# The Global VLBI Alliance

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**Abstract** By its very nature, VLBI has always depended on international collaborations. These have led to the formation of several formal VLBI networks, which in turn regularly form combined arrays. In astronomy, "global VLBI" is the term often used for the coordinated observations of the European VLBI Network (EVN) and the Very Long Baseline Array (VLBA). In the past, the "Global VLBI Working Group" (GVWG) worked as an umbrella for the space VLBI and ground VLBI network collaboration (VSOP), organizing the logistics (time allocation of ground network resources was agreed in the GVWG) and technical compatibility. Nowadays, as several independent VLBI networks and instruments exist, we recover that spirit, by the establishment of a Global VLBI Alliance (GVA).
The GVA facilitates the flow of information between VLBI networks, including sharing strategies, technical developments for compatibility, logistics, operations, and user support. It also promotes, proposes, and coordinates common observational campaigns with these existing networks. Moreover, with the advent of the Square Kilometer Array (SKA) and its precursors, such global coordination of the various networks and their participating telescopes will be required. The next-generation Very Large Array (ngVLA) may also collaborate with a global VLBI array. In such scenario, the GVA will serve as contact point and framework of collaboration of the VLBI networks and these other facilities. Additionally, it can encourage and support new VLBI activities (like the African VLBI Network, AVN; Iniciativa VLBI IberoAmericana, IVIA; or developments in India and southeast Asian countries).
The GVA will also facilitate that adequate information is provided to the users. For this, a unique common portal will explain the characteristics of the different networks, and the options for users to access them or in combination.
Since there is a big synergy of developments with geodetic VLBI—and many radio observatories share their facilities and equipment between different VLBI applications—the discussions in the GVA will be very relevant to the IVS.

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## 1 Introduction

Very Long Baseline Interferometry (VLBI), by its very nature, has always depended on international collaborations. Currently, several formal VLBI networks exist, which in turn regularly form combined arrays. A Global VLBI Alliance (GVA) facilitates the flow of information between VLBI networks, including sharing strategies, technical developments for compatibility, logistics, operations, and user support. It also promotes and coordinates common observational campaigns with these existing networks, fosters and supports new VLBI activities, while increasing the visibility, as well as scientific and societal impact of VLBI. The GVA, moreover, facilitates the interaction with the users and serves as contact point and framework of collaboration of the VLBI networks and other astronomical facilities—in view of the growing need of multi-messenger studies.

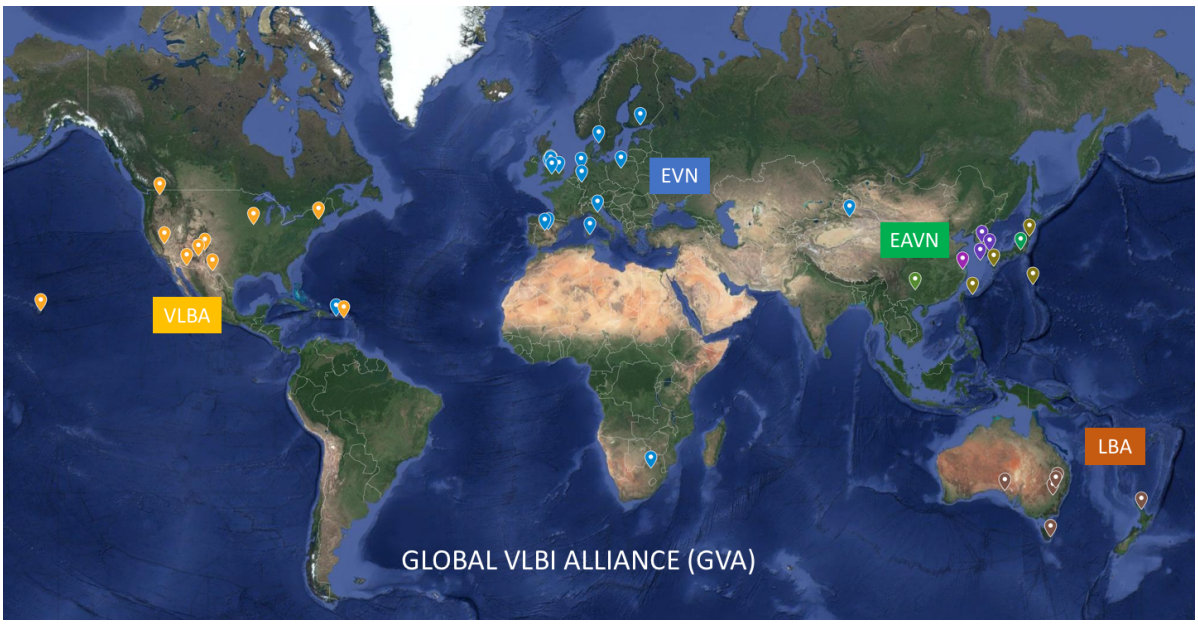


**Fig. 1** VLBI networks in the Global VLBI Alliance.

## 2 VLBI Networks in the GVA

The Global VLBI Alliance is open to every VLBI network, and at this moment (March 2022) it includes those who can operate at some common frequencies. These networks are:

- The European VLBI Network (EVN),
- the East-Asian VLBI Network (EAVN), comprised of the Chinese VLBI Network (CVN), the Korean VLBI Network (KVN), and the Japanese VLBI Exploration by Radio Astronomy (VERA)—the last two also operating together as KaVa,
- the Very Long Baseline Array (VLBA) in USA, and
- the southern hemisphere Long Baseline Array (LBA), with radio telescopes in Australia and South Africa.

It is to note that several radio telescopes and institutional members of the networks above are also participating in IVS campaigns. Moreover, since there is a big synergy of developments with geodetic VLBI, and many radio observatories share their facilities and equipment between different VLBI applications, the discussions in the GVA will be very relevant to the IVS.

## 3 Structure of the GVA

The Global VLBI Alliance is structured as follows:

- GVA Director's Forum (GVAD): VLBI network directors or representatives (up to two per network) to discuss any aspect of the global cooperation.
- Science Forum (GVAS): evaluates and fosters the unique and complementary contribution of VLBI to astrophysical research. Members are active scientists, not necessarily linked to any of the VLBI networks in the GVA.
- Technical R&D Forum (GVAT): discusses opportunities and coordinates the development of new instrumentation or procedures.
- Operations and Logistics Team (GVAO): facilitates and coordinates observations scheduled with several VLBI networks, or with participation of third-party instruments (e.g., multi-wavelength/multi-messenger).
- Communication and Outreach Team (GVAC): coordinates activities and tools to increase the scientific and societal impact of VLBI.

The GVAS, GVAT, GVAO, and GVAC all report to the GVAD.

## 4 The GVA Science Forum

The GVA Science Forum (GVAS) evaluates and fosters the unique and complementary contribution of VLBI to astrophysical research. Members are active scientists, not necessarily linked to any of the VLBI networks in the GVA.

The GVAS provides the opportunity for scientists to identify needs and engage in discussions on how to keep the VLBI facilities responding to the latest astronomical challenges, participating and providing input to roadmap exercises. Recent examples are the excellent review of VLBI in the EVN science vision 2020–2030 document [1], "VLBI20-30: a scientific roadmap for the next decade – The future of the European VLBI Network," to optimize its unique role in the context of a rapidly evolving set of global astronomical facilities as planned for the next few decades. In the USA, the NSF Decadal Survey on Astronomy and Astrophysics 2020 (Astro2020) [2] supports the NSF to fund design and cost studies and prototyping for the next-generation Very Large Array (ngVLA), a potential replacement for the Jansky Very Large Array and the Very Long Baseline Array radio astronomy facilities.

The scientists involved can evaluate not only the synergies between VLBI facilities, but also exploit the unique and complementary characteristics that enhance the contribution of VLBI to astrophysical research, such as different frequency coverage, angular resolution, sensitivity, availability for studies that require observations with different cadences, real-time capabilities, access to different regions of the sky, and so on. Moreover, this will incorporate the VLBI aspect to roadmap exercises such as the Astronet Science Vision and Infrastructure Roadmap for European Astronomy [3], facilitating the coordination of VLBI networks with other astronomical instruments.

The GVAS is also a forum for cross-fertilization where scientists of some regional VLBI networks can meet with other colleagues and start global collaborations, in line with the true international nature of VLBI.

## 5 The Technical R&D Forum

The GVA Technical Research and Development Forum (GVAT) discusses opportunities and coordinates the development of new instrumentation or procedures. A primary goal is to make the VLBI networks sufficiently compatible as to allow joint observations, which requires capability for observing at common frequencies, using the same data transport and formatting protocols, storage, etc. Users also benefit from similar proposal tools and data reduction platforms.

The role of the GVAT is also to evaluate the best way to answer the expectations of the VLBI users, as described in the science vision documents, from the development of state-of-the-art instrumentation to the logistics of how the observations are made. Joint efforts to achieve increased sensitivity, survey speed, agility, frequency range, and post-processing capabilities are beneficial for all VLBI networks. For example, expected increases in correlator and data imaging capacity, possibly combined with Phased Array Feeds (PAFs) on the larger VLBI telescopes, would make imaging over large fields of view a standard capability, and flexible VLBI arrays and real-time capabilities will also allow follow-ups of transient events detected either in large field of view radio surveys or by instruments operating in other parts of the electromagnetic spectrum.

Currently there are several instances in which the staff responsible for R&D, scheduling, and logistics of VLBI networks regularly meet; the GVAT will extend the scope to the global scale and facilitate the exploration of not only the synergies but also the complementarity of the network characteristics, to fulfil the requirements of the user science cases.

## 6 Operations and Logistics Team

The GVA Operations and Logistics Team (GVAO) takes care of identifying and solving the details that facilitate coordinated observations with several VLBI networks, and/or with participation of third-party instruments (e.g. multi-wavelength/multi-messenger).

The team is composed of the officers responsible for operations and scheduling, in close collaboration with the chairs of the Time Allocation Committees (TACs), to discuss aspects such as proposal submission tools and deadlines, evaluation criteria, and other data policies which need to be consistent among the networks.

## 7 GVA Communications and Outreach

The results of VLBI, and its capacity to complement the information obtained in studies with other astronomical techniques, are made visible by the Communication and Outreach Team (GVAC), whose important mission is to promote the visibility of VLBI, its networks, making joint advocacy of VLBI. This is done by the maintenance of the GVA web portal [4], presence in social networks [5], organization or participation in conferences, workshops, schools and other events, among other things.

## References

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