IVS Technology Coordinator Report

Alan Whitney

Abstract

In 2008 the Technology Coordinator was active in the following areas: 1) support of work to implement a new geodetic VLBI system as outlined in the IVS Working Group 3 "VLBI2010" study, 2) continued development and deployment of e-VLBI, 3) organization of the 7th Annual e-VLBI Workshop held at Shanghai Observatory in Shanghai, China, and 4) development of the VLBI Data Interchange Format (VDIF) specification. We will briefly describe each of these activities.

1. VLBI2010 Progress

Progress continues towards the goal of a next-generation geodetic VLBI system. Some of the highlights are described in the following.

1.1. Development of the VLBI2010 Broadband System

A collaboration of Haystack Observatory, NASA/GSFC, and HTSI has implemented the first demonstration broadband systems on the 18 m antenna at Westford, MA, and on the 5 m MV-3 antenna at NASA/GSFC. Significant progress was made in 2008.

In the past year

- phase cal was added;
- a new digital phase cal was designed and tested and is ready for installation;
- RF filters were installed in the Dewar to reduce the effect of interference below 3.1 GHz;
- DBEs were improved;
- the complete broadband system was installed at both sites;
- fringes were obtained from 3.4 to 9 GHz.

Some problems remain.

- MV-3 has low efficiency due at least partly to an incorrectly shaped sub-reflector.
- The focus setting needs to be optimized at Westford.

For more details see the Haystack Technology Development Center report in this volume.

1.2. VLBI2010 Studies

A progress report on the status of VLBI2010 development has been completed [1]. In it are included the recommendations for antenna specifications and the results of the simulations that have led to these recommendations.

1.3. DBE2/Mark 5C

A next generation of digital back end (DBE2) and recorder (Mark 5C) are under development at Haystack Observatory [2]. Two important features of this system are a) the ability to record at 4096 Mbps and b) communication via 10 Gbps Ethernet.

In the past year the DBE2 board was completed and received at Haystack Observatory. The board was powered up, and initial communication was achieved. Much of the digital signal processing firmware has been simulated, and programming of the Power PC is about to begin.

The Mark 5C is derived from a Mark 5B+ by the addition of a daughter board containing the 10 GigE interface and the deletion of the I/O board. The daughter board has recently been completed and tested, thus enabling testing of communication between the DBE2 and the Mark 5C.

2. e-VLBI Development

2.1. Continued Expansion and Development of Routine e-VLBI Data Transfers

All data recorded on the Japanese K5 systems are now e-transferred from Tsukuba or Kashima to either MPI or Haystack, depending on the target correlator. K5 modules from the Antarctic site of Syowa and the sites of the smaller Japanese antennas are shipped to Tsukuba, transferred over the network to Haystack, converted from K5 to Mark 5 format in the transfer process, and written on Mark 5 modules. UT1 Intensive data from Wettzell, Japan, and Ny-Ålesund are transferred to either MPI or to a site near the Washington correlator (where the last couple of km is currently via sneakernet!), depending on the target correlator for the data.

Welcome news! The station at Fortaleza, Brazil, is now connected, and tests are on-going. The Mark IV correlator at USNO in Washington, D.C., will be connected to high-speed fiber ($\sim$600 Mbps) sometime early 2009. In addition, we expect that the Kokee station will also be connected to high-speed network sometime early in 2009, initially at $\sim$100 Mbps. These connections should help to significantly reduce the latency for the time-critical processing of UT1 data from days to hours.

2.2. 7th International e-VLBI Workshop Held at Shanghai, China

The 7th International e-VLBI Workshop was held 16-17 June 2008 in Shanghai, China, hosted by the Shanghai Astronomical Observatory. The workshop was attended by 87 participants from 11 countries.

Presentations at the workshop showed continuing progress in e-VLBI on several fronts. In Europe the JIVE EXPReS project continues to connect European astronomical VLBI telescopes in real-time and conducts regular scientific e-VLBI experiments with up to six stations at data rates nearing 1 Gbps/station. Australia continues to make rapid progress in connecting its telescopes and has also developed a software correlator system to support real-time observations.

At the end of each day a panel discussion was held following the presentation sessions. The panel discussion on the first day was on e-VLBI funding and organization. On the second day, a lively discussion took place about data formats, transfer protocols, and related issues, which led to the formation of a task force to study these issues (see below).

The workshop also featured two e-VLBI demonstrations, the first involving the Chinese VLBI Network (e-CVN) using four telescopes (Sheshan, Urumqi, Beijing, and Kunming) demonstrating the near-real-time mode used to track the Chang'E spacecraft during its flight to the moon in October 2007. The second demonstration collected and correlated (via software correlator) data from a variety of telescopes in China, Japan, and Australia, using global high-speed networks over a 12-hour period at data rates of 256 Mbps and 512 Mbps.

All presentations from the Shanghai workshop are available at:

http://www.shao.ac.cn/eVLBI2008/presentation/.

The 8th International e-VLBI Workshop, titled "Science and Technology of Long Baseline Real-time Interferometry", will be held 22-26 June 2009 in Madrid, Spain, sponsored by CNIG-IGN of Spain and the EXPReS project. We all look forward to another valuable and stimulating meeting.

3. VLBI Data Interchange Format (VDIF) Task Force

One important outcome of the 7th International e-VLBI Workshop was the creation of a task force to study and recommend a universal VLBI data format that is suitable for both on-the-wire e-VLBI data transfer, as well as direct disk storage. This task force, called the VLBI Data Interchange Format (VDIF) Task Force, is envisioned as the first of a two-part effort, the second of which will address standardization of e-VLBI data transmission protocols. The formation of the VDIF Task Force was prompted particularly by the increased e-VLBI activity and the difficulties encountered when data arrive in different formats from various instruments and various parts of the world. Appointed to the VDIF Task Force were Mark Kettenis (JIVE), Chris Phillips (ATNF), Mamoru Sekido (NICT), and Alan Whitney (MIT Haystack, chair). The VDIF group has been very active; a final report to the VLBI community is expected in early 2009.

References

[1] Petrachenko, W.T., et al., Design Aspects of the VLBI2010 System, Progress Report of the IVS VLBI 2010 Committee, this volume, 2009.

[2] Whitney, A., A. Niell, Haystack Technology Development Center Report, In: International VLBI Service for Geodesy and Astrometry 2007 Annual Report, NASA/TP-2008-214162, D. Behrend and K. D. Baver (eds.), 253-256, 2008.