Canadian VLBI Technology Development Center

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Abstract

The Canadian Technology Development Center has developed an "end-to-end" geodetic VLBI system built on S2 equipment. The development of this system has led to an operational IVS network. Development work continues to streamline operations and improve S2 instrumentation.

1. Introduction

The Canadian VLBI Technology Development Center is a collaborative effort of the Space Geodynamics Laboratory (SGL), the Geodetic Survey Division of Natural Resources Canada (GSD/NRCan) and the Dominion Radio Astrophysical Observatory (DRAO) of the Herzberg Institute for Astrophysics of the National Research Council of Canada, (DRAO/HIA/NRC).

2. S2 VLBI Geodesy

The S2 VLBI observation program continued in 2003 as the operational "E3" IVS observing network. The "E3" Network consists of Algonquin, Yellowknife, the Canadian Transportable VLBI Antenna (CTVA), Kokee observatory, and the Transportable Integrated Geodetic Observatory (TIGO) located in Concepcion Chile. Yellowknife and Kokee were not scheduled to observe in all twelve sessions, but split the year to ensure a four–station network for all sessions. The small network size limited the contribution to EOP determination.

3. S2 VLBI Data Acquisition System (S2-DAS)

The S2 VLBI data acquisition system is being jointly developed by SGL and GSD. The S2-DAS is designed to accommodate up to four VLBA/Mark IV-type single sideband baseband converters (BBCs), each with a local oscillator (LO) independently frequency switchable under computer control. The objective of the development of the S2-DAS is to enable high sensitivity group delay measurements without appealing to a more costly parallel IF/baseband sub-system.

A sixth network DAS has been prepared for use at the Svetloe antenna, and is expected to be in place in the spring of 2004.

The DAS Operating System (DASOS) has seen extensive development in the past few years. Further software development continues to improve robustness and efficiency. New algorithms for automatic gain control and status monitoring are currently being tested and will be included in the next official release. Due to reduced personnel at SGL, hardware support for the S2–DAS was moved to the laboratories at GSD.

4. S2 VLBI Correlator

The Canadian Correlator is a six station correlator (expandable to ten stations) using S2 playback terminals and is designed to handle S2 frequency switched bandwidth synthesis data.

Recent activity has focussed on the development of visualization and statistical analysis software to enhance system performance monitoring.

Maintenance of the playback terminals was completed in early 2003. A large backlog of VSOP observations was given priority as the HALCA mission came to an end. Correlator staff was cut to one person as a result of the end of HALCA operations. It is expected that the S2 correlator will apply to become an IVS Correlator in 2004.

5. Canadian Transportable VLBI Antenna (CTVA)

The CTVA is a 3.6m radio telescope acquired to facilitate densification of the terrestrial reference frame in remote regions. The antenna will be collocated with GPS elements of the Canadian Active Control System (CACS) to provide fiducial station positions. The GSD is responsible for CTVA system development.

Figure 1. CTVA positioned in St. John's, Newfoundland.

The CTVA spent all of 2003 in St. John's, Newfoundland. During the spring of 2003, the Kvarz CH1-75 maser received a new crystal oscillator, as a short term replacement the CTVA was able to produce results using a passive maser. CTVA uses a group of local university and college students for all observing operations.

As an operational antenna in an IVS network, the CTVA will apply to become an IVS Network Station in 2004.

6. S2 Geodetic Experiment Scheduling, Operations and Analysis

Due to the small size of the E3 network contributions to EOP determination were limited. Results of the few 5–station E3 sessions were presented at the April 2003, IVS Analysis workshop

in Paris. With the larger network, E3 results were shown to be comparable to the R4 network. This work included simulations that indicated a 5–station S2 network that included Svetloe could produce EOP uncertainties that are at the level of the IVS R4 network. These results have lead to the inclusion of Svetloe in the E3 Network in 2004.

The analysis component of the Canadian Technology Development Center will apply to become an IVS Analysis Center in 2004.