IVS Newsletter

Issue 27, August 2010

Biennial Directing Board Elections Coming in Fall 2010

– Dirk Behrend, NVI, Inc./GSFC and Kerry Kingham, USNO

Is the IVS going in the right direction? Are there items missing on the agenda? Should certain activities be intensified and/or other activities be reduced? The opportunity to influence the policies of the IVS is at your fingertips, either when casting your vote later this year or through taking on direct responsibility as a candidate. This fall is election season for the IVS Directing Board!

Following the discontinuation of the FAGS position, the IVS Directing Board currently has fifteen members (see, e.g., the Board section of the IVS Terms of References at http://ivscc.gsfc.nasa.gov/about/org/documents/ivsTOR.html#board). There are four appointed ex officio members (mostly from the scientific unions), three permanent members (the three "coordinators"), five representative members (for the IVS components), and three members at large (to balance out the representation). In the upcoming elections of fall 2010, one third of the Board (i.e., five positions) is up for election. Three out of these five positions can only be filled by new candidates, because the incumbents are not eligible for re-election in accordance with the IVS re-election rule of allowing only two consecutive full terms. The incumbents that are "maxed out" are: Kerry Kingham (Correlators and Operations Centers representative), Andrey Finkelstein (at large), and Xiuzhong Zhang (at large).

The five positions up for election in fall of 2010 are:

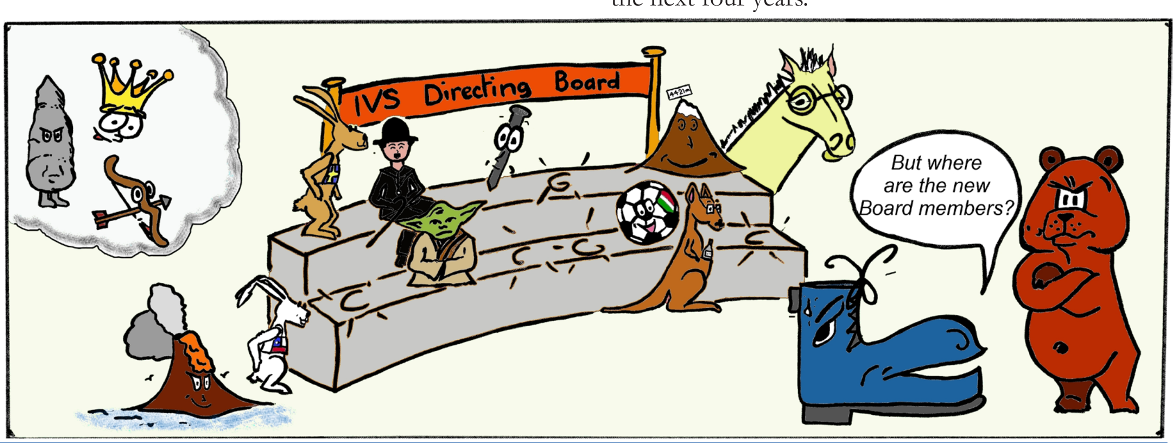
- Network Station representative (4-year term, incumbent: Hayo Hase);
- Correlators and Operations Centers representative (4-year term, incumbent: Kerry Kingham, incumbent not re-electable);
- at large (2-year term, incumbent: Andrey Finkelstein, incumbent not re-electable);
- at large (2-year term, incumbent: Kazuhiro Takashima);
- at large (2-year term, incumbent: Xiuzhong Zhang, incumbent not re-electable).

The two representative positions will be elected by the Associate Members; the three at large members will be determined by the Directing Board once the representative election is completed.

At the Directing Board meeting in Hobart in February 2010, the Election Committee for the fall elections was formed with Kerry Kingham (chair), Oleg Titov, and Dirk Behrend. The Election Committee will prepare and distribute a call for nominations by October/November 2010. The call will also contain more detailed information about the election procedure. However, the nomination time will soon be on us, so it is time for you to consider who among your colleagues should be on the Directing Board.

Candidates for any position on the Board can only be nominated from the list of current IVS Associate Members. Associate Members are individuals who are associated with a Permanent Component supported by a Member Organization. We request that the contact persons of the Permanent Components check the names of the Associate Members listed for their component and notify the Coordinating Center if changes are necessary. Note also that only the Associate Members will be allowed to vote in the elections.

The new Directing Board will meet in person for the first time on 1 April 2011 in Bonn, Germany in conjunction with the EVGA meeting. At that meeting the first term of Harald Schuh as IVS chair will come to an end. Hence, one of the first actions of the new Directing Board will be the election of the chair for the next four years.

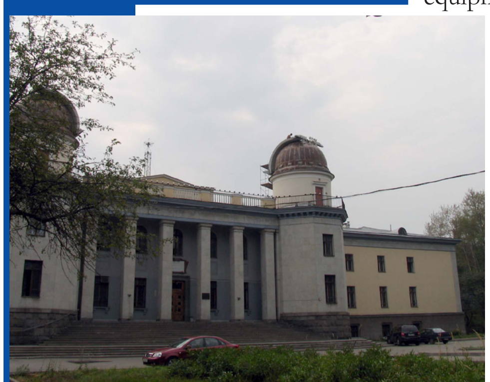


Feature

Sternberg Astronomical Institute of Moscow State University

Sternberg Astronomical Institute (SAI) of Moscow State University (MSU) is a permanent component of the IVS supporting an Analysis Center since summer 2008. SAI's VLBI activities, however, date back much longer; in fact, SAI sports one of the longest legacies in VLBI history. Newsletter editor Hayo Hase e-interviewed the head of the VLBI group of SAI, Dr. Vladimir Zharov, to learn more about the history, current activities, and future outlook of SAI.

Vladimir, how did you get involved in VLBI?



(top) Dr. Vladimir Zharov, head of the VLBI group of SAI; (below) The building of Shternberg Astronomical Institute was completed in 1954; it consists of the main building with four towers, and seven separate pavilions.

I performed my *Kandidat* work under supervision of Prof. Leonid Matveenko and obtained my *Kandidat of Sciences* (equivalent of PhD in Russia) in 1983. Prof. Matveenko is one of the "fathers" of VLBI. As astrophysicist he was interested in the OH-maser regions and observed them on different VLBI interferometers including Puschino–Simeiz. In the late seventies, Prof. Matveenko invited me to participate in this work. The experience I gained was very important, because we worked both "hands-on" to adjust/repair the equipment and "mentally" to analyze the data.

You work at Sternberg Astronomical Institute. Who was 'Sternberg'?

Pavel Karlovich Shternberg (also Sternberg; 2 April 1865 – 1 February 1920) was a Russian astronomer and revolutionary. He was a professor at Moscow University (1914) and the Director of the Moscow Astronomical Observatory (1916–1920). He was one of the leaders of the armed revolts in Moscow (in 1905 and 1917). In 1917 he helped ousting the Kerensky Government and establishing the Bolshevik rule in Moscow. Sternberg Astronomical Institute and the lunar crater Shternberg are named after him.

SAI is part of the famous Lomonosov University. How many students are studying at the university and in astronomy/geodesy?

Moscow State University (MSU) is the oldest university in Russia. It was established in 1755. More than 40,000 students (graduate and postgraduate) and about 7,000 undergraduates study at the university. Currently about 100–120 students (undergraduate and graduate) and 15–20 postgraduate students study at the Astronomy Department. The duration of study is 5.5 years, but this will increase to six years in 2011. During the third year of studies students select one out of three *cathedras* (main subjects) for their future studies; one of these subjects is offered by the *Cathedra of Celestial Mechanics, Astrometry and Gravimetry* in which I am the head of. Approximately 20–25 graduate and 5–7 postgraduate students are in our *cathedra*. During their studies, the students undergo practical training in Kalyzin (a small town about 200 km north of Moscow) on a 70-m radio telescope and in the North Caucasus on a local GPS/Glonass network. This is also where a new observatory for SAI (near Kislovodsk) is under construction. More information about SAI can be found at http://www.sai.msu.ru.

What about your VLBI group? Who is contributing to and working on IVS products?

Our VLBI group consists of five persons. Mark Kaufman, scientific researcher, is responsible for the automation of computing and analysis of results. His main tasks are automatic data updating, search of new NGS or database files on the IVS servers, and program initiation. He also updates the EOP database and compares our results with the results of other ACs. Dmitry Duev, a postgraduate student, is adapting the ARIADNA software for the observation of spacecraft with VLBI for navigational purposes under my and Prof. L. Gurvits' supervision. Nikolay Vorontsov is an engineer who developed a program in his diploma work for simultaneously processing several NGS files. He is currently working on processing all files of the IVS data holdings using one of the supercomputers of the MSU to get a global solution. Svetlana Nosova is an engineer too. She is responsible for the development of a program to generate SINEX files and to read SINEX files from other ACs for the estimation of EOP and other parameters. Finally, my contribution to the VLBI work is to update existing programs and to develop new software.

What software do you use in the analysis of VLBI data?

We use and further develop the ARIADNA software in order to contribute to IVS products. The software is used in the calculation of all types of VLBI products. The latest version is also installed on the correlator of the AstroSpace Center in support of the Radioastron mission. Some elements of the software were developed at the beginning of the eighties during my PhD work. As was planned, the software is being used for processing VLBI data with accepted models and for testing new models, algorithms, and the like. Of special interest is the testing of new models for tropospheric refraction (for the calculation of the VLBI delay observable) with and without mapping functions.

According to your experience, did you encounter any weaknesses in the models of VLBI data?

The main limiting factor is the uncertainty in the tropospheric delay. From my point of view, modeling the path delay as the sum of a hydrostatic part and a wet part only works in theory—although ARIADNA currently uses this hypothesis. A shortcoming of this approach is the presentation of the terms as the product of a zenith delay and a corresponding mapping function. This results in a non-linear least-squares adjustment problem for the wet zenith delay, contributing a model error to the determination of the tropospheric delay. Reducing the path delay uncertainty by a factor of five will be very important for future VLBI2010 work, but a reduction by a factor of ten would be a scientific feat in my opinion.

What does the implementation of VLBI2010 mean for you in your day-to-day work? Can you imagine the impact of a working VLBI2010 system on your daily duties for IVS?

The VLBI2010 project is challenging for the IVS community. To reach its goals it is necessary to solve many problems. One of them is to develop low-cost antennas with unique characteristics. The same can be said about the backend and recording systems, systems for data transfer and correlation, to name a few. This work is interesting for us and for our students. One of our ideas is to erect one of the antennas of the Russian VLBI2010 network at our new observatory (near Kislovodsk). This observatory will be used both for scientific work and training of students. Having a working antenna and being part of the VLBI2010 network will give us the opportunity to participate in IVS activities, on the one hand, and to train students and specialists of other SAI departments as well as other institutes involved in the work, on the other.

Russia has been a pioneering nation in space research and exploration. With several papers published in this field, how can VLBI help in space navigation?

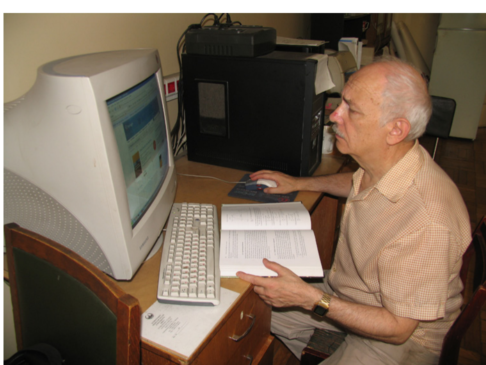
I gained my first experience with VLBI for space navigation working under Prof. Matveenko in the VEGA mission to determine the velocity of winds in the atmosphere of Venus. Since that experiment the VLBI technique has improved significantly. A recent application has been the measurement of the change in position of the Huygen's lander of the Cassini mission in order to determine the velocity of winds in the atmosphere of Saturn's moon Titan. A further significant contribution of VLBI will be the accurate positioning of navigation satellites relative to the ICRF.

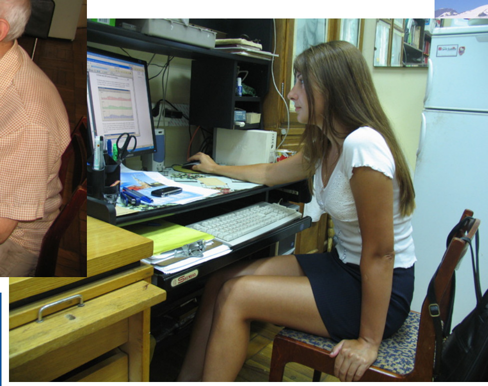
In your view, should space positioning become a new subject for the IVS community? Could you envision new products that would enrich the product list of the IVS?

Space positioning has already become a new field of research for our VLBI group. We study it from two perspectives. The first is connected with the Radioastron mission, a space–ground radio interferometer. It is necessary to calculate the delay for the interferometer with baselines varying from a few 1,000 to 350,000 kilometers. One of the challenges of this mission is to precisely position the space radio telescope, a problem we are currently solving. The second direction of our investigation is the observation of spacecraft as radio source to determine the spacecraft position relative to the ICRF. I think that prospective work could be the observation of GNSS satellites with VLBI. It would give the possibility to directly determine the satellites' position relative to the ICRF and would connect the VLBI network directly to the Earth's center of mass.

Finally, if you may express a wish, what would be your's?

From experience and talks with colleagues from different countries, I can suggest a new idea: create a special VLBI fund for students (graduate and postgraduate) who want to work on VLBI. This fund could be used to cover living expenses during training courses which, in turn, have to cover different aspects of VLBI (from planning of observation to correlation and analysis). I think it is important, because the realization of the VLBI2010 project will require many highly-skilled specialists.





(top) Mark Kaufman, scientific researcher; (right) Svetlana Nosova, engineer.

(top) Dmitry Duev, postgraduate student and Nikolay Vorontsov, engineer.

HartRAO 26-m Radio Telescope Recommissioned

– Jonathan Quick and Michael Gaylard, HartRAO

On 3 October 2008, barely a month after observing continuously through the 15 days of the CONT08 campaign, the HartRAO 26-m ceased operations after loud cracking noises were heard emanating from the telescope. It soon became clear that the spherical roller bearing at the southern (upper) end of the polar shaft had failed and would need replacement. However this bearing is situated some 20 m above the ground on a static shaft which carries the full 200 ton load of the antenna moving structure. Furthermore, this shaft was originally shipped fully assembled by the antenna manufacturer and no provision was made for field replacement of any of the bearings.

Darren Forren (GD Satcom) prepares to lift the universal knuckle joint that will join the A-frame legs to the polar shaft support collar. The 15-m single piece fiber-glass composite prototype KAT antenna is visible in the background.

So the process is simple, you jack it up, pop the end cap off the shaft, change the bearing and re-assemble it, right? This we now know, with the benefit of hind-sight! However, when we first started consulting engineering firms about the repair, none would commit to more than quoting for a design study about how they might possibly achieve the repair with no promises about whether they thought it could actually be done. And worse still, the sums of money being asked for were significant fractions of our annual budget. So next, the question of replacement instead of repair was asked, and further whether such a replacement antenna should be built at Hartebeesthoek or somewhere else given the issue of gradual urban encroachment. The idea of converting the mount into azimuth/elevation by moving the upper section of the antenna onto a new azimuth alidade was proposed as yet another option.

The legs of the custom A-frame support structure slot into place beneath the failed bearing housing. Note how the massive steel beam at the base acts as a bridge across the sub-surface tie-beams of the original antenna foundation.

However, in March 2009 a chance comment by a visitor put us in contact with a local agent of General Dynamics Satcom Technologies in the USA, who then undertook to provide us with a realistic proposal for the antenna repair. A preliminary costing was received in early July, and an in-principle decision to go ahead with the repair was made on 22 July 2009, in no small part due to letters of support provided by our VLBI colleagues. With the provisional seven-figure price-tag in hand, we then sought funding through the National Research Foundation within which we operate. Funding was finally secured in late October 2009, over a year after the bearing had failed, and a formal order was processed on 25 November 2009.

Just to give you an idea of the difficulties involved, here are some quotes from an e-mail from GD Satcom:

"*Replacement of the bearings must be carefully done, as the two bearings also support the thrust load of the rotating structure at the declination angle, as well as the weight. This makes the replacement very tricky, as an alternate support system must be devised to keep the antenna safe and in position while the bearings are removed and replaced.*"

"*The antenna will be very susceptible to wind damage during the rework period, so appropriate reinforcements will be required to mitigate the damage and safety risks. Thus the work must be done quickly and during a time of the year that has longer periods of low winds. The alternate support system will transfer support loads off of the axles and onto adjacent structures that may not be as well suited to carry them.*"

Now the hard work began in Richardson, Texas, culminating in a critical design review in early March 2010. Manufacture at quite considerable steel structural components then commenced. Civil works for the construction of the necessary foundations for the temporary A-frame support lasted through to late April. Early in June the support components arrived, together with engineers and technicians, just in time for the World Cup! Erection of the new support took just under 3 weeks, with the antenna being lifted (by millimeters) for the first time on 30 June so that the shaft end cap could be removed.

Now for the first time we could see the bearing. This showed that the inner race had failed; in fact, chunks of it and damaged rollers fell out as it was exposed. Interestingly, some of the fractures showed significant oxidization, suggesting that the original failure may have been up to 10 years previously! During the next week, as the process of extracting the bearing piece by piece continued, the outer race shattered like glass as heat was applied to it, indicating some serious work hardening.

Another week later, after much preparation that involved heating the housing up to 200° C with ceramic heaters, heating the bearing inner race and cooling the inner shaft with liquid nitrogen, the new bearing slipped into place. Replacement of the end cap and tear-down of the support structure took only a day, as the excitement began to build. The 26-m telescope drove again for the first time on 20 July 2010, some 21 months after it had failed.

So, in the end the cost of the actual bearing was less than 2% of the final price tag. However, should it fail again, or the bearings at the other end of the polar shaft give way, we have a slightly-used, large A-frame jacking support ready and waiting to repeat the process for a lot less money and in a much shorter time! And, who knows, perhaps this will spur someone to look more closely at replacement possibilities.

Photographs showing the repair process can be found on the HartRAO Web site, at *www.hartrao.ac.za/news/100906_26m_repair/*

(left) With the antenna safely supported, the top end of the fixed part of the polar shaft has now been removed to expose the failed bearing. Damage to the inner race is clearly visible on the right. (top) The Hartebeesthoek 26-m antenna drives over to the west for the first time following the replacement of the south polar shaft bearing.

VLBI2010 at the GGAO: Antenna Construction Begins

– Mark Evangelista, Honeywell Technology Solutions, Inc./NASA GSFC

While not in the IVS network observing schedule for several years, activities at the Goddard Geophysical and Astronomical Observatory (GGAO) in Greenbelt, Maryland have not diminished. The GGAO serves as the test bed for NASA VLBI2010 development activities. Of late, the most notable activity has been the installation of the new 12-meter antenna being undertaken by NASA, Honeywell, and the MIT Haystack Observatory. While in the planning stages for well over a year, it was only recently that approvals were granted from various local agencies within the state of Maryland and NASA management which allowed this effort to commence. Pre-construction requirements included tree harvesting and reforestation maps, soil erosion/drainage control plans, RFI studies, and various other technical and administrative hurdles. Patriot Antenna Systems, recently acquired by Cobham PLC based in the UK, manufactured the antenna in Michigan which was delivered to GGAO in December. On 8 July 2010 ground was broken at the GGAO to begin construction of the first 12-meter VLBI2010 antenna in the NASA-operated network. On 6 August 2010 the antenna foundation installation was completed.

A much smaller, but key, VLBI2010 component is the new broadband digital phase calibrator. With phase-cal generator electronics—designed by the MIT Haystack Observatory—and RF packaging, distribution and temperature control being designed and integrated by Honeywell, two prototype units have been assembled and successfully tested thus far. Current development activities consist of defining and controlling phase calibrator temperature parameters as well as design of an RF-tight enclosure to eliminate any possible leakage into the new RF receiver front end—quite a challenge considering the broadband VLBI2010 requirements.

(top) 25 auger cast pilings were bored before 61 cubic meters of concrete were added in a continuous pour to complete the 12 meter VLBI2010 antenna foundation. (below) Irv Diegel, of Honeywell Technology Solutions, Inc., works to integrate temperature control electronics into a prototype broadband phase calibrator.

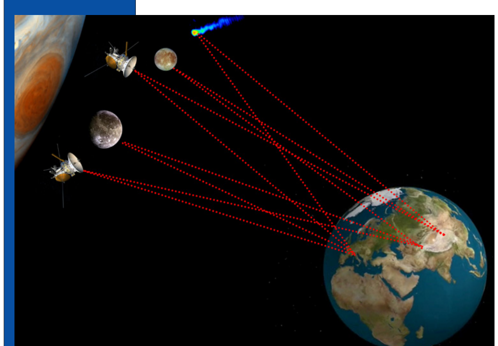
In collaboration with the MIT Haystack Observatory, other activities at the GGAO include operational testing utilizing the new Mark 5C and ROACH Digital Back End (RDBE)—a combination supporting increased data rates, among other functions. Additionally, holographic techniques to characterize antenna reflector efficiencies and to generate deformation models are being developed and refined on the existing GGAO 5-meter VLBI antenna. These efforts will yield methodologies that can be applied to the new 12-meter and other VLBI antennas. Automated site-survey tie measurements utilizing the latest robotic total station survey instrumentation have begun. Significant progress is being made toward development of VLBI2010 systems as is evident with recent successful (fringes detected) broadband observations. These ongoing activities take us ever closer to the next generation of VLBI products.

Working Group 5 on Space Science Applications

– *Leonid Gurvits, JIVE*

In March 2009, the IVS Directing Board decided at its meeting in Bordeaux, France to establish a Working Group on Space Science Applications (WG5). The group is co-chaired by Patrick Charlot (Laboratoire d'Astrophysique de Bordeaux, IVS Directing Board member) and Leonid Gurvits (Joint Institute for VLBI in Europe, external expert). WG5 is tasked with the investigation of synergies between IVS and VLBI space science applications, to look for mutually beneficial collaborations, and to eventually give recommendations for possible future actions. The composition and Terms of Reference of the group are posted on the IVS Web site at http://ivscc.gsfc.nasa.gov/about/wg/wg5/.

Radio astronomy and exploration of space, arguably two of the most technologically challenging endeavors of the modern human civilization, are no strangers to each other. Both got "off the ground" in the middle of the 20th century. One can trace lots of examples of mutually beneficial interactions between the realms of radio astronomy and space flight. High points of these interactions include tracking of the upper stage of the first "Sputnik" rocket by the 76-m radio telescope (now the Lovell Telescope) at Jodrell Bank Observatory (UK) in October 1957, reception of TV pictures from the Moon of Neil Armstrong's "That's one small step for man; one giant leap for mankind." by the Parkes radio telescope in Australia in July 1969. In return, space exploration infrastructure offered a lot of valuable assets to radio astronomers too. For example, in 1964 the Soviet deep space eight-dish communication antenna ADU-1000 in Evpatoria (Ukraine) enabled a group of young radio astronomers, led by G. Sholomitsii from the Sternberg Astronomical Institute in Moscow, to discover the fundamental property of extragalactic radio sources—their variability.



A generic configuration of Planetary Radio Interferometry and Doppler Experiment (PRIDE)—an advanced VLBI experiment with planetary orbiters and surface probes. The top observational target on the cartoon is an extragalactic object serving as a phase-referencing source for VLBI observations. The ultimate goal of PRIDE is to provide GPS-level accuracy of state-vector determination of planetary probes anywhere in the Solar System.

And then VLBI came on the scene, with its ability to pinpoint position of celestial radio sources with breathtaking accuracy. For astronomers, these sources were remote galactic and extragalactic radio sources. But there were also others who designed, built, and launched a different type of "sources": spacecraft equipped with radio transmitters of all kinds. These "non-astronomers" wanted to know the celestial position of these artificial sources no worse than or even better than "traditional" astrometrists. Their desire triggered VLBI observations of spacecraft, especially deep space probes, for which standard deep space trajectory determination techniques were unable to provide the necessary accuracy.

There is a great variety of successfully accomplished VLBI tracking experiments with deep space and planetary missions. These include VLBI observations of the international VEGA missions to Venus and the Halley comet in 1984-86, ESA's Huygens Probe during its descent in the atmosphere of Titan in January 2005, NASA's Cassini (Saturnian system) and Phoenix (Mars) missions by the VLBA (USA), the Lunar missions Chang'E-1 (China) and SELENE/Kaguya (Japan) in 2007-2008, and the Japanese mission IKAROS launched toward Venus in 2010. A number of advanced VLBI experiments with planetary missions to Mercury, Venus, Moon, Mars, and outer planets are in the implementation and preparation phase at the time of writing.

There is a great deal of synergy and complementarity between the methods used by the IVS and those employed in spacecraft VLBI tracking. In addition to the most obvious application of IVS specific know-how (for estimates of spacecraft state-vectors by means of VLBI tracking), other outcomes of IVS studies might be very useful for space operations too. For example, VLBI-based geodetic support for deep space network facilities as well as IVS-style surveys of extragalactic sources suitable for phase-referencing observations of spacecraft may prove to be extremely valuable for achieving ultimately accurate orbit determination. These are several of the reasons why WG 5 on Space Science Applications has been established.

To fulfill its task the Working Group has focused its attention on the following aspects:

- investigation of synergies in scientific and technological areas between the IVS core activities and VLBI experiments in application to planetary and space science missions;
- determination of areas of VLBI support of planetary and space science missions where experiments conducted by the IVS (possibly together with other VLBI networks) can be mutually beneficial;
- investigation of the desirability and feasibility of establishing a mission-specific liaison between IVS and appropriate space agencies and other organizations involved in planetary and space science missions.

WG5 is currently working on a white paper, which will be made public after approval by the Directing Board. Comments and suggestions with regards to WG5 or the white paper may be sent to the author (lgurvits@jive.nl).

'TOW'ing to a Technology Transition

– Mike Poirier, MIT Haystack Observatory

Through the last 30 years or so the acquisition of VLBI data has been dependent on the ability of station support personnel to manage a complex combination of old and new systems. We have seen many changes in equipment and technologies which have improved our station reliability. The largest and most recent improvement was the switch from the tape recording systems to the disk based recording systems. This change removed (what I believe to have been) the single largest contributor to poor VLBI data from our stations.

Most of our data acquisition equipment has been aging and some components within our systems are no longer easily available. This makes us more dependent on our limited supply of station spares. With the upcoming VLBI2010 systems we will have the possibility to replace many aging components in our systems. The VLBI2010 systems will be another great leap forward in technology. This, in turn, will allow our stations to provide a higher level of data quality to the analysts. The plans are to have new more capable systems from the antenna, through the receiver, down to the recorders, which will have the ability to stream data over networks directly into the correlators.

Station personnel will have to learn and understand new equipment, methods, and technologies. We will have to be flexible and advance our own skill sets as we integrate these new technologies into our systems. New procedures, check-off lists, and tasks must be created and entered into our station operations manuals. Most important is that this information must be taught to all operators; a good platform for this is the next Technical Operations Workshop (TOW), which is scheduled for the second week in May 2011 at Haystack Observatory. Only the proper operation of the new technology will ensure that this transition will be transparent to the science community. We therefore strongly encourage the IVS Network Stations to budget for a further education of their station personnel and to send the appropriate people to dedicated training workshops such as the TOW.

Seeking SAC-SOS Centers

– Dirk Behrend, NVI, Inc./GSFC

The IVS is seeking SAC-SOS centers. SAC-SOS? That's right. Not a survival bag or Spanish saxophones, but Special Analysis Centers for Specific Observing Sessions. A call was sent at the end of May to the analysis e-mail exploder; the full text is available in the e-mail archive at http://ivscc.gsfc.nasa.gov/pipermail/ivs-analysis/2010-May/004362.html. The call is directed mainly at Associate Analysis Centers, but of course any interested party may commit to this task.

While the R1, R4, and Intensive sessions are analyzed in depth on a regular basis, other 24-hour sessions largely lack this intense close look. Such an intense close look, however, is needed to create a feedback loop with the stations and schedulers enabling an overall performance improvement. Hence, proposals to upgrade to a special analysis center for a Specific Observing Session (or SAC-SOS) are very much welcome. In particular, responsible SAC-SOS are sought for the following observing series: T2, OHIG, Europe, APSG, CRF, R&D, and RDV. All these sessions deserve a stronger visibility; denominating responsible SAC-SOS is a very important first step. Form-free proposals can be submitted to the Coordinating Center (ivscc@ivscc.gsfc.nasa.gov) by 20 October 2010 in order to be considered at the next Directing Board meeting, but also at any time thereafter.

Please contact the Analysis Coordinator, Axel Nothnagel (nothnagel@uni-bonn.de), for any inquiries with regards to SAC-SOS.

Upcoming Meetings...

Journées 2010
Paris, France
Sep. 20-22, 2010

Nuclear Opacity in AGN
Seoul, Korea
Oct. 20-21, 2010

IAG Commission 1 Symposium
Marne-La-Vallée, France
Oct. 4-8, 2010

GGOS/IAU Workshop
Shanghai, China
Oct. 25-28, 2010

9th International e-VLBI Mtg.
Perth, Australia
Oct. 18-20, 2010

AGU Fall Meeting
San Francisco, USA
Dec. 13-17, 2010

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

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

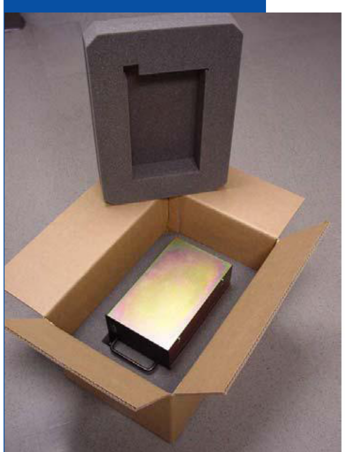
http://ivscc.gsfc.nasa.gov/.

NEWS...

The Geodetic Media Pool Evolves

– Dirk Behrend, NVI, Inc./GSFC

From 7-track tape to instrumentation tape, from thick tape to thin tape, from tape to disk, from PATA to SATA—the geodetic VLBI media pool has been evolving ever since VLBI observations began. Clearly the evolution of the media pool went hand-in-hand with the continuous development of the VLBI data acquisition systems (e.g., Mark I through newest flavor of Mark 5, K-1 through K-5), where each development step brought along an increased possible data rate. With the advent of the option of transferring large amounts of data via high-speed Internet connections, it has been an inherent hope that the media pool may become superfluous some day. This may be so, but it will not be any day soon, not least because connecting all stations and correlators with high-speed lines is a major challenge.



(top) Mark 5 module ("8-pack") populated with eight disks. (below) Mark 5 module with shipping covers installed is readied for shipment in tailor-made shipping box.

Tape drives and tapes were retired at the end of 2006. Since then only disks have been used, at first solely PATA disks and recently SATA disks. Hence, the current geodetic media pool consists of mostly PATA and some SATA disk modules. The modules are sometimes referred to as "8-packs", which speaks to the fact that eight disks populate a Mark 5 frame to form a Mark 5 module. In recent months SATA disks have become cheaper than PATA disks, causing PATA disks to peter out in the marketplace. Also, no larger-capacity disks are produced as PATA. Hence, the latest change to the media pool is the gradual turn over to SATA modules.

Still, the cost for Mark 5 modules is the sum of the cost for the disks and the frames. Hence, for a transition time it has been more economical to reuse existing frames and repopulate those with disks of higher capacity. In addition, as the storage requirement for basically all IVS sessions has increased to above 1 TB per station per session (due to increased observation rates), the use of the older 960 GB modules (A-size modules) has become uneconomical because of higher shipment costs for doubled up A-size modules. With a significant number of modules of the geodetic media pool having A-size (about one quarter), NASA Goddard Space Flight Center decided to upgrade most of the A-size modules (107 to be exact) to 4-TB modules. The necessary 856 PATA 500-GB disks have been purchased and the U.S. Naval Observatory is currently working on repopulating the modules.

The IVS Network Stations and other agencies participating in IVS contribute to the geodetic media pool of Mark 5 modules. The pool is managed by Cynthia Thomas of the Coordinating Center in collaboration with the correlators and stations. Though the failure rate of modules is relatively low, some modules have to be replaced after a number of years. Hence, any contribution to the pool is welcome. New modules will be of the SATA kind. Please feel free to contact the Coordinating Center if you want to contribute and to learn about the currently recommended media type and disks.

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