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ATNF Receiver Upgrades Through the Twenties

Alex Dunning, Tasso Tzioumis, Douglas B. Hayman, Mark Bowen, and Stephanie L. Smith*
CSIRO Space and Astronomy, Marsfield, NSW 2122, Australia, e-mail: stephanie.smith@csiro.au

We present the upgrade schedule and objectives for ATNF receivers for the 2020 – 2030 decade. The working life of CSIRO's radio telescopes have been extended by frequent upgrades to the receivers, taking advantage of developments in technology. The overall telescope performance is improved by focusing on increasing the field of view, bandwidth and sensitivity of the receivers with a consequent reduction in the time taken to complete astronomical surveys.

CSIRO operates three radio astronomy observatories throughout Australia, collectively known as the Australia Telescope National Facility (ATNF). The ASKAP radio telescope is an array of 36 prime focus 12 m reflectors located at Inyarrimanha Ilgari Bundara, the Murchison radio-astronomy observatory in Western Australia. Murriyang, the Parkes radio telescope is a 64m prime focus single reflector telescope located near Parkes in New South Wales. The Australia Telescope Compact Array (ATCA) is an array of 6 Cassegrain 22 m reflectors located near Narrabri in New South Wales.

The ASKAP radio telescope is unique due to the room temperature phased array feeds and digital signal processing with 36 simultaneous dual polarized beams available on each antenna. An upgrade to the ASKAP LNAs will begin in July 2024. Initial calculations suggest receiver sensitivity can be doubled by redesigning the current room temperature LNAs. The outer 6 antennas will be upgraded with new LNAs from July 2024 – June 2026, and if the expected performance is achieved a decision will be made on whether to seek additional funding and continue upgrading the LNAs on the remaining 30 antennas.

Murriyang, the Parkes radio telescope, is currently operating with a dual polarized wideband single pixel receiver from 0.7 – 4 GHz. A cryogenic phased array feed operating over the frequency range 0.7 – 1.95 GHz with up to 72 dual polarized beams has been under development over the last five years and is expected to be installed this year. The long-term plan is to develop two more wideband single pixel receivers to cover the frequency range 4 – 32GHz giving continuous frequency coverage from 0.7 – 32 GHz for broadband astronomy and satellite tracking.

The ATCA antennas have five feeds, with noncontinuous frequency coverage from 1.1 – 105 GHz. The Broadband Integrated GPU Correlator for the Australia Telescope (BIGCAT) project is underway using multi-input, high speed Xilinx RFSoC devices for digitization and GPUs for data processing and will result in a system with double the current instantaneous bandwidth from 4 to 8 GHz, improved performance, and greater flexibility. Installation of the BIGCAT system is scheduled for later this year.

This process will bring all our telescopes up to current state of the art and we look forward to new development of science needs and engineering technologies to drive our next decade of upgrades.