New Zealand VLBI Station, Warkworth

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Abstract The Warkworth Radio Astronomical Observatory is operated by the Institute for Radio Astronomy and Space Research (IRASR), AUT University, Auckland, New Zealand. Here we review the characteristics of the VLBI station facilities and report on a number of activities and technical developments in 2019/20.

1 General Information

The Warkworth Radio Astronomical Observatory 12-m antenna, shown in Figure 1, is located some 60 km north of the city of Auckland, near the township of Warkworth. Specifications of the Warkworth 12-m and 30-m antennas are provided in Table 1.

The 12-m antenna is equipped with an S/X dual-band dual-circular polarization feed at the secondary focus and an L-band feed at the prime focus. Backend data digitizing is handled by a digital base band converter (DBBC) manufactured by the HAT-Lab, Catania, Italy [2].

The 30-m antenna is currently equipped with an uncooled C-band dual-circular polarization receiver and an uncooled X-band dual-circular polarization receiver. In addition, a 4.8 GHz uncooled dual-circular polarization receiver was built for RadioAstron participation. We also have a separate DBBC for backend data digitizing.

The station frequency standard is a Symmetricom Active Hydrogen Maser MHM-2010 (75001-114).

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Fig. 1 Photo of the Warkworth 12-m during the southern winter of 2020 (image courtesy of Stuart Weston).

Table 1 Specifications of the Warkworth 12-m and 30-m [1] antennas.

	12-m	30-m
Antenna type	Dual-shaped Cassegrain	wheel-and-track, Cassegrain beam-waveguide
Manufacturer	Cobham/Patriot, USA	NEC, Japan
Main dish Diam.	12.1 m	30.48 m
Secondary refl. Diam.	1.8 m	2.715 m
Focal length	4.538 m	10.44 m
Surface accuracy	0.35 mm	1.2 mm
Mount	alt-azimuth	alt-azimuth
Azimuth axis range	$90^\circ \pm 270^\circ$	-179° to $+354^\circ$
Elevation axis range	7.2° to 88°	6.0° to 90.1°
Azimuth axis max speed	5°/s	0.37°/s
Elevation axis max speed	1°/s	0.36°/s

We have now moved to Flexbuffs (Super-Micro servers) running jive5ab [3] for recording and data

storage connected to the DBBC via fiber, which allows parallel real-time streaming and recording of data. The observatory network is directly connected to the national network provided by Research and Education Advanced Network New Zealand Ltd (REANNZ) via a 10-Gbps fiber link to the site [4].

2 Component Description

2.1 The 12-m Antenna: Progress and Issues

We are now having to replace major mechanical components on this antenna due to wear and tear. In mid-2020 the elevation gearbox was replaced, and in 2019 some of the bolts holding the turning head to the azimuth bearing were very badly corroded and had to be replaced. With the recent upgrade of the Australian AuScope antennas to VGOS receivers, the University of Tasmania very kindly passed one of their S-X Tsys/Pcal systems to us. We will look to install this hopefully in the very near future.

2.2 The 30-m Antenna: Progress and Issues

We still have to fully commission a Tsys/Pcal unit sourced from Haystack on this antenna; this is work in progress.

2.3 Warkworth Network

We have installed a CISCO 100 Gbps fiber switch, and all DBBCs and Flexbuffs are now interconnected with fiber at 100 Gbps. When we can upgrade the NREN link provided by REANNZ, we can also use this switch to provide 100 Gbps. In September 2016, the international circuits from New Zealand provided by REANNZ were upgraded to be 100 Gbps and bi-directional to the United States' west coast and to Australia. REANNZ has also acquired bandwidth on the new Hawaiki Cable, which provides redundancy for international circuits via Sydney.

We have used the Flexbuffs with the new 100-Gbps switch to create a small DiFX [5, 6] cluster, upon which we have correlated local twin dish experiments and some VLBI sessions with Australia.

3 Current Status and Activities

We have reduced the number of IVS sessions with the 12-m during the 2019/20 period by about 26% with respect to our previous report (82 in 2015 and 80 in 2016). This reduction was initiated to reduce the wear and tear on the antenna. A breakdown of IVS session types completed over this two year period is presented in Table 2.

Table 2 The 12 m IVS 2019 and 2020 session participation.

	Number of sessions	
Session	2019	2020
AUA	11	8
AOV	10	7
CRDS	5	4
OHIG	4	4
R1	7	7
R4	22	11
Total	59	41

In addition, both antennas are now active for Australian LBA sessions each semester, the choice of antenna being dependent on frequency. With the addition of the X-band feed to the 30-m, we would expect to see the LBA workload shift more to the 30-m antenna in the future. Also, cooperation with various space agencies for spacecraft tracking has continued using the 12-m antenna, with some interest shown in using the 30-m in the future.

References

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