

## **COMMISSION B4 WORKING GROUP**

## **GLOBAL VLBI ALLIANCE**

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## **TRIENNIAL REPORT 2021-2024**

### **1. Background**

The Global VLBI Alliance (GVA) is a Commission B4 Working Group that was established in the previous triennial term. The GVA came to existence as a joint initiative of the the European VLBI Network (EVN), the East Asian VLBI Network (EAVN), the Very Long Baseline Array (VLBA), and the southern hemisphere Long Baseline Array (LBA). Its aim is to promote and help develop VLBI on global scales. The GVA interconnects astronomers ('users') from different communities through the Science Forum (GVAS), which provides the chair for the WG itself. The GVAS will develop and nurture VLBI science use cases that need to be addressed on global scales and with multiple facilities in the multi-messenger era. The related technical developments are being pushed forward at different levels, but they are coordinated at the highest level at the Director's Forum (GVAD).

With the emergence of new facilities in all domains, the GVA will provide a single point of contact to organise global VLBI campaigns with the Square Kilometre Array (SKA), the Next Generation Very Large Array (ngVLA) and the upgraded Giant Metrewave Telescope (uGMRT), to name a few. The GVA array will have the potentials to support multi-messenger campaigns including the LIGO-Virgo-KAGRA Collaboration, the Cherenkov Telescope Array (CTA), the IceCube Neutrino Observatory, the Extremely Large Telescope (ELT) and others. A virtual network of support centres within GVA will facilitate the information flow and support for the users.

### **2. Developments within the past triennium**

#### *2.1. Structuring the GVA*

Creating a Science Forum (GVAS) was the first step in initiating the GVA working group. The GVAS engages in discussions with the community about global VLBI science cases. The first meetings were organised at the URSI AT-AP-RASC in Gran Canaria in June 2022 and at the IAU 2022 in Busan, South Korea, with special VLBI and GVA sessions, respectively. At these meetings various GVA structures have been proposed like the GVAT to coordinate the development of new instruments and procedures, which

could be a natural extension to the existing International VLBI Technological Workshop (IVTW) activities, the GVAO, an operations and logistics team, and the GVAC, a communications and outreach team. While there is some motion in the direction of setting up a technology forum, these structures have not been realised yet. Regarding the operations, the EVN and the VLBA are already accessible as a global array through a single proposal. Deepening the collaboration with other networks may require MoUs. As for information on the networks and outreach activities, a central web page was created (<http://gvlbi.evlbi.org/>).

### 2.2. *Science Forum themes*

While there are Science Vision documents (Venturi, Paragi, Lindqvist et al. (2020), USA NSF Decadal Survey, Astronet Science Vision) describing the priorities, opportunities and challenges for the next decade, it is important to establish the leading science cases for a more global approach. Since there is a broad range of science cases that can be addressed with VLBI, four themes have been defined, and VLBI champions have been invited to coordinate activities within these themes:

- AGN, jets, radio galaxies – Francesca Panessa (INAF-Rome);
- Galactic science, maser astrometry – Tomoya Hirota (NAO);
- Science opportunities with new instruments (e.g. SKA-VLBI) – Jimi Green (CSIRO);
- Transients – Pikky Atri (Astron)

### 2.3. *First meeting of the GVAD*

A major GVA event was related to the "Life begins at 40!" conference in Bologna in May 2023. A special session was organised where the working group was introduced. There were fruitful discussions about the GVA science themes and how to approach them on global scales. There was a wide agreement that for observing prime multi-messenger targets (other than AGN, e.g. BNS, BH-NS mergers), or following up on transients (and their host environments) at cosmological distances, our current networks would strongly benefit from a substantial increase in sensitivity. Also, reacting to very rare transients (e.g. a Galactic supernova) that may require round-the-globe monitoring require a tight collaboration.

The special session was followed by the first formal meeting of GVAD representatives with the following participants:

- Chris Phillips [Long Baseline Array];
- Tiziana Venturi & Simon Garrington [European VLBI Network/EVN+e-MERLIN];
- Hideyuki Kobayashi [East Asian VLBI Network];
- Walter Brisken [Very Long Baseline Array];
- Taehyun Jung [Korean VLBI Network];
- Mareki Honma [VERA/Mizusawa];
- A. Zensus [Global mm-VLBI Array/Effelsberg];
- A. Slowikowska [JIVE/EVN]

There were further GVA-related presentations and discussions at the URSI GASS 2023 meeting in Sapporo.

### 3. Future plans

A major task for the GVA is to increase the collecting area available for VLBI by facilitating more global VLBI observations, and integrating new elements in VLBI arrays. Good examples for the latter include first tests with uGMRT, FAST, MeerKAT, the Ghana Radio Observatory and (in the near future) the Thai National Radio Telescope (TNRT) – together with the EVN and the LBA. Increasing the recording bandwidth to an operational level of 4 Gbps and higher is also a priority. This requires coordinated developments to allow for compatible observing modes, but it also requires further investment and coordination in making sufficient recording media available. How to guarantee adequate correlation resources and user support are other important aspects.

As a mid-term goal, we need an action plan on how to address transient phenomena, either in standalone VLBI observations, or in support of multi-messenger campaigns. The recent EVN-lite initiative, offering 100s of hours of ad-hoc EVN sub-arrays on a best effort basis, is an example that could perhaps be broadened to a more global exercise.

A better reach of the Southern skies requires a strong support of the VLBI initiatives in Africa, South-East Asia, Australia and South America. The mid- and low-frequency components of the SKA are being constructed in the coming years. Our aim is to help commissioning and test observations with these telescopes, with the long-term goal of realising and operational SKA-VLBI network.

Zsolt Paragi  
Chair

### References

- Venturi, T., Paragi, Z. & Lindqvist, M. (eds.) 2020, *VLBI20-30: a scientific roadmap for the next decade – The future of the European VLBI Network* (<https://arxiv.org/abs/2007.02347>)
- USA NSF Decadal Survey on Astronomy and Astrophysics 2020, *Pathways to Discovery in Astronomy and Astrophysics for the 2020s* (<https://nap.nationalacademies.org/resource/26141/interactive/>, <https://ww2.aip.org/fyi/2021/astro2020-decadal-survey-arrives-priorities-major-facilities>)
- Astronet, 2021, *Science Vision and Infrastructure Roadmap for European Astronomy* (<https://www.astronet-eu.org/forums/roadmap-community-consultation>)