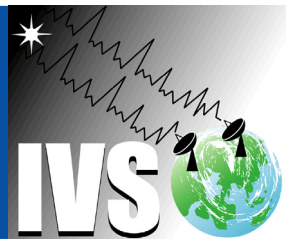


# IVS Newsletter

Issue 37, December 2013



## Shanghai: Host City of GM2014

– Fengchun Shu, SHAO



*A visit to Sesban will be part of the General Meeting.*

In the first week of March 2014, the Shanghai Astronomical Observatory (SHAO) will play host to the VLBI community and organize the 8th IVS General Meeting. Registration deadline for this event is January 30. Please visit the meeting Web site at <http://ivs2014.csp.escience.cn> for more information.

Shanghai, located on China's central eastern coast just at the mouth of the Yangtze River, is China's largest city and port and is a window through which the world can witness China's development and current circumstance. The Pearl of the Orient is one of the main tourist destinations in China for foreign travelers

and is renowned for its well-known historical landmarks such as the Bund, the Yuyuan Garden, and the City God Temple. Shanghai is also known for its modern, flourishing, and ever-expanding Pudong skyline including the Oriental Pearl TV Tower and Jinmao Tower.

If you want to have a look at the colorful architectures from different countries, then the Bund is the place that you cannot miss. The Bund is referred to the area along banks of the Huangpu River, which is an amazing place that includes various buildings, shops, bars, banks and so on. Adjacent to the Bund, the Nanjing Road is a famous street mall where you can buy everything that you need. The Shanghai Museum, People Square, and the Shanghai Grand Theatre are also not far away. Then if you are interested in the Chinese culture and have a desire for the local food, your tour destination must include the Yuyuan Garden and the City God Temple. These two places are perfect examples of Chinese traditional gardens and architecture.

If you want to witness the beautiful Shanghai skyline, the Oriental Pearl TV Tower should be your first choice. This tower is 468 m high, the sixth highest in the world, so you can take in everything in a glance. In all, Shanghai has so many attractive sights, that you should not miss out on this opportunity! But when you are here, do not overlook the many gorgeous places in the neighboring provinces of Jiangsu and Zhejiang, such as the famous Suzhou Gardens and the West Lake in Hangzhou. Since ancient times, the region of Shanghai, Jiangsu, and Zhejiang has been legendary for its prosperity and scenic beauty.

In conclusion, Shanghai is a unique, elegant, and vibrant city. I am confident that you will have a wonderful time here. Welcome to Shanghai!



*Shanghai's Oriental Pearl Tower.*



*Getting around Shanghai is easy with the extensive subway system.*

# VGOS News

## First African VGOS Site Funded

– Ludwig Combrinck, HartRAO

The Hartebeesthoek Radio Astronomy Observatory (HartRAO), South Africa is actively engaged in upgrading the station to meet the expectations and technological requirements of the Global Geodetic Observing System (GGOS). Towards this end, several major instrumental upgrades and additions will be implemented during the period 2014 to 2016. These upgrades include a VGOS antenna, Lunar Laser Ranger, kHz Satellite Laser Ranger, and a seismic vault containing geophysical instruments (wideband seismometer, gravimeter, and accelerometer).

Funding for the VGOS antenna has been allocated over a three-year period, commencing 2014 and ending during 2016. This then is also the allocated time frame for installation of the antenna and supportive instrumentation. We envisage that the selected antenna will be of geodetic quality and should meet the VGOS standards of slewing time, axis intersection accuracy, and stability. It would be possible to schedule both the existing 15-m VLBI antenna and the VGOS antenna to increase source coverage. The existing 26-m antenna will be allocated to astronomy and celestial reference frame experiments. Of course the VGOS antenna needs to be located on bedrock and be placed at a point where it will be maximally protected from any possible sources of radio frequency interference (RFI). Due to the nature of the site, which is occupied by all the major space geodesy techniques, careful selection is necessary to avoid possible system interference, such as could be had from the SLR radar system. A possible location has been identified, towards the north of the 26-m antenna and SLR station, where exposed bedrock

is clearly seen. A complete RFI and geotechnical investigation will be made during early 2014 to assess the suitability of this site. The RFI tests will be done with a wideband antenna and spectrum analyser. To ensure realistic measurements, the RFI antenna will be mounted on a rotator fixed to the top of a 15-m extendable mast and will occupy the site for some weeks to ascertain RFI levels. The geotechnical survey will include resistivity and refractivity tests as well as drilling to extract geological core samples.

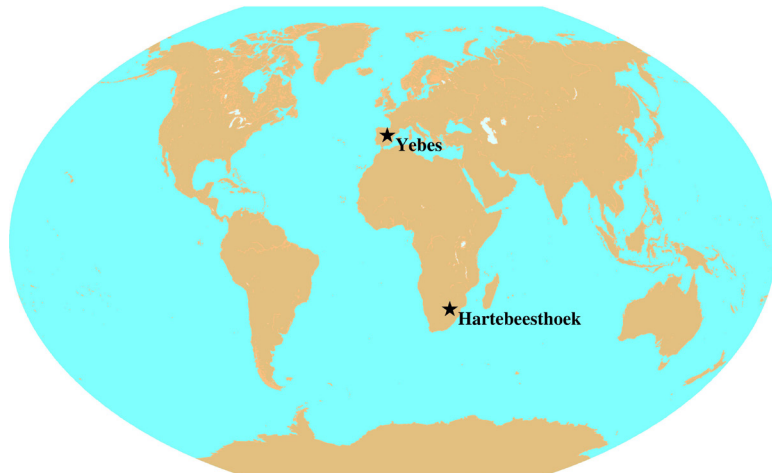
An automated site-tie system is being developed using a remote controlled and programmable total station which is capable of high accuracy distance, angle and position measurements. These site ties are crucial to determine inter-system vectors and instrument positional stability as well as calibration pier stability. The sub-daily ties will allow determination of daily motions due to gravitational droop and thermal expansion as well as longer term effects due to geophysical parameters such as changing ground water levels. The integration of the total station instrument into a working system will require development and research. System development will be done as part of post-graduate student projects.



*View of the current HartRAO instrumentation. The VGOS antenna will be installed towards the right of the photo, in line with the SLR to minimize RFI as SLR tracking is minimal in the north-south line.*



*Former HartRAO director George Nicolson at the proposed location for the VGOS antenna.*



*Location of the VGOS sites at Hartebeesthoek and Yebes. The Yebes telescope was recently inaugurated (see facing article).*

## First Spanish VGOS Radio Telescope Inaugurated

– José Antonio López and Francisco Colomer, IGN Spain



*The new Yeibes skyline with the VGOS telescope in the front.*

On 21 October 2013, the first VGOS radio telescope of the Spanish-Portuguese RAEGE Project was inaugurated in Yeibes (near Madrid) by the Spanish Minister of Development, D<sup>a</sup> Ana Pastor, and the President of the Regional Government of Castilla-La Mancha, D<sup>a</sup> María Dolores de Cospedal. In the inauguration ceremony the minister emphasized that the technological progress in Spain does not stop with difficult economic times and that this investment in new infrastructure is part of the policy to reverse the negative economic indices. Science and innovation are the keys to change the situation. Both officials unveiled a bronze dedication plaque with the name “Jorge Juan” of the new radio telescope. Jorge Juan was a Spanish geographer who participated in the 18th-century expedition to Peru (now Ecuador) to measure the length of a degree of latitude at the Equator. After his return, the Spanish King Carlos III entrusted him with founding the Royal Astronomical Observatory (in 1757); today the observatory is part of the Instituto

Geográfico Nacional, which is also the owner of the Yeibes Observatory.

The “Jorge Juan” radio telescope, built by MT Mechatronics GmbH, is dedicated to geodetic VLBI and is the first of four very fast RAEGE telescopes that will be fully VGOS compliant. The Spanish-Portuguese VGOS network will be covering three continental plates with sites in Spain in Yeibes (Eurasian Plate) and Tenerife (African Plate) and in Portugal on the Azorean islands of Santa Maria (Eurasian Plate) and Flores (North American Plate). The acronym RAEGE stands for “Red Atlántica hispano-portuguesa de Estaciones Geodinámicas y Espaciales.” The construction of the telescope on Santa Maria is well advanced. The engineers of the HF laboratories are working full speed on a second feed for “Jorge Juan,” because the first one was shipped to the Japanese VGOS site at Ishioka for testing. It is expected that “Jorge Juan” will become available for the IVS in the first half of 2014.

The Scientific and Technical Advisory Committee (CACT) of the RAEGE Project had a meeting in the afternoon of the ceremonial day. Francisco Colomer chaired a full program of presentations given by members of IGN and CACT about VLBI-related activities. The evening was eventually finished off with enjoying regional culinary specialties.



*D<sup>a</sup> Ana Pastor and D<sup>a</sup> María Dolores de Cospedal unveil the dedication plaque during the inauguration ceremony.*



## AUSTRAL: The Southern Hemisphere Observing Program

—*Jim Lovell, University of Tasmania*

The AuScope VLBI Project recently received additional operational funds which will allow the VLBI array to participate in 170 days of observations per year until July 2015. Sixty of these days will be dedicated to AUSTRAL sessions with scheduling in the Vienna VLBI Software (VieVS), observations with the three AuScope antennas plus Warkworth 12-m and Hartebeesthoek (15-m and 26-m), and correlation at Curtin University.

The AUSTRAL observing program is divided into three streams focused on high priority geodetic and astrometric aims:

- 12 days per year will be dedicated to astrometric observations to monitor and enhance the southern hemisphere reference frame in preparation for ICRF3.
- 18 days per year to improve the density of the time series for the southern antennas and to measure and monitor the motion and deformation of the Australian plate. This will also act as a demonstration of the capabilities of the AuScope array by tailoring observations for high data rates and smaller antennas.
- Four 15-day CONT-like campaigns over the next two years. The first campaign will commence on November 28, 2013 with another a year later and two more in 2015. As demonstrated in previous CONT sessions, the fixed array, multi-day observations demonstrate the current

capabilities of geodetic VLBI and reveal the level of systematic errors in the solutions (e.g., Lovell et al 2013, JoG 87, 527). The AUSTRAL-CONT campaigns will be used to examine these effects in more detail, in particular the influence of source structure (Charlot 1990 AJ 99, 1309; Shabala et al 2013, JoG submitted). The 2013 session will be scheduled such that the individual source observations are repeated at the same sidereal time so the interferometer response to structure is kept constant from day to day. We will observe three source samples over five days each, selected on their Structure Index (SI). One sample will contain low SI sources only, another with high SI only, and a third with a source selection typical of usual rapid-turnaround sessions (i.e., R1 and R4). In this way we hope to characterize the level of source structure influence in geodetic solutions and isolate its effects from other influences such as the troposphere.

*The following is a non-exhaustive list of institutions and people contributing to the AUSTRAL sessions: University of Tasmania (Jim Lovell, Stas Shabala, Jamie McCallum and John Dickey), Curtin University (Cormac Reynolds), Auckland University of Technology (Sergei Galyaev, Tim Natusch and Stuart Weston), Hartebeesthoek Radio Astronomy Observatory (Jonathan Quick), Vienna University of Technology (Johannes Böhm and Lucia Plank), Shanghai Astronomical Observatory (Jing Sun).*

## GFZ Potsdam Hosts 30th Board Meeting

—*Dirk Behrend, NVI, Inc.*

On 7 September 2013 IVS Chair Axel Nothnagel convened the 30th Directing Board meeting at the GeoForschungsZentrum Potsdam, Germany. The meeting was held in the historical library of GFZ where already Friedrich Robert Helmert did part of his research some 100 years ago.

In his first full DB meeting as chair, Axel continued the tradition of his two predecessors to discuss status reports given by the coordinators, committee and working group chairs, and other entities relevant for IVS activities. John Gipson, as new IVS Analysis Coordinator, reported that work on the next realization of the International Terrestrial Reference Frame (ITRF2013) was being initiated and that a call for contributions from the IVS analysis centers would go out soon.



*Historical library at GFZ Potsdam.*

Shinobu Kurihara reported about efforts to establish a regional group to organize the geodetic/astrometric VLBI community in the Asia-Oceania region—similar to what the EVGA does for the European VLBI community. The Board fully endorsed the establishment of such a group.

Further discussion points were compiled into the meeting notes that are available on the IVS Web site at <http://ivscc.gsfc.nasa.gov/about/org/board/dbmeet30.pdf>. The next DB meeting will be held in conjunction with the IVS General Meeting on 8 March 2014 in Shanghai.

## VieVS Workshop Enlightens Users

– Denise Dale and Marisa Nicola, HartRAO



*Participants of the 4th VieVS User Workshop.*

On 9–10 September 2013, the 4th Vienna VLBI Software (VieVS) User Workshop was held at the Vienna University of Technology. Twelve participants from various parts of the world (Russia, Czech Republic, Japan, Poland, Spain, Germany, Turkey, South Africa, and Australia) attended the workshop. The developers of VieVS presented lectures on VLBI and the structure and usage of the VieVS software. In the afternoons, the participants engaged in practical exercises to get hands-on experience using the VieVS software.

On the first day of the workshop, Johannes Böhm gave an introduction into VLBI analysis for geodesy and astrometry. An overview of the VieVS software package was given by Hana Krásná, who also provided us with a general overview of the VieVS directories and modules. Matthias Madzak presented a talk on `Vie_setup`, which provides the Graphical User Interface (GUI) for VieVS and also allows for changes to the source code to enable the user to change the interface directly. Reading NGS files and other auxiliary files with `Vie_init` was discussed by Tobias Nilsson, and theoretical delay modeling in `Vie_mod` was presented by Lucia Plank. Lucia also talked about the comparison between different VLBI analysis software packages. Station models and station corrections in `Vie_mod_v21` were presented by Hana Krásná and the least squares adjustment to estimate geodetic parameters from VLBI observations in `Vie_lsm` and `Vie_lsm_scan` (specifically for VieVS v 2.1), were explained by Kamil Teke and Johannes Böhm. Tobias Nilsson explained how special files and OPT-files can be created and provided solutions to identifying and solving problematic VLBI sessions. Afternoon exercises included the processing of a session with a clock break, creating the OPT file, processing Intensive sessions, superstation and supersource files, and adding new stations and sources.

On the second day, the extension modules of VieVS (`Vie_sched`, `Vie_sim`, and `Vie_glob`) were explained in more detail to participants. Hana Krásná explained how `Vie_sched` can be used to create optimal schedules for observations and how `Vie_glob` is used for combining solutions of different sessions. Lucia Plank talked about generating artificial delay

observables with `Vie_sim`. The afternoon exercises covered scheduling of observations as well as simulated observations, data analysis of artificial observations and computing station coordinates using a global adjustment. The workshop concluded with talks on current and planned future developments for VieVS.

The first VieVS version was released in late 2009. In May 2013, version 2.1 of the software was released. The next version of VieVS will be released before the next workshop in September 2014 and will include additional VLBI space applications (Lucia Plank) and enable the user to use external tropospheric files (Armin Hofmeister & Matthias Madzak).

For us, the workshop was extremely useful and very informative, providing us with a good understanding of the structure and different features of the software. One of the highlights of the workshop was meeting and engaging with the other participants and users of VieVS, exchanging ideas and learning about different research groups around the globe. We would like to thank the developers of VieVS for an extremely useful and well written software package and an incredible, very helpful and fun workshop. More information about the software and the workshops can be found at <http://views.geo.tuwien.ac.at/>.



*(top) The baroque Karlskirche is within walking distance of the university.  
(below) Schönbrunn Palace is another cultural monument in Vienna.*



## KASI, Jeju Host VLBI Developers

– Christopher Beaudoin and Alan Whitney, MIT Haystack Observatory



Participants of the 2nd International VLBI Technology Workshop (IVTW).

In early October, our colleagues at the Korea Astronomy and Space Science Institute (KASI) hosted the 2nd International VLBI Technology Workshop (IVTW) at Seogwipo, on Jeju Island of South Korea. The workshop focused on four subjects: (1) station status reports, (2) e-VLBI/science, (3) wide band development, and (4) frequency standards. The status reports were globally well-balanced from presentations on the plans for the new geodetic observatory in Ny-Ålesund to the latest developments in New Zealand. With the US science funding climate as it is, questions have recently been circulating regarding the status of the VLBA. In his report, we learned from Walter Brisken that VLBA operations are currently being supported at a level of 50% by the USNO with the other 50% coming from the NSF and other scientific partners, but with the VLBA longer-term future still in jeopardy.

In the e-VLBI/science session, our JIVE colleagues gave presentations on e-VLBI applications using the 'jive-5ab' software as well as the status of the EXPRES/NEX-PRES project. Transitioning from technology to science, Zolt Paragi delivered a talk on Radio Transients in the Local Universe while Richard Dodson presented a technique to phase reference the KVN and extend its millimeter-wave VLBI coherence times beyond the limits of the turbulent atmosphere.

On the subject of wide-band development, NICT reported on a new wide-band VLBI system, GALA-V, that will incorporate a 3-bit high speed digitizer (supporting sample rates up to 20 GSps) in-lieu of a conventional pre-digitization down-conversion stage. Technical presentations in this session also covered developments on the LBA, the new Mark 6 high-speed data recorder, and efforts on-going at Haystack with its partners to conduct the first tri-baseline VGOS experiments.

The final session covered frequency standards and methods of time/frequency transfer; topics that are intimately related to meeting the VGOS picosecond-accuracy requirements. The technique presented by Do-Heung Je on phasing the KVN demonstrated sub-picosecond timing accuracy and, hence, the feasibility of meeting the stringent VGOS timing requirements. As I learned at the 2nd IVTW, the time/frequency-transfer techniques developed for ALMA and the KVN should be given consideration by VGOS and GGOS technical developers responsible for accurately conveying a station's time/frequency standard.

Attendees also had the pleasure of visiting the nearby Tamna radio telescope, one of three such radio telescopes situated within South Korea, which is capable of VLBI observations up to 129 GHz while also supporting geodetic observing frequencies. This fun and interesting event marked the end of a most interesting and useful meeting that was expertly organized and executed by our South Korean hosts. The 3rd IVTW will be held at JIVE in 2015.

### Upcoming Meetings...

EVN Technical and Operations Group Meeting  
Bad Kötzing, Germany  
January 23-24, 2014

8th IVS General Meeting  
Shanghai, China  
March 2-7, 2014

EGU General Assembly  
Vienna, Austria  
April 27-May 2, 2014

<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](mailto: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/>.

## How to Verify Operational Readiness

– Rich Strand, NVI, Inc.

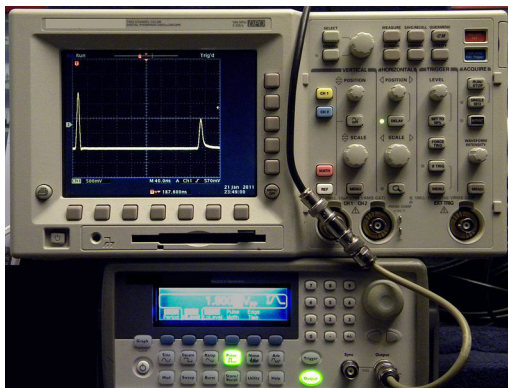
This “How To” chapter of the IVS Newsletter discusses how to verify the operational readiness and to help troubleshoot problems with the electronics that can be found at all radio observatories by using a selection of test equipment.

Many observatories now use staff that we call “observers,” or those that operate the Field System. Most of the instruments described below can be used by observers with little training and often these instruments are installed next to the data acquisition equipment.

The first most common device is a *Digital Volt Meter* (or *DVM* for short). Most electronic repair starts with a DVM. This device also includes the function to measure resistance and current flow. Many power supplies have a meter that can display voltage and current but also include a monitoring point for the staff to verify the reading if necessary. Many have just the monitoring point and some have no easy way to verify the DC voltage. Operationally, it is always a good idea to have staff that can quickly detect and verify a failed power supply by using a DVM.

*Counters* are necessary for VLBI observing and usually interface to the Field System. They are used to measure the time between two pulses, for example clock offsets, and to count cycles to measure a frequency, for example the Video Converter Local Oscillator. Rack-mounted and using a time standard for a reference they require little attention, but observing staff should be able to identify if the counter needs to be reset. Knowledge of the trigger settings in manual mode is also helpful at times.

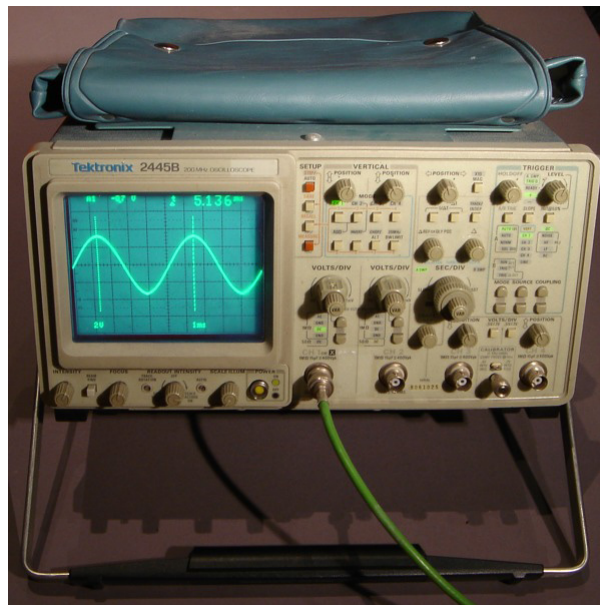
The most important instrument is the *oscilloscope* or “*scope*”. They are used to monitor the Phase Calibration (PCAL) signal, and one should be rack-mounted in view of the observer with an external sync to the maser. Scopes are required for electronic repair and are often found on roll-around carts. The Hardware class at TOW teaches the students the value of detecting “ripple” in a power supply using a scope which is an indication of a coming failure.



The *spectrum analyzer* is next up and in my opinion should also be rack-mounted near the data rack in view of the operator to monitor the S-band IF coming from the receiver in the telescope. This instrument contains a receiver and band scope to display a frequency or band of frequencies in the radio spectrum at a calibrated level. This is mandatory for all VLBI data rack repair. At one time this instrument was very expensive, but now they are being sold as small units that connect to a PC.

The *FFT (Fast Fourier Transform) spectrum analyzer* has the electronics to capture a signal that is changing in the time domain and transform it quickly into the frequency domain. This is exactly what is needed to carefully analyze the PCAL signal by looking at a video converter baseband spectrum for the weak PCAL signal and measure its amplitude and possible spurs. This instrument will be very useful for testing each channel at all IVS stations observing in the CONT14 campaign.

Other test instruments of limited value to the operator, but often indispensable to repair staff, is the *Time-Domain Reflectometer (TDR)*, which is used to find problems in the RF cables. The *Vector Network Analysis (VNA)* is used for amplifier measurements and filters. The industry now has many antenna analyzers that operate independently or use a PC for storage of the plots. These would be used by a radio observatory to verify the impedance of antennas used for support activities in the HF to UHF spectrum.



Examples for a TDR with signal generator (left) and an oscilloscope (above).

## IAA RAS Awards Gold Medal of Merit to VLBI Scientists

– Yuri Bondarenko, *Institute of Applied Astronomy RAS*



*Prof. Leonid Matveenko, Prof. Anton Zensus, and the Director of IAA RAS Prof. Alexander Ipatov.*

The Scientific Board of the Institute of Applied Astronomy of the Russian Academy of Sciences (IAA RAS) awarded the prestigious Gold Medal of Merit to world-renowned scientists and radio astronomers Professor Anton Zensus (Germany) and Professor Leonid Matveenko (Russia) “for the implementation and realization of astrophysical research with the VLBI network ‘Quasar’.” A ceremonial meeting was held on July 26, 2013 in St. Petersburg, Russia.

Prof. Zensus is director at the Max Planck Institute for Radio Astronomy in Bonn, Germany. He is leading the research division for VLBI. His research activities focus on studies of the nuclei of extragalactic radio sources associated with active galaxies. Prof. Zensus is involved in many international research collaborations and member of

various scientific advisory and steering committees. He was awarded a doctoral scholarship by the German Research Foundation in 1982. In 1994 he received an Alexander-von-Humboldt Research Award and in 1999 a Max Planck Research Award. In 2005 he was appointed Honorary Professor at the University of Cologne in Germany.

Prof. Matveenko is the Chief Scientist and Head of the VLBI Laboratory at the Space Research Institute RAS in Moscow, Russia. He was the first to suggest the idea of the VLBI technique in 1962; he published the first results with co-authors in 1965. Prof. Matveenko is a member of the International Astronomical Union, Deputy Editor-in-Chief of *Astronomy Letters*, a Russian recipient of the Medal of Honor of the American Biographical Institute, and an Honored Scientist of the Russian Federation. In 2006 he was awarded the Gratitude of the President of the Russian Federation.

The ceremony was attended by representatives of the Russian Academy of Sciences, the Consul General of Germany in St. Petersburg, and several journalists. We congratulate Prof. Zensus and Prof. Matveenko for receiving this accolade.

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