Goddard Geophysical and Astronomical Observatory

Katie Pazamickas

Abstract This report summarizes the technical parameters of the Very Long Baseline Interferometry (VLBI) systems at the Goddard Geophysical and Astronomical Observatory (GGAO) and provides an overview of the activities that occurred in 2023–2024, provides the outlook for 2025, and lists the outstanding tasks to improve the performance.

1 Location

The Goddard Geophysical and Astronomical Observatory (GGAO) consists of a 12-meter radio telescope for VGOS development, a 1-meter reference antenna for microwave holography development, an SLR site that includes MOBLAS-7, the next generation Space Geodesy Satellite Laser Ranging (SGSLR) system, a $48''$ telescope for developmental two-color Satellite Laser Ranging, a GPS timing and development lab, GNSS, a DORIS system, meteorological sensors, and a hydrogen maser. The 5-meter radio telescope for VLBI is no longer in service. In addition, the site is a fiducial IGS site with several IGS/IGSX receivers.

GGAO is located on the east coast of the United States in Maryland. It is approximately 15 miles NNE of Washington, D.C. in Greenbelt, Maryland.

- Longitude 76.4935
- Latitude 39.0118
- GGAO12M
- Code 61A
- Goddard Space Flight Center (GSFC)
- Greenbelt, Maryland 20771
- https://space-geodesy.nasa.gov/NSGN/sites/GGAO/GGAO.html

2 Technical Parameters

In October of 2010, construction of the 12-meter VGOS developmental antenna was completed. This antenna features all-electric drives and a Cassegrain feed system. The antenna has a VGOS broadband receiver and associated subsystems.

The technical parameters of the 12-m radio telescope are summarized in Table 1.

Table 1 Technical parameters of the GGAO 12-m radio telescope.

Parameter	12-m Antenna
Owner and operating agency	NASA
Year of construction	2010
Diameter of main reflector	12 m
Azimuth range	$\pm$270 deg
Azimuth velocity	5 deg/sec
Azimuth acceleration	1.3 deg/sec/sec
Elevation range	5–88 deg
Elevation velocity	1.25 deg/sec
Elevation acceleration	1.3 deg/sec/sec
Focus	Cassegrain
Receive Frequency	2–14 GHz
Bandwidth	512 MHz, four bands
VLBI terminal type	VGOS
Recording media	Mark 6

3 Staff of the VLBI Facility at GGAO

GGAO is a NASA research and development and data collection facility. The VLBI facility at GGAO is operated under the Space Exploration Network Services and Evolution (SENSE) contract by Peraton. The Peraton staff includes Katie Pazamickas (Station Manager), Jay Redmond (Station Engineer), and Todd Tolley (Station Engineer) conducting VLBI operations and maintenance at GGAO with the support of the sustaining engineering Peraton team.

4 Mission Support

Having ceased VLBI operations in May 2007, the MV3 5-m antenna is retired due to issues with the obsolete controller. The 12-m VGOS antenna has participated in many VLBI Global Observing System (VGOS) 24-hour experiments, including CONT17, VGOS Trial, and VGOS Intensive observations. The antenna currently observes VGOS-OPS observations on a regular basis and occasional VGOS-RD sessions, as well as other observations as required.

5 Recent Activities

Much of the 2023 and 2024 activities at GGAO have been focused on VGOS observing using the 12-m antenna. Other activities worth noting include:

- Conducted IVS observations using the Mark 6 recorders to demonstrate the VGOS capabilities on a regular schedule (provided by the IVS);
- Participated in 29 VGOS-OPS sessions in 2023 and 2024;
- Participated in 41 VGOS Intensive sessions in 2023–2024;
- Participated in five R&D sessions in 2023–2024;
- Obtained regular cable delay measurements to use along with the observation data;
- Assisted with GRITSS (Geodetic Reference Instrument Transponder for Small Satellites) testing when needed;
- Tested the VLBI Communications Center (VCC) software, developed by NVI;
- Completed a Mark 6 system upgrade;
- Supported NVI in Field System upgrades as a test station;
- Supported the operations of Single Dish Tests.

E-transferring entire VGOS-OPS and VGOS Intensive sessions to various correlators has become routine.

6 Outlook

GGAO will continue to support VGOS, e-VLBI, and other developmental observations and activities during the upcoming year. Plans for 2025 include:

- Conducting IVS observations using the Mark 6 recorders to demonstrate the VGOS capabilities on a regular schedule as dictated by the IVS;
- Continuing to assist with GRITSS testing as needed;
- Continuing to troubleshoot and potentially upgrade the 12-m antenna controller;
- Continuing to work on identifying spare elevation motors and required engineering changes;
- Continuing to investigate how and why the cables are degrading in the azimuth wrap and continuing to mitigate water intrusion;
- Continuing taking cable delay measurements for observation data correlation;
- Sub-reflector replacement due to damage caused by the weather;
- Technology upgrades for the GGAO digital backend;
- Continuing to operate as a test station for VGOS development.