IVS Newsletter

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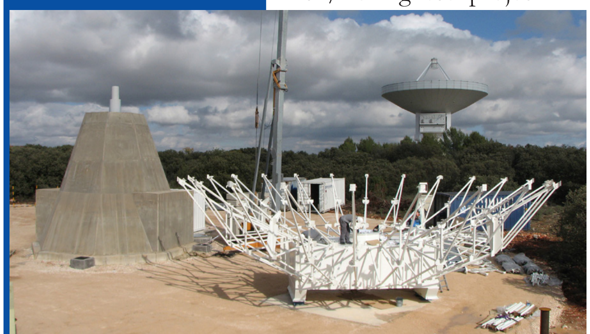
Construction of RAEGE Telescopes in Full Swing

– *José A. López-Fernández, IGN Spain and Luis R. Santos, DRCTC Governo dos Açores, Portugal*

The VGOS network continues to grow. Recently construction work began on two new VLBI2010-type radio telescopes, one at Yebes and the other on Santa María (Azores). Both telescopes are part of the Spanish/Portuguese project "Atlantic Network of Geodynamical and Space Stations" (RAEGE for short) that will be completed with two additional stations on Tenerife (Canary Islands) and Flores (Azores).



The first RAEGE radio telescope is being built at Yebes, Spain. The concrete tower was built during the summer of 2012 and installation of the steel backstructure is currently underway. The completion of the assembly work is foreseen for February 2013, and the commissioning using the tri-band (S/X/Ka) receiver developed at Yebes Labs is anticipated for the summer of 2013.

The building project of the RAEGE radio telescopes was initiated at the end of 2010 when the contract for the design, construction, and commissioning of the first three radio telescopes was awarded to MT Mechatronics (Germany). The design of the radio telescopes was completed in the summer of 2011. During 2011 and 2012 the backstructures of the three radio telescopes were built by Asturfeito in Cantabria, Spain. Other parts, such as the reflector panels, were fabricated by COSPAL Composites in Italy.

The RAEGE station on Santa María (Azores) also started with the building of the concrete tower. The infrastructure project includes the construction of a control building as well as other service facilities. The installation of the radio telescope is planned to commence when the Yebes radio telescope has been commissioned.

The RAEGE radio telescopes are Azimuth/Elevation turning head telescopes, reaching azimuth and elevation slew speeds of 12°/s and 6°/s, respectively. The optical design is based on a 13.2-m ring focus reflector. In its basic configuration, the observation frequency is in the range of 2–40 GHz. It can be enhanced up to 100 GHz by using additional options.

For geodetic telescopes it is essential to be able to accurately measure the position of the intersection of the azimuth and elevation axes. Therefore a concrete pillar is installed at the center of the telescope tower, allowing the installation of a measurement system to be located at the intersection of axes and visible from the outside through openings.

Another important requirement in geodetic VLBI is path length stability. In order to handle path length errors, an active deformation measurement and "flexible body compensation" (FBC) method is foreseen, similar to established methods used for surface and focus/pointing error corrections.

Construction of the radio telescope at Yebes is in full swing; complete assembly is expected by April 2013. The concrete tower has been finished and is ready for the installation of the telescope backstructure. The steel parts are already on site and the backstructure is being assembled on the ground. The servomechanism is fully installed and tested at the workshop in the azimuth cabin; this will allow a fast assembly on site. Likewise the control electronics is installed in a cabinet, which has also been tested at the workshop, ensuring a direct and fast installation. The construction of a tri-band receiver at S/X and Ka bands, developed at Yebes Labs, will assure the first RF and VLBI tests. The commissioning of the RAEGE Yebes radio telescope is foreseen for the beginning of next summer.

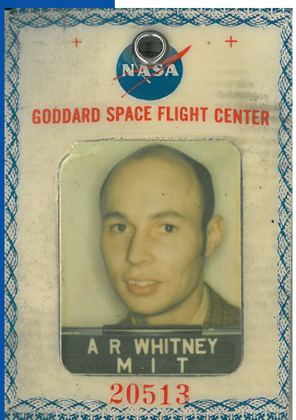
Activities have also started at RAEGE's Santa María site with the construction of the concrete tower and infrastructure facilities. The assembly of the steel backstructure is anticipated for June 2013. On 17 September 2012, an official inauguration ceremony kicked off the start of construction. The event took place in the presence of local authorities as well as regional government representatives. The infrastructure project includes the construction of the main control building, a building for power distribution, a social facilities building (to be built in a second phase), and access roads. The Santa María site will include a completely isolated gravimetry pavilion, buried in a small hill, on top of which a permanent GNSS station will be installed.

RAEGE is the most important space geodesy and VLBI project being carried out in Portugal. It is also the only project that allows the verification of simultaneously installing and combining multiple devices for time-and-frequency determination as a service to the scientific community in the Azores region.

Feature

Alan Whitney Heading Towards Retirement

One of the most prominent figures of technological developments in VLBI is planning retirement. At the end of January 2013, after dedicating basically his entire professional career to VLBI, Dr. Alan Whitney will retire from Haystack Observatory. Alan started out as a VLBI pioneer and concludes his work life as the IVS Technology Coordinator, a position he has held since the inception of the service. Newsletter Editor Hayo Hase talked to Alan to get a glimpse of Alan's many accomplishments and countless contributions to the VLBI community.



(top) A young Alan circa 1969. (below) Susan Hockfield (16th President of MIT) presents Alan with his 2011 Excellence award (left to right; Susan Hockfield, Alan & Sarah Whitney).

Alan, looking back to the old days, where and when did you hear first about VLBI?

I was looking for a PhD thesis topic at MIT in fall of 1967, just a few months after the very first successful VLBI experiments in July 1967, and it was suggested that I might talk with Prof. Irwin Shapiro about his interest in VLBI. Irwin was particularly interested in using the new-fangled VLBI technique as a tool for a high-precision test of Einstein's GR theory of the bending of light in a gravitation field. So I talked with Irwin and fortunately showed enough credibility that he was willing to take me under his wing. Haystack Observatory was involved in those very early VLBI experiments, so it was a natural place from which to pursue the gravitational-bending experiment. Irwin wanted to measure "wideband group delay" for the GR experiment, a new concept which had not yet really been tested. The idea was to track the second-order group-delay difference between the bright quasars 3C279 and 3C273 as the apparent position of 3C279 changes slightly as is passes near the sun, which it does every October. At the time, the only available VLBI digital-data system was the Mark I tape system, capable of recording 720 kbps and consuming one standard 12-inch-diameter, 2400-ft computer tape every three minutes (for a staggering 16 MB of storage!). Alan Rogers of MIT had suggested "frequency switching" as a way to emulate a large bandwidth, but a lot of equipment had to be developed to implement this scheme, and it was very complicated. So I was put to work to help design and build some of this equipment. The very first 'wideband' group-delay experiment was conducted in April 1968 between the Haystack Observatory 37-m antenna and the Onsala 25-m as a test of this new equipment; we observed at L-band (~1660 MHz), frequency switching over total spanned bandwidth of a few tens of MHz. The results were, to say the least, less than stellar (i.e., no fringes) mostly due to equipment issues. Fortunately, it was mostly uphill from there, though the first attempt at a GR light-deflection experiment in October 1968 between Haystack and Green Bank, WV, was also pretty much a failure, but due more to the unexpected severity of corrupting effects of the solar corona rather than equipment. Nevertheless, I was hooked on VLBI and still am after 45 years.

Your PhD thesis "Precision Geodesy and Astrometry via Very Long Baseline Interferometry" dates back to 1974. It contains the theory of correlation and is cited till this day by those who want to understand more about correlation. Do you remember what the difficulties were when writing your thesis?

Oh, yes! Despite several more years of valiant efforts to do a successful GR light-deflection experiment, and with ever more sophisticated equipment and software, the solar corona turned out to be formidable foe. In the meantime, I had also become heavily involved with geodetic-VLBI using basically the same equipment, and there were beginnings of notable success as early as 1969. The first 'successful' wideband geodetic-VLBI experiment took place in January 1969 between Haystack and the Green Bank (WV) 140-ft antennas, spanning 110 MHz over six 360-kHz frequency channels around 1660 MHz; the baseline was determined to within ~2 meters in length and ~5 meters in orientation, a big breakthrough at the time! By the time 1973 rolled around and continued GR light-deflection experiments continued to yield less than hoped for results, it was clear that geodetic VLBI offered a better thesis opportunity. So I took it and ran with it, completing my thesis in January 1974.

What activities were carried out by you prior to the famous NASA Crustal Dynamics Project (CDP)?

Haystack and NASA became VLBI partners in 1969 when Tom Clark, another early pioneer in VLBI, approached Haystack to collaborate on the next VLBI GR experiment. This experiment was by far the most sophisticated attempt to crack that nut, involving Haystack, Green Bank, and OVRO (California) but again was thwarted by the solar corona, though quite a few hours of geodetic data were taken during nighttime hours when the GR target sources were not visible. I actually spent nearly a year living with Tom Clark and his gracious wife Elizabeth while I wrote correlation software to run on the NASA/GSFC IBM model 360/91 computer, then one of the largest and fastest in the world; it boasted 300 kB of RAM memory, a few MB of magnetic drum memory (no magnetic disks!), and many computer-tape machines capable of reading Mark I VLBI tapes. Some 3000 tapes were recorded during the experiment, taking months of processing time. Though the GR results were disappointing, the geodetic results were quite promising, measuring the Haystack-to-Green-Bank baseline length to order 1 m and the baselines to California to order 2 m, which was impressive for the time. Over the next few years, the geodetic results improved steadily, to the point that NASA created the Crustal Dynamics Project in 1979, making considerable resources available for further geodetic-VLBI development.

The Mark IV VLBI Correlator ready to ship to Bonn in 1999.

The breakthrough of VLBI in the geodetic world was marked by the NASA CDP in the 1980s. What were the (technological) challenges at the time?

There were several major technical challenges. The first was to dramatically improve the recordable data rate to gain desperately needed sensitivity, and a second was to develop a correlator that could process such data rates. The Mark III data-acquisition system improved Mark I data rates by a factor of more than 60 to 224 Mbps, and the Mark III correlator provided the platform for correlation processing a 4-station VLBI experiment at the same rate. (NRAO had developed the Mark II system in the early 1970s, but it was not used for geodetic-VLBI.) There were also challenges in equipment calibration, to which Alan Rogers contributed improved phase and cable calibration systems that are still in use today. Post-correlation processing also presented challenges, which resulted in the HOPS (Haystack Observatory Processing System) primarily authored by Roger Cappallo and Colin Lonsdale that is still in use today, as well as improvements in the Calc/Solve software suite at NASA/GSFC and MIT.

Alan Rogers, Arthur Niell, and Alan in 1989.

How could the idea of a global VLBI network be successfully implemented in an era when the world was politically divided into East and West?

In the 1980s the political divide prevented implementation of a truly global VLBI system. The major activity in those years was in North America, Europe, Australia, and Japan. Though not truly global, it did begin to give experience in doing VLBI on a global scale. Starting in the early 1970s some occasional astronomical VLBI experiments were conducted with Russia using the 22-m Crimea telescope, but the beginnings of a truly global VLBI array did not become realizable until the early 1990s following the end of the cold war.

In the 1990s the GPS system was fully implemented, showing the power of this technique for geodesy. How did VLBI survive this battle as an indispensible geodetic observation method?

VLBI and GPS are complementary in several ways, each having strengths and weaknesses. VLBI accurately measures the earth's geometry on all size scales, as well as exquisitely measuring the Earth's motions in the fundamental inertial reference frame defined by the distant quasars. As a result, VLBI is very sensitive to earth rotation and polar motion changes and can make very accurate earth-scale dimensional measurements (plate tectonics, for example). The orbits of GPS satellites, on the other hand, are relatively insensitive to changes in UT1 or polar motion and so require external information (mostly from VLBI) to calibrate the GPS system for use on the surface of the Earth. On the other hand, GPS is exquisitely accurate at making differential vector baseline measurements over relatively short distances (<1,000 km) and is far less expensive per measurement than VLBI.

What were the technological achievements of the 1990s?

The 1990s saw a huge amount of effort devoted to building very large (for that time) correlators that could process the large and increasing set of high-data-rate data from many stations. The results of these efforts were the Mark IV and VLBA correlators, both capable of processing many stations at data rates from 256 Mbps to 1 Gbps. Only within the last few years are these correlators being replaced by software correlators that have been made possible by the inexorable progress of Moore's Law.

IVS was founded at the end of the last century, in 1999. What were the reasons for its creation? What was your role in that process?

IVS was founded primarily as an international coordinating organization for the practice of geodetic VLBI; such an organization is clearly a necessity if global geodetic VLBI is to be truly successful. IVS also provides a formal organization with which to interface to other global geodetic organizations, such as IAG, that provide a higher level of coordination with other measurement and analysis techniques, providing an important seat at the table for the contributions that VLBI has to offer. I helped to formulate some of the early ideas and documents for IVS, along with many others, and then joined the IVS Board as Technology Coordinator.

The IVS is recognized as a service of the IAG as well as the IAU and it is well established among other services. How do you see the role of the Technology Coordinator w.r.t. the VLBI2010 initiative forming the VGOS network?

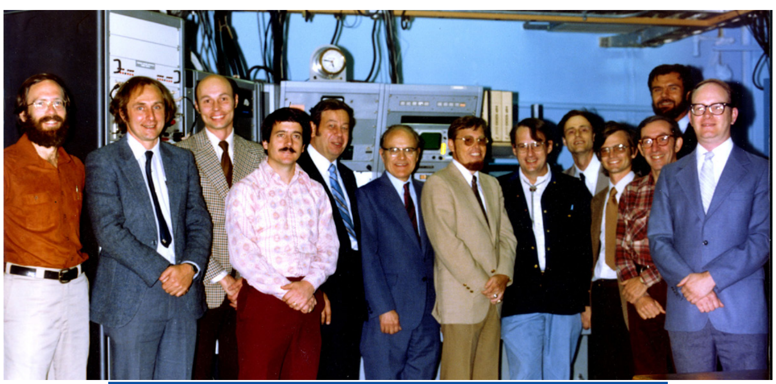
I have always considered that one of the most important jobs of the Technology Coordinator is to promote and lead the development of VLBI standards to help ensure global inter-operability of independently developed VLBI equipment and systems. I first became involved in VLBI standards development in the mid-1980s when I led the development of the SNAP (Standardized Notation for Antenna Procedures) protocol adopted by the widely used NASA/GSFC Field System. I have also led the development of VEX (VLBI EXperiment configuration/schedule), VSI-H/VSI-S (VLBI Standard Interface Hardware/Software) in the late 1990s, and VDIF (VLBI Data Interchange Format) within the last few years. Without standardization, global VLBI would be a much more difficult and fragmented global enterprise.

At Haystack Observatory you are involved in the proof-of-concept work by using the Westford radio telescope as a pioneering instrument. What has been achieved so far and what do you expect?

Over the years, both the 37-m Haystack telescope and the 18-m Westford telescope have served as test beds for VLBI development work. Today, Westford continues this important role in VLBI development work, particularly for VLBI2010 system development, along with the 12-m NASA/GGAO telescope in Maryland. But VLBI development is certainly not limited to these telescopes and takes place at several other places in the world.

If we look into the future of VLBI, what will be the biggest challenges to preserve the VLBI method, the IVS, and the infrastructure used for VLBI?

VLBI will always be part of the astronomy toolkit due to its place as the highest-angular resolution technique of any physics measurement technique known. Healthy survival of geodetic VLBI depends on successful efforts to meet or exceed the VLBI2010 goals, as well as continued support by the global community. That also means continued political support, which is sometimes tricky despite excellent technology and results. Geodetic VLBI could potentially become an important tool in studying and measuring the effects of global climate change, particularly sea-level change, but international efforts on this front, and particularly in the U.S., have been somewhat weak.



Dedication of Westford Antenna for geodetic VLBI in 1980.

Once freed from so many responsibilities, what are your personal plans for the future?

Well, firstly, I am not intending to completely disappear for a while, and plan to continue to work on a part-time basis. On the other hand, there are some things that my lovely wife Lois and I would like to pursue. Ironically, over the last 40 years I have arguably seen more of the rest of the world than I have of North America so we would like to take some leisurely travels to see some more of the interesting things not so far away; first on the list is to visit more of the many U.S. and Canadian national parks, some of which are absolutely spectacular. Lois and I are also very interested in family genealogy and hope to have time to explore and uncover more of our respective family roots which, unsurprisingly, both trace back primarily to Europe. Of course, there is a long list of 'honey do' tasks that have accumulated over the years that I mean to tackle, including finish carpentry work in our newly renovated home. Lastly, I have as a result of playing the violin for nearly 60 years and having met my wife through violin playing, developed an interest in violin making and repair and have attended some summer courses along these lines at area universities. I'll never be a Stradivarius, but I enjoy doing the precision work involved in violin making and repair. On the other hand, my daughter Sarah, a professional violinist in New York City, will never let me lay hands on her instrument! Too risky, she says!

Any final words?

I have been privileged to be involved with VLBI since very nearly its origins and have been able to stand on the shoulders of those real pioneers who had the vision and skill to do the first early pioneering work; among those I have worked closely with and know well are Irwin Shapiro and Alan Rogers, both whom are still active today. I look back in awe at what they were able to achieve, and I hope that I have been able to contribute at least a little bit to the progress achieved by the global collective effort of the last 45 years.

Alan, we thank you for this interview and hope to see you from time to time at our IVS events. On behalf of the IVS community, I would like to express our deepest appreciation for your commitment to improving VLBI. All the best for the future!

1967 and the Birth of Modern Geodetic VLBI: A Historical Update

– David Jauncey, CSIRO Australia

In the August 2012 IVS Newsletter article "1969: The Birth of Modern Geodetic VLBI" the author, Alan Whitney, one of the early pioneers of VLBI (geodetic and otherwise) comments that "exactly when the use of VLBI for high-precision geodetic measurements was first recognized is somewhat cloudy". He then recalls Irwin Shapiro's suggested use of VLBI for high-precision geodesy, as well as recalling the 448 MHz Algonquin Park to Prince Albert baseline analysis undertaken by H.E. Jones.

My understanding of the early history, having been there through the first days of VLBI, clearly puts the date of the initial recognition as the 21-July-1967 issue of the journal 'Science'. This issue contains two consecutive reports on pages 302 and 304. The first article is "Radio Method for the Precise Measurement of the Rotation Period of the Earth" by Tommy Gold at the Center for Radiophysics and Space Research at Cornell University. The second article is "Implications for Geophysics of the Precise Measurement of the Earth's Rotation" by Gordon MacDonald at the Institute for Defense Analysis in Arlington, VA.

Tommy Gold's interest in VLBI at Cornell was an important component in setting up the original NRAO–Cornell VLBI Team. His was a well-timed, visionary article, received 12 June 1967, only weeks after the first fringes from widely-spaced telescopes were successfully found by both the Canadian VLBI and NRAO–Cornell Teams. Gold addressed the various problems to be encountered and also proposed ways that these might be expected to be overcome (e.g., finding radio sources that are sufficiently small, precise time and frequency synchronization, recognition of a specific fringe). He then predicted some of the potential applications, Earth rotation, solid Earth tides, precise clock synchronization, polar motion, and so on. Gold concludes that "...the system discussed here is, of course, elaborate. Nevertheless, it may be worthwhile setting it up, not only for the more precise measurements of the motion of the Earth around its center of mass, but also for the determination of distortions of the surface and other geophysical effects, and possibly for the determination of proper motion in radio sources. Very precise measurements are often used not only to determine the magnitude of known or expected effects, but also to search for new ones."

Was Gold's paper unknown to others in the VLBI and geodesy community at the time? A look at its citations shows that the Canadian Group was well aware of it and referenced it in Norm Broten's 1967 Nature article. Marshall Cohen's 1969 Annual Reviews article notes both the Gold and MacDonald articles as potential harbingers of the things to come in geodetic VLBI. Moreover, some members of the MIT Haystack Team were also aware of it. Bernie Burke's article in Physics Today, July 1969, page 54, addresses both the astronomy and geodetic applications, and also references both Gold's and MacDonald's articles. Interestingly, Burke notes that a joint MIT Lincoln Laboratory group is involved, and lists a "C. Whitney" at MIT as a member of this collaboration. Could it be that this is Alan Whitney, especially as no "C. Whitney" appears as a co-author on the series of VLBI and geodetic VLBI papers coming from this collaboration, while an "A.R. Whitney" certainly does so.

History, as noted by time and Alan Whitney, has well demonstrated the successes of geodetic VLBI. The setting up and operation of the IVS has certainly demonstrated the success of Tommy Gold's proposal.

Response from Alan Whitney: I thank Dave for clarifying and expanding the early history of the development of ideas for using VLBI for geodetic measurements; it is important that this history be accurately represented, and I apologize for any omissions I may have made. The early leaders and thinkers who recognized the potential of VLBI for geodesy are absolutely due their just credit.

`Tis TOW Season

– Dirk Behrend and Ed Himwich, NVI Inc./GSFC

After the holiday season, we will go right into the TOW season which will culminate in the 7th IVS Technical Operations Workshop to be held at Haystack Observatory May 6–9, 2013. Although we do not expect a Santa TOW to make an appearance, we anticipate venerable VLBI experts to share their knowledge with the technical staff of the VLBI stations. As in previous installments, the meeting will be oriented towards hands-on training and problem resolution in VLBI operations. With the advancement of the digital technologies, it is foreseen that the newer developments will be integrated into the class offerings.

Preparations have started with the establishment of the Program Committee. Internal discussions within the PC as well as feedback from the prospective students (expect a call for feedback to be sent out by early February) will make sure that the topics covered will be the most useful for the attendants. Of course, if you have any requests or ideas for topics, please feel free to contact the IVS Network Coordinator Ed Himwich (Ed.Himwich@nasa.gov) at any time.

We look forward to a large attendance at the TOW. Remember that a prerequisite for having good VLBI data is to have quality equipment and well trained station personnel to operate it.

VLBI Training School and WG6 Activities

Rüdiger Haas is the chairman of IVS Working Group 6 "Education and Training" and heads the organization committee of the first Training School on VLBI for Geodesy and Astrometry to be held in Espoo (Helsinki), Finland. Editor Hayo Hase interviewed Rüdiger about these two important activities for the IVS.

(above) Campus of Aalto University. (below) The venue of the VLBI Training School.

Rüdiger, we know that several VLBI events are planned in Helsinki in March 2013. Could you provide us with a short outline?

The EGU and IVS VLBI Training School will start on March 2 (Saturday) and end on March 5 (Tuesday). The last session of the School on Tuesday afternoon will be combined with the 14th IVS Analysis Workshop. After that, the 21st EVGA Working Meeting will take place March 6–8 (Wednesday through Friday). The EVGA dinner will be on Wednesday and an EVGA business meeting will take place on Thursday morning. The excursion to the Metsähovi Radio Observatory will take place on Friday, where the IVS Directing Board will also have its meeting. So it will be a very interesting and intense week.

What is the motivation for organizing a VLBI School and who is the target group?

The IVS realized that there was a need not only for a next generation VLBI system but also for a next generation of VLBI researchers that would work with this system. Therefore, IVS initiated a working group on VLBI education, and one task of this working group, WG6, is to organize a VLBI training school. So the motivation for the school is to educate young people, the next generation, and to attract young researchers to VLBI. The target group consists primarily of master students and doctoral students, but we would also like to welcome senior researchers who could function as 'multiplicators' spreading the newly acquired knowledge at the school to their own students. We regard this to be of particular importance in emerging countries.

If I am interested in participating in the school, what do I have to do?

We have a limited financial support provided by the European Geosciences Union (EGU), the Onsala Space Observatory (OSO), and RadioNet. We intend to use this money entirely to support the students so that they can attend the school. To make the financial support that can be given per student meaningful, we decided to restrict the number of students to 40. Interested persons should submit a short application including a personal statement describing the motivation for the application, some information on the educational background, and a letter of recommendation by a supervisor. We require as educational background a bachelor or higher degree in geodesy, astronomy, physics, geophysics, electrical engineering, or engineering physics.

What aspects of VLBI will be covered? Will it be more technical or more scientific?

We aim at covering all aspects of VLBI for geodesy and astrometry, i.e., technical, operational, and scientific aspects.

Why will the school take place in Helsinki?

The main reason for having the school at Aalto University in Espoo, just 500 m outside Helsinki, is that we wanted to minimize travel. Since the EVGA as well as the IVS Analysis and Directing Board meetings were already planned to take place at Aalto University, we thought it sensible to arrange the VLBI school in connection with these events. Most of the teachers of the VLBI school would have traveled to Helsinki anyway; so, now they only need to travel once, saving the environment and travel expenses. And, as an additional benefit, the students of the VLBI school can stay on and attend the scientific meetings immediately after their school.

What is the charter and what are the achievements of WG6?

The charter of IVS WG6 has three major points; namely, (1) to establish contacts to educational institutions worldwide in order to raise the interest in VLBI, (2) to develop educational material on VLBI that can be distributed to these educational institutions, and (3) to prepare and organize VLBI training. We have collected already a quite extensive list of contact persons in educational institutions. So far not all continents are covered homogeneously, but we are working on that. We collected existing educational material from various universities and VLBI experts and made it available on the EVGA Web page. It is our plan to compile the presentation material of the VLBI school for distribution to educational institutions.

Are you still looking for educatiion material suitable for teaching and outreach?

Yes, of course we are! If a reader of the Newsletter knows about or has access to existing educational material, we would appreciate it very much if this material was provided to us. It can be sent directly to me at rudiger.haas@chalmers.se or to any other member of WG6.

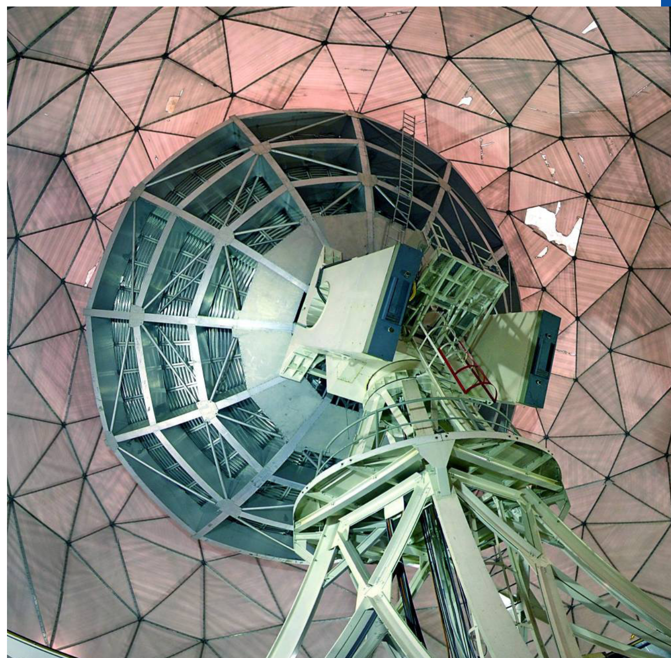
Where can I find comprehensive information on VLBI for geodesy and astrometry?

Well, I am not aware of any single Web page that provides all information on all aspects of VLBI for geodesy and astrometry. But the Web pages of the IVS and of many of its components provide a lot of material, usually focusing on special aspects of VLBI.

Just to mention a few:
http://ivscc.gsfc.nasa.gov/about/vlbi/whatis.html,
http://www3.mpifr-bonn.mpg.de/div/vlbicor/index_e.html,
http://www.usno.navy.mil/USNO/astrometry/vlbi-products,
http://www.spacegeodesy.go.jp/vlbi/en/,
http://www.haystack.mit.edu/geo/index.html, and
http://www.obs.u-bordeaux1.fr/BVID/content.html.
Technical aspects are covered extensively at http://vlbi.org/.

Thank you for the interview. We wish you a successful school.

Thank you very much!



(left) Metsähovi VLBI Station. (top) Metsähovi's radio telescope and panoramic view of the radio observatory site.

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
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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/.

Upcoming Meetings...

VLBI Training School
Espoo, Finland
March 2-5, 2013

EVGA Working Meeting
Espoo, Finland
March 5-8, 2013

EGU GA 2013
Vienna, Austria
April 7-12, 2013

7th IVS TOW Meeting
Haystack Observatory
Westford, MA, USA
May 6-9, 2013

AOGS 2013
Brisbane, Australia
June 24-28, 2013

IAG Scientific Assembly
Potsdam, Germany
September 1-6, 2013

Journées 2013
Paris, France
September 16-18, 2013

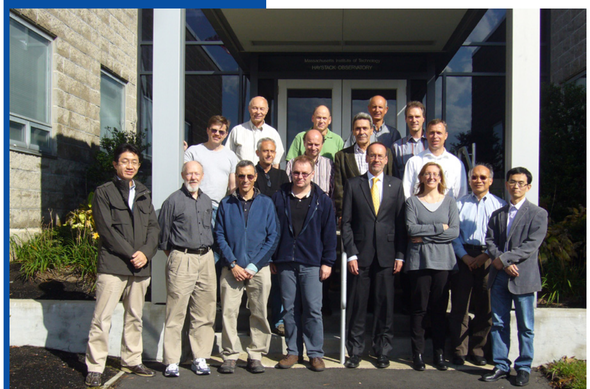
AGU Fall Meeting
San Francisco, USA
December 9-13, 2013

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

Recent Directing Board Activities

– Dirk Behrend, NVI, Inc./GSFC

The Directing Board held its 28th meeting at Haystack Observatory on 20 October 2012 right before the 1st International VLBI Technology Workshop at the same location. Major discussion topics included the progress of the IVS Working Groups and Committees as well as the evolution of the VLBI2010 Global Observing System (VGOS). Selected items are covered in other articles of this Newsletter.



The participants of the IVS Directing Board meeting at Haystack Observatory.

Another major item on the agenda pertained to the future composition of the Board. With Alan Whitney retiring, the position of the IVS Technology Coordinator needed to be refilled. Natural Resources Canada (NRCan) proposed Bill Petrachenko as the new Technology Coordinator. The Board unanimously approved the proposal. I would like to thank Bill for taking on this important task. With Bill's background in VLBI2010 technology, he was the ideal candidate to take over the reins from Alan. On a similar note, IVS Analysis Coordinator Axel Nothnagel gave notice (three months) of his resignation as coordinator. Unlike Alan, however, Axel will continue to be active in VLBI and IVS matters, seeking new duties and responsibilities within the IVS and, at the same time, allowing a new analysis coordinator to introduce new ideas. We hope that at the 8 March 2013 Directing Board meeting in Helsinki a new IVS Analysis Coordinator can be appointed.

Finally, following the IVS Directing Board elections in December and January, the new Board will elect a new chair at its Helsinki meeting. Current Acting Chair Harald Schuh will continue to be the IAG Representative on the Board, while his obligation as IAG Vice-President disallows him to be the chair of any IAG body including the IVS. It is also worthwhile noting that Harald left TU Vienna in November and is now with GFZ Potsdam. There he already established a VLBI group, which became an Associate Analysis Center of the IVS in December.

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