

# 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 and for the AuScope VLBI Project. During 2010, the Hobart 26-m antenna continued to make a significant contribution to IVS through participation in 70 observing sessions. The new Hobart 12-m AuScope antenna was officially opened in February and commenced operations later in the year, with 16 IVS observations. Construction of the AuScope Katherine and Yarragadee antennas was completed and fringes successfully obtained between Katherine and Hobart.

## 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 change over between geodetic and astronomical requirements. Standard receiver packages provide for operation at L band, S, C, X, and K bands. There is also the 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 5A 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 70 geodetic VLBI experiments during 2010. These were divided between the APSG (1), CRF (1), OHIG (2), R1 (38), R4 (21), RDV (2), and T2 (2), programs plus four additional TQAK observations of 3-h duration each to examine post-seismic movement at TIGO following the Chilean megaquake. All experiments were recorded using Mark 5A. During 2011 the new Hobart 12-m antenna will take up the majority of the geodetic observing with the 26-m participating in one observation per month to ensure continuity of the Hobart timeseries.



Figure 1. The three AuScope VLBI sites as of December 2010 (photos by Jim Lovell and Vince Noyes).

#### 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 have been 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. Each antenna is being equipped with room temperature dual-polarization S/X receiver systems (SEFD is 3500 Jy in all bands), Vremya-ch Hydrogen maser standards, HAT-Lab DBBC samplers, and Conduant Mark 5B+ recorders. Construction of all three antennas at Hobart, Katherine (Northern Territory), and Yarragadee (Western Australia) has been completed. The Hobart 12-m antenna was officially opened on February 9, during the

Sixth IVS General Meeting, hosted by the University of Tasmania. The Hobart 12-m commenced IVS observations later in the year and participated in 16 sessions: APSG (2), CRF (1), R1 (7), and R4 (6). Installation of receiver, recording, and control equipment was completed at Katherine and first fringes detected to Hobart in December. Final installation work is scheduled for Katherine in early 2011, to be followed by Yarragadee, and both sites are expected to commence IVS observing in the first half of 2011.