

# Algonquin Radio Observatory

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## Abstract

The Algonquin Radio Observatory (ARO) is situated in Algonquin provincial park, about 250 km north of Ottawa and is operated by the Geodetic Survey Division (GSD) of Natural Resources Canada in partnership with the Space Geodynamics Laboratory, CRESTech.

The antenna is involved in a large number of international geodetic VLBI sessions each year and is a key site in the ongoing Canadian S2 developments. The ARO is the most sensitive IVS Network Station.

This report summarizes recent activities at the Algonquin Radio Observatory.



Figure 1. Algonquin Radio Observatory 46m Antenna

## 1. Overview

The ARO 46 m antenna was used in the first successful VLBI experiment in 1967 and was involved as early as 1968 in geodesy, when the baseline length between the ARO and a telescope in Prince Albert, Saskatchewan was measured to be 2143 km ( $\sigma=20\text{m}$ ).

The GSD also maintains a permanent GPS monitoring station at Algonquin which is used by all IGS Analysis Centers as a fiducial reference. Satellite laser ranging and absolute gravity observations are also available for the site which is located on the stable pre-cambrian Canadian Shield. Local site stability has been monitored regularly using a high-precision network.

## 2. Site Improvements

In order to improve the operational performance of Algonquin, GSD undertook a major upgrade of the antenna control system which was completed in 1997.

This antenna control system still uses the original azimuth and elevation encoders to determine antenna position. We have made some progress in the effort to upgrade these and efforts continue in a manner that will not affect scheduled operations.



Figure 2. Visiting neighbour

## 3. General Specifications

- Latitude : N 45° 57' 19.812"
- Longitude : E 281° 55' 37.055"
- Elevation : 260.42m
- Reflector : 46m diameter with first 36.6m made of 0.634cm steel plates surrounded by 4.6m of steel mesh.
- Foci : S and X band at prime focus. Gregorian capability with 3m elliptical subreflector.
- Focal length : 18.3m (prime focus)
- Focal ratio :  $f/D = 0.4$  for full surface and 0.5 for solid surface.

- Surface accuracy : 0.32cm for solid portion and 0.64 for mesh.
- Beamwidth : 3.0 arcmin at 3cm wavelength (10Ghz)
- Azimuth speed : 24 degrees per minutes.
- Elevation speed : 5 degrees per minutes.
- Receiver : S and X cryogenic receiver.
- VLBI equipment : VLBA4 with thin tape drive. S2 DAS and RT.
- PCFS version : 9.5.3
- Time standard : NR Maser
- GPS receiver : BenchMark
- Timing receiver : CNS clock

#### 4. Antenna Survey

The antenna is surrounded by a high stability network made of thirteen concrete piers. This network has been precisely measured five times to obtain the geodetic tie between the VLBI, the GPS, and the SLR reference points with a precision of a few mm. The VLBI antenna itself requires a special indirect survey since the reference point cannot be accessed directly.

#### 5. Algonquin Operations

Algonquin Radio Observatory is involved in several international VLBI networks. Geodetic VLBI activities are summarized below.

ARO participated in the VLBI observation of Nozomi for precise orbit determination in collaboration with the Institute of Space and Astronomical Science (ISAS), Communication Research Laboratory (CRL) Japan, the Canadian Space Agency (CSA) and SGL, CRESTech.

ARO has participated in testing of bi-static radar observations of satellites in collaboration with SGL.

##### 5.1. Sessions Performed January 1, 2003 - December 31, 2003

Session Type	Number of Sessions
R4	50
E3	10
R&D	10
T2	2
Total	72