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. 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 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 are in the process of upgrading them in a way that should not affect scheduled operations.

The antenna field system was modified to allow satellite tracking.

The ARO is currently using a Mk3 VLBI system (on long-term loan from NASA) and we expect to upgrade to Mk4 early in 2001. 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.

We are developing an L-band receiver for bi-static radar applications. This receiver may be useful for reception of GPS signals.

Figure 2. Fox at the Algonquin staff house

3. General specifications

- Latitude : N 45 57 19.812
- Longitude : E 281 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. To be upgraded to MkIV in 2001.

  S2 data acquisition and recording terminal.
- PCFS version : 9.4.13
- Time standard : NR Maser
- GPS receiver : Rogue

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.

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.

Figure 3. Rapelling off the Algonquin 46 m Antenna

5. Algonquin Operations

A new GSD staff member, Anthony Searle, has joined the VLBI group at GSD and has been assisting with experiment operations.

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

A number of additional experiments have taken place in recent years at ARO. In September 1999 ARO was used to transmit high energy pulses to assist in the characterization of sensors on board satellites. ARO also participates in international astronomical observations as part of the "Polar Bear Network".

In 2001, the ARO is scheduled in weekly NEOS experiments plus 12 CORE experiments. We anticipate that it will also participate in 10-20 CGLBI (Canadian Geodetic Long Baseline Interferometry) S2-based experiments.

Experiments Performed March 1, 1999-December 31, 2000

Experiment Type	March-December 1999	January-December 2000
NEOS-A	10	31
CORE-A	21	6
CGLBI	6	17
CORE-B	6	3
CORE-1	0	6
NAVEX	2	0
CRF	1	1