IVS NEWSLETTER
ISSUE 67, December 2023

Heidi—Girl of the Layout Alps

Dirk Behrend
NVI, Inc./NASA GSFC

The year is 2001. The IVS was a very young service, still in its toddler years. The Directing Board felt that it was important to involve the Associate Members more actively in the "IVS life" and decided to create the Newsletter. Hence, an intrepid trio consisting of Nancy Vandenberg, Hayo Hase, and Heidi Johnson set out to create this new information tool for the community. In December of that year the Inaugural Issue was published, and we haven't looked back since.

From the onset, Heidi took on the task of creating the layout of the Newsletter. She weathered two changes to the General Editor (in 2004 and 2013) and powered through as Layout Editor over twenty-two years, making sure to keep the high standard that was initially set. She was instrumental in giving the golden issue (Issue #50) a celebratory touch. And she smoothly transitioned to a new layout with Issue #61.

Fast forward to 2023: having mastered 66 issues and the recent pandemic, Heidi decided that it was time to move on and focus on other tasks. The baton of handling the layout will pass to Nancy Kotary, while Hayo will continue to serve as Feature Editor. Heidi, it has been a real pleasure to work with you over the many years (almost two decades). We will miss your positive and uplifting attitude. Best of luck in your new endeavors. Of course, we stay in touch on other IVS matters.

Peak-to-Peak

From the Alps to the Eifel to the mountains of Spitsbergen, we move from mountain to mountain but also from highs to lows in this issue. We say goodbye to Heidi and NYALES20 but say hello to ITRF2020 and IUGG Res. #1 and celebrate a gathering. Enjoy.

Inside this issue

Effelsberg Radio Observatory

The 100-m radio telescope in Effelsberg, Germany, is one of the most exciting radio telescope sites to visit, because of its dimensions, its breathtaking construction, and its visitor center. The telescope is located in a protected valley near Bad Münstereifel (about 40 km southwest of Bonn). It was inaugurated in 1971 and was (for almost 30 years) the largest fully steerable single-dish radio telescope in the world. To this day, it is the largest radio telescope in Europe and is mostly used for astronomical observations. In 2013, Effelsberg became an IVS Network Station. Newsletter Editor Hayo Hase interviewed the observatory leadership team of Alex Kraus [AK] and Uwe Bach [UB] via email. This exchange was slightly edited for length and clarity.

The 100-m Effelsberg telescope with the observatory building in the background (picture by Norbert Tacken)

Alex and Uwe, please tell us about the characteristics of your facility? How long does it take you to walk from your office to the elevation axis?

[AK] The telescope's main dish has—as its name indicates—a diameter of 100 meters and is therefore one of the two largest, fully-steerable radio telescopes in the world (slightly smaller than the Green Bank Telescope in the US). Its most important feature is the "principle of homologous deformation" (i.e., the telescope is constructed in a way that gravitational forces lead to a controlled deformation of the dish); when tilted, it always maintains a parabolic shape, just with a different focal length. This technique allowed a relatively light-weight construction of the antenna when compared to modern telescopes with an active surface.

[UB] The main building and control room are located close to the telescope; thus, we enjoy a nice view of the antenna from our offices. It is an awesome view when the dish is passing by the control room windows. It certainly impressed me every time I saw it during my first years at the observatory. And it is still impressive when we go to the telescope for work or with visitors.

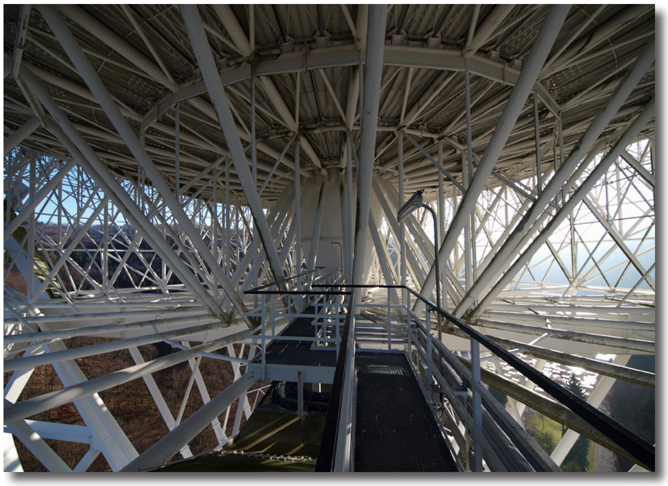
[AK] From my office, I would need about ten minutes to reach the entrance to the tilting part of the telescope at a height of about 50 m—it would be even longer if there wasn't an elevator from the azimuth track to the elevation axis.

The telescope was designed before VLBI was available—its initial use was single-dish radio astronomy. What was the scientific motivation in the late 1960s to build the largest steerable radio telescope in the world?

[AK] The main motivation was to build a flexible and versatile telescope, for all kinds of radio astronomical research. Originally, it was planned to construct an 80-m telescope; but with the advancement of homologous deformation, it turned out that a larger dish would be possible.

[UB] From the very beginning, a broad range of science fields was covered by the researchers of the institutes, like continuum surveys, spectroscopy of atomic and molecular lines, pulsar research, and interferometry.

(continues)



Backup structure of the main reflector—important to realize the homologous deformation of the dish (picture by Norbert Tacken).

The Effelsberg telescope is operated by the Max Planck Institute for Radio Astronomy (MPIfR) of the Max Planck Society—an institute well known for its VLBI correlator in Bonn. How and when did Effelsberg become a player in VLBI?

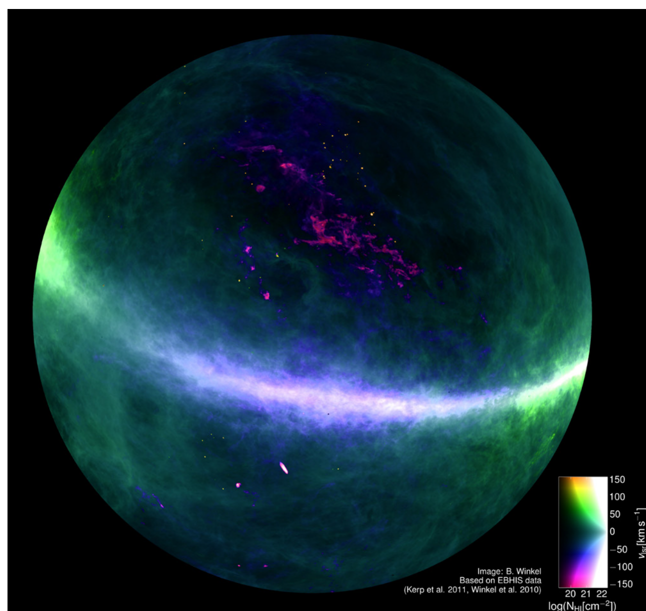
[AK] As mentioned, the telescope was always meant to be a multi-purpose instrument. Consequently, the first VLBI observations were already requested in 1972 (just after the commissioning phase ended) and then performed in 1973. In 1980, the European VLBI Network (EVN) was founded, and since then the 100-m telescope has played a vital role in EVN observations. In the same year, the first geodetic observations were performed. Until today, VLBI uses about 30% of the available telescope time.

Which observation frequencies were initially used, and which spectrum are you able to cover today—after more than 50 years of upgrading and overhaul?

[AK] First light was achieved by observing the supernova remnant HB21 at a wavelength of 11 cm. Soon after the inauguration on May 12, 1971, other receivers were added. In the past decades, we always tried to keep the telescope and its equipment up to date. Currently, our receivers allow us to observe in a frequency range from 300 MHz to 95 GHz. In recent years a new broadband system was installed, so that we have fewer systems today but covering a broader frequency range. Apart from a few bands, which are heavily used by other services (like the GMS mobile phone band) and the oxygen band at 50–60 GHz, the frequency coverage is nearly continuous. The receivers are complemented by state-of-the-art backends to allow for various observing modes.

The workshops at Effelsberg and Bonn are very capable in receiver developments. Can you name a few developments that stand out?

[UB] The MPIfR electronics department has always developed very good low-noise amplifiers (LNAs) for cryogenic receivers, and in recent years also for wider frequency ranges. Systems that are currently being constructed include a wideband receiver for VLBI that covers 18–50 GHz and 77–100 GHz at the same time with only two separate horns and a dichroic plate. A wideband, low-frequency receiver that covers 1.3–6 GHz is already available and has been successfully commissioned. Interesting for



Hydrogen column density and velocity on the Norther Hemisphere as observed by the Effelsberg-Bonn HI survey (Kerp et al., 2011; picture by Benjamin Winkel).

(continues)

Alex (left) and Uwe (right) in the main reflector of the telescope (picture by Silvia Steinbach; © Industriefotografie Steinbach).

geodetic work will be the BRAND receiver, which is being built by a European collaboration and will cover 1.5–15 GHz in a single feed. All new receiving systems are going to be directly digitized at the frontend; and the data is transferred via network to a central GPU cluster providing various software backends for spectroscopy, pulsar, or VLBI observations. [AK] Both workshops are heavily involved in the development of new receivers—all mechanical parts are built by these guys.

How many observations do you have per day and how much of your valuable time is dedicated to the IVS and/or geodetic observations?

[AK] The number of observations per day varies—sometimes we have several short programs, which take only a few hours, sometimes we have programs which go on for 48 hours or more. Overall, we use about 75% of our time for scientific observations. The focus is on astronomy while geodetic observations are currently done for 2 x 24 hours per year. The telescope is operated on a 24/7 basis—only on Christmas and New Year's do we stop for a few days.

How does a radio astronomy instrument benefit from geodetic VLBI?

[UB] Astronomical VLBI needs precise a-priori position information for the antenna, which can be provided by geodetic VLBI. However, we can also learn a lot about our antenna itself. The absolute phase measurements from geodetic VLBI provide us with a better understanding of antenna deformations, the change of the focal length, and cable length differences due to temperature changes.

Most contributions to geodesy were made at legacy S/X band. Will Effelsberg be able to provide VGOS broadband observations?

[UB] As mentioned above, we plan to equip Effelsberg with a BRAND receiver. This will cover the legacy S/X frequencies and could replace the current receiver that is getting old. If our large and slow antenna is of use for VGOS observations as well, we would be glad to contribute to this program. [AK] We hope to do the first tests of the new BRAND system next year. Stay tuned!

How much is Effelsberg affected by unwanted electro-magnetic emissions from telecommunication transmitters and what do you do to conserve a radio-quiet access to the cosmic radio sources?

[AK] Radio frequency interference is undoubtedly one of the major problems for radio astronomy nowadays (if not the most severe one). We spend a lot of effort to avoid unwanted emissions from our own hardware. Since 2001 we have had a dedicated Faraday cage, in which most of our servers, backends, and so on are housed

(continues)

and which provides a shielding of about 100 dB. Equally or even more important are our activities in frequency management issues. Two of our colleagues, Benjamin Winkel and Gyula Jozsa, are heavily involved in these. Benjamin is currently the chairman of CRAF (Committee on Radio Astronomy Frequencies, www.craf.eu), a European organization to coordinate activities and to protect the frequencies used in radio astronomy. He developed a very capable Python library for compatibility calculations called *pycraf* (see *http://ascl.net/1810.008*).

During the more than 50 years of Effelsberg operation, what have been the most surprising discoveries from the scientific and/or technical points of view?

[AK] There are a number of noteworthy mentions. In 1982, a map of the complete sky at a wavelength of 73 cm was published by Glyn Haslam et al., which became kind of an icon for the institute and is still widely used. In the late 1970s, the telescope enabled the first discoveries of water and ammonia outside our Milky Way. This was topped in 2006, when the water line was observed in a very distant quasar—the light traveled about 11 billion years to reach us. That was a world record at the time!

The measurement of the precession of a pulsar in the gravitational field of another led to a

Control room of the 100-m telescope with telescope operator Norbert Tacken on duty (picture taken by himself).

Telescope at night with Moon and Jupiter in the background (picture by Norbert Tacken).

remarkable confirmation of the General Theory of Relativity—this was published in 1998 by Michael Kramer et al. In 2013, a magnetar, which is a pulsar with an extremely strong magnetic field, was discovered with the telescope in the Center of our Milky Way.

In 2018 and 2021, we supported NASA by observing the beacon signal of the InSight and the Perseverance landers during the EDL (Entry, Descend, and Landing phase) on Mars. This was not really a scientific project, but it was a lot of fun to be in the control room of the telescope during the landing and being connected to mission control in Pasadena.

Is the radio telescope so large that it completely fills up your brain, or are you able to disconnect and enjoy some leisure activities? If so, which ones?

[AK] In order to relax, I do some sports: I run, cycle, and play tennis. And my family keeps me busy as well. If I have time left, I play my guitar.

[UB] To clear my head, I really enjoy being outdoors. Whether it's simply going for a walk, running, cycling, or swimming, everything is welcome.

Thank you to both of you for your time.

Fare Thee Well, Old Lady!

Susana Garcia Espada, Norwegian Mapping Authority

The Ny-Ålesund 20-meter antenna (Ny), operated by the Norwegian Mapping Authority (NMA), saw its last light on 14 August 2023. It was then officially shut down and all VLBI operations in Ny-Ålesund were moved to the two 13-meter telescopes at the new Brandal Geodetic Observatory. The construction of the 20-meter telescope was started in 1993. On 4 October 1994, Ny observed its first session (NA075). Almost 30 years later, on 15 August 2023, the dismantling of the antenna commenced.

Ny-Ålesund is the world's northernmost year-round research station. The decision to install a VLBI antenna in Ny-Ålesund was because of both its geographical location (Svalbard, Norway)—making it the northernmost VLBI station in the network—and the radio quiet zone in the frequency range from 2–32 GHz (since 1994). NMA's Geodetic Observatory is situated at 78.9° N and 11.9° E on the west side of the island of Spitsbergen on the bay of Kongsfjorden.

The Geodetic Observatory featured a 20-meter legacy S/X VLBI radio telescope at the Rabben site until August 2023 (left), as well as fast-slewing VGOS twin telescopes at the new facility at Brandal Geodetic Observatory (right).

Our colleagues from GBO working on the 20-m antenna, taking panels and gear boxes as spare parts.

(continues)

Dismantling process of the Ny-Ålesund 20-m antenna (Ny).

Spitsbergen is the biggest island in the Svalbard archipelago.

The 20-m radio telescope was used for geodetic purposes and regularly participated in legacy S/X VLBI sessions. It has contributed to many scientific studies. Its location in the Arctic, in the vicinity of several large glaciers, has been valuable and demanding at the same time. An accelerating uplift has confirmed that the Svalbard glaciers are losing mass due to climate change; this has created a challenge for the stability of the reference frame.

The design and construction of the telescope were identical to the 20-m dishes at Green Bank (West Virginia, USA) and Kokee Park (Hawaii, USA). NMA donated telescope as well as spare parts from the Ny-Ålesund 20-m antenna to Green Bank Observatory (GBO). Our colleagues from GBO spent two weeks in Ny-Ålesund salvaging parts like panels, gearboxes, and electrical components eventually filling an entire container. So, in a way parts from the "old lady"—as those working at Ny-Ålesund Observatory used to call the antenna in the later years—will live on in its sibling in Green Bank. Eventually, a Norwegian company was contracted to finish the demolishing work in September. The "old lady" was completely dismantled in less than two weeks.

The main reasons for the full dismantling were airport safety and economic concerns. The antenna was too close to the runway of the airstrip that we use to travel to this remote location: with certain wind directions it could create turbulence for the propeller planes. One of the conditions for building the new observatory at Brandal was the decommissioning of the 20-m antenna to save on operational costs. In recent years it became more difficult and expensive to

(continues)

maintain the antenna, as spare parts were no longer available on the market.

NMA's efforts are now focused on the operations of the new Geodetic Earth Observatory at the Brandal site. The Ny-Ålesund North antenna (Nn) has participated in the VGOS network since August 2022. The Ny-Ålesund South antenna (Ns) has been part of the legacy S/X network; and it is planned to install a VGOS receiver at the end of 2024.

The site of the former Ny antenna after dismantling. In the distance (about 1.5 km) the new Brandal Geodetic Observatory with the Nn and Ns antennas.

The Ny-Ålesund Geodetic Observatory at the Brandal site: Ns antenna (left), Nn antenna (right).

December Network Report

Alexander Neidhard, IVS Network Coordinator

As promised in the August issue, I will continue to brief the community on station-related items explaining current work packages, mentioning ongoing discussions, and giving feedback on current issues. In addition, I will try to summarize network topics discussed at the IVS Directing Board level, so that feedback can also be given from stations as well as other components.

General overview. The legacy network continues to be, with some exceptions, the stable and continuous "workhorse" of the IVS. Meanwhile, the VGOS network is steadily growing. Santa Maria became part of the core VGOS network after installing a superconducting filter to block out unwanted frequencies in Band A from a nearby radar system and thus meeting the full VGOS specs (including observations on all four bands). This is a great accomplishment. Nevertheless, we still lack guidelines to handle stations that cannot observe on either of the main bands A or D. Further efforts to build new VGOS stations are underway in various countries and stages. Beyond the projects listed in the table, there are also activities in China, India, Indonesia, and Malaysia.

Station	Recent milestone	VGOS broadband
GGAO	VGOS-OPS, VGOS-RD	ready
Westford	VGOS-OPS, VGOS-RD	ready
Wettzell (Ws)	VGOS-OPS, VGOS-RD	ready
Yebes (Yj)	VGOS-OPS, VGOS-RD	ready
Ishioka	VGOS-OPS, VGOS-RD	ready
Kokee Park (K2)	VGOS-OPS, VGOS-RD	ready
Onsala (Oe, Ow)	VGOS-OPS, VGOS-RD	ready
McDonald	VGOS-OPS, VGOS-RD	ready
Hobart	VGOS-OPS, VGOS-RD	ready
Katherine	VGOS-OPS, VGOS-RD	ready
Ny-Ålesund (Nn)	VGOS-OPS, VGOS-RD	ready
Santa Maria	VGOS-RD	imminent
Sheshan	VGOS tagalong	imminent
Yarragadee	S/X observing	imminent
Wettzell (Wn)	VGOS fringe tests	2024
Ny-Ålesund (Ns)	S/X observing	2024
HartRAO	signal chain work	2024
Metsähovi	signal chain work	2024
Matera	RT built	2024
Chiang Mai	site preparation	2024
Songkhla	site selected	end 2024
Gran Canaria	RT stored, land purchase	2025
Fortaleza	RT and signal chain built	2025
Flores	RT design, RFI surveys	2025
Kanpur	proposal	2025
Badary	fixed broadband system	2017 [S/X/Ka]
Zelenchukskaya	fixed broadband system	2017 [S/X/Ka]
Svetloe	fixed broadband system	2019 [S/X/Ka]
Tahiti	site selected, RFI survey	beyond 2027

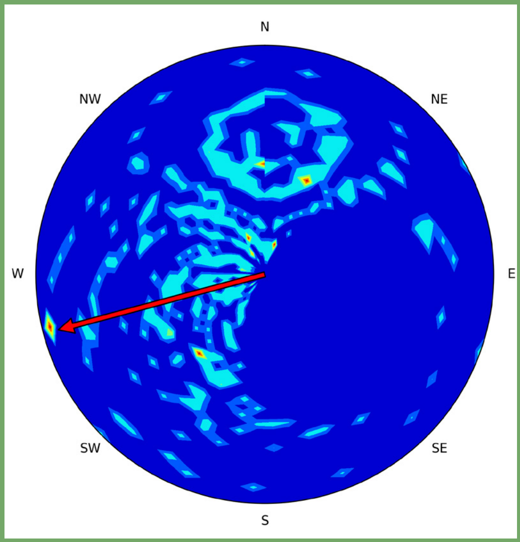
Overview of individual VGOS projects (from Behrend et al., submitted to EVGA2023 Proceedings).

The cadence of the 24-hour VGOS sessions was changed to three per month in the fourth quarter; a return to weekly observing is still hindered by limited data transfer and storage capabilities at the stations and correlators. The VGOS Intensives generally show a very good performance. There are ongoing plans to align the timeslots of the Intensive observing program to IGS Rapids and to increase the robustness of the program by introducing additional baselines.

Special activities. A questionnaire was considered in a recent OPC meeting. Network security as well as constraints at the stations and correlators (e.g., restrictions on ports, IP addresses, protocols, access, network transfer rates, working hours and timing, pull or push method, storage amount and type) give rise to the need for an improved coordination of the data transport activities. As such information is partly classified, it should not be made publicly available. Nonetheless, collected information about the current situation will help the Board to make informed decisions. We will prepare a basic questionnaire and start with interviewing the correlators during the last quarter of the year. After that, we will continue to gather information about transfer restrictions with the stations.

(continues)

Another aspect of the station survey will be a compilation of already existing technical solutions. We also plan to widen the scope of the Network Station Configuration Files with the inclusion of current technical, environmental, network, and responsibility information—also adapted to the new techniques and VGOS sites. For instance, VGOS sites with more than one antenna are not yet up-to-date or properly represented on the IVS website. Another goal is to allow for possible regular updates using a web application, similar to *site logs* of the SLR stations at the ILRS European Data Center (EDC). Therefore, I inquired whether the EDC system could be extended for IVS use. Unfortunately, the EDC does not have enough staff for such additional tasks. However, a new university network at the "Wettzell campus" could offer possibilities for our own implementation. This approach could lend itself to using "webhooks" for handling session status updates such as "start" and "stop" messages. Finally, one-on-one interviews might be the best way to get all information—even though it is very time consuming.



Sample output from the toolbox which might be used for a continuous RFI monitoring using spectra sky plots with direction detection.

Lastly, let me mention a student project at TU Munich that is related to network coordination. The students have made progress in developing a toolbox which uses the *mark5access* library to analyze power spectra and offers outputs inspired by a direction finder. The toolbox can use recorded data from a 1-hour or 24-hour session and shows strong sources on individual maps. The software could be used by the stations and/or correlators.

What else? A VTC subgroup led by Chet Ruszczyk (Haystack) started work on defining fixed observation frequencies for VGOS. In November, an initial sequence was tested in a VGOS R&D session; more tests are anticipated for next year. With the increase of radio interference, it is recommended that VGOS stations regularly monitor their RFI environment. The CDDIS Data Center will implement a password rotation scheme with a 90-day renewal period for all Earthdata Login accounts in mid-January 2024. This will potentially impact stations getting/sending session-related files from/to CDDIS.

Meetings

2023

11-15 December	AGU Fall Meeting, San Francisco, CA, USA

2024

4-9 March	Thirteenth IVS General Meeting, Tsukuba, Japan
14-19 April	EGU General Assembly 2024, Vienna, Austria
13-21 July	45th COSPAR Scientific Assembly, Busan, South Korea
6-15 August	IAU XXXII General Assembly, Cape Town, South Africa
9-13 December	AGU Fall Meeting, Washington, DC, USA

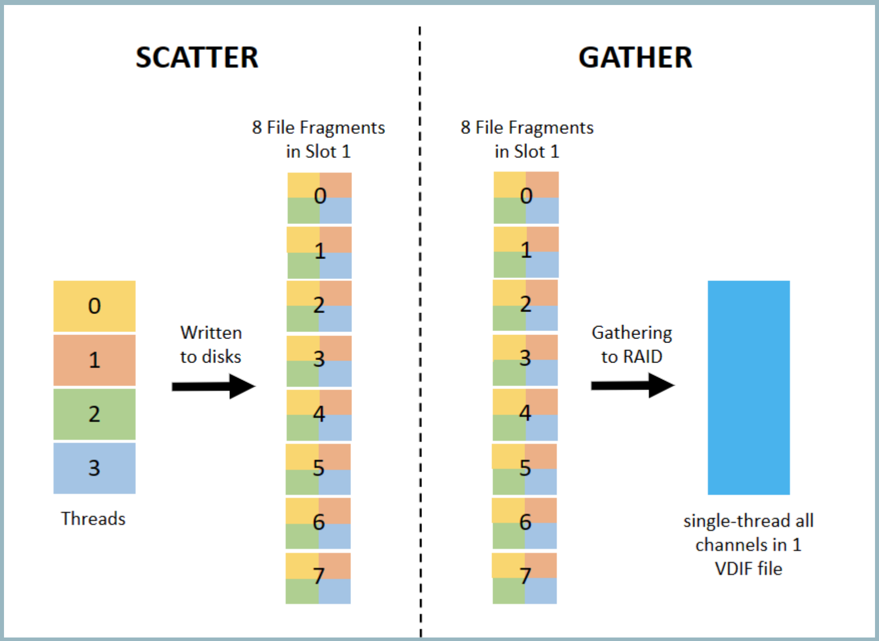
The Gathering

Alex Burns and Mike Poirier, MIT Haystack Observatory

For sites that use the Mark 6 data recorder, you are probably familiar with the process of gathering data after recording a session. But what is really happening here behind the scenes? Gathering is an additional process after recording on the Mark 6 caused by the way the data are written onto the disk module packs. The data from the backend digitizer first goes into the RAM of the Mark 6, into a ring buffer. It quickly fills the buffer, coming in from the network interface at the current rate of 8 Gbps. To drain the buffer, the Mark 6 writes blocks of data, broken down into chunks of smaller than 10 MB, onto whichever of the 8, 16, or up to 32 individual hard drives inside the disk modules is ready to receive the data. Using this method, the buffer can drain quickly, and the performance of the recorder is not limited if one of the hard drives inside the module is slower than the others.

This does present a problem, though. The data is scattered across the hard drives in seemingly random small chunks! Luckily, the data blocks all contain a header, and the gather program can read these headers and assemble all the blocks together into one VDIF file for each scan. This is an important step in data management for stations using the Mark 6.

The process of gathering produces a single file, containing all four threads, or bands, in the case of the RDBE, from all the file fragments on the individual hard drives. A second module is set up in the normal RAID configuration, and the gathered files are assembled there as normal, contiguous VDIF files. These files can then be sent over the network to either another Mark 6 at the correlator or any other file server. If this process is not done when the correlator receives the data, it not only needs to open the files but assemble the scans on the fly before correlation. This slows down the correlation process considerably. It may seem like extra work at your station, but it is all a part of managing the larger and larger amounts of data we are recording as part of VLBI. We at each station are going to need to keep on top of our data, so we can meet the processing goals set by the community and get back to rapid turnaround sessions. Quickly gathering your data after a session is complete, if needed, and getting it to the correlator will keep the data flowing and the science going!



Concept of scattering and gathering data at Mark 6 sites.

IUGG Adopts VLBI-Focused Resolution Related to Spectrum Management

Hayo Hase, BKG

The General Assembly of the International Union of Geodesy and Geophysics (IUGG) took place from 11 to 20 July 2023 at Messe Berlin in Germany. The IUGG consists of eight semi-autonomous associations, each responsible for a specific subject area within the overall activities of the Union; one of them is the International Association of Geodesy (IAG). More than 4,700 participants from more than 100 countries took part in this event.

The IUGG Council is composed of one authorized delegate from each affiliated body. It discusses the proposed resolutions and decides on them. For this General Assembly, the IVS together with the GGOS Bureau for Networks and Observations, submitted a draft resolution "Improving the protection of geodetic observatories from active radio services," which had been prepared by the VGOS group of the European Committee for Radio Astronomy Frequencies (CRAF). This resolution was adopted in Berlin.

It is the first resolution of the largest geo-scientific union to express its concern about the increasing number of ground- and space-based transmitters jeopardizing undisturbed VLBI observations of cosmic radio sources in the universe. It "calls on the affiliated organizations to engage in spectrum management issues at national, regional, and international levels in order to safeguard their interests in the use of the electromagnetic spectrum." The resolution (see the full text version at *https://iugg.org/wp-content/uploads/2023/09/2023_IUGG-GA-Resolutions.pdf*) resolves "to support the introduction and maintenance of local radio quiet zones or local coordination zones around the stations of the global VLBI network."

This resolution is another milestone on the way to maintaining observing conditions under which VLBI measurements can be successfully carried out. In 2021, the 12th General Assembly of the IAU adopted Resolution B1 (see full text version at *https://www.iau.org/static/archives/announcements/pdf/ann21040a.pdf*) "in support of the protection of geodetic radio astronomy from radio frequency interference." Now the two major scientific organizations with which the IVS is directly associated have issued declarations on the protection of VLBI sites. These documents can be useful for the spectrum administrations in protecting our interests. They also raise awareness among scientists, managers, and GGRF users that massive satellite constellations and mobile communications will endanger VLBI products.

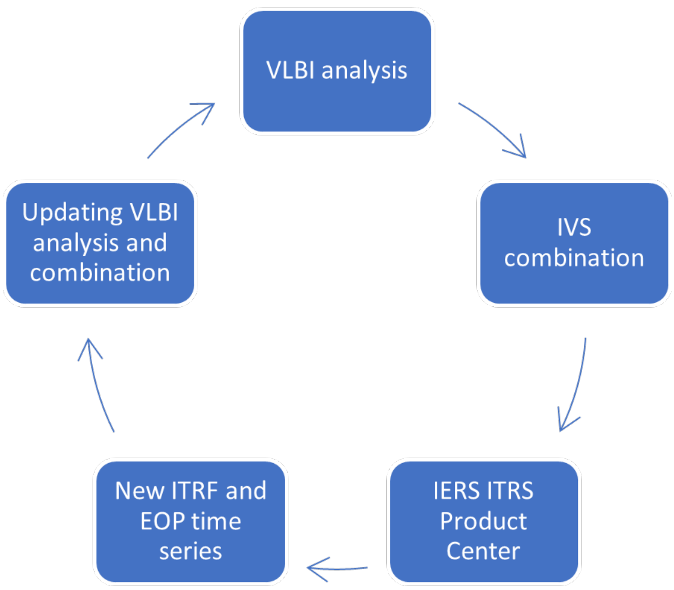
Protection zones for geodetic VLBI sites are currently being discussed as an ITU-R recommendation in ITU-R Working Party 7D. This initiative has so far been supported by the spectrum administrations of Germany, Norway, Spain, and South Africa.

The IVS Directing Board has set up a VTC subgroup to define a frequency configuration for VGOS that should be used for VGOS operations in the longer term. So it makes sense to apply for these bands to be recognized in the Radio Regulations.

Transition to ITRF2020

Sabine Bachmann, IVS Combination Center

Our home planet is a system that permanently undergoes changes. Consequently, the positions of the telescopes are affected as well. This is one of the reasons why we constantly observe extragalactic sources to derive the positions of the telescopes. However, we do not only want to have time series but also to insert these antenna positions into a global network so that a model of their positions can be created.



Planning-evaluation cycle for ITRF2020.

True to the motto "the more the better," we—the IVS people—joined forces with our colleagues from the other space-geodetic techniques (DORIS/IDS, GNSS/IGS, SLR/ILRS). All four techniques were asked to share their precious data for one higher goal: a common reference frame. For our efforts, we were promised a combined international, inter-technique terrestrial reference frame (ITRF), combined EOP time series, post-seismic deformation models, a seasonal geocenter motion model, and much more.

So it happened that the IVS Analysis Centers (ACs) mobilized all their forces, implemented all the specifications in demand, and re-processed all VLBI observations from the 1980s until the end of 2020—more than 7000 sessions. Between the individual contributions from the IVS ACs and the promised ITRF, however, there stood the IVS Combination Center, which put one or the other obstacle in the way of the ACs when discrepancies occurred in their contributions. The combined inter-technique ITRF plays an important role in the VLBI analysis, as does the consistency of all four space-geodetic techniques using a common reference frame. The IVS finally handed over its contribution in April 2021 and then impatiently waited for the final product—the ITRF2020.

But first we had to deal with the preliminary version, the ITRF2020P. The IVS was asked to test and evaluate this version and to give feedback whether it met our needs—since we are also a user of the product to which we contributed. Implementing, testing, and giving feedback was done, and finally, on April 22 of 2022, we held the final product(s) in our hands. ITRF2020 was there!

No one wasted time and immediately set about implementing the ITRF2020, further evaluating the frame and re-processing the more than 7000 sessions between the 1980s and February 2023. The ACs were asked to hand in the re-processed SINEX files by February 28, 2023, so that the Combination Center could submit the combined contribution by March 31, 2023. Both deadlines were held (with the usual expected deviations) and since April 1, 2023, the Rapid combination is aligned to the ITRF2020 by using the ITRF2020 as a priori station information.

Still, things don't always go smoothly when bigger changes need to be made. One AC contributed one month late, another needed to do a complete re-processing after fixing some bugs, a third one struggled with older sessions. Nonetheless, against all odds, the IVS managed to transition its operational daily SINEX as well as rapid EOP products to ITRF2020 on schedule.

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 the General Editors; the deadline is one month before the publication date. The editors reserve the right to edit contributions.

General Editors	Dirk Behrend (*dirk.behrend@nasa.gov*), Kyla Armstrong (*kyla.l.armstrong@nasa.gov*)
Feature Editor	Hayo Hase (*hayo.hase@bkg.bund.de*)
Layout Editor	Nancy Kotary (*nwk@mit.edu*)

Current and past newsletter issues are available at: *https://ivscc.gsfc.nasa.gov*.

IVS Coordinating Center NASA GSFC, Code 61A.1 Greenbelt, MD 20771
https://ivscc.gsfc.nasa.gov | *ivscc@lists.nasa.gov* | phone: 301-614-5939

IVS
INTERNATIONAL VLBI SERVICE
FOR GEODESY AND ASTROMETRY