

RENEWING IONOSPHERIC MONITORING IN WESTERN AUSTRALIA

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INTRODUCTION

A new ionosonde was installed in the Perth region of Western Australia in October 2010. This was to replace an ionosonde that had been running for many years at Mundaring, but that was unfortunately vandalised a few years ago. The ionosonde is an IPS 5D ionosonde and has been located at the Perth Observatory on land owned by the Western Australia Department of Conservation. Data from the ionosonde is sent in real-time through the Observatory network to the Australian Space Forecast Centre of IPS Radio and Space Services, now a program within the Australian Bureau of Meteorology. This ionosonde continues a 70+ year history of monitoring the ionosphere in the southwestern corner of the Australian continent.

HISTORY

The earliest ionosonde in Western Australia was established by the US Carnegie Institute of Washington Department of Terrestrial Magnetism (DTM) in 1938 at an existing DTM site first established in 1919. It was located near the remote township of Watheroo, 212 km north-northeast of Perth, and shared the location with other geophysical sensors, primarily magnetometers.

In 1947 the station was taken over by the Bureau of Mineral Resources (BMR), an agency of the Commonwealth government that is now known as Geoscience Australia.

The Watheroo ionosonde was the second ionosonde established in Australia overall. The first was installed at Mount Stromlo near Canberra. This instrument was built in Australia by a Dr Pulley in 1935, and first data from it was generated in 1937.



Ionospheric equipment at the Watheroo Observatory (Kevin Ward)

BMR experienced difficulties in finding and keeping staff for the Watheroo station. The region was isolated, and the living conditions were rather primitive. The ionosonde was thus moved to a site near the Mundaring Weir, on the shore of Lake O'Connor, the first water source for the city of Perth, in the year 1959. An administrative centre, called the Mundaring Geophysical Observatory was located in the township of Mundaring, about 10 km from the site where seismometers and the ionosonde were located. The magnetometers were moved to another site at Gnaragarra on the coastal plain to the west of Mundaring.





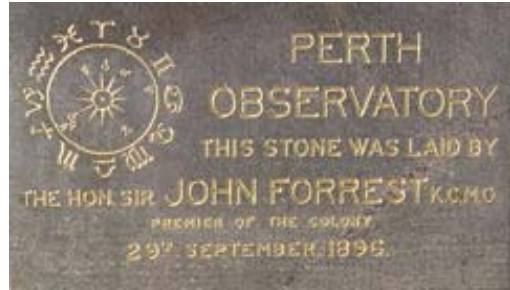
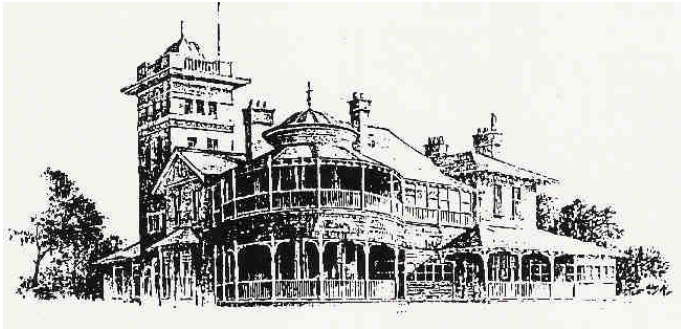
The then Ionospheric Prediction Service (IPS) eventually assumed responsibility for the ionosonde and the data it produced, and data was available from this site up until the end of 2007. The image to the left (taken ~1970) shows the rear of the Mundaring ionosonde building as seen from the top of one of the antenna towers.

Unfortunately, on December 25 in 2007 the ionosonde and related equipment was subject to vandalism which took it off the air. Attempts to repair the damage were subject to continuing vandalism culminating in a savage axe attack on the building and the electronic equipment. Situated in a remote isolated location in a National Park, there was little that could be done, and a decision was made to try and find a more secure location. It is ironic that just three years previously, in January 2005, catastrophic wild-fires were deflected away from the ionosonde site by fire-fighters saving it from certain destruction.

After two years of searching and negotiation, an agreement was reached to site a new ionosonde at the Perth Observatory at Bickley in the Darling Range, about 10km line of sight distance from the old Mundaring Weir location.

THE LOCATION

Perth Observatory is the only remaining state government funded astronomical observatory in Australia. It was originally sited close to the centre of Perth when it was constructed in 1896. However, this site became unusable by the mid 20th Century and it was relocated in 1966. It is now located approximately 25km to the east of the Perth central business district at Bickley in the Darling Range.



The administration building and foundation stone of the original Perth Observatory site.

The new site hosts a modern administration building and several optical telescopes that are used for research and public education. The geographic coordinates are 32.00778°S, 116.13528°E.



Perth Observatory administration building and landscaped grounds.

The aerial image below shows the location of the ionosonde in the Perth Observatory complex.



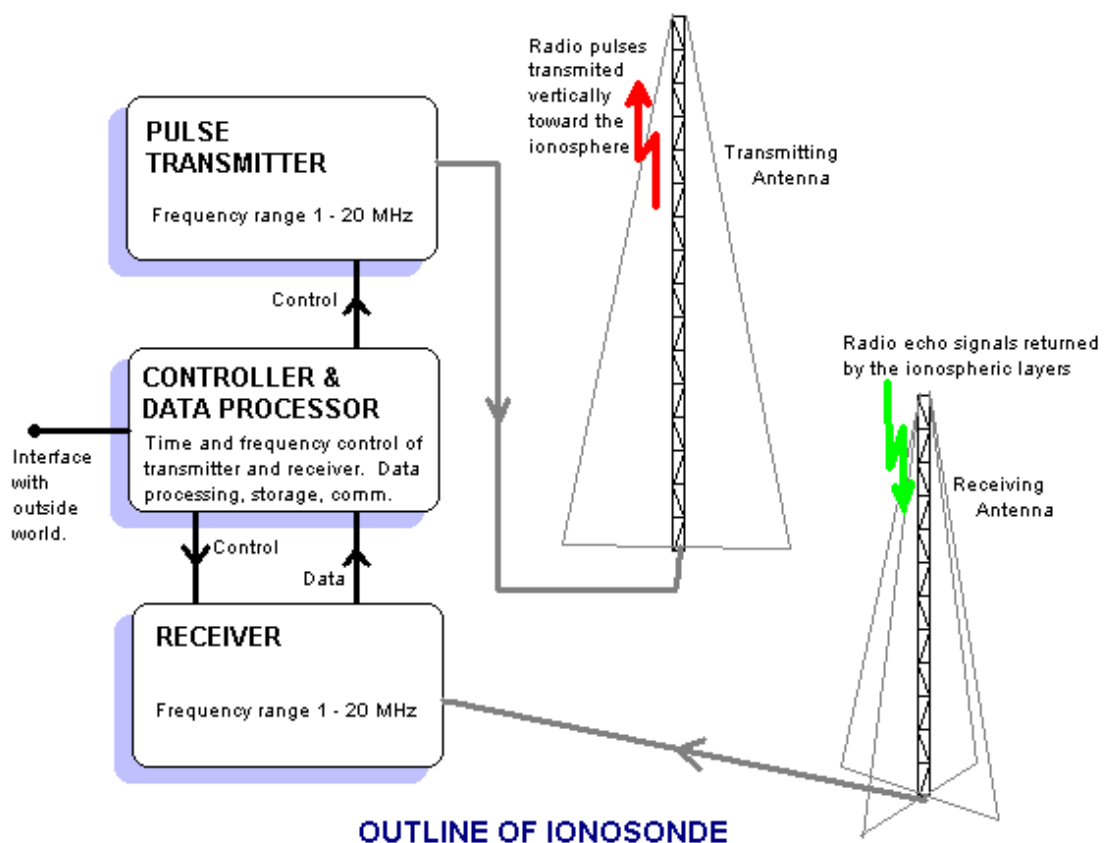
The following map shows the relative location of the old Mundaring weir site to the new Perth Observatory site, the distance between them being around 10 kilometres.



THE IONOSONDE

The ionosonde deployed at the Perth Observatory site is an IPS 5D ionosonde designed by Bruce Paterson at IPS headquarters in Sydney, and constructed by IPS engineering staff. The installation was carried out by Mike Hyde with antenna rigging assistance from John and Steve Webster.

The ionosonde electronics are housed in an air conditioned 10' shipping container. This provides a high level of security and also makes relocation easy if this is ever necessary. The 25m high transmit antenna mast (linear polarisation in the north-south magnetic meridian) is located a few metres to the south of the container, and the 21m high receive antenna mast (dual circular polarisations for O and X trace separation) is located about 50m further south.



Simplified outline of the IPS 5D ionosonde.

The ionosonde consists of totally separate transmitter and receiver modules, each with their own frequency synthesizer. The control machine in a windows based PC, and this feeds data to a Unix-based PC, which communicates with the outside world.

The receive antenna feeds into an O/X separator with two outputs. These feed into two separate receivers, which allows both the ordinary and extraordinary traces to be recovered from each transmitter pulse, and thus reduces the time required for a sounding. Soundings are routinely carried out every five minutes.

The rack contains two identical ionosondes and switchover between units can be accomplished remotely from Sydney in the event of a single unit failure. The image below shows the electronics rack inside the container.

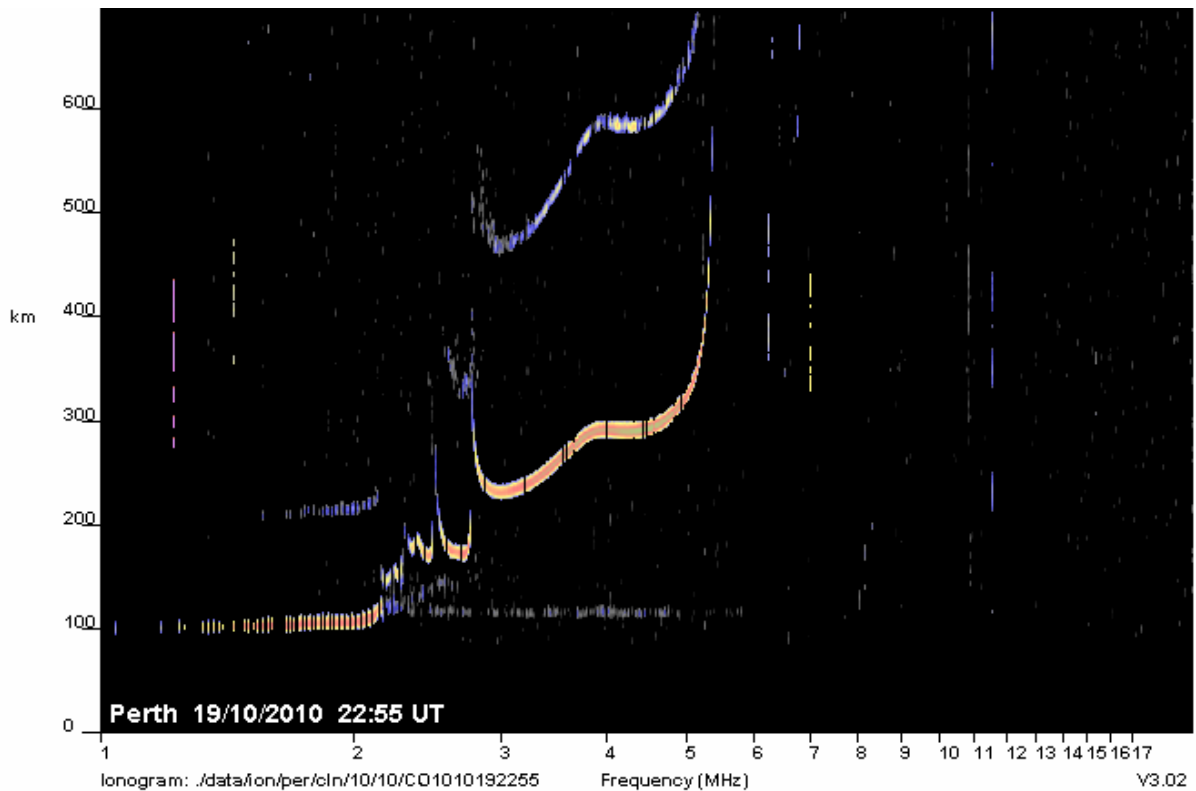


The image at right shows the electronics racks with the complete ionosonde system. The two ionosondes are in the left hand rack, with the communications PC and monitor in the right rack. Above is a close up view of a single 5D ionosonde receiver (top) and transmitter (bottom).



DATA OUTPUT and AVAILABILITY

The Perth ionosonde saw first light on 13 October 2010, and real-time data was available from the IPS Sydney web site on the 14th. The image below shows one of the early ionograms from the station.



All data from this ionosonde are available in near real time from the IPS web site at

<www.ips.gov.au/HF_Systems/1/3>