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 of Natural Resources Canada in partnership with the Space Geodynamics Laboratory, CRESTech.

The antenna is involved in a large number of international geodetic VLBI experiments 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. Snowy Algonquin Radio Observatory 46 m 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 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. Antenna 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.

The ARO is currently using an Mk3 VLBI system (on long-term loan from NASA). We recently installed a VLBA4 system (on loan from USNO) and plan operations once a frequency upconverter is installed. ARO is equipped with an S2 data acquisition system and recording terminal and has played a crucial role in testing and development of the geodetic S2 system.

Development of an L-band receiver for bi-static radar applications continues. This receiver may be useful for reception of GPS signals.

Figure 2. A bird in Steve Farley's hand at the Algonquin Observatory.

3. General Specifications

- Latitude : N 45 57 19.812
- Longitude : E281 55 37.055
- Elevation : 260.42 m
- Reflector : 46 m diameter with first 36.6 m made of 0.634 cm steel plates surrounded by 4.6 m of steel mesh.
- Foci : S and X band at prime focus. Gregorian capability with 3 m elliptical subreflector.
- Focal length : 18.3 m (prime focus)
- Focal ratio : f/D = 0.4 for full surface and 0.5 for solid surface.
- Surface accuracy : 0.32 cm for solid portion and 0.64 for mesh.
- Beamwidth : 3.0 arcmin at 3 cm wavelength (10Ghz)
- Azimuth speed : 24 degrees per minutes.
- Elevation speed : 10 degrees per minutes.

- Receiver : S and X cryogenic receiver.
- VLBI equipment : MkIII with thick tape drive. Upgrade to VLBA4 underway.

  S2 data acquisition and recording terminal.
- PCFS version : 9.5.3
- Time standard : NR Maser
- GPS receiver : AOA Benchmark

4. Antenna Survey

The antenna is surrounded by a high stability network made of 13 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.

We have recently re-measured the network. In addition to tying GPS and SLR to VLBI, we will attempt to study antenna deformation as a function of elevation angle.

5. Algonquin Operations

Algonquin Radio Observatory is involved in several international VLBI networks. We summarize below the geodetic VLBI activities in the reporting period.

ARO has participated in international astronomical observations as part of the "Polar Bear Network" and has participated in international asteroid tracking experiments. Software extensions to the PCFS have been developed to enable (GPS and other) satellite tracking.

In 2002, ARO is scheduled in 52 IVS R4 experiments, monthly IVS E3 experiments, and in 10 R&D experiments. We anticipate that it will also participate in 5-10 CGLBI (Canadian Geodetic Long Baseline Interferometry) S2-based experiments.

5.1. Experiments Performed January 1, 2001- December 31, 2001

Experiment Type	Number of Experiments
CGLBI	14
NEOS-A	51
CORE-B	4
CORE-C	7
CONTM	2
Total	78