

# Hobart, Mt. Pleasant Station and AuScope VLBI Project Report

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## Abstract

This is a brief report on the activities carried out at the Mt. Pleasant Radio Astronomy Observatory at Hobart, Tasmania. During 2009, the Observatory participated in 58 IVS VLBI observing sessions of 24 hours each. Construction of the Hobart 12 m antenna for the AuScope VLBI array was completed, and the year ended with a successful fringe-check between it and the 26 m antenna. Construction of the Katherine antenna was also completed, and work began on the third antenna at Yarragadee.

## 1. Introduction

The Mt. Pleasant Observatory is located about 15 km north east of Hobart at longitude 147.5 degrees East and latitude 43 degrees South. Hobart is the capital city of Tasmania, the island state of Australia located to the south of the mainland. The station is operated by the School of Mathematics and Physics at the University of Tasmania. The station has a co-located GPS receiver and a site which is used for absolute gravity measurements.

## 2. Brief Description of Hobart 26 m VLBI Facilities

The antenna is a 26 m prime focus instrument with an X-Y mount. The focus cabin has a feed translator with provision for four different receiver packages, which enables rapid changeover between geodetic and astronomical requirements. Standard receiver packages provide for operation at L band, S, C, X and K bands. There is also a dual frequency cryogenic S/X geodetic receiver. All of these receivers are cryogenically cooled. The antenna has a maximum slew rate of 40 degrees per minute about each axis. The station is equipped with a Mark IV electronics rack and a Mark 5 VLBI recording system. There is another disk based recording system used by other Australian VLBI antennas.

## 3. Staff

Staff at the observatory consist of academics, Prof. John Dickey (director), Dr. Simon Ellingsen and Prof. Peter McCulloch, who has a large input into the receiver design and implementation. Dr. Jim Lovell is Project Manager for the AuScope VLBI project. Dr. Jamie McCallum is a post-doctoral fellow and has had input into the development and implementation of AuScope-related hardware at the observatory. Mr. Tim Hoban is employed as a computer programmer for the AuScope project. Mr. Brett Reid is the Observatory Manager whose position is funded by the university. In addition we have two electronics technical officers, Mr. Eric Baynes and Mr. Brenton Jones. For operation of the observatory during geodetic observations we rely heavily on support from astronomy PhD. and post-graduate students.

#### 4. Geodetic VLBI Observations

The Hobart 26 m antenna participated in 58 geodetic VLBI experiments during 2009. These were divided between the APSG (2), CRF (4), IYA09 (1), OHIG (5), R1 (32), R4 (11), R&D-2 (1), RDV (1) and T2 (1) programs. The 26 m also participated in five astrometry/geodesy-related observations with other IVS stations and the Australian Long Baseline Array: TANAMILBA (4) and LBA-V271CR (1). All experiments were recorded using Mark 5A.

#### 5. The AuScope VLBI Project

AuScope is part of the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS). It encompasses NCRIS Capability 5.13: "Structure and Evolution of the Australian Continent". An important part of this is the acquisition of three new radio telescopes and a data processing facility for geodesy. AuScope aims to provide a fundamental reference frame in Australia to 1 mm accuracy based on the locations of three radio telescopes as established by VLBI observations. Each site will also host a permanent GPS receiver to tie the telescope reference frame to a denser GPS frame of  $\sim 100$  antennas across the continent. The construction and operation of the array is being managed by the University of Tasmania with data correlation supported by Curtin University of Technology.

Three 12 m diameter antennas are being supplied by Patriot Products division of Cobham Satcom. The antennas have surface accuracies of 0.3 mm RMS and slew rates of 5 deg/s in azimuth and 1.25 deg/s in elevation. During 2009, the first antenna was built and commissioned at Mt. Pleasant, the second was built at Katherine (Northern Territory), and work on the third at Yarragadee (Western Australia) commenced. Once commissioned, the AuScope VLBI array will replace the Hobart 26 m antenna as the University of Tasmania's contribution to IVS. The AuScope VLBI array will eventually participate in geodetic observations for 180 days per year. Each site will be equipped with room temperature S/X receiver systems, Vremya-ch Hydrogen maser standards, HAT-Lab DBBC samplers and Conduant Mark 5B+ recorders. 2009 ended with the first successful fringe detection between the Hobart 12 m and 26 m antennas on December 23.

This five year project, for which funding started in 2007, will vastly improve the capabilities of the IVS in the southern hemisphere. The construction and operation of the array is being managed for AuScope by the University of Tasmania.



Figure 1. The three AuScope VLBI sites as of 24 December 2009 (photos by Jim Lovell, Brett Reid and Vince Noyes).