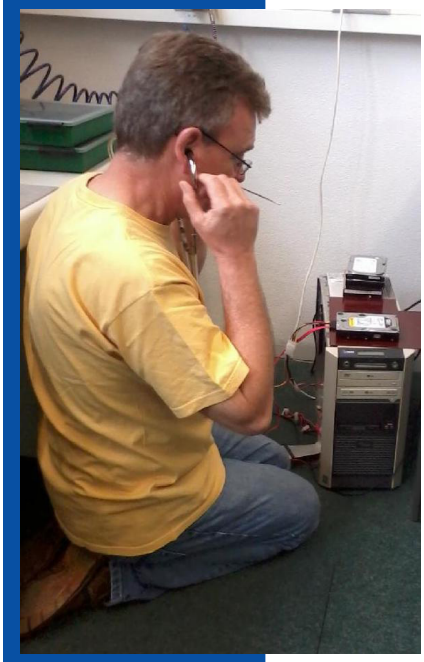
IVS Newsletter

Issue 39, August 2014

CONT14: A Success Story

– Cynthia Thomas, NVI, Inc.



Walter Alef examined a disk from a CONT14 module to find signs of "spinning life". He did not and the disk was removed from correlation.

S-U-C-C-E-S-S! Yes, CONT14 was successful. The Continuous VLBI Campaign 2014 (CONT14) was scheduled during the period of May 06 at 00:00:00 UT through May 20 at 23:59:59 UT with Badary, Fortaleza, Hartebeesthoek (15-m antenna), Hobart (26-m and 12-m antennas), Katherine, Kokee, Matera, Ny Ålesund, Onsala, Tsukuba, Warkworth, Westford, Wettzell, Yarragadee, Yebes, and Zelenchukskaya as participating stations. There were sufficient modules available for recording at a rate of 512 Mbps and all seventeen stations observed without any major problems. Nine stations transferred their data electronically to the Bonn Correlator, while the other stations physically shipped their modules. The 15-day campaign was correlated successfully by the Bonn Correlator within two months. That's incredible!

The main contributing factor to the success of CONT14 was team work. First, it began with the EVN Scheduler, Richard Porcas, who coordinated with IVS so that we could get the requested time period. Second, it was due to all of the stations that provided observing time. Third, it was the agencies that purchased (HartRAO, NASA, Matera, Yebes, Onsala, Ny Ålesund, Wettzell) and loaned (IAA and AuScope) modules to support CONT14. Fourth, it was the Coordinating Center that organized the modules with the help of the Bonn, Haystack, and Washington Correlators. Fifth, the Washington Correlator, Haystack Correlator, Bonn Correlator, and the Coordinating Center met in monthly telecons to discuss the details of CONT14. Thanks Chet Ruszczyk for the Mark 5 software upgrade allowing us to record more than 1,023 scans on a single module. Sixth, the Coordinating Center designed and created the schedule files. Seventh, the Washington Correlator received the Fortaleza data and e-transferred it to Bonn.

Once the data had been recorded and was ready to be shipped or e-transferred to Bonn, it was unclear whether Bonn was prepared and ready to process their first CONT campaign in its entirety. Well, there was nothing to fear. They were absolutely up to the task! To make this happen, all routine activities at the Bonn Correlator were suspended for about two months to process the CONT14 data. Thank you Radioastron and GMVA (Global Millimeter VLBI Array) for your understanding and support. Second, all non-CONT14 electronic data transfers to Bonn were suspended to allow the nine stations to e-transfer 192.5 TB of data to Bonn. A thanks goes to the LOFAR group, the computer division, and the VLBI Technology Department of MPIfR to make enough space on the RAIDS so that the e-transferred data could be stored. A very special thanks goes to Walter Brisken who flew to Bonn on short notice to fix a bug in the DiFX software; otherwise the correlation would not have been possible. Thanks to David Gordon for reviewing the databases. And, lastly, special thanks to Alessandra Bertarini, Laura La Porta, and other Bonn Correlator staff for working around the clock to get the data processed and released within two months!

More information on CONT14 can be found at http://ivscc.gsfc.nasa.gov/program/cont14

The daughter of Alessandra Bertarini helped with the correlation. Here she resets a Mark 5 unit when it hanged.

Feature

The Turkish IVS Analysis Center at KTU

The KTU-GEOD IVS Analysis Center (AC), located at the Department of Geomatics Engineering, Karadeniz Technical University (KTU) in Trabzon, a city on the Black Sea in northeastern Turkey, has been an IVS component since 2009. Newsletter editor Hayo Hase interviewed through e-mail Dr. Emine Tanır Kayıkçı and Dr. Kamil Teke, who form the team that is responsible for the KTU Analysis Center and carry out the VLBI data processing.

Dr. Emine Tanır Kayıkçı and Dr. Kamil Teke.

Emine and Kamil, when KTU joined the IVS in 2009, a new country was added with Turkey to the IVS family. How did you become familiar with VLBI?

Thank you so much for this interview and the opportunity to introduce ourselves to the IVS community. We are currently a group of two people. One of us, Emine Tanır Kayıkçı, is working at the Department of Geomatics Engineering, Karadeniz Technical University situated in the Trabzon province of Turkey, where our Analysis Center (AC) is located. The other member, Kamil Teke, is working at the Department of Geomatics Engineering, at Hacettepe University in Ankara. Hence, our two work places in Trabzon and Ankara are about 730 km apart. This long distance has not caused too many difficulties until now. As to your question, Turkey's membership in the IVS goes back to our PhD study years (2004–2011) at the Institute of Geodesy and Geophysics (IGG) at Vienna University of Technology (TU Vienna), where Prof. Schuh, our PhD advisor, encouraged us to work on VLBI. In 2008, Emine finished her PhD thesis about VLBI intra-technique combination on the normal equation level. After finishing her PhD at TU Vienna in the beginning of 2008, she left the IGG group and began to work at the geomatics engineering department at KTU. While Emine was at TU Vienna, also Kamil Teke, who is a former colleague of hers from Karadeniz Technical University, joined the IGG group in 2007 to pursue his PhD. In the scope of his PhD work, Kamil developed a parameter estimation module (vie_lsm) for the Vienna VLBI Software (VieVS) under the supervision of Prof. Schuh and he obtained his PhD degree in 2011. After his PhD, Kamil left Vienna in 2011 and went back to Turkey to work at the geomatics engineering department of Hacettepe University. Currently the two of us are the only people in Turkey working in geodetic VLBI. We are trying to find graduate and postgraduate students to become part of our VLBI team.

How did you learn about the IVS?

That happened when we were PhD students at TU Vienna, analyzing VLBI sessions: we used IVS data and products.

What made you apply for an IVS membership?

With our continued interest in VLBI and the encouragement of Prof. Schuh, we prepared a proposal to become an IVS Analysis Center (AC) at Karadeniz Technical University (KTU). Our proposal was approved during the week of the EVGA meeting in Bordeaux, France in 2009; the IVS Directing Board approved our application for establishing an AC named as KTU-GEOD in Turkey. Without any doubt, Prof. Schuh is the father of the VLBI activities in Turkey with his continued support of our activities. Being an official component of the IVS as an AC is very important for us for various reasons: we want to stay in touch with the VLBI community and for the future it is our aim to supervise PhD students who would like to study on analyzing VLBI sessions. This will hopefully lead to an enlargement of our VLBI group, which currently has only two members as mentioned before.

You are recognized as an IVS Analysis Center. Who does the actual analysis? What exactly are you doing? What are your future plans?

[Kamil] Both of us are doing the analysis of VLBI sessions with the Vienna VLBI Software (VieVS). I am basically responsible for analyzing VLBI sessions using VieVS and I have been contributing to the development of VieVS. Currently, as an idea of Prof. Böhm, I am adding certain constraints on the coordinate estimates, clock estimates, and troposphere estimates of the co-located VLBI antennas as Matlab functions, which will, in the end, most likely be incorporated into the vie_lsm module of VieVS. Besides that, I am doing some tests on the repeatabilities of certain parameters like VLBI baselines, antenna TRF coordinates, and EOP when GNSS troposphere delays are reduced from VLBI observations of IVS sessions, e.g., Intensives and IVS–R1 and IVS–R4.

Students performing a local survey at the Department of Geomatics Engineering of KTU.

[Emine] I am currently working on optimized parameterization of VLBI auxiliary parameters in a least squares adjustment. I have studied that topic since 2013 when I performed a short-term scientific visit to GFZ Potsdam to work with the VLBI group there, in particular with Prof. Schuh, Dr. Heinkelmann, and Dr. Nilsson. Furthermore, in order to get graduate students involved in our VLBI-related studies, I have supervised diploma theses on VLBI-related topics. One of them was prepared by Mr. Nijat Mammadaliyev, who developed a software function in the scope of his diploma work, reading SINEX files from IVS ACs and IGS ACs in order to be able to compare the tropospheric parameters. It was a great success for him, since we do not have any main courses at our department on VLBI except some seminar lectures given by me. Now, he has been accepted to the MSc program at the Technical University of Berlin (TU Berlin) and hopefully he will continue with VLBI. Additionally my PhD student, Mrs. Selma Zengin Kazancı, will compare troposphere delays estimated by VLBI with those derived from other space geodetic techniques. Thus, I am planning to include her in our group as a member of KTU-GEOD IVS AC.

Do you have some science projects with VLBI?

In the past typically one parameter set (i.e., station coordinates, troposphere parameters, clock parameters, and Earth orientation parameter) was estimated for one 24-hour session. These days, as far as we are concerned, the IVS wants to increase the time resolution to three hours, two hours, one hour, or even shorter periods. This is because many geodynamical and astronomical effects contain sub-diurnal periods. Thus, one of our aims is to contribute to the IVS by reliably estimating these parameters from VLBI observations with higher time resolution.

Are you interested in having a VLBI network station somewhere in Turkey? Do you have plans to extend your analysis activities?

Yes, we are interested in having a VLBI network station in Turkey. However, this target is unrealistic in the near future. But sure, we want to extend our analysis activities.

How large is the community of "space geodesists" and/or "radio astronomers" in Turkey?

As far as we know, space geodesists in Turkey are not too common. Yes, we have contacts with the community of space geodesists within the body of the Turkish National Geodesy Commission, which is the national sub-commission of the IAG (International Association of Geodesy). Other surveying-related commissions are working under the Chamber of Surveying and Cadastre Engineers in Turkey, which has been a member of the FIG (Fédération Internationale des Géomètres) since 1969. We are members of these commissions and have participated in national conferences held by these national organizations to present our VLBI-related studies. Concerning the community of "radio astronomers", unfortunately we do not have any contacts so we do not know the number of radio astronomers in Turkey.

Everybody has dreams of an ideal world. What would be your dream, thinking of the current situation of VLBI in Turkey?

Considering the situation of VLBI in Turkey, our dream would be to have radio telescopes observe in IVS sessions, maybe even to track spacecraft, and to have enough technical background and scientific knowledge about space missions and radio astronomy. In order to realize our dream, we need to work hard and get financial support from national scientific funding organizations.

Master students at the entrance of the Geomatics Engineering Department building of the Hacettepe University in Ankara.

Master class at the Geomatics Engineering Department of the Hacettepe University.

Survey work on the Hacettepe University campus.

contd. from page 3

How realistic are the different aspects of your dream?

It seems to be unrealistic presently in Turkey. On the other hand, we keep in our mind the quote from John Updike that says, "Dreams come true; without that possibility, nature would not incite us to have them."

When the working day finishes, leisure time begins. What are your other interests or activities besides VLBI?

[Kamil] I have a newborn baby, and when the working day finishes leisure time does not really begin for me. Nowadays, I like walking with my wife in the park near our house. On the weekends we enjoy fishing in our hometown and growing plants and vegetables in our garden.

Kamil in his office at Hacettepe University in Ankara.

Emine at the KTU Analysis Center in Trabzon.

[Emine] At the end of my work day, when I arrive at my house, I find my two-year-old daughter waiting for me (and for my husband, too) to play with her, especially at playgrounds in nearby parks. She is our whole world, and my husband and I want to spend more time with her after work. Our favorite places for leisure time are those with mini-trains, pony rides, slides, and so on. Once a month I meet each of my three groups of girlfriends from high school, my department, and other departments of my university. Since our parents live in the countryside, we often visit them. Our daughter loves having time with farm animals, dogs, chickens, and ducks there.

TOW–headed Again

– Rich Strand, NVI, Inc.

Once again, MIT Haystack Observatory at Westford, MA, USA will be hosting an IVS Technical Operations Workshop (TOW). For the eighth time, VLBI station operators will gather under the auspices of the IVS in the period from 4–7 May 2015. TOW is an ongoing program since the late 1980s (hence actually predating the IVS) where the station operators can meet the experts and attend classes, ensuring that the IVS community is provided with well-trained observing staff at each station.

This "workshop" happens once every two years and provides classes in all aspects of VLBI data acquisition and observing with a technical overview of station electronics, instruments, and techniques required for the IVS mission. It is a good time to meet all members in the VLBI group including the correlator staff, equipment design staff, and the IVS coordination team. It also provides an opportunity to discuss station problems and issues with other station operators in closed sessions.

Rich Strand (left) during a workshop of an earlier TOW.

We usually suggest anyone that starts or stops a VLBI session using the Field System should attend TOW at least once—and again at some point for a refresher course. English language skills, sufficient to read most of the Field System commands, are recommended, but we also adjust classes for non-native English speakers.

The TOW workshop will run over three-and-a-half days with classes, lectures, and workshops. On Sunday evening, an opening party will be organized to meet the teaching staff and all the students attending from each radio observatory in the program. Prior to the workshop you will be able to select your classes via the TOW Web page.

It has been demonstrated that station performance improves when their staff have attended a TOW workshop. Operational guidelines are important to learn, but TOW also allows operators to have a chance to ask questions one-on-one with the VLBI design team and scientists as well as correlator and software experts.

For further information or suggestions please contact Dirk Behrend (Dirk.Behrend@nasa.gov) and/or visit the TOW Web page at http://ivscc.gsfc.nasa.gov/meetings/tow2015/.

Unified Analysis Workshop – The 2014 West Coast Version

– Dan MacMillan, NVI, Inc.

On June 27–28, 2014, IVS representatives (Johannes Böhm, Harald Schuh, Chopo Ma, John Gipson, and Dan MacMillan) and representatives from SLR, GPS, and DORIS met in Pasadena, California for the fourth Unified Analysis Workshop (UAW). A primary objective of this series of workshops is to understand and correct the systematic differences between geodetic techniques so that technique combinations can be done consistently. Topics of interest to VLBI analysts at this UAW include the VLBI–SLR scale difference, geophysical fluids, and technique combination.

There has been a longstanding reference frame scale difference between VLBI and SLR. In the most recent IERS terrestrial reference frame, ITRF2008, the scale difference (VLBI–SLR) was 1.05±0.13 ppb (parts per billion). The difference between the VLBI and SLR estimates of the distance between any two points "scales" with the distance between these points. If there is a 1 ppb scale difference, this means that station heights will differ by 6.4 mm on average, corresponding to the length of the radial vector from the geocenter to the station, which has a length approximately equal to Earth's radius, or 6,378 km.

Meeting attendees for the Unified Analysis Workshop.

Dan MacMillan gave a presentation on the errors in VLBI scale. The main contributions that reduce the scale difference are troposphere modeling and a small contribution from radio source structure, but these only account for 0.1 ppb. Gravitational deformation of VLBI antennas can potentially have a much larger effect on scale. It produces an additional signal path delay that is absorbed into height measurement, since it is highly correlated with the sine of elevation. Tom Clark and Per Thomsen developed a signal path model for the deceased 26-meter antenna at Fairbanks. Pierguido Sarti and Claudio Abbondanza found models for the two 32-meter dishes at Medicina and Noto (see article in IVS Newsletter from December 2010). Applying each of these models (scaled by the diameter squared) to all the VLBI antennas increases the VLBI–SLR scale difference by 0.3 ppb (Fairbanks), 0.45 ppb (Noto), or 0.8 ppb (Medicina). Given the size of the effect, it was agreed that the IVS should try to measure the deformation of all antennas; however, there are obvious practical difficulties in accomplishing this.

There was some discussion of checking that the Consensus Relativistic Model (1991) used by VLBI does not lead to scale inconsistency with SLR, although it was stated by the developers of the model that the choice of geocentric coordinates was made to allow comparison of VLBI and SLR station positions. John Ries suggested that we need to look at the refractive index expressions used by SLR (optical) and VLBI (microwave) in troposphere modeling to determine whether more modern expressions could account for systematic scale effects. Cinzia Luceri and Graham Appleby gave presentations that indicated that the range calibration biases are still a possible source of significant SLR scale error. Estimating range biases has the effect of increasing the SLR scale by a significant fraction of 1 ppb. There is also the SLR "Blue Sky Effect," which arises because SLR only observes during clear sky conditions when atmospheric pressure is high. If atmospheric pressure loading is not modeled, SLR station mean vertical estimates will be systematically lower by 1–3 mm than VLBI and GPS stations that observe for all sky conditions.

John Gipson gave a presentation comparing high frequency Earth Orientation Parameters (EOP) derived from tidal models and from VLBI and GPS measurements. In general the tidal models are consistent with each other as are the empirical space-geodesy models. The discrepancies between the tidal and empirical models have decreased over time as both kinds of models have improved. Harald Schuh gave a presentation on his group's project SPOT (Short Period Ocean Tidal variations in Earth rotation) to develop a new high frequency Earth rotation model based on empirical ocean tide models. The main purpose of the SPOT model is its application to space geodetic observations such as GNSS and VLBI.

Daniela Thaller discussed the effect of loading contributions (atmosphere, hydrology, and non-tidal ocean) on VLBI and SLR station position, EOP, and geocenter estimates. For example, applying the sum of these contributions in geodetic solutions results in RMS differences (relative to not applying them) of 3.1 mm in the vertical at Wettzell, 2.3 μsec in UT1, 71 μas in Y polar motion, and 3.2 mm in the geocenter.

Future UAW workshops will be organized loosely every two years. We would like to thank Tom Herring and the local organizers from JPL for a well-run meeting.

IVS and ITRF2013 – A Status Report

– Sabine Bachmann, BKG Frankfurt

It all began in March 2013 when an inconspicuous e-mail came in via IVSmail informing about the "Call for Participation" for the ITRF2013. The deadline for final data submission was listed as February 2014. A long time to go and a lot of time to collect data for a combined solution—one might think.

Sabine Bachmann is the head of the IVS Combination Center at BKG Frankfurt.

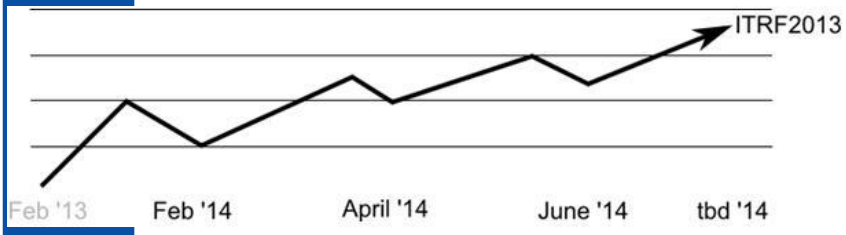
Why a combined solution? Because the IVS already did so for the ITRF2008, and it worked well. So why not do it again? But the reasons for a combined solution are, in fact, more profound…

But let's start at the beginning. The path from a VLBI observation to a result is actually quite long. Observing different radio sources with different telescopes is difficult enough, considering the possible permutations between these variables. Generating a dedicated schedule taking into account not only visibility and quality of a radio source but also geometric obstacles (radio signals are strong enough to travel billions of light years through space, but they are not able to get through the thinnest crust of the Earth) and telescope availabilities, must be a challenge on its own…

Once all the telescopes have recorded the prearranged, agreed-upon signals the disks are shipped around the globe in order to get correlated and to produce an observable. This process usually takes ten times more time than measuring the session itself!

There are many ways to analyze the observables in order to extract the coordinates of the telescopes and the Earth orientation parameters. And each way is the right way or, perhaps better, one possible right way. Thus there are no absolute criteria to decide which one is the "most right" way. The approach to find the best possible way is finally to take all the solutions and to create a combined one taking into account the value of each individual contribution. For ITRF2013, ten analysis centers offered a solution; i.e., there were ten right ways. A solution consists of a bundle of files in Sinex format, containing the result of the whole VLBI processing chain: station coordinates and EOP for the contribution to the ITRF2013. The task of the IVS Combination Center is then to take the files from the Analysis Centers, to combine them into one solution, and to hand over the result to the ITRS Product Center of the IERS. Since VLBI is an "old" geodetic space technique, data are available since the end of the 1970s. Week after week and session after session, there are altogether nearly 5,500 24-hour sessions from each Analysis Center.

Now, in July 2014, the IVS Data Center collected most of the promised Sinex files. After some months of lively discussions on modeling and parameterization, several e-mail exchanges, software adjustments, and re-analyses of complete file sets (thanks to all the cooperative and understanding people for doing this), it seems that there will be an IVS contribution to ITRF2013. Well, soon. Most of the critical problems are solved and a first combined solution for testing has been sent to one of the ITRF2013 combination centers. They said that the data does not look too bad. That's promising!



Prognosis for the IVS contribution to the ITRF2013.

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/.

Proper VLBI Logging and Commenting

– Rich Strand, NVI, Inc.

One of the assigned tasks for the Network Coordinator, who provides support to the VLBI observatories around the world, is to help troubleshoot and correct station problems as reported by the operators. This How-To article addresses how VLBI station operators can help to provide the best information to quickly identify the loss of data.

The process starts with the "Ready" message. This usually is the first source of information that is read before each session and noted for any possible concerns by the operator as they complete the station check-off list. Stations using the PC Field System have all the tools they need to verify the system is ready end-to-end, i.e., from photons striking the waveguide to weak radio signals being recorded by the data acquisition system.

The "End" message is the place to report any and all problems during the session. This message should have any comments that may be of value to explain missing scans or lost data. This message is archived on the IVS Web site and often used for research or review that may be needed later during the processing stage.

The real asset available for the operator during the observing session is the Field System operator comments. It is usually the first place we check if the correlator team reports a problem with a station during their data processing. A good example of this is a comment by the operator reporting a short power hit at the station and the corrective action that had to be taken to mitigate ensuing problems. This comment then gives a clue to the correlator folks that fringes will be lost during that time as well as its cause, saving them time as they know what to expect.

Comments in near real-time are valuable to help solve a problem, but later explanations are also helpful. The Field System operator comments are extracted after the session for a review, which allows quick access to the conclusion or solution of the data loss. It is not unusual to see the comment "Ant problem", followed sometime later with what really happened. As long as comments are being made in the log that indicates a problem or a possible loss of data, it will save time later in the data processing.

To illustrate this, let's assume that the correlator reports no fringes at X-band. In one example, there are no comments in the log and the "End" message reports all scans recorded. This requires a complete review of the Field System log for clues to the cause. In another example, the log contains multiple operator comments about the IFC having a loss of amplitude due to a near lightning hit. Clearly, the second example with these operator comments indicates the station is doing their part to provide as much useful information as possible to the team in the next step of the VLBI process.

All comments have value. A source below the horizon can mean a problem in the scheduling software. Only an operator comment might detect this. The data module ran out of space may indicate a need to review what modules are to be shipped to what station. "Bad winds" would explain "antenna slewing" and "Ran FMSET" would explain a clock break.

A good thing for station operators to remember is that they start the VLBI process and that many others follow their work to conclusion. Operators can find the guidelines for making comments in the TOW handbook, Operations chapter, 2.0 "Making comments in the log."

Upcoming Meetings...

Journées 2014
St. Petersburg, Russia
September 22-24, 2014

EVN Symposium 2014
Cagliari, Italy
October 7-10, 2014

IAG Commision 1 Symposium 2014
Kirchberg, Luxembourg
October 13-17, 2014

IDS Workshop
Konstanz, Germany
October 27-28, 2014

19th International Workshop on Laser Ranging
Annapolis, MD, USA
October 27-31, 2014

Symposium of Japan VLBI Consortium
Tsukuba, Japan
October 29-31, 2014

SciDataCon 2014
New Delhi, India
November 2-5, 2014

3rd International VLBI Technology Workshop
Groningen, The Netherlands
November 10-13, 2014

AGU Fall Meeting
San Francisco, CA, USA
December 15-19, 2014

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

IVS Election Season

– Dirk Behrend, NVI, Inc.

The next IVS election season is at our doorsteps with yet another two-year cycle coming to a close in February 2015. Election season will start in the fall of this year. As usual, a nomination phase of about one month will precede the actual elections of the representative positions and the at-large positions. With the spring 2015 Directing Board meeting scheduled to be held in conjunction with the 2015 EVGA meeting in Ponta Delgada, Azores, Portugal in late May 2015, we anticipate that the nomination phase will commence in December 2014. The elections will then be held in January/February 2015. The final decision on the actual dates will have to be made by the Election Committee which has not been established yet.

In the 2014/2015 elections six positions need to be refilled. These are three representative positions with a four-year term and three at-large positions with a two-year term. The representative positions will be elected by the IVS Associate Members; after the representative election, the three at-large positions will be determined by the Directing Board to balance out its membership. Three of the six 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. That means that roughly 20% of the new Board will be new faces.

The six positions up for election are:

- Representative positions (four-year term):
  - Correlators and Operation Centers Representative (incumbent: Alessandra Bertarini)
  - Networks Representative (incumbent: Hayo Hase, not re-electable)
  - Analysis and Data Centers Representative (incumbent: Arthur Niell)
- At-large positions (two-year term):
  - Alexander Ipatov
  - Shinobu Kurihara (not re-electable)
  - Fengchun Shu (not re-electable)

The Election Committee will prepare and distribute a call for nominations by October/November 2014. 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. This is your chance to influence the policies of the IVS. Candidates for any position on the Board can only be nominated from the list of current IVS Associate Members. Please ensure with the Coordinating Center that this list is complete and up-to-date for your component.

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