installation was re-elected Secretary and Fiona Somers Staff Clerk took on the job of Treasurer, previously held by Tracey Irwine.

SOUTH AUSTRALIA & NORTHERN TERRITORY

Chris Fox and Fiona Harris spent an enjoyable holiday extending over several weeks in Darwin and renewed acquaintances with many Broadcasting staff stationed there.

Graham Ward also visited the Top End with his family on a motoring holiday and witnessed at first hand, the problems experienced by people living at Alice Springs during the recent flooding.

Ray Galliford from Buildings Branch rejoined the office during the absence of Denis Collins STO1 Electrical who returned to Sri Lanka for a second term of secondment with the ITU.

New arrivals in the Branch include Mark Borgas Engineer Class 1, Jim Heath STO 1 from Queensland and Roberta Coleman Clerical Assistant in the Darwin Office.

Jack Gilbertson who for many years tended the grounds and gardens at 5CL/5AN Pimpala retired in July when he handed in his pruning shears.

The Branch held its annual Golf Day at the picturesque North Adelaide Club with SBM Rod Cunningham being among the 13 competitors. Wes Graham collected the trophy for lowest score while Mark Borgas was overall winner.

QUEENSLAND

Brian Cleary Broadcasting Operations Manager, went to Melbourne in April to act as State Broadcasting Manager, Victoria and during his absence Graeme Christie acted as BOM while Chris Duffy acted as PTO.

Several marriages took place recently, including Bob Sampson E & C Estimator, Craig Haines and Ian Leather both of the Radio Lines Group.

David Boreham E & C technical staff became a proud father with the birth of lovely daughter Hanna.

George Marshall OIC Radio Centre Bald Hills retired in February. George had a distinguished career having served as OIC 4QA Mackay, 2CR Cumnock and 2NR Lawrence before taking up the Bald Hills post. All the best George in your retirement.

Tony Delisser Technician-in-Training has been training hard, hoping to eventually represent Australia in triathlons at the 1990 Commonwealth Games in Auckland. Performance to date has been encouraging with wins in the State 1986 and 1987 series and a win in the Pines in 1987. Keep up the good work Tony.

NEW SOUTH WALES

A number of promotions have been made in the Clerical area including Kathleen Lord, Grace Perkins, Melany Bartholomensz, Marie Luchi, Margaret Shotbolt and Christine Iliopoulos.

A welcome is extended to Chris Brown who has taken over the difficult job of running the Registry.

As mentioned briefly in the March 1988 issue of The Broadcaster, Ken Nugent Technical Officer Grade 1 of the New South Wales Broadcasting Branch was the recipient of the Telecommunications Society of Australia Award for 1988.

Ken received the Award which comprises $150 and the

Ken Nugent (centre) being congratulated by Acting Chief State Engineer Alan Johnson (left) and Chairman Telecommunications Society, John Solly.

Society's medallion at a function at Telecom House on 2nd March. The presentation was made by Alan Johnson Acting Chief State Engineer.

Ken commenced with the PMG Department in 1973 as a Line-man-in-training and was employed for 12 years on External Plant duties. In 1986 he completed stage three and four of the Electronics Certificate Course, graduating with Honours and receiving the Medal of the North Sydney Technical College for the highest pass in stage four.

Black Mountain Tower

New Feeders Installed

The 194 m high Black Mountain Tower in Canberra is one of Australia's best known telecommunications towers, as well as a tourist attraction.

Included in the facilities are transmitters for Commercial, ABC and SBS TV services.

The provision of two 6 1/8 inch feeders became necessary recently to replace the interim SBS antenna and to cater for future services. The installation of such large cables on normal lattice steel structures provided for TV services is a major exercise, but in the case of Black Mountain Tower, it was an extremely difficult operation. A great deal of planning and design went into the project before commencement of the actual installation.

Planning was made more difficult because of the need to relocate existing services which had encroached on the space reserved for the feeders. In addition, the mast had to be rewired for obstruction lighting, beacon and power outlets and telephone services. The commercial transmitter feeder needed relocation to allow room for cable hauling operations and to enable personnel to climb through, after installation. Waveguides also encroached into the feeder space and needed to be shifted.

The first problem encountered was at the reduction point between the Band II and Band III stacks. There was no way the cable would fit through the confined space. Because of the need to temporarily secure the cable and readjust the cable stockings, there was not sufficient time available to do this work in the planned outage time allocated, so operations were suspended for the day.

That was not the end of problems. The antenna system had been installed but some panels were not up to specifications and as they required further testing the cable hauling operation was put on hold.

The cable head was secured by slings and turnbuckles off the tower leg and the load partly taken by the winch using the turnbuckles. The cable was temporarily secured with cable hangers at every second position over its entire length. The weight was then taken off the winch and the wire removed from the drum in order to secure the tower for the expected two or three weeks delay.

On return to the job, the cable stockings were adjusted and the cable hauled without further incident. The most difficult part was in hauling the last few metres with the Tirfor as it had to be operated off the side of the mast and the operators could not use the full length of the handle for leverage. Another Tirfor was set up at the third cable stocking to assist in the lift.

The second cable had to be slung differently due to the diminishing amount of room in the Band III stack. Lessons had been learned from the first cable haul, so the second operation went much more smoothly.

Cable being rolled off the drum under the watchful eye of State Broadcasting Manager Mike Stevens (right).

The two cables fixed in position.

After clearing obstacles, the next step was to determine how best to rig the tower to haul the cables. A number of alternatives were considered but because there was no room on the Band V stack to mount the head block, it was decided that the head block would have to be slung below the point of the cable connection. This meant that the last three metres would have to be hauled with a three tonne Tirfor. Because the safe working load of the winch available was only two tonne and the total cable weight was almost three tonne, a moving block would have to be installed about half way through the lift. A convenient place was just above the water tank where the cable could be secured whilst re-rigging for the movable block.

Just prior to the hauling operation a 30 kilogram spinner connector was installed. It was no easy task, and took three hours to install.

In preparing the cable for hauling, two cable stockings were placed at the head, one at two metres from the connector and the other two metres lower. The second stocking was to be used to haul the last three metres with the Tirfor. Two more cable stockings were installed as the cable was hauled. These were 50 metres apart and were supported by 50 metre slings and turnbuckles. Each stocking was adjusted to share the load equally over the length of the cable.

Two 30 metre tails had been terminated at one end and pulled into the lower ground ceiling and manoeuvred into position by means of strategically placed Mesdan pullers and Tirfors.

The vertical cables were terminated to an exact level and attached to the horizontal tails with elbows. This task took some time to complete due to the confined work space available.

Black Mountain Tower is no easy place to work. There are never ending changes of direction, lighting is bad and there is very limited visibility. One of the major problems is to keep tail lines and the winch rope from crossing and fouling other cables and of course preventing damage to the enormous number of other cables and wave guides using the tower.

The staff worked under extreme pressure without a word of complaint. Just remember fella's after this one, it's all down hill.

DOUG SMITH

Profiles

ROD CUNNINGHAM

Rod Cunningham, State Broadcasting Manager, South Australia and Northern Territory, commenced service in the Postmaster General's Department in January 1961. After qualifying as a Technician he went on to complete an Electronic Engineering Degree and commenced as a project Engineer on exchange and broadband installation in 1969. Rod has worked throughout most of South Australia installing telephone exchanges and networks. In particular, he was involved in the commissioning of the East-West Microwave system and satellite service to the Ceduna earth station.

With the formation of the Operations Department in 1975, Rod became the Operations Aide to the Chief Manager Operations and assisted with the formation of the new districts.

In 1978 Rod established the PABX marketing group and later moved into other commercial activities as an Account Manger and Sales Manager for major customers based in South Australia and the Northern Territory.

Prior to taking up his position as State Broadcasting Manager in April, Rod led a project team in Headquarters developing Tradelink, a new product for the communication of trading documents between businesses. Tradelink is a unique product as it combines Telecom's traditional network skills together with the development and marketing of computer software.

Rod and his wife Viv have two teenage sons.His interests include writing scripts and co-ordinating a church puppet group, assisting in the management of a retirement village south of Adelaide, and the restoration of an old Volkswagen.

Rod Cunningham

Barrie Morton

BARRIE MORTON

Barrie Morton, Manager Northern Territory Section, has spent 23 years at various broadcasting locations. Employed by the Postmaster General's Department in 1964 as a Technician-in-training, the first permanent stop was 8AL Alice Springs. Although a small station, the duties also involved work on the first HF radio telephone network.

Having qualified as a Senior Technician, the expansion of rural television allowed a move to ABRS3 Loxton South Australia where he became shift leader. Six years in the quiet country town caused a desire to return to the Territory.

A move in 1979 to the Broadcasting Service centre Adelaide as Assistant OIC allowed Barrie to develop the maintenance and operational requirements of all unstaffed stations in SA and NT. During his years in Adelaide, the Service Centre was involved in many broadcasting projects, including the development of the Transportable Emergency Broadcasting Station for the Natural Disaster Organisation.

On the formation of the NT Broadcasting District in 1984, Barrie became the OIC, operating and maintaining all the National broadcasting facilities throughout the Territory. Servicing 29 remote unstaffed transmitters was a heavy workload, with a lot of travel a basic requirement. Since being appointed Section Manager in October 1986 Barrie has responsibility for all broadcasting services in NT including Radio Australia Cox Peninsula.

Being married with two children and keen on playing baseball, sailing and other outdoor activities, fully occupies his spare time.

WES GRAHAM

Wes Graham, Broadcasting Operations Manager South Australia, joined the Postmaster General's Department as a Technician-in-training in 1951. During the fourth year of training he was allocated to Radio and Broadcasting and since being advanced to Technician in 1956 has remained in the broadcasting area.

Prior to qualifying as Senior Technician in 1959, Wes worked as a Technician at the NBS studios, 5CK Crystal Brook and 5PA Penola. After advancement to Senior Technician, he was employed on field intensity survey, inspection and installation work throughout SA and NT.

After the introduction of television in South Australia, Wes took up the position of shift leader at the Spencer Gulf television transmitter site near Pt. Pirie and in 1969 became OIC of the station.

Later in 1969, he was transferred to Adelaide as Senior Technical Officer, Inspections performing technical inspections of commercial broadcasting stations, together with inspections and maintenance activities associated with national broadcasting transmitters.

Wes transferred from the Inspections role to that of STO Installation Support in 1972, and in 1976 was appointed to the position of OIC Broadcasting Services Centre. The Services Centre in South Australia is responsible for the installation of broadcasting equipment, and a wide range of maintenance activities including the 'lead house' role for maintenance of various types of NEC FM transmitters.

Following retirement of Lew Grubb, Wes was appointed to the position of Broadcasting Operations Manger on 1 January 1987.

Wes and wife Ondrea have three children, all of whom have 'flown the coop'. His outside interests include golf and service club activities.

Wes Graham

Wayne Croft

WAYNE CROFT

Wayne Croft Senior Engineer, Engineering and Construction Section, South Australia joined Telecom as an Engineer Class 1 in June 1985. Wayne after graduating from the University of Adelaide in 1981, gained employment with Sola Optical Australia, an Adelaide based opthalmic and safety lens manufacturer which has a world wide manufacturing base. His responsibilities involved the design, construction and commissioning of industrial control, and process monitoring systems. He was also safety officer for the South Australian manufacturing plant for approximately two years.

Since he has been employed in the Broadcasting Branch Wayne has been involved in most of the new broadcasting installations in S.A./N.T. over the past couple of years, including the installation of the three 50kW Continental transmitters comprising the Northern Territory High Frequency Inland Broadcasting Service with stations at Katherine, Tennant Creek and Alice Springs. he has found the transition from industrial control technologies to broadcasting technology to be quite dramatic but immensely enjoyable.

Most of Wayne's spare time in recent years has been occupied by his two daughters, and house extensions. When time permits, he enjoys touring and playing squash.

ABU General Assembly

ASIA – PACIFIC BROADCASTING UNION

In October 1987 I was privileged to attend the 24th General Assembly of the Asia-Pacific Broadcasting Union as a member of the ABC delegation. The joint hosts for this meeting were the National Broadcasting Services of Thailand (NBT) and the Television Pool of Thailand (TPT) and the venue was the Royal Orchid Sheraton Hotel, Bangkok.

It was a pleasure to meet and join in discussion again with many old friends from previous Assemblies and also to make quite a few new acquaintances. The Engineering Committee is always very active and consistently offers more than sixty technical documents for presentation and discussion. These are additional of course to the administrative and other considerations pertaining to the activities of the ABU Secretariat, Technical centre and associated groups. This year was no exception and more than ninety papers were presented on a very wide range of topics during the seven continuous days of Working Party and Engineering Committee meetings. Most of these promoted some discussion and many formed the basis of some sixteen Recommendations to the Plenary Assembly.

(Left to Right) H. Esen TRT – Turkey (Chairman), S. Jithavech NBT– Thailand (Vice Chairman), M. Chadwick ABC– Australia (Rapporteur)

For those not involved in late night drafting sessions, executing meetings and the like there was of course some time available to engage in social activities and informal discussions with other delegates. Several formal functions were arranged by the host organisations for our enjoyment which provided an ideal opportunity for delegates to meet the Thai people and learn something of their culture and way of life.

Australia will be the host country for the 25th General Assembly to be held late this year in Sydney. Needless to say I am looking forward to some personal involvement and am hopeful that the Broadcasting Directorate will assume a fairly high profile. Technical papers relating to the installation, operation and maintenance of transmission systems are always well received and I would welcome any contributions of this nature. I have no doubt that arrangements will be made for authors to personally present their documents and join in any relevant discussions. I can assure you that there is great personal satisfaction to be gained from participation in such international forums.

MAX CHADWICK.

Chinese Delegation

VISITORS FROM DESIGN INSTITUTE

During December 1987 the Directorate, in co-operation with the ABC, had the pleasure of hosting a delegation of engineers and architects from the Design Institute of the Ministry of Radio, Film and Television in the Peoples Republic of China who were visiting Australia for the prime purpose of studying the design and construction of tall integrated structures like Black Mountain Tower in Canberra and the Centrepoint complex in Sydney. The delegation which was led by the Vice President of the Design Institute, Qi Yongyi, and included a liaison officer who acted as interpreter, embraced a wide range of architectural and engineering design disciplines.

Upon arrival in Melbourne the visitors were welcomed by the Director, Broadcasting. Mr Qi explained the purpose of their visit and outlined the very large broadcasting development program upon which his Ministry has recently embarked. This will include the construction of several composite concrete towers similar to but generally much larger than our Black Mountain structure.

Travelling by road from Melbourne to Canberra a slight deviation was made to pay a brief visit to the Radio Australia Transmitting Station at Shepparton.

After an overnight stop in Wagga Wagga the party duly arrived at Black Mountain Tower where they were welcomed by the tower manager Mr Peter Dundas-Smith. Peter explained the historical background to the construction of the tower and outlined the major design concepts and facilities incorporated in the structure. A short videotape of the tower construction was of great interest to the delegation and Mr Qi was subsequently presented with a copy.

Chinese delegation with Directorate staff and ABC tour organiser (B. Matson – 1st left standing)

Recognising the depth of information being sought it was necessary from time to time to invoke the assistance of the T.O.I.C., Bill Roy, and other staff from the Canberra Telecom District who had detailed knowledge of the various items of plant.

Not withstanding the language barrier which our interpreter handled with ease, the visitors quickly established a close and friendly relationship with their escorts and everyone they met. My only regret is that there was not enough time available to show them more of the flora and fauna and other beauties of our country, but as Mr Qi was quick to point out, the purpose of visiting Australia was to expand their technical knowledge and it was necessary to keep the mind focused on that objective.

MAX CHADWICK

From the Back Room

The Storeman

Spare parts held at broadcasting stations are critical to the stations' operation. Components required to keep a transmitter on air are usually of a specialised nature, and are not readily available from the local radio or electrical shop. Some parts are extremely bulky and expensive, such as transformers, and may be infrequently or never used, but must be available during the life of the station.

At a typical large station such as Radio Australia Darwin which has a store of components and parts valued at about $700,000 to service high power transmitters of overseas manufacture, the procurement of many components can be regarded as a mini-project.

Because of the lead time for many items, the Storeman must keep at least three months in advance of the need of the operations staff. This can involve a lot of work and planning, checking usage, breakage, replacement costs etc.

The purchasing cycle is activated by the discovery of a need for materials or components. The origin of this discovery may lie in the usage of a component to repair a fault, a part to carry out a modification or to improve reliability, or during a stock check when it is found that certain spares have been reduced to the minimum holding quantity by usage.

Once the need has been recognised, action will be started by either the station OIC or the Storeman following discussion with the OIC.

First responsibility of the Storeman is to determine the likely source of supply. Occasionally only one supplier can be chosen and that firm may be specified on the requisition.

In due course the goods will be delivered to the station, but receipt is not the end of the story. The Storeman must examine the consignment to find out if any damage has occurred in transit. There may also have been some mistake, either in the quantity supplied or in the nature of the goods. Fragile components like transmitting tubes or vacuum capacitors, may need to be tested to ascertain whether any internal damage had occurred during transit from the supplier.

If the received articles are in accordance with the order, the appropriate order copy will be signed and forwarded on to enable payment to be made. The articles will then be placed into store, to await withdrawal for actual use. At the same time the stock records are up-dated to show the addition of the new components into stock holding.

Parts or materials can usually be specified by reference to a manufacturer's catalogue number or part number. This would appear to be a sufficiently rigid description of the goods, but it must be remembered that most suppliers reserve the right to change their designs without notice.

Whatever method of purchasing is used, and whatever the type of goods involved, once they have been accepted by the Storeman, they become an immediate storage problem. The solution could be a very simple matter of placing items on a vacant rack. On the other hand, the item may be a huge EHT transformer with nowhere to put it out of the wet weather. Problems of this kind differ from pure mental worries. They possess a sickening and grotesque physical reality.

Safe custody and security of stock demands that the storage area be locked up outside of hours of attendance by the Storeman. At other times entry to the store is usually restricted to the Shift Leader or other authorised member of the shift. Clerical routines must be designed and implemented to provide accurate feedback of all material withdrawals.

ALAN HOLLAND

Let's Play It Safe

TRANSMISSION LINES/ANTENNAS

Radio Linestaff frequently work in a hazardous environment and the dangers of electromagnetic radiation and contact with energised conductors are ever present. Before any work is done on an antenna, transmission line, or line switching matrix, the radio frequency supply to that particular plant must be disconnected. After the transmitter has been disconnected from the system or closed down, safety procedures require that the system on which work is to be carried out be solidly earthed or short circuited, as appropriate.

A system of keys or tags (or both) should be used to ensure that the external plant cannot be powered while work is in progress. Where motor driven antenna or line switches are used, the system of keys and tags must be so devised as to ensure that no antenna or transmission line can be energised while work is being done on it and also that the switches cannot operate while work is being done on or near the switching equipment itself.

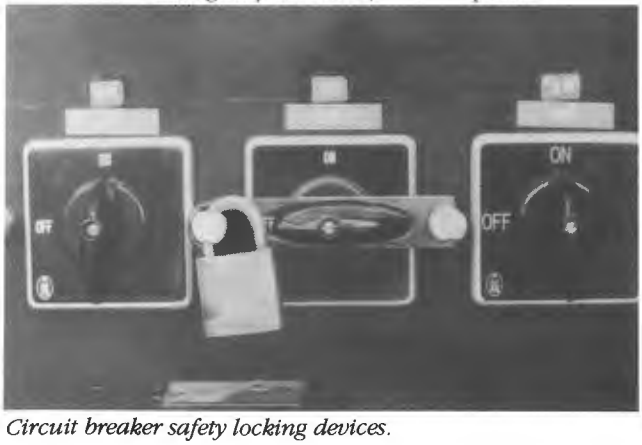
Open wire transmission line.

Where work is to be carried out at a station, the Officer-in-Charge or his delegated officer is responsible for:

- Thoroughly familiarising himself with the work to be done by the Radio Linestaff and understanding the extent and nature of the protection required.
- Arranging and directing the application of necessary protective measures.
- Conveying a clear explanation of the protection provided to the Radio Linestaff carrying out the work.

The Radio Lines Party Leader who is to perform the work is responsible for:

- Making certain that sufficient and adequate protection has been provided, and for conveying to the men working under his control the exact positions of the boundaries of the protection and the plant upon which it is safe to work.
- Establishing a means of communication with the Station OIC or his delegated officer.
- Being at the location of the work when the authority-to-work is cleared.
- Estimating and reporting the expected time of normal clearance and emergency clearance, when requested.



Circuit breaker safety locking devices.

The following practices in force at Radio Australia Shepparton are typical of procedures which must be followed prior to the commencement of work on transmission line/antennas.

Step 1: • Refer to the station 'Radiation Book' to ensure that no excessive radiation level exists in the proposed work location.

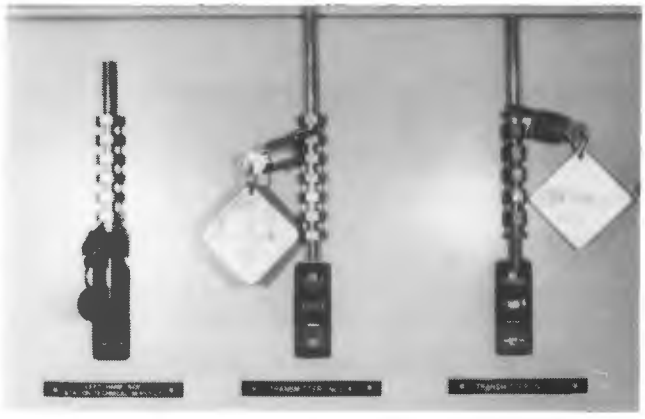
• Refer to the current Operational Schedule (RA100) to ensure that the transmission line/antenna is not scheduled for use.

Step 2: • Liaise with the Shift STO and carry out the following:

– Complete the required information in the transmitter/antenna book and indicate to the STO the time frame that work will be carried out.

– Sign the book and have the STO sign.

– If the proposed work area is between the matrix switch and transmitter building, obtain the key to the transmitter high tension interlock or circuit breaker (A padlock must be placed in position when the circuit breaker is OFF).



Matrix arm isolation switch fitted with cradle and padlock..

Step 3: • Move the matrix switch and carry out the following:

– Check that the respective transmitter/antenna arm is in the 'home' position.

– If all is safe turn the matrix arm power switch to the OFF position and fit the cradle,locking it with a padlock.

– When working near the antenna reversing switches, power must be turned off to prevent their use.

– Proceed to the work location and apply shorting lead and earth.

– Reverse this procedure on completion of work.

SAFETY HINTS

- Regard all transmission lines/antenna as live until steps 1 - 3 have been completed.
- Keys to the transmitter high tension interlock or keys for locks to paddocks, on circuit breaker and the matrix switch must not leave the possession of the holder until all persons are clear of the work area.

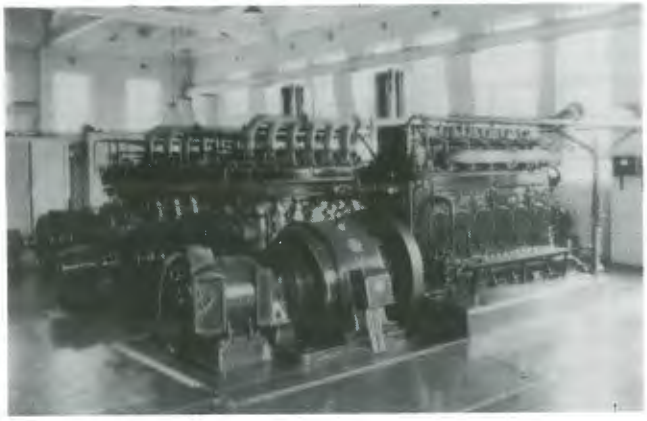
BRIAN MCKENZIE.

Line termination access platforms showing barred access step covers.

Broadcasting Milestones

6WA WAGIN

On 7 December 1986, a 50th birthday celebration was held at 6WA Wagin, and was attended by 130 people from many parts of Western Australia. It proved to be a great day of reminiscing and meeting up with old friends for many of the past employees at the station.



Original 6WA power plant 1936.

The official opening of 6WA, known as the South West Regional Station, was held on Monday, 7 December 1936 in the Wagin Town Hall at 8 p.m. The opening program was advertised as a 'colossal program with the Perth Symphony Orchestra and Ron Moyle's Dance Band'. The opening was attended by one of the largest crowds that the Town Hall had ever housed.

Staff who were at the 50th birthday celebration, and who were part of the original operating group, included Fred Moore who worked on the station from 1935 to 1939 as a Technician, and from 1941 to 1944 as OIC; Reg Johns, a Technician from 1936 to 1940; and Percy Eaton who worked there from 1936 until 1939, and returned from 1944 to 1947 as OIC.

A number of families lived on site in the station's heyday. There were four houses, single men's quarters, and facilities included a tennis court and a cricket pitch. Many local farmers remember the social occasions held there, with tennis being played under lights.

The original transmitter was a water cooled type with power being generated on site. This meant a large number of people being required to operate the facilities. They included Fitters and Turners, Diesel Mechanics, Electricians and Technical staff. In all there were 17 people. Commercial power was connected in 1961.

The 200 m radiator had a good share of publicity during its erection. On 25 August 1936, during a howling gale, part of the structure collapsed, causing a delay in commencement of transmissions from the station. A photographer had taken a photograph of the mast which was swaying in the wind, and shortly after he left the base, the top 100 m crashed to the ground.

The original 10 kW transmitter was replaced by the current STC 50 kW model in 1957, and the station's coverage area now encompasses the larger part of Western Australia's south west corner as far east as Esperance and Coolgardie.

BILL SMALLEGANGE

Bob Howie Broadcasting Operations Manager (left) now retired and Bill Smallgange OIC inspecting the present 6WA transmitter.