IVS Newsletter
Issue 53, April 2019

Welcome to Crabtown: Annapolis to Host GM2020

– *Kyla Armstrong, NVI, Inc./NASA GSFC*

Hello and welcome to Annapolis, the site of the 11th IVS General Meeting! Located on the scenic Chesapeake Bay, the city of Annapolis will host the General Meeting from March 22–28, 2020. Along with the General Meeting, various splinter meetings as well as an IVS Directing Board will take place.

As the capital of the state of Maryland, Annapolis was founded in 1649. While waiting for Washington, DC to be built, Annapolis served as the temporary capital of the newly formed United States. The Treaty of Paris, which officially ended the Revolutionary War, was signed in Annapolis in 1783. Annapolis is a famous sailing port, and during the colonial era Annapolis served as a shipping port as well. Annapolis is home to a few famous landmarks, including the United States Naval Academy and the Maryland State House.

View down Main Street with the Maryland Inn as part of the Historic Inns to the right. The Maryland Inn has Treaty of Paris fame.

Annapolis, along with Baltimore (approximately 40 km away) and Washington, DC (50 km away) serve as the three cities which make up the Baltimore-Washington Metropolitan Area, home to 9.3 million people. Because the area is so densely populated there are three major airports within an hour to each other: BWI-Thurgood Marshall Airport is the closest, about 20 minutes away from the Annapolis city limits.

March in Maryland can sometimes be a bit tricky; depending on the year, late March can either be extremely cold or spring-like. The average high is 15ºC and the average low is 3.5ºC.

Maryland is home to a unique seafood cuisine; so many of the restaurants in Annapolis serve famous Maryland crab cakes and steamed shellfish sprinkled with our Old Bay seafood seasoning. If you don't care for seafood Maryland also has an abundance of "soul food" restaurants—fried chicken, pork chops, collard greens, among others are available to make your palate happy.

In addition to the typical icebreaker and traditional dinner, we plan on offering different excursions to see more of Annapolis, Washington DC, and the surrounding areas.

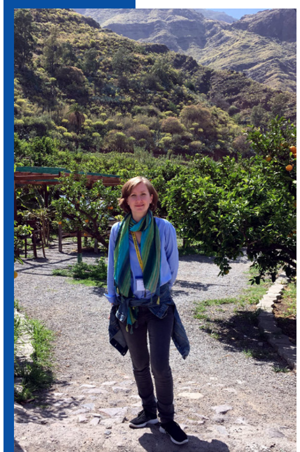
We hope that your visit to Annapolis for the GM2020 is a great one and that we make you feel at home! We can't wait to see you!

Steamed blue crab is a delicacy in the Chesapeake Bay region.

Main entrance to Governor Calvert House, the main venue of GM2020.

Metsähovi: A Radio Observatory and Geodetic Fundamental Station in Finland

The Finnish IVS Network Station at Metsähovi, some 40 kilometers west of Helsinki, is a joint effort between the Finnish Geospatial Research Institute (FGI) and Aalto University. Activities at the site date back to the early 1970s. Newsletter editor Hayo Hase interviewed the head of the FGI department Markku Poutanen [MP] and the VGOS project manager Nataliya Zubko [NZ] learning about the station's history, the institutions involved, the various activities underway including the VLBI efforts as well as other interesting tidbits.



Nataliya Zubko.

[Hayo] Finland is one of the larger countries within Europe by area; but with 5.5 million inhabitants it is also one of the least densely populated. Nevertheless, geodesy has a long tradition in Finland. The VLBI group is part of NLS. What is NLS?

[MP] Finland has a long tradition in geodesy. When the Finnish Geodetic Institute (FGI) was established in 1918, the main reason was to create the nation-wide geodetic network for mapping the country. The tasks included first order triangulation, leveling, and gravity measurements. Later, one of the prime motivators has been the ongoing postglacial land uplift which makes it important to continuously update the national reference systems.

Markku Poutanen.

In 2015 the FGI was merged to the National Land Survey (NLS), which is the national institute responsible, for instance, for the cadaster of Finland, under the name Finnish Geospatial Research Institute (FGI). FGI retained all its duties after the merger but became a research unit within the NLS.

During its 100-year history, FGI has created connections to sister organizations all over the world, not least because of many famous geodesists. People to mention include Veikko Heiskanen, T.J. Kukkamäki, Tauno Honkasalo, and Juhani Kakkuri. The international reputation helped to open doors and offered many opportunities for the participation in international projects and research.

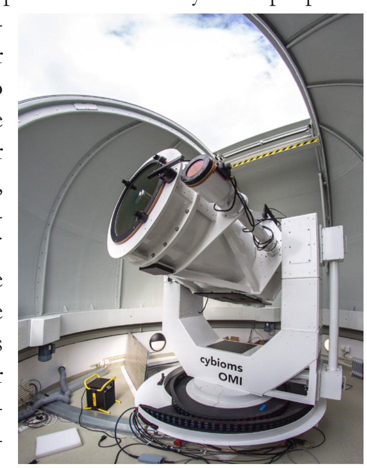
Within the NLS, an organization of 1,600 people (compared to FGI's 120 people), there are more opportunities to propose new collaborations within the organization. A good example is the development of the permanent national GNSS network, which has extensively developed after the merger. And not to forget the new radio telescope which is mostly funded directly by the NLS.

How did geodetic VLBI become part of your duties?

[MP] There was an evaluation of Finnish geodesy in mid-1990s. In the report of the evaluation panel, one topic they recommended to add in the tasks of the FGI was geodetic VLBI. The reason behind the recommendation was that VLBI was the only basic space-geodetic technique we did not have at the Metsähovi Geodetic Observatory. Since 1978 we have operated an SLR system, and since 1992 a GPS receiver as part of the IGS network. We also have a DORIS beacon as well as superconducting and absolute gravimeters.

VLBI was already discussed earlier, but lack of resources was one of the main reasons not to extend tasks in that direction. After a few years of planning and preparations, geodetic VLBI observations were started in 2004 as a co-operation with the Metsähovi Radio Observatory of the Aalto University (at that time the Helsinki University of Technology). The Aalto University radio telescope is located adjacent to the FGI Metsähovi station. Both sites started their operations in the 1970s—so our co-operation has a long history.

After ten years of doing VLBI campaigns, in 2014, we started preparations for obtaining our own geodetic VLBI system. The Aalto telescope is used for many other purposes and its availability for geodesy is very limited for any given year. It is also not conforming with the VGOS requirements for a telescope. In addition, we pay rent for the telescope time. Because of the development in the direction of VGOS, we saw that the alternatives were either having our own telescope or abandon geodetic VLBI altogether.



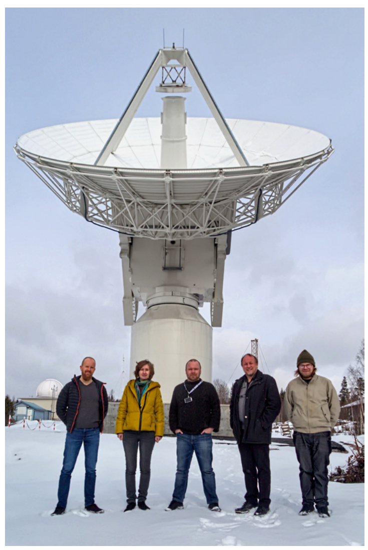
Metsähovi's SLR telescope. (Photo Jyri Näränen)

How did Metsähovi become a fundamental station for geodesy?

[MP] Originally, in the 1970s when we started our activities at Metsähovi, there was no "fundamental station" concept globally. We also had no specific plans at that time but the station gradually developed with activities around the SLR. Two important people in this development were the Director General of the FGI, Juhani Kakkuri, and the Metsähovi station manager, the late Matti Paunonen. We started to construct our first SLR in 1975, and it became operational in 1978. For a long time, it was the only space geodetic instrument at Metsähovi. But with the arrival of GPS, we established a permanent GPS station there in 1991. A bit later it became part of the global IGS network. Today, several GNSS instruments are installed at the site.

A more systematic development started in 1994 when a new laboratory was built for gravimetric observations. A superconducting gravimeter was installed, and the fundamental point of the Finnish gravity system was placed in the same building. It is also the home of our absolute gravimeter.

The DORIS beacon is about 3 km from the main site because of RFI restrictions imposed by the radio telescope, but we have made local ties to connect both sites. Additionally, we have at Metsähovi a DLR TerraSAR-X reflector, a test field for GNSS antenna testing, a 60-m deep borehole (currently unused, originally for a tilt meter), a leveling instrument test field, zero of the Finnish height system, and many environment-measuring instruments (e.g., ground water, moisture, and an advanced weather station). With the increasing number of instruments, the status of Metsähovi increased as well, and after completion of the current renewal it will be one of the most versatile geodetic stations in the world.



The FGI VGOS group at the new telescope in Metsähovi (from the left): Joona Eskelinen, Nataliya Zubko, Jyri Näränen, Markku Poutanen, and Niko Kareinen. (Photo Arttu Raja-Halli)

What are the plans for Metsähovi to become a GGOS station?

[MP, NZ] Commissioning of the new radio telescope is ongoing, with plans to have the telescope tested in 2019. The signal chain components have been purchased and partly delivered to Metsähovi. The receiver arrives in September this year. We are planning to install and test all signal chain components together during 2019-2020. It is perhaps optimistic to expect to be fully operational in 2020; it very much depends on success of the installation but also possibility to get more person resources. Full system testing takes time. The SLR system has about the same schedule. We are expecting the last installations and first test this year, with final testing and fine-tuning in 2020. When completed, all instruments should be operational for a full GGOS station.

Who is working in which field?

[MP] The Metsähovi observatory is a part of the Department of Geodesy and Geodynamics of the FGI. Markku Poutanen is the director of the Department. Jyri Näränen is the Metsähovi Station manager and Nataliya Zubko is the project leader of our VGOS telescope project. We have about 25 people in the Department, and approximately half of them have regular tasks at Metsähovi, although about half a dozen currently work mostly at Metsähovi.

In the VGOS group, in addition to Nataliya and Niko Kareinen (VLBI), we also have Joona Eskelinen (technical issues) and Jyri (mainly infrastructure). Jyri and Arttu Raja-Halli are working on the installation of our new SLR system. Hannu Koivula (leading the reference frame group), Sonja Nyberg, Simo Marila, and Ulla Kallio are our GNSS experts and also work on traditional geodetic measurements. Ulla is responsible for the local ties at Metsähovi. Mirjam Bilker-Koivula is leading the gravimeter group, and others related to the gravimetric observations at Metsähovi are Jyri and Arttu, Heikki Virtanen, Timo Saari, and Hannu Ruotsalainen.

GNSS antenna test field. The new SLR dome is in the background.

What are the current and planned future contributions from NLS to the IVS?

[NZ] We are currently participating in IVS-T2 and EUROPE sessions with a few sessions per year using the Aalto University radio telescope. We are planning to contribute more intensively to the observations when our VGOS telescope is ready. Also, we just started a four-year research project funded by the Academy of Finland. This is a consortium between FGI and the Aalto University Metsähovi Radio Observatory. The aim of the project is to bring together expertise from radio astronomy and geodesy to develop methods to mitigate the systematic errors that spatially resolved structure of quasars introduces to geodetic VLBI observations. This problem is crucial to be solved for the VGOS observation, although our initial research show that we can improve also standard S/X observations.

How were you able to get funding for modernizing Metsähovi station?

[MP] We are not sure ourselves… In 2010–2012 we had long discussions with our ministry (Agriculture and Forestry) about the renewal of the Metsähovi station. All of the instruments at that time were old, and it was foreseen that we could not continue long before the whole station must be closed. After a visit of people from our ministry and the Ministry of Finance at Metsähovi, we were promised 8 million € of special funding. This included the renewal of our permanent national GNSS network, SLR, the gravimetric instruments, and a new radio telescope for geodetic VLBI. Our international position in the global geodetic network and perhaps some favorable domestic political situations to support research were key reasons why the funding was granted.

Panorama of Metsähovi (from the left): the gravimetric laboratory, VGOS telescope, main building, new SLR dome, and the radome of Aalto University radio telescope. (Photo Jyri Näränen)

After almost a decade later, we must be satisfied that practically all plans we described to our ministry are either fulfilled or will be completed next couple of years. We are a couple of years behind the original schedule; but taking into account the extremely tight budget, unexpected events that always happen with such large projects, and especially the very limited human resources, things have gone surprisingly well.

Today we try to use the 2015 resolution of the General Assembly of the United Nations on global geodetic reference frames for sustainable development as the reasoning why we need to maintain and develop our geodetic infrastructure, and especially Metsähovi.

Is Global Change a subject of the political discussion in Finland? Are you concerned of the sea level rise in your country?

[MP] Global change is one of the topics discussed in Finland, and increasingly now when the parliament elections are coming in April. The sea level rise is not the main topic; more discussion is on global warming in general which has its largest effect at high latitudes. The postglacial rebound and land uplift at Finnish coastlines is between 3–9 mm/year, and it is mostly compensating the global sea level rise today. This is perhaps one reason why sea level rise is not among the key issues in the public discourse.

When you're not working, what are your favorite leisure activities?

[MP] Since my background is in astronomy, it is still my hobby. I'm currently the chair of the Finnish amateur astronomers' society Ursa, with 18,000 members. I also participate in photography and science popularization whenever there is some free time.

[NZ] I like to swim. So, when I have time, I go to the swimming pool or swim in the lake during the summer months. Also, just recently, I started to attend dancing classes, and it may become my new hobby.

Directing Board Meets for the 40th Time

– Dirk Behrend, NVI, Inc./NASA GSFC

As part of the slew of meetings held in Las Palmas de Gran Canaria, Spain, the IVS Directing Board came together for its 40th meeting on March 21. After the recent Board elections, this was the first meeting of the new Board, which was attended by both the outgoing and incoming Board members. In a way the timing was befitting as there was a new spring with six completely new members (Laura La Porta, Nancy Kotary, Chet Ruszczyk, Alet de Witt, James Anderson, and Jinling Li) attending for the first time.

The IVS Directing Board in the Hotel AC Gran Canaria at the end of a long day.

Axel Nothnagel reported that he will serve out his full 4-year term as IVS Chair. He is going to retire from the University of Bonn at the end of September 2019; however, he expects to get an affiliation with the TU Vienna for a couple of years. Hence, he will likely have more time available for the IVS and VLBI work.

The Board agreed to have only an online version of the major IVS publications (General Meeting Proceedings, Biennial Report). If a local host of a GM is willing to support a printed version in their own publication series, this should be accommodated. The Board was concerned that the recent elections had a voter turnout of only 33%. Avenues will be investigated to boost interest in the governance of the IVS; a first step will be to understand where deficiencies lie (e.g., geographical distribution).

The Board approved the Final Report of Working Group on Galactic Aberration and WG8 was officially closed. It also agreed that Sigrid Böhm (TU Vienna) be the second IVS representative on the IERS Directing Board, after Guangli Wang (SHAO) had relinquished his position. The Board decided not to shift the start times of the legacy S/X sessions to 0h UT due to an adverse effect on several stations. There is an urgency to get mixed-mode observing operational to do the tie between VGOS and legacy S/X before 5G becomes fully established (severe RFI on S-band).

IVS Holds Third VLBI Training School in the Canaries

– Andy Sargent, U.S. Naval Observatory

Participants of the Third VLBI Training School in Las Palmas de Gran Canaria, Spain.

Three years have passed since the previous VLBI Training School in 2016 and for those of us who are new to VLBI, missed the last one, or even just wanted to attend a second time, the prospect of gaining formal exposure in a classroom environment was exciting. So, every morning around 8 AM we gathered at the bus stops a little tired but happy to partake in the 3rd VLBI Training School. While waiting for the bus we were able to chat with our cohorts to catch up and learn of new projects and developments or to meet for the first time.

Attendance was high for the 3rd IVS VLBI School: there were 54 participants in total, and the students ranged from all levels of expertise including undergraduate, masters and PhD students as well as postdocs and several senior scientists and professionals among disciplines including geodesy and astrometry. Participants attended from many institutions, universities and laboratories were from all over the world: Spain had the most attendees with 12, including the LOC, followed by USA (11), China (8), Germany (7), Austria (4), Norway (4), Sweden (2) and Australia, Finland, France, South Africa, Thailand and The Netherlands (1 each).

The lectures, combined with the hands-on tutorials, gave all students a solid foundation in VLBI techniques, methodologies and current practices as well as insights into future technologies. Each day we would attend classes at the University of Las Palmas de Gran Canaria. The first day was all about introducing VLBI and why it was important for us to attend. The first-day lecturers Axel Nothnagel and Aletha de Witt explained why we do VLBI by discussing the motivations for geodesy and astrometry. We moved on to discuss what radio sources we observe in VLBI and how the stations operate the radio telescopes and receivers. At the end of the day we were treated to a quiz to exercise our knowledge on the technical aspects of antennas, feeds and receivers.

The next few lectures went in-depth about the details of VLBI operations: we learned how the data is sampled, how we store and transport data and data modeling for correlation. John Gipson gave us a very informative lecture on how to actually schedule VLBI observations using the NASA GSFC software, sked. The second and third days also consisted of a lot of hands-on exercises on how to use Sked, how to correlate the raw telescope data, how to determine the delays for fringe fitting and finally data analysis for geodesy. The lecturers were all well prepared for the interactive exercises and a student could log in to one of several accounts on a shared laptop to perform the analysis or there were ready-to-use images available with the software pre-installed. Since the participants came from all levels and areas of VLBI, the groups were broken up to include at least one expert, perfect for the correlation and analysis exercises where each student had someone that could coach them how to use DiFX for correlation, *Fourfit* for fringing, and nusolve for analysis.

In the lecture hall at ULPGC.

Overall, the school was a useful endeavor for everyone who attended and we all had a great time. The coffee and stretch-your-leg breaks gave us the opportunity to chat with other students and the lecturers to ask any questions we had. Megan Johnson, an astronomer at U.S. Naval Observatory thought the school was super intense, saying "there was a TON of information covered over the three days. But the school was comprehensive and covered all of the topics that I was hoping it would."

Participants during one of the exercises.

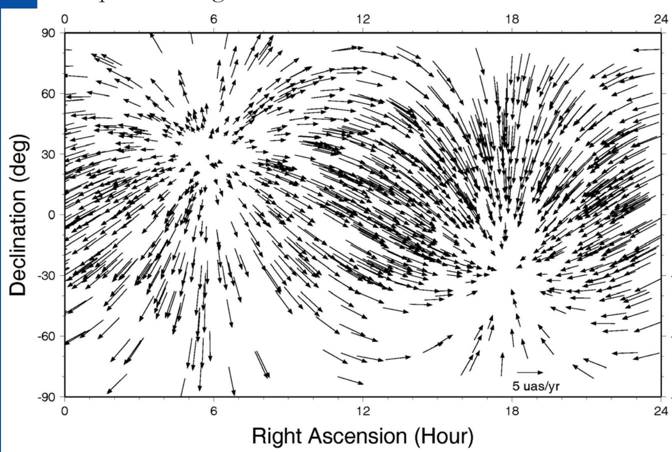
A big thanks goes out to the organizing committee who organized the school and classroom, breaks for coffee/treats, and lunches. On the last day, the LOC organized a short retreat before dinner after the lectures completed. We were treated with a bus ride to the city of Arucas and enjoyed live music by a one-man show in front of the Church of San Juan Bautista and were able to see several people dressed in costumes in celebration of Carnival. Our last stop was for dinner at Los Chorros where we enjoyed a lot of delicious food (including Canarian potatoes), a toast to our success followed by a lot of laughter and dancing.

News...

Get Ready for ITRF2020

– John Gipson, NVI, Inc./NASA GSFC

In January of 2019 Zuheir Altamini put out a call for the space geodesy techniques to participate in ITRF2020. The latest version of the ITRF will use all data available through December 31, 2020, and the IVS contribution to this will be due in early 2021. I will give more details on the time table as I learn them. Here I wanted to focus on some changes required for the VLBI Analysis software, and it is not early to begin getting ready for this. Here is a quick summary of the required changes.



Aberration proper motion field for an aberration constant of 5.8 μas/yr.

Use of ICRF3 as a priori source position. ICRF3 was approved by the IAU in 2018, and became official on January 1, 2019. Unlike previous CRFs, ICRF3 includes Galactic Aberration—that is the effect of the acceleration of the solar system around the galactic center. This causes an apparent change in source position with time. Although the maximum effect is small (~5.8 μas/year) this can lead to large differences after 40 years—the time span of geodetic VLBI.

Gravitational Deformation of VLBI antennas. VLBI antennas deform as the elevation angle changes. This deformation causes a change in the signal path length, which in turn causes a change in the measured delay. Since the change in delay is elevation dependent, it will cause a change in any of the estimated parameters that depend on elevation, which are tropospheric delay (~1/sin(el)), local Up (~sin(el)), and axis offset (~cos(el)). The change in local Up can be large—up to 100 mm for Effelsberg. More typically it is on the order of 1–10 mm. For ITRF2020, the effect of gravitational deformation should be included for all antennas that we have models for. As of April 2019, six antennas were measured. I have a table which gives the change in delay as a function of elevation for these antennas. I know that there are plans to measure more antennas in the near future, and I will update the table as this happens.

New Pole Tide Model. As a result of the 2017 Unified Analysis Workshop in Paris, the IERS pole tide model was changed. The primary difference is in which position to use for the pole. The new pole-tide model does a linear fit to the position of the pole over a long period of time, and uses this as the a priori position. If this sounds familiar, it is—this is the formulation of the 2003 IERS standards which was subsequently changed in 2010. The changes to your software should be relatively straightforward.

New HF-EOP Model. The current IERS model of diurnal and semi-diurnal EOP variation originated in 1996. This model was derived from a model of ocean tides based on Topex/Poseidon data. In 2003 the IERS standards were updated to include the effect of libration on Polar Motion, and in 2010 they were updated again to include the effect of libration on UT1. Much has changed over the last 30 years, and many scientists have found that the IERS model differs significantly from models derived from space geodesy. In 2017 an IERS working group was formed to evaluate various HF-EOP in different space geodesy techniques, and to make a recommendation. As a first step, the WG gathered the available models and put them in a common form, and wrote software to use the different models. All of this is publicly available. The evaluation of the different models is still in progress, but based on independent analysis using the models in processing GNSS and VLBI data, the two best models are the ones by Sibois and Desai of JPL (which is derived from new tidal models) and an empirical model derived by myself from VLBI data. Some SLR analysis centers are in the process of testing several models, and we should hear from them shortly. The working group hopes to make a recommendation by the end of the summer.

Upcoming Meetings...

Tenth IVS TOW
Westford, MA, USA
May 5-9, 2019

Journées 2019
Paris, France
October 7-9, 2019

IUGG General Assembly
Montreal, QC, Canada
July 8-18, 2019

GGOS Days 2019
Rio de Janeiro, Brazil
November 11-14, 2019

Unified Analysis Workshop
Paris, France
October 2-4, 2019

AGU Fall Meeting
San Francisco, CA USA
December 9-13, 2019

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

Why is my Offset so Peculiar?

– Ed Himwich, NVI, Inc./NASA GSFC

An issue that has become more important recently is the so-called Peculiar Offset. This primarily comes up in the correlation of data. However, it is also a significant issue at the stations. Simply put, the Peculiar Offset is the signal path delay at the stations from the VLBI reference point at the antenna to where the time-tag is inserted into the data stream by the formatter (typically in a Mark IV formatter, Mark 5B recorder, FiLa10G for VDIF, or RDBE), i.e., the point where *fmout-gps* is measured. We need this value so that we can set the observation time-tags to agree with when the VLBI signal passed the VLBI reference point, rather than when it was time-tagged for recording.

Why is it "Peculiar"? Because the value is "peculiar" (individual) to each station.

Why is it called an "Offset"? Because the correlator adds this delay to the *fmout-gps* values to get the correct *Used* correlation clock for each station. It is the "offset" from the *fmout-gps* value. You may have noticed the +CLOCKS section in the IVS Correlation Reports. You can determine a station's effective Peculiar Offset for that experiment by subtracting its *fmout-gps* value from its *Used* value. The *Used* value is the correction to the recorded time-tags to associate the data with the VLBI reference point.

Although it should seem that the Peculiar Offset for a given station should not vary from experiment-to-experiment, it does. This can happen for obvious reasons: the IF cable lengths changed, the type of formatter changed (e.g., Mark 5B to VDIF with FiLa10G), or other changes that affect the path signal delay of the station (e.g., adding a FiLa10G between a DBBC2 and a Mark 5B). Other changes may be less obvious: a change, accidental or intentional, in the triggering of the counter or some instability in the electronics of the signal path or formatter. A change in the GPS receiver being used, its configuration, or its cabling can also appear as a Peculiar Offset change. There is also noise in the observation, such as ionosphere variations, which affect the observed value of the offset (although not the true value). Whether changes are accidental or intentional, the correlator must take them into account when correlating the data.

Why do we care about the Peculiar Offset? Because its changes directly affect our estimates of UT1, which is one of our most unique products. While the correlator can (and does) determine the relative values of the Peculiar Offsets to correlate the data, the correlator cannot determine if there is an average shift in all the values. Such a shift is called a Universal Clock Adjustment (UCA). While a UCA does not affect correlation, it does affect UT1. A UCA that causes a +1 μs shift in the time-tags will shift UT1 by −1 μs. Since the Peculiar Offsets contribute to the final time-tag, it is very important that we get them right! We try to keep them consistent at the 0.1 μs level or better to support a UT1 measurement precision of 1 μs.

Unfortunately, we do not know what the correct Peculiar Offset values are. The overall UCA was set arbitrarily to a reference value in the past. To maintain consistency with that reference, we adjust the UCA for each experiment to keep the Peculiar Offsets for all stations in average agreement with that reference from the past. Although that reference is arbitrary, we suspect that it is probably in error by only 1 or 2 μs. We hope eventually to determine the correct Peculiar Offset for every station, but even once we do, we will still see variations in the observed values.

The correlators have to examine the Peculiar Offsets for each experiment and determine if one (or more stations) is an outlier due to some change. The remaining stations can be used to make sure that there is no UCA relative to the historical reference. The bottom line is that it is very helpful if the stations report to the correlators when they have made any change in the signal path at the station, particularly cabling and electronics. A change in the GPS receiver being used, its configuration, or its cabling can also be significant. There may still be other effects that the stations are not aware of, but at least the correlators should be warned when a change is expected. (As an aside, there is no effect on the Peculiar Offset for changes in the timing system up to the formatter, e.g., cables from the Maser to the rack or the epoch of the 1 PPS feeding the formatter. These are all calibrated out by the *fmout-gps* values that are recorded during experiments.)

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 (see below).

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

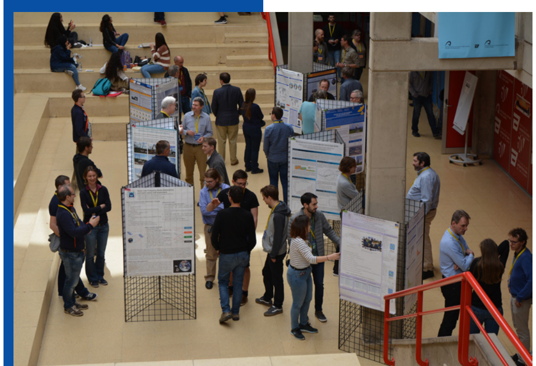
https://ivscc.gsfc.nasa.gov/.

EVGA2019: On an Island

– Dirk Behrend, NVI, Inc./NASA GSFC

EVGA Chair Rüdiger Haas (left) addressing the participants during the opening of the meeting.

In line with its recent history, the geodetic/astrometric VLBI community met on an island to conduct the proceedings of the 24th Meeting of the European VLBI Group for Geodesy and Astrometry (EVGA). Following the Azores in 2015 and Svalbard in 2018, this time our European colleagues invited us to the island of Gran Canaria. Some 114 participants followed this call; it was clearly an international crowd that found its way to the third-largest island of the Canary Islands.



Part of the poster area during a break.

Like the IVS Training School, the venue for the EVGA meeting was the Universidad de Las Palmas de Gran Canaria (ULPGC)—albeit in a different building. Over the course of two very busy days there were 52 oral and 39 poster presentations given. The presentations were grouped together under the session themes of Technology, Observations, and Analysis. The organizers and authors made their presentations available online at http://www.oan.es/evga2019/sciprog.shtml in the form of PDF files. The interested reader is encouraged to check them out to get a feel for the scope of the meeting.

The meeting dinner was held in the La Marinera restaurant at the northern end of the 3-km-long beach Playa de las Canteras, which is considered one of the world's best city beaches. As part of this evening event, the organizers awarded a prize for the best picture taken by an attendee; the winners were presented, among other things, with a bottle of ronmiel ("honey rum", a local specialty), which then was promptly shared among friends. The evening culminated in the serving of a special dessert: a cake with the replica of a RAEGE VLBI antenna was enjoyed by all participants to mark the 20th anniversary of the IVS.

In addition to the meetings covered in this Newsletter issue, the meeting week also included an IVS Analysis Workshop, a face-to-face meeting of the VTC, and a meeting of the Southern VLBI Astrometry Group. The local hosts have to be congratulated on their impeccable organization of the number of meetings. We definitely want to come back to see the RAEGE VGOS antenna at Artenara on Gran Canaria in its full glory.

The next EVGA meeting will be held in March 2021 in Paris. Following the custom of recent years, it may as well be held on the Île de la Cité.

Cake commemorating the 20th anniversary of the IVS.

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