

THE HISTORY OF THE FORMER RADIO AUSTRALIA HIGH FREQUENCY TRANSMITTING STATION AT DARWIN, NORTHERN TERRITORY, 1966 TO 2010

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The History of the former Radio Australia High Frequency Broadcasting Station at the Cox Peninsula, (Darwin) Northern Territory, Australia, 1966 to 2010.

This is a research paper, authored by Bob Padula OAM - its scope is to discuss and examine the planning, construction, commissioning, operations, decommissioning and closure of the Australian Government's ¹High Frequency Broadcasting facility at the Cox Peninsula, Northern Territory. Australia, in the years 1966 to 2010.

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Aerial view of the facility in 1969 (Internal Australian Post Office publication)

¹ The [Australian Government](#) Postmaster-General's Department (PMG) was established at [Australia's Federation](#) tasked with responsibility for postal and telegraphic services. It was abolished in December 1975.

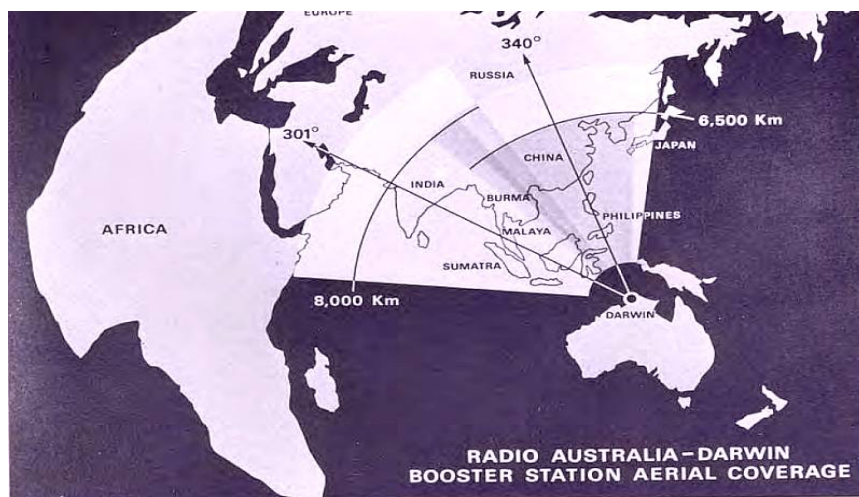


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Click to hear
**RADIO AUSTRALIA'S TUNING SIGNAL AND
OPENING ANNOUNCEMENT - recorded in 1964!**



(Australian Post Office archives)



1. BACKGROUND



1947 - communications facilities at Darwin (From Australian War Memorial archives)

[Radio Australia](#)² Darwin - that modern state-of-the-art international shortwave broadcasting station as it once was, is gone, gone forever! It is no longer on the air, it has been dismantled, and the property has reverted to its original inhabitants, the Belyuen Aborigines.

In the early part of the year 1942, [Darwin](#) was largely destroyed in double bombing raids on the same day, and ultimately, a total of 64 bombing raids were made on the town. The coastal maritime station VID was destroyed in the first raid and the radio service was quickly transferred to the airport radio station on the edge of town.

Darwin was rebuilt after the war, and it was largely destroyed again by [Cyclone Tracy](#) on Christmas Day 1974, and it has again arisen for the third occasion, this time as a beautified modern city.

Likewise, the Radio Australia shortwave station underwent three different and separate eras.

● Click this [link](#) to view a **silent video clip** of the bombing of Darwin in 1942

● Click this [link](#) to watch a **video** of the destruction of Darwin by Cyclone Tracy in 1974

2. CONSTRUCTION

² **Note:** At the time of construction, the station was an Australian Government asset within the Postmaster General's Department (also known as the Australian Post Office)



The new station was a “booster” facility, provided to increase the effectiveness of Radio Australia broadcast transmissions to the area north and north west of Australia. The Peninsula is Australia's closest point to South-East Asia and it lies in the path of transmissions beamed northwards from Shepparton.

At the time, it was the highest powered broadcasting station in Australia and was of world standard in size and power.

At commencement, the estimated total cost of the station was about AU\$1 million, divided almost equally between the radio engineering works and the other engineering works involved in establishing sites, buildings, roads and power-supplies for the station. It was the only station in the world, whose staff went to and from work by launch...across Darwin Harbour.

1967

Work commenced on the station at a location on Cox Peninsula, 12 km across the harbour, or 150 km around the unmade road. Three Collins transmitters rated at 250 kW were installed.

Cox Peninsula was chosen because ample space was available. Actually, 30 square kms were taken over because it was close enough to Darwin to have the use of that city's facilities. For instance, power for the transmitters came from the Darwin powerhouse and was fed at 66,000 volts through two submarine cables.

Two separate stations were installed - a transmitting station on the north-west tip of the peninsula and a receiving station approximately 12 km east of the transmitting station.

1969

In February, the first transmissions commenced, though full usage was not implemented until nearly three years later. Initially, programming was taken off-air on shortwave from Lyndhurst³ and Shepparton⁴ and also from Brisbane⁵, though three program lines became available three years later when the microwave link to Darwin was completed from Mt. Isa in western Queensland. The three program lines from the studios in Melbourne were designated as VLK, VLL and VLM.

1974

In December, the station was rendered inoperable as a result of the Christmas cyclone and that was the end of its first era of operation, after just three years of full time on-air duty. During this interim period, a new, and supposedly temporary, shortwave station was installed into a vacant American NASA building on the edge of Carnarvon⁶ in Western Australia. In the

³ The [Lyndhurst](#) (Victoria) shortwave transmitting station was used from xxxx to xxxx for the ABC's Domestic and Overseas Services.

⁴ The [Shepparton](#) (Victoria) shortwave transmitting station opened in 1943

⁵ The [Brisbane](#) (Queensland) shortwave transmitting station was used from 1943 to 1993 for the ABC's Domestic service and Radio Australia

⁶ The [Carnarvon](#) (Western Australia) shortwave transmitting station was used from 1975 to 1996 for Radio Australia broadcasts.



meantime, consideration was given as to whether the Darwin station should be renovated, or re-erected further inland.

1984

In September, ten years after the station was damaged in the cyclone event, the Radio Australia transmitter facility was re-activated at its original location with a regular schedule, using two transmitters on air and a third on hot standby.

1994

Two new Thomson transmitters were installed; and soon afterwards, the 300 kW Thomson transmitter at Carnarvon, VLK, was taken to Darwin, where it was installed as VLU, but never taken into active service for Radio Australia.

1997

On June 30, the station was again closed, this time due to budget restrictions.

1999

A lengthy series of short test broadcasts were transmitted from Darwin with the use of several different transmitters and antenna systems. These tests were performed to keep the station alive in anticipation of possible coming events.

During this interim period, several other international broadcasting services, such as the BBC London, Deutsche Welle Germany, and the Voice of America and others as well, made overtures to the Australian government requesting the usage of the Darwin station as a relay facility. All of these requests were denied, in the interests of national security.

2000

In June, the station was sold to the religious broadcaster [Christian Voice](#). (Voice International). This was to generate annual savings of about \$1.6 million.

2001

Political tensions and unrest in Indonesia were associated by the Australian Government releasing special funding to hire capacity on a lease-back arrangement from Christian Voice, for coverage into Asia. This allowed extension of daily Radio Australia Indonesian output to 4hrs 30mins, and English for seven hours.

2005

In January, regular Christian Voice broadcasts commenced. Two Continental transmitters formerly in use with [Adventist World Radio](#) as KSDA3 and KSDA4 on the island of Guam were installed at Darwin and taken into regular service. The 300 kW Thomson from Carnarvon was also activated by Christian Voice.

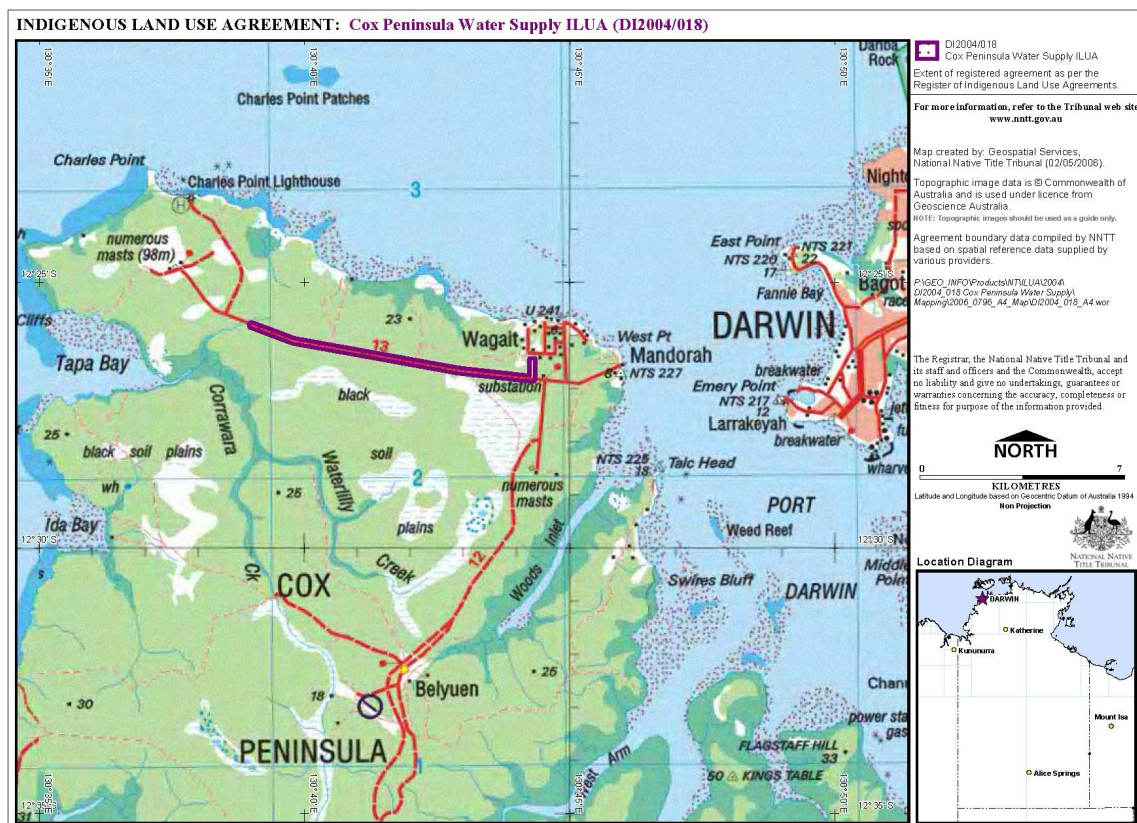


3. CLOSURE



2010

Just before mid-2010, Christian Voice Abandoned the station, which was again closed, quite unceremoniously, and this time dismantled. Some equipment went to Shepparton for subsequent installation for carrying Radio Australia programming, and some went to the new [HCJB](#) station at Kununurra, just across the state line near the northern coast in Western Australia. The building and the property at Cox Peninsula were given back to the Aboriginal Belyuen Community who inhabit the area.



2006 - map showing Indigenous Land Use Agreements, Cox Peninsula

Note: “Numerous Masts” denote the transmitting site at top left, and the receiving station at the centre

APPENDICES



1. RECEIVING STATION



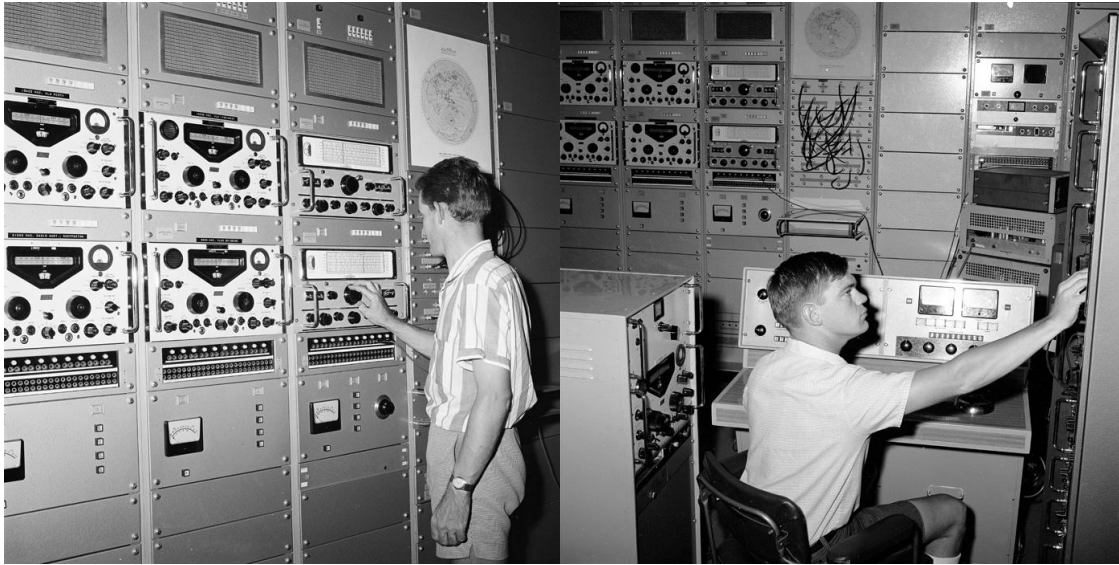
Earth view of site of former receiving station - Lot 8, Cox Peninsula Rd, Mandorah (2014)

This was located 12 km east of the transmitting station and was closed in 1974 when the microwave broadband link was extended to Darwin, thus providing the program feed from the Melbourne studios. It was sited at what is now Lot 8, Cox Peninsula Rd, south of what is now the small town of Mandorah. Road access is possible (now) only during the dry season along present-day Highway 34, but ferry transport is used through the year.



1968 - entrance to the receiving station (Geocaching)





1971 - Racal receivers at the Station (NLA)

There were two receiving antennas, vertically polarised log-periodic types, designed and manufactured by Co-el of Italy for optimum performance on the Darwin-Shepparton path, with high front-to-back ratios to minimise cross-fire from the nearby 250 kW transmitters, as well as from existing high-power transmissions in the area north and north-west of Darwin.

Output was fed to four diversity receivers manufactured by Racal Electronics, UK, monitored and selected by an operator for relay to the transmitting station via a microwave radio link manufactured by Radio Corporation of America. This system looped the programme through Darwin to permit the Australian Broadcasting Commission to monitor and insert program material if necessary.



1971 - antenna infrastructure (NLA)



2. TRANSMITTING STATION



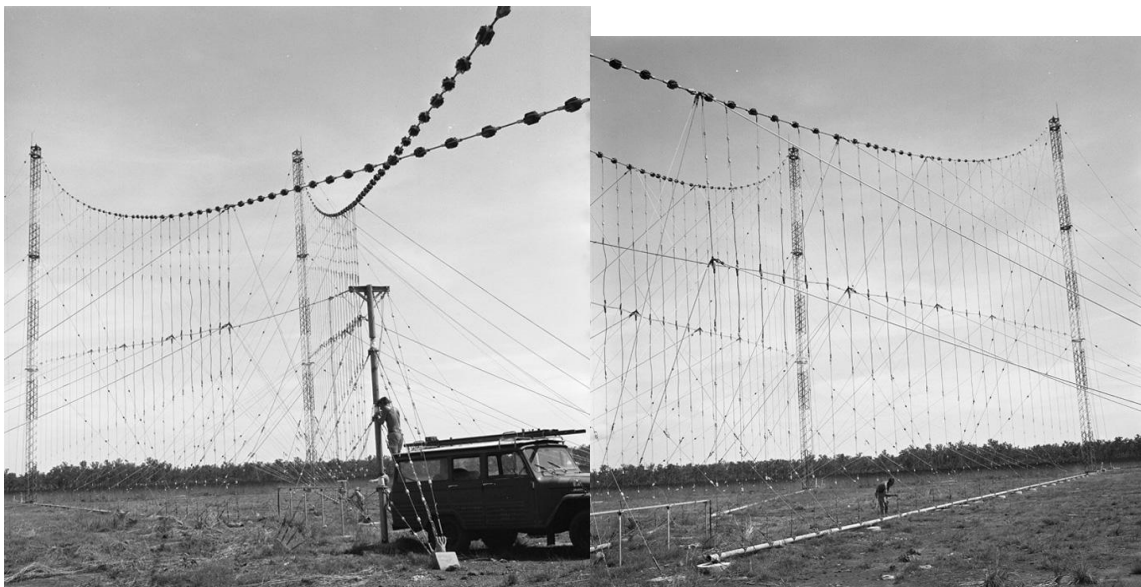
1971 - antenna infrastructure (NLA)

This initially comprised three American-built Collins Model 821A-2 high-frequency transmitters, each capable of delivering a power output of 250 kW. At the time, these transmitters represented the latest advances in broadcasting technology and embodied extensive solid-state circuitry.

3. DIGITAL CONTROL COMPUTER SYSTEM

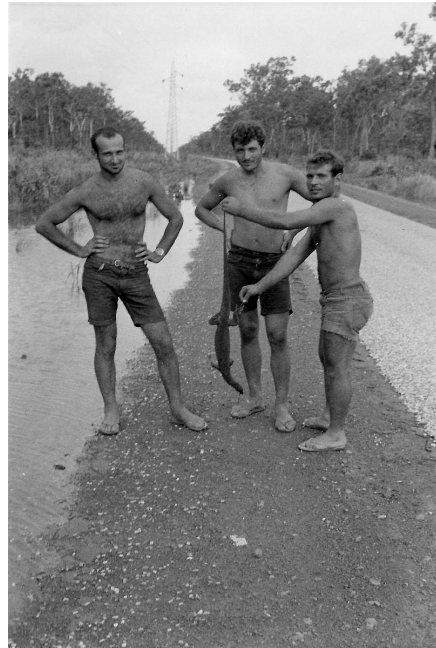
This was used for transmitter control, and for normal on-off frequency changing and tuning requirements on the transmitters.

It carried out all routine testing and logging of transmitter operating conditions at predetermined intervals and permanently recorded this data. In the event of a transmitter fault occurring, the computer control shut down the equipment, and provided an alarm and accomplished diagnostic investigation, under direction, to isolate the fault



1971 - riggers adjusting antenna infrastructure (NLA)





1968 - Members of the Engineering Construction Team (Source : Tullio Zanotti)



1971 - entrance and transmitter building (NLA)



4. DESIGN



1971 - Racal receivers at the transmitting station (NLA)

Power amplifiers and modulator stages of the 250 kW transmitters utilised [vapour-phase-cooled](#) tubes with maximum anode dissipations in the order of 300 kW. The use of vapour-cooled anodes reduced the water flow to only 5 per cent of that required for earlier water-cooled tubes and enabled the high heat energies involved in the 250 kW transmitters to be dissipated in a cooling system of acceptable physical dimensions.

The transmitters were designed to operate with full carrier output, with the modulating signal (usually speech) heavily clipped which raised the average depth of modulation to enhance intelligibility.

Distortion resulting from the clipping process was considered acceptable. For speech with clipping ([trapezoidal modulation](#) to a depth of 95%) was employed, the output of the transmission from a 250 kW transmitter equals that of a 550 kW transmitter operating without trapezoidal modulation.

Racal receivers were installed at the transmitter control room for local monitoring of the output of the transmitters. These were identical to the receivers installed at the receiving station.





1971 - rear of transmitters (NLA)

Program input equipment for the transmitter was fabricated by Post Office staff in South Australia, with the exception of the Swiss Brown Boveri speech clipping and compressing amplifiers which were necessary for the trapezoidal modulation process.

5. TECHNICAL CONSTRAINTS

Serious problems were encountered during the lifetime of the station, caused by coronal discharge issues at the tops of the antenna towers. It was subsequently found that this was seriously influenced by the geographical location of the towers, sited in a high-humidity, tropical environment. This caused destructive corrosion effects on the towers and infrastructure, and a high level of power loss. A stop-gap solution was for output power to be deliberately limited, which effectively compromised the station's service effectiveness.



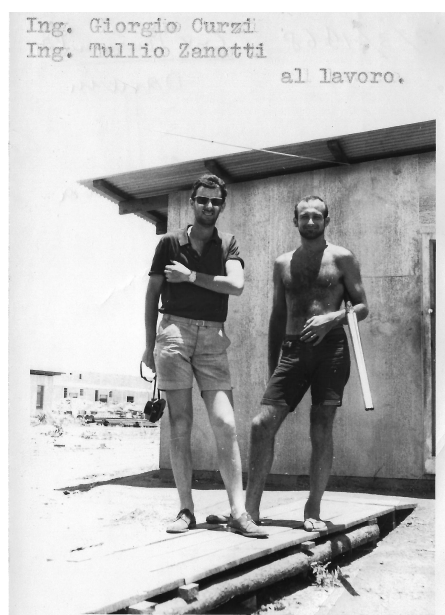
At times, the station was forced to shut down completely, due to lightning and tropical storms. Attempts to mitigate these problems included the installation of Corona rings on the insulators of the antennas, but this was only partially successful. Attempts to operate the station at its design output capacity of 250 kW were disappointing.

Furthermore, it was found that the use of frequencies above about 15 MHz for reaching the nearer areas of Asia was unreliable, due to “ionospheric skip” effects and antenna design limitations at the time.

These constraints and the increasing cost of maintenance were some of the factors in the decision to terminate Radio Australia services from the station in 2000.



1968 - Engineering Construction Team (Source: Tullio Zanotti)



1968 - Tullio Zanotti (at right) (Source: Tullio Zanotti)



6. ANTENNAS



← 1968 - construction works (Source -
Tullio Zanotti)

The three transmitters were linked to five antennas via open-wire transmission lines, allowing up to 500 kW power-handling capability through a Brown Boveri matrix switch which enabled any transmitter to be connected to any antenna. The antennas were two-bay, vertically polarized log periodic arrays erected above a highly-conductive earth

system but with a balanced input impedance to enable direct connection to the balanced transmission line system. *Height was 95 metres.* There were powerful lamps at the tops of the masts These were visible for 41 km.

There were five [log periodic](#) arrays installed to cater for transmissions to the required target areas on the Asian continent. These were designed for 500 kW working to permit parallel operation of two 250 kW transmitters if required for future needs.

The design of the antenna provided for maximum received signal levels in the target areas while also providing a high degree of protection on other bearings, particularly rearwards, to minimise cross-fire into the receiving station antennas. The average gain of 18 dB was available from the transmitting arrays, and the effective radiated power using 250 kW transmitter power was 23 megawatts towards the target areas.

By utilising the log periodic type of antenna array, it was possible to cover all transmissions with only five arrays, through a simple transmission line-switching facility. A 500 kW dissipative line constructed from stainless steel tubing was used as a non-radiating test load. 14 antenna towers were constructed, with much of the physical work taking place during the wet season.

Antenna azimuths were 301 degrees and 340 degrees, northwards to Asia, There was considerable back-lobe radiation to the south, yielding strong signals in southern Australia and the western Pacific throughout the entire transmission span. The station was also heard in Europe, the Middle East, Africa, and the Americas, well beyond its original design specifications.



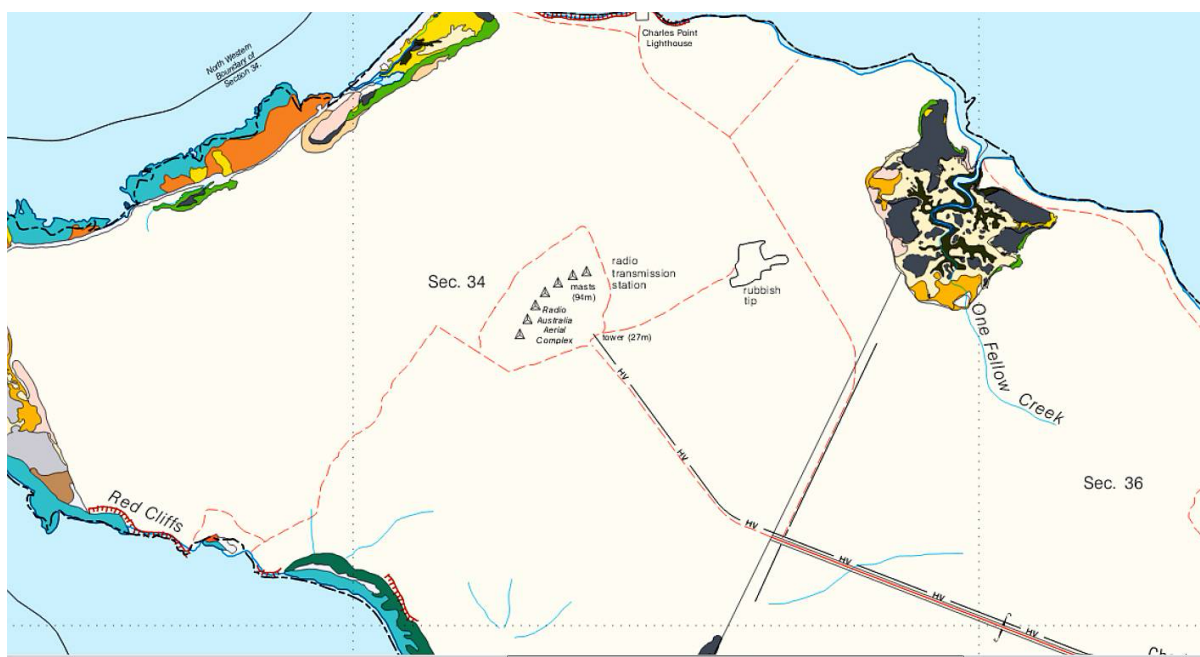


1971 - the PMG Launch, and antenna infrastructure (NLA)

7. TRANSMITTER SITE - 1994

Portion of a cartographic map produced by the Northern Territory Government.

Note - the full map may be downloaded as a PDF file from this [link](#)





1968 - Engineering Construction Team (Source: Tullio Zanotti)

8. OPERATING FREQUENCIES

In January 1970, operating frequencies were:

6055 7180 9595 9650 11840 11960 15130 15355 17715 21485

9. LANGUAGES

In 1970, languages used were: English, Indonesian, French, Chinese, Cantonese, Vietnamese and Thai.

10. TIMES OF OPERATION

In 1970, the station operated continuously from 2100 to 1730 (20 hrs 30 mins daily). There were no transmissions outside of those hours.

In 2009, the last year as a Christian Voice station, operations were from 2200 to 1700 (19 hrs daily, continuously).



AUSTRALIAN WAR MEMORIAL

026983

1942 - Burnt-out Hanger at Darwin airport, destroyed by Japanese bombing (AWM)





1942 - The first radar station aerial (background) installed in Darwin is camouflaged to look like a tree. It was the first in Australia to give warning of approaching Japanese raids. (AWM)

11. ORIGINAL CONTRACT

This summary of the Contract was published in the Melbourne "Argus" on February 14, 1967.

"The Commonwealth Minister for Works, Senator Gorton, said today the transmitter building, to cost \$659,478, would be built by Mazolin, Ninotti and Co Pty Ltd, of Darwin: the receiver building, to cost \$222,627, would be built by another Darwin firm, P. Scaturchio and Sons; and the power house, to cost \$122,681, would be built by a Queensland firm, Steelcon Company".

12. TIMELINE

This is a chronological listing of significant events associated with the facility:

- **1964** - proposal for construction submitted to Federal Government
- **1967** - tenders invited, contracts awarded for construction, and work started
- **1968** - construction completed
- **1969** - facility activated
- **1974** - receiving station decommissioned
- **1974** - Cyclone Tracy destroys most of antenna infrastructure at transmitter and receiver sites - station off-air
- **1980** - proposal for rehabilitation submitted to Government
- **1981** - tenders called and contracts for rebuilding
- **1984** - reconstruction completed - transmissions resumed
- **1994** - three additional transmitters commissioned
- **1997** - regular Radio Australia transmissions ceased
- **1999** - test transmissions made on a limited basis using ABC content
- **2000** - station sold to Christian Vision
- **2001** - Government leases temporary capacity from Christian Vision to extend services into Asia
- **2005** - Regular Christian Vision transmissions commenced - two additional transmitters commissioned
- **2010** - Christian Vision abandons station - infrastructure and equipment dismantled and sold
- **2011** - land and buildings given to local Aboriginal people

ABOUT THE AUTHOR





This Paper is a work by *Bob Padula, OAM, MIE(Aust), CPEng, ARMIT (Comms Engineering)*, of Mont Albert, Victoria, Australia. Bob is a Chartered Professional Communications Engineer, (RMIT University), holding the rank of Life Member, Institution of Engineers (Australia), providing specialized technical consultancy services and authorship in the field of international high frequency broadcasting and radio communications technology.

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