Goddard Geophysical and Astronomical Observatory

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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 2015–2016 as well as the outlook lists the outstanding tasks to improve the performance.

1 Location

The Goddard Geophysical and Astronomical Observatory (GGAO) consists of a 5-meter radio telescope for VLBI, a new 12-meter radio telescope for VGOS development, a 1-meter reference antenna for microwave holography development, an SLR site that includes MOBLAS-7, the NGSLR development system, a 48″ telescope for developmental two-color Satellite Laser Ranging, a GPS timing and development lab, a DORIS system, meteorological sensors, and a hydrogen maser. In addition, we are 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.

NASA GSFC

GGAO Network Station

IVS 2015+2016 Biennial Report

Table 1 Location and addresses of GGAO at Goddard.

Longitude	76.4935° W
Latitude	39.0118° N
MV3 Code 299.0 Goddard Space Flight Center (GSFC) Greenbelt, Maryland 20771	
`http://cddis.nasa.gov/ggao/vlbi.html`	

2 Technical Parameters

The 5-m radio telescope for VLBI at MV3 was originally built as a transportable station; however, it was moved to GGAO in 1991 and has been used as a fixed station. In the winter of 2002, the antenna was taken off its trailer and permanently installed at GGAO. This antenna has not been operable for the past two years and it is not operable at this present time.

In October 2010, construction of the new 12-meter VGOS developmental antenna was completed. This antenna features all-electric drives and a Cassegrain feed system. Integration of the broadband receiver and the associated sub-systems is underway as a joint effort between Harris Corporation and the MIT Haystack Observatory.

The technical parameters of the radio telescopes are summarized in Table 2.

3 Staff of the VLBI Facility at GGAO

GGAO is a NASA research and development and data collection facility. It is operated under the Space Communication Network Services (SCNS) contract by Har-

Table 2 Technical parameters of the radio telescopes at GGAO.

Parameter	5-m	12-m
Owner and operating agency	NASA	NASA
Year of construction	1982	2010
Diameter of main reflector d	5 m	12 m
Azimuth range	$\pm 270^\circ$	$\pm 270^\circ$
Azimuth velocity	$3^\circ/\mathrm{s}$	max. $5^\circ/\mathrm{s}$
Azimuth acceleration	$1^\circ/\mathrm{s}^2$	$1.3^\circ/\mathrm{s}^2$
Elevation range	$\pm 90^\circ$	$5-88^\circ$
Elevation velocity	$3^\circ/\mathrm{s}$	max. $1.5^\circ/\mathrm{s}$ (elevations $> 70^\circ$)
Elevation acceleration	$1^\circ/\mathrm{s}^2$	$1.3^\circ/\mathrm{s}^2$
Receiver System		
Focus	Cassegrain	Cassegrain
Receive Frequency	2–14 GHz	2–14 GHz
T_{sys}	100 K	50 K (Theoretical)
Bandwidth	512 MHz, four bands	512 MHz, four bands
G/T	26 dB/K	43 dB/K
VLBI terminal type	CDP	VGOS
Recording media	Mark IV	Mark 6

ris Corporation. The staff at GGAO consists mainly of two operators and one backup engineer. The Harris staff includes Katherine Pazamickas and Jay Redmond conducting VLBI operations and maintenance at GGAO with the support of Heidi Riesgo.

4 Mission Support

Having ceased VLBI operations in May 2007, MV3 continues on a full time basis to be a major component in the program to demonstrate the feasibility of the VGOS broadband delay concept. Working under the guidance of the Harris team, the VGOS antenna has participated in many VLBI Global Observing System (VGOS) 24-hour experiments.

5 Recent Activities

Much of the 2015 and 2016 activities at GGAO have been focused on experiments using the VGOS 12-m antenna. However, there were some other activities worth noting:

- The digital backend software was upgraded.
- IVS observations were conducted using the Mark 6 recorders to demonstrate the VGOS capabilities on a regular twice a month schedule.
- RDBEs, Mark 6, UDC and Field System computer software were integrated.
- Additional testing of the 16 Gbps VLBI recording, demonstrated using Mark 6 was performed.
- Tried to understand the azimuth wrap and how and why it damages cables, along with taking cable delay measurements to use along with the observation data.

6 Outlook

GGAO will continue to support VGOS, e-VLBI, and other developmental observations and activities during the upcoming two years. Tentative plans for 2017 include:

- Repairing azimuth and elevation gearboxes seal to prevent oil contamination.
- Conducting IVS observations using the Mark 6 recorders to demonstrate the VGOS capabilities on a regular twice a month schedule.
- Continuing to investigate how and why the cables are degrading at the azimuth wrap.
- Continuing taking cable delay measurements for observation data correlation.

- Trying to understand why the antenna will not move in elevation under computer control when first started up on cold mornings.
- Participating in the VGOS part of the Continuous VLBI Campaign 2017 (CONT17).
- Developing MCI monitoring system display.