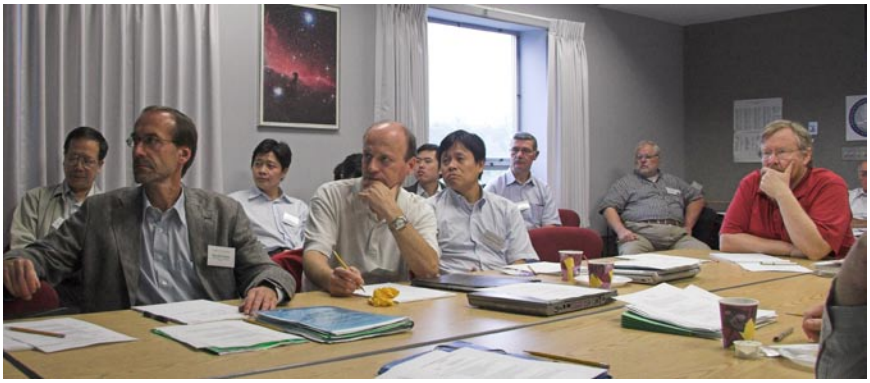
IVS Newsletter

Issue 16, December 2006

Face to Face with the Future: A Perspective on the First VLBI2010 Workshop

– Jonathan Quick, Hartebeesthoek Radio Astronomy Oberservatory

Most IVS members are fully aware that the VLBI technique currently relies on ageing (if not very old) radio telescopes scattered haphazardly across the globe. Clearly the question of how to improve the technique requires us to define how we propose to replace those telescopes and where to put those replacements. This is the goal of the VLBI2010 Committee (V2C) who met together face-to-face for the First VLBI2010 Workshop in September 2006 at Haystack Observatory in Massachusetts. The workshop was not limited to the V2C members only, but was open to everybody and attracted some 30 participants altogether.



Participants at the First VLBI2010 Workshop during a session.

As an interested observer, who happened to be at Haystack at the time of the meeting, I give an overview of the points that interested me and hopefully are of interest to the larger IVS community as well.

Probably by now you have heard talk of smaller dishes, indeed a lot smaller, which all seems a mite counter-intuitive as we all strive to make our big dishes perform as well as possible. So, how did that decision come about? Well, it turns out that, although sensitivity is a factor in geodesy, the technique suffers most from a paucity of data: too few observables in any given amount of time. Thus, if you could make these small dishes perform even close to the current large ones, then the ability of the small dishes to slew around from source to source in a fraction of the time really adds value—did you listen to your favorite dish creak its way across from one horizon to another lately. Simulations presented at the meeting, involving schedules of some 29,000 source observations in 24 hours, showed clearly that the ability to model everything much better should yield the required aim of ≤1 mm accuracy.

So, how do you get those small dishes to work well enough? By recording every photon they receive instead of the small fraction of the bandwidth we currently do, i.e., using wideband feeds and recording systems that will span all the way from S to X-band and beyond. You can detect a much fainter signal via the so-called multi-band delay, avoiding the ambiguities that hide in the gaps. Many of the reference quasars, which we all observe routinely, are actually quite strong sources on a celestial scale of things, and we spend a lot of time waggling back and forth between them as it is!

And, is this all do-able in our lifetime? Well, all those bright people at the meeting seem to think it is! There are rumors of really wideband feeds being developed in Sweden, companies able to make really fast 12 m dishes at low cost, digital boards running around under the interesting name of iBob, and even of money to build things in some parts of the world.

So, living in interesting times is not always a curse. There are still lots of studies to be done, but you might just see a little dish nodding around in your neighborhood sometime in the not too distant future—after all 2010 is just around the corner! I am eagerly awaiting 2010 in South Africa.

Please Vote

All IVS Associate Members have the privilege and opportunity to vote in the elections for representative positions on the IVS Directing Board. Please visit http://ivscc.gsfc.nasa.gov/about/org/board/elections for more information.

The voting period is December 1-12, 2006.
Please cast your vote.

Permanent Component

Yebes Observatory, Spain

Yebes Observatory is an IVS Network Station in the center of the Iberian Peninsula run by the Spanish Observatorio Astronómico Nacional (OAN). A 14-m antenna was used for VLBI observations until 2004, but a new 40-m antenna has been constructed and is ready to come online very soon. Newsletter Editor Hayo Hase interviewed the VLBI Project Coordinator Francisco ("Paco") Colomer via e-mail to learn more about the current state.

Pablo de Vicente and Isaac Lopez-Fernandez in front of the new 40-m radiotelescope at Yebes.

Paco, where exactly is Yebes Observatory located?

The Yebes Astronomical Center (Centro Astronómico de Yebes, CAY) is about 70 km north-east of the city of Madrid. It holds the radio telescopes and engineering laboratories. Midway between Yebes and Madrid is Alcalá de Henares, where most of the administration (as well as myself) have offices; Alcalá is very close to the Madrid-Barajas International Airport.

Which institution does CAY belong to? What are the reasons for an astronomical observatory to be part of a geodetic institution?

CAY is the most important section of the National Astronomical Observatory (Observatorio Astronómico Nacional, OAN), which, in turn, depends on the National Geographic Institute (Instituto Geográfico Nacional, IGN) at the Spanish Ministry for Development (Ministerio de Fomento). OAN was created by King Charles III in 1790 when astronomy was a necessary tool for navigation and cartography. IGN is responsible for—among other duties—producing maps, so OAN became a part of IGN as early as the 19th century. Now, in the 21st century, OAN produces direct geodetic results, and we are working on turning Yebes Observatory into a geodetic Fundamental Station.

What types of VLBI activities are being carried out at Yebes?

IGN, through OAN, is a full member of the European VLBI Network (EVN) and a co-founder of the Joint Institute for VLBI in Europe (JIVE). The first astronomical VLBI observations were carried out in 1990, and the first geodetic campaigns were run in 1995. We have a well established group of VLBI astronomers who use the available facilities to study molecular line emission in cosmic objects. Some geodetic VLBI and GPS studies have been carried out in the last years, though the production is still small.

Who are the people in your VLBI group and what are their functions?

People involved in VLBI operations—but also busy in many other areas—are Pablo de Vicente (technical coordinator) and myself (project coordinator). Of course, several engineers at Yebes help out with equipment, receivers, and calibration: Isaac López, Rubén Bolaño, José Antonio López-Fernández, Alberto Barcia, and Carlos Albo. María Rioja is our geodetic VLBI scientist. In astronomical VLBI observations, also Jean-Francois Desmurs and the OAN students participate. And, finally, on the institutional side, there are Rafael Bachiller (Director of OAN) and Jesús Gómez-González (General Sub-director of Astronomy, Geodesy and Geophysics at IGN).

Could you tell us a few things about the new radio telescope at Yebes? How far is its construction? What are the design parameters? Who did build it and when do you expect to see first fringes?

The construction of the new 40-meter radio telescope has been completed. Commissioning has started by measuring the surface accuracy of the primary reflector using holographic techniques. First results appear to be very good. Further measurements and corrections should allow us to achieve the expected 150 μm rms. The antenna has Nasmyth-Cassegrain optics, and the Nasmyth mirror plus two auxiliary mir-

Jean-Francois Desmurs, Francisco Colomer and Rebeca Soria (now Support Scientist at JIVE) in front of the historic OAN building in Madrid (Royal Astronomical Observatory of Madrid, ROAM).

rors are in place and aligned. The holography receiver (12 GHz uncooled, to be placed in primary focus) and the first-light receiver (21-26 GHz HEMT) have been built and are ready to be installed. We expect to do so in the next months, providing first astronomical results by May 2007 and first fringes by the end of summer 2007.

What are the primary goals of the new radio telescope? And what are the plans for the old one? What contributions to IVS can we expect from Yebes?

The new 40-m radio telescope will substitute the old 14-m one in all EVN and IVS activities, and it will also operate in single-dish mode as an optimum complement to the excellent high-frequency 30-m IRAM radio telescope in Granada, Spain. It will span several frequency bands between 2 and 115 GHz, with efficiencies around 90% (and no lower than 50% at the shorter wavelengths). We may devote a lot of observing time to VLBI projects, including IVS campaigns (probably up to one session per week).

The old antenna needs refurbishing and could be used as a dedicated antenna for geodetic VLBI. But another attractive application would be the usage as a tracking station for the Japanese VSOP-2 satellite, which will be launched in 2012. On the other hand, we expect to enlarge the scientific output in geodesy by increasing the number of people working in this field in the coming years.

Yebes' old 14-m radiotelescope.

As a member of EXPReS (EXpress Production Real-Time e-VLBI Service) and chair of an SA2 (Service Activity 2) component, what are your goals at Yebes for the coming years?

We are very committed to always keep Yebes Observatory and its instrumentation at the state-of-the-art. Connecting the new 40-m radio telescope by fiber optics to JIVE (as planned in the EXPReS project) and other institutions, is a major strategic move. Work is under way, and we expect to have the high-speed link in 2007 at about the time the new telescope will have first light.

What co-located geodetic equipment—such as GNSS, SLR, or other complementary devices—do you have at your site? Are there plans for further installations?

As already mentioned earlier, by installing gravimeters at Yebes in 2007 we will make a big step towards our goal of converting Yebes Observatory into a geodetic Fundamental Station. Yebes Observatory already has the 40-m VLBI antenna and a permanent EUREF GPS station (which serves as the reference station of the Spanish GPS network).

Where do you see the role of the IVS?

As members of the astronomical and geodetic VLBI communities (EVN and IVS), we realize how important it is to coordinate efforts. This is particularly important in the technical developments such as DBBCs, recording systems, receivers, software, and so on.

New IVS Member Organization Pulkovo Observatory

In September 2006 the Central Astronomical Observatory at Pulkovo of the Russian Academy of Sciences, St. Petersburg, Russia—widely known as Pulkovo Observatory—became a member organization of the IVS. Under the technical leadership of Dr. Zinovy Malkin, Pulkovo Observatory will contribute as an Associate Analysis Center (PUL) to the study of the Celestial Reference Frame (through computation and investigation of radio source catalogues, investigations of long-term stability of source positions, and source structure studies), the Earth Orientation Parameters (through computation and analysis of EOP series), and the Terrestrial Reference Frame (through computation and analysis of station coordinates and baseline length series). The Analysis Center's staff also includes Dr. Anisa Bajkova and Ms. Yulia Sokolova. With the addition of Pulkovo Observatory, the IVS now has 22 Analysis Centers.

The IVS Newsletter is published three times annually, in April, August, and December. Contributed articles, pictures, cartoons, and feedback are welcome at any time.

Please send contributions to
ivs-news@ivscc.gsfc.nasa.gov.
The editors reserve the right to edit contributions. The deadline for contributions is one month before the publication date.

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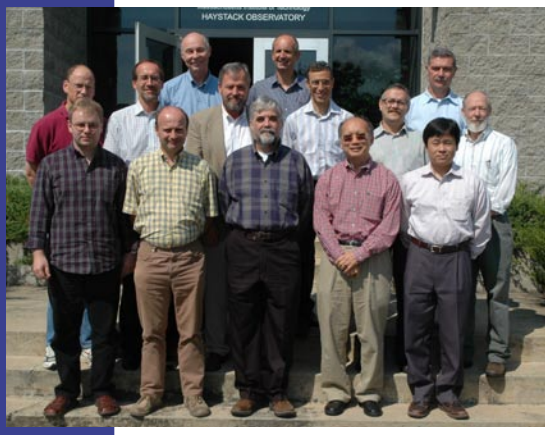
The newsletter is published in color with live links on the IVS web site at http://ivscc.gsfc.nasa.gov/.

NEWS...

Notes from the 16th IVS Directing Board Meeting

– Wolfgang Schlüter, BKG

The 16th Directing Board Meeting was held at Haystack Observatory on September 16, 2006. The board welcomed Patrick Charlot as the new representative of the International Astronomical Union. He succeeds Patrick Wallace who was the IAU representative from April 2003 to September 2006. On behalf of the board, the chair thanked Patrick Wallace for his excellent work and the important contributions he made for the IVS community.



The IVS Directing Board in front of Haystack's main building.

As in previous meetings the chair, the coordinating center director, and the coordinators gave reports about their activities providing general information to all board members.

Board elections will be held in December and January. The list of Associate Members—who are invited to vote—will be updated for that purpose. The terms of the two Network representatives (Wolfgang Schlüter, Shigeru Matsuzaka) and of the Correlators and Operation Centers representative (Kerry Kingham) will end in February 2007. Also the terms of the three at large members (Zinovy Malkin, Franco Mantovani, Yasuhiro Koyama) will end. An election committee was nominated by the board. Alan Whitney (chair), Harald Schuh and Dirk Behrend will drive the election procedure.

Some technical aspects that are worth mentioning here are:

- Tape drives can be retired by the end of the year. It is planned to observe only with Mark 5 and K5 in 2007.
- An additional EOP series was established, which refers to the middle of the session.
- The Pilot Project "Baseline Lengths" was closed and baseline lengths were made an official product of IVS.

The progress in e-VLBI development, such as the connection of Ny Ålesund with high-speed access, and the status of the digital recording systems, such as Mark 5B and K5/VSSP, were reported. A transition plan will be set up for the introduction of the Mark 5B (Mark 5A+) systems, as a close coordination between the correlators and network stations is required.

Some concern about the disk media reliability and the availability came up. As a result, requests to purchase more media will be made. The feedback about the meteorological sensors at the network stations did not meet the expectations. More effort seems to be necessary to explain the importance and impact of the meteo data, the final goal being to improve the meteo data acquisition at the stations.

The chair of the VLBI2010 Committee (V2C), Bill Petrachenko, reported about the First VLBI2010 Working Meeting, which was held the day before the board meeting at Haystack. The V2C agreed on some of the specifications for the VLBI2010 antenna:

- 12 m dish size (minimum),
- 30 s end-to-end slew time, and
- 2–18 GHz frequency range.

At the 2007 IAG General Assembly in Perugia, the service representatives in the IAG Executive Committee will be elected. The board nominated Harald Schuh as the IVS candidate. For the realization of a new ICRF, Chopo Ma proposed the establishment of a joint IVS/IERS Working Group.

The 16th Board meeting took place in the nice atmosphere of the Haystack Observatory. I would like to thank the host, in particular Heidi Johnson, for the excellent organization and the kind support. The notes of the meeting are available on the board page of IVS web at http://ivscc.gsfc.nasa.gov/about/org/board/dbmeet16.txt. The next meeting is planned for February 24, 2007 at the Fundamental Station Wettzell.

A view of the Millstone Hill Zenith Antenna (front) and Steerable Antenna at the Haystack site. The radome visible in the back encloses the 37-m Haystack Radio Telescope.

Every man takes the limits of his own field of vision for the limits of the world.

- Arthur Schopenhauer

News...

The IVS in the Frame of Global Politics

– Hayo Hase, BKG

It can be stated that the global climate change directed global politics towards focusing on Earth monitoring as a very important issue to make sustainable development happen. The IVS is contributing to this field through its participation in GGOS. In the following I try to outline the interconnections.

In 2002, the World Summit on Sustainable Development was held in Johannesburg, South Africa. Political leaders from member countries of the United Nations discussed the necessity for sustainable development on a global scale. Facing the ongoing global climate change, they concluded that political decisions on sustainable development had to be based on future environmental conditions. Unfortunately, a lack of historical Earth monitoring data in many areas of the world does not allow sound predictions of the environmental impact of future developments.

Consequently, a follow-up Earth Observation Summit was held in Washington, DC in 2003. This conference was attended by 30 countries as well as a few international institutions. A declaration was adopted stating that the individual Earth monitoring programs should be better coordinated in the future. One of the aims is to reduce data scarcity in many parts of the world in order to get a better handle on the system Earth or the system of systems of the Earth. A sustainable development requires coordinated and environmentally friendly Earth monitoring activities.

In 2004, the second Earth Observation Summit was held in Tokyo with about 350 participants from 43 countries. The results of the first summit had led to the formulation of the idea of a "Global Earth Observation System of Systems" (GEOSS) which should be implemented according to a 10-year plan.

The GEOSS idea was discussed further in the subsequent year, before it was ratified at the third Earth Observation Summit in Brussels in 2005. The declaration was signed by the Group on Earth Observation (GEO) which is composed of representatives from currently 65 nations and 43 international institutions. They agreed also on the Integrated Global Observing Strategy (IGOS), which defines the activities within the 10-year implementation plan. GEO's vision for GEOSS is to realize a future, in which decisions and actions are based on coordinated, comprehensive, and sustainable Earth observations and information for the benefit of humankind.

In parallel to this development, the International Association of Geodesy (IAG) started its project "Global Geodetic Observing System" (GGOS) in 2004. It provides observations of the three fundamental fields of geodesy: the Earth's shape, the Earth's gravity field, and the Earth's rotational motion. The IVS is a fundamental part of the GGOS project. Together with the other measurement services, it provides GGOS with the observational basis to maintain a stable, accurate and global reference frame, which, in turn, is crucial for all Earth observation and many practical applications. At a GGOS Workshop held at the Technical University of Munich on October 2006 the scientific road map and the strategy for GGOS until 2020 was further developed and a GGOS2020 Reference Document was discussed.

South African President Thabo Mbeki speaking at the World Summit 2002 in Johannesburg, South Africa.

GGOS contributes to the emerging GEOSS not only with an accurate reference frame, but also with observations related to the global hydrological cycle, the dynamics of the atmosphere and oceans, and natural hazards and disasters. GGOS acts as the interface between the geodetic services and external users such as GEOSS, the IGOS Partnership (IGOS-P), and United Nations organizations. A major goal is to ensure interoperability of the services and GEOSS.

On May 23, 2006 GGOS was accepted as a contribution to IGOS-P. IGOS-P brings together the efforts of a number of international bodies that are concerned with the observational component of global environmental issues—both from a research and a long-term operational point of view.

In conclusion, members of the IVS have good arguments at hand to justify their VLBI activities on a political level. Ask your national representatives in GEO how they want to achieve the goals of GEOSS and let them know that your IVS component is already working on the realization of GEOSS.

Useful links:
http://www.earthobservations.org
http://www.igospartners.org
http://www.ggos.org
http://geodesy.unr.edu/ggos/index.html

NEWS...

GRF2006—A Symposium on Global Geodetic Reference Frames in Munich

– Johannes Böhm, Vienna University of Technology

Commission 1 'Reference Frames' of the International Association of Geodesy (IAG) invited scientists from all over the world to participate in the symposium 'Geodetic Reference Frames' (GRF2006) that was held in Munich, Germany, from October 9–14, 2006. More than 150 participants came to the capital of Bavaria to attend this meeting which was held in the building of the Bavarian 'Landesamt für Vermessung und Geoinformation' (State Agency of Surveying and Geoinformation) in the city of Munich. More than 50 oral and 40 poster presentations were given in 9 sessions. Sessions included 'Combination of Space Techniques' (chaired by Markus Rothacher), 'Global Reference Frames' (Claude Boucher), 'Regional Reference Frames' (Zuheir Altamimi), and 'Interaction of Celestial Reference Frames' (Harald Schuh), the latter dealing with future realizations of the International Celestial Reference Frame. More details can be found at http://iag.dgfi.badw.de/?grf2006 .

Hermann Drewes (here while presenting a talk) and his team from the DGFI did a great job in organizing the symposium GRF2006.

GRF2006 was the first symposium on Reference Frames after the release of the new ITRF2005 (International Terrestrial Reference Frame 2005) which was presented and discussed in several sessions. Two highlights were the presentations about the new ITRF2005 by Zuheir Altamimi, Institut Géographique National (IGN), and Hermann Drewes, Deutsches Geodätisches Forschungsinstitut (DGFI). The new ITRF2005 constitutes a considerable improvement over ITRF2000, although there are still some open questions concerning the scale of the SLR frame.

Another highlight was the joint session with the XXIII International Congress of the Fédération Internationale des Géomètres (FIG) and the INTERGEO, a German congress and trade exhibition for geodesy, geoinformation and land management, which was held in parallel to the GRF2006 symposium. Among other interesting presentations in this geodesy forum, Markus Rothacher introduced the Global Geodetic Observing System (GGOS) to a broader community and Zuheir Altamimi once more outlined the ITRF2005.

GRF2006 was perfectly organized by Hermann Drewes and his team from the DGFI. In addition to the scientific schedule, they also organized a Welcome Party at the Bayerische Akademie der Wissenschaften, and they invited us to the cellar of Munich's City Hall for a traditional Bavarian meal with beer and liver loaf. Finally, on Saturday the participants had the chance to join an excursion to the fundamental station Wettzell.

Volker Tesmer (left) and Leonid Petrov (right) discussing Dr. Petrov's presentation about an empirical Earth rotation model during a coffee break.

Upcoming Meetings...

AGU Fall Meeting San Francisco, USA December 11-15, 2006	EGU General Assembly Vienna, Austria April 15-20, 2007
European VLBI Meeting Vienna, Austria April 12-13, 2007	Fourth IVS TOW Haystack Observatory Westford, MA, USA April 30-May 3, 2007
8th IVS Analysis Workshop Vienna, Austria April 14, 2007	IUGG General Assembly Perugia, Italy July 2-13, 2007

http://ivscc.gsfc.nasa.gov/meetings

Tic Tac, TOW

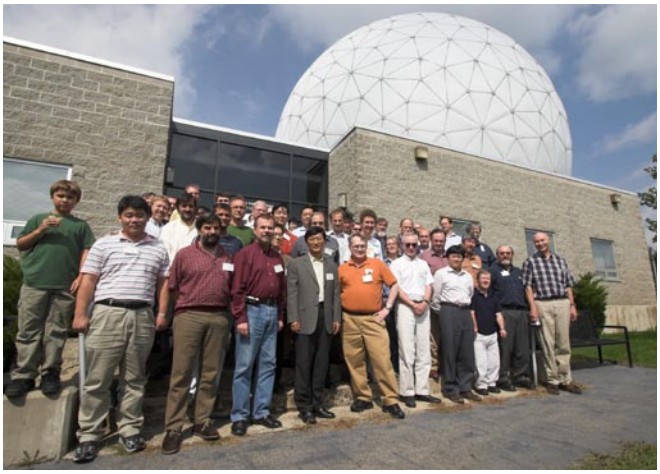
'Tis time again. The clock strikes TOW. Haystack Observatory is going to host the fourth IVS Technical Operations Workshop (TOW2007) in the period from April 30 to May 3, 2007. Like its predecessors, this TOW will be tailored for the technical staff of the stations to get hands-on training and problem resolution in VLBI operations. A special feature this time will be the training on the new Mark 5B system. Mark your calendars.

http://ivscc.gsfc.nasa.gov/meetings/2007/

Haystack Hosts Fifth International e-VLBI Workshop

– Chester Ruszczyk, MIT Haystack Observatory

A successful fifth International e-VLBI Workshop was held at the MIT Haystack Observatory from September 17–20, 2006. Approximately 60 participants attended the meeting that focused on exploring the current state of high-speed astronomy data transmission, concentrating on e-VLBI, but recognizing the synergy with other geodesy/astronomy applications requiring real-time or near-real-time high-speed data transmissions. Attendees from Australia, China, Finland, Germany, Japan, Korea, The Netherlands, Sweden, Spain, United Kingdom, and the United States participated in the workshop.



Participants at the e-VLBI Workshop at Haystack Observatory.

The four-day workshop was separated into two events: two days of tutorials and two days of regular presentations. General networking and e-VLBI tutorials kicked off the workshop and were sponsored by Internet2 and MIT Haystack Observatory. The oral presentations that followed included a poster session and panel discussions, constituted the main portion of e-VLBI workshop and allowed participants to provide status, both present and future plans, and summaries of ongoing work of their perspective e-VLBI programs. All the presentations from the workshop are available at http://www.haystack.edu/geo/vlbi_td/abstract.html.

The invited networking tutorials focused on the basics of TCP fundamentals, performance tuning, software tools available to help diagnose performance problems, and Optically-switched networks. The e-VLBI specific tutorials focused on the VLBI Standard Interface – Electronic (VSI-E) protocol fundamentals and a Mark 5B tutorial and demonstration.

The main e-VLBI program included a variety of presentations, including status/plans of participating organizations, network research projects and results specific to e-VLBI, software and distributed correlator development, as well as e-VLBI-specific hardware development efforts.

Each presentation day ended with a panel discussion on a different topic, including Linux kernel and distribution upgrade plans, and convergence of new technologies for e-VLBI. A result of the latter discussion is that an e-VLBI task force will be created to focus on networking issues facing the community at large. Look for news on the charter and members in the coming weeks.

Keep your Correlator Happy!

– Mike Poirier and Mike Titus, MIT Haystack Observatory

As we all know, the data that we record gets shipped off to many different correlators for processing. Immediately after a session ends, the disk packs are shipped out and the stations have very little to do with the data anymore.

There are many things we can do to help our correlators do their job more smoothly. The first and most important one is to provide good quality data. This means you should double-check the setup of all station equipment and monitor the operations so that they run smoothly. You should provide explicit Pre-Ops messages which should include timing offsets, pointing information, cable length, the first source, the time you started recording, weather conditions, and any information that you deem to be important.

During the session, if anything appears to be awry, please enter a comment into the log. These comments should include any specific scans that were missed for any reason, phase cal issues, disk pack errors, possible timing/clock problems, or any other issue which may cause concern. Your Post-Ops message should list any missed scans or problems. This information could point the correlator to a possible problem which may save hours of processing time. Please ship your disk packs quickly and correctly to avoid delays in processing or disk damage. The faster the disks are processed and released, the easier it will be for the correlator to supply you with new disk packs.

The feedback from the correlator to the station can also be very important to the station in diagnosing data quality problems. There are many conditions where the session seems to run normally at the station, but when the correlator processes the data it is discovered that there was some sort of problem. This information will be passed back to the station so that they can investigate and correct this problem prior to future sessions. Stations should also read the correlator reports which are the first order of feedback and are designed specifically with the station in mind.

We really have to remember that the data we produce continues to the correlators and any information we can provide to them, no matter how insignificant it may seem, may drastically improve the processing.

Termination of Canadian VLBI Program

– Dirk Behrend, NVI, Inc./GSFC

In early October, the Associate Director General of Natural Resources Canada (NRCan) informed IVS Chair Wolfgang Schlüter by telephone that the Canadian VLBI Program has been terminated. This decision came down from the Treasury Board of the Canadian Government that had committed to save 1 billion Canadian dollars from programs and activities that are no longer effective. VLBI is one "saving area" in a long list of affected programs, where the full list can be viewed at http://www.tbs-sct.gc.ca/media/nr-cp/2006/0925_e.asp.

With the Canadian VLBI Group, the geodetic/astrometric community, in general, and the IVS, in particular, would be losing a vital player whose loss will be felt for years to come. The IVS Directing Board sent a letter to the Canadian Government and NRCan requesting a reconsideration of their decision. Other institutions and organizations—such as the International Association of Geodesy (IAG), the International Earth Rotation and Reference Systems Service (IERS), International Laser Ranging Service (ILRS), and the International DORIS Service (IDS)—followed. In addition, the German Ministry of the Interior officially requested NRCan to revisit the matter and several individuals voiced their dismay with the decision.

At this point, we can only hope that the outcry was loud enough to have an impact. But not having received any response from the Canadian officials, it seems that we are a far cry from a decision reversal. If nothing changes in the immediate future, the Canadian VLBI Program will peter out and cease to exist by the end of the Canadian fiscal year, i.e., by the end of March 2007.

All Canadian stations (Algonquin, Yellowknife and the transportable CTVA) have not been included in the planning of the 2007 observing program. Also, the E3 sessions have been cancelled and will not be observed in 2007.

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