Goddard Geophysical and Astronomical Observatory

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Abstract This report summarizes the technical parameters and the technical staff of the VLBI system at the fundamental station GGAO. It also gives an overview about the VLBI activities during the 2014 report year. The outlook lists the outstanding tasks to improve the performance of GGAO.

1 GGAO at Goddard

The Goddard Geophysical and Astronomical Observatory (GGAO) consists of a 5-meter radio telescope for VLBI, a new 12-meter radio telescope for VLBI2010 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 (Table 1).

NASA Goddard Space Flight Center

GGAO Network Station

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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://cddisa.gsfc.nasa.gov/ggao/vlbi.html`	

2 Technical Parameters of the VLBI Radio Telescopes at GGAO

The 5-m radio telescope for VLBI at MV3 was originally built as a transportable station, but 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.

In October of 2010, construction of the new 12-meter VLBI2010 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 Exelis and the MIT Haystack Observatory.

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

3 Technical Staff of the VLBI Facility at GGAO

GGAO is a NASA R&D and data collection facility and is operated under the Space Communication Network Services (SCNS) contract by Exelis Inc. The staff

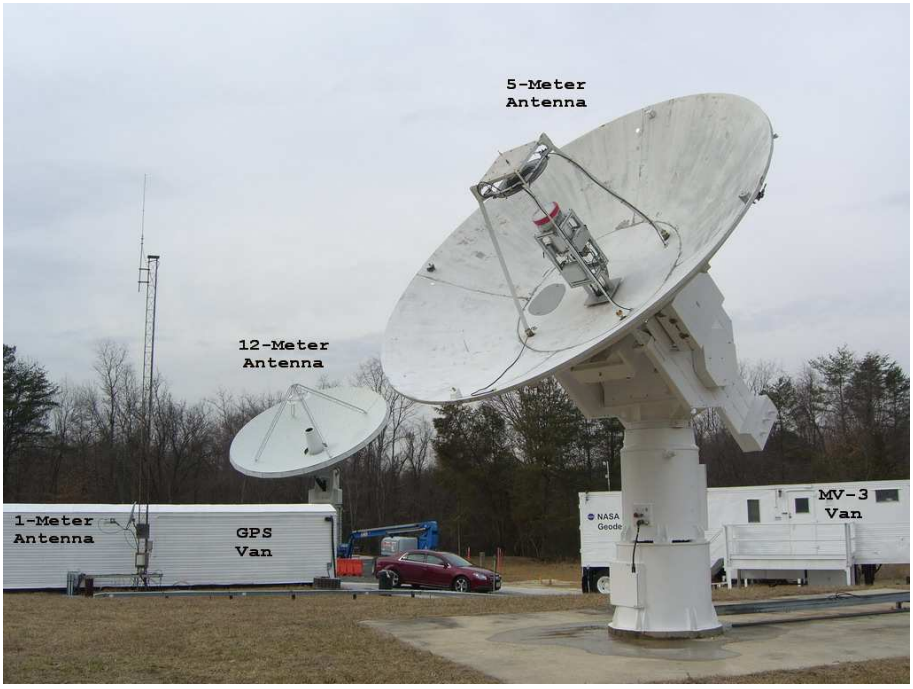

Fig. 1 Goddard Geophysical and Astronomical Observatory.

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	$5m$	$12m$
Azimuth range	$+/-270^\circ$	$+/-270^\circ$
Azimuth velocity	$3^\circ/s$	$5^\circ/s$
Azimuth acceleration	$1^\circ/s^2$	$1^\circ/s^2$
Elevation range	$+/-90^\circ$	$5-88^\circ$
Elevation velocity	$3^\circ/s$	$1.25^\circ/s(Avg.)$
Elevation acceleration	$1^\circ/s^2$	$1^\circ/s^2$
Receiver System		
Focus	Cassegrain	Cassegrain
Receive Frequency	$2-14GHz$	$2-14GHz$
T_{sys}	$100K$	$50K(Theoretical)$
Bandwidth	$512MHz$, four bands	$512MHz$, four bands
G/T	$26dB/K$	$43dB/K$
VLBI terminal type	CDP	VLBI2010
Recording media	Mark IV	Mark 5C

at GGAO consists mainly of two operators and one backup engineer. The Exelis staff includes Jay Redmond and Katherine Pazamickas conducting VLBI operations and maintenance at GGAO with the support of Ricardo Figueroa.

4 Status of MV3 and VLBI2010 at GGAO

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 VLBI2010 broadband delay concept. Under the guid-

ance of the Exelis team, the majority of MV3's S/X components were upgraded, and antenna refurbishing should be completed by early 2015 to provide additional support to the VLBI2010 System. Tasks started in 2013 and finished in 2014 for the 5-m antenna included the following:

- The 017 Electronic Box was refurbished, and new wiring and upgraded components were installed.
- The Cryogenic Dewar and its components were restored for X-band operations. Also, the cryogenic thermometer, vacuum gauge, and bias voltage box were installed and tested.
- The FSS Subreflector and Feed assembly, including the FSS, was recoated with a highly reflective surface, repaired, and placed back on the antenna.
- The ACU and control panel are in the process of upgrade and troubleshooting.
- Two of the Sargent Welch Directorr Model 8816-Bs were refurbished using a repair kit. One was mounted and tested in the antenna.

Much of the 2014 activities at GGAO focused on performance testing and upgrading of the VLBI2010 12-m antenna. But some other activities worth noting included:

- Continued wideband system testing and characterization of the 12-m antenna.
- Procurement of new test equipment for characterization of the wideband RF hardware.
- Continued broadband phase cal and cable cal performance testing.
- Integration of RDBEs, Mark 6 recorder, UDC, and Field System computer software.
- Installation of RDBE-G hardware.
- VLBI observations between Westford and GGAO with RDBE-G hardware/software and the Mark 6 recorder.
- Upgrade of timing distribution and standardization of broadband rack cables.
- Additional testing of 16 Gbps VLBI recording, demonstrated using the Mark 6 recorder.
- Refurbishing of the 5-meter antenna control unit and vacuum system.

5 Outlook

GGAO will continue to support VLBI2010, e-VLBI, and other developmental activities during the upcoming year. Tentative plans for 2015 include plans to:

- Continue to upgrade the VLBI2010 broadband receiver system on the 12-m antenna.
- Conduct IVS observations using the Mark 6 recorders to demonstrate the VLBI2010 capabilities on a regular twice a month schedule.
- Continue testing of the new broadband phase calibrator for the VLBI2010 system.
- Continue the upgrade of the 5-m antenna and initiate testing in S/X band.
- Continue to measure the baseline between the 5-m and the 12-m antennas for position ties to the reference frame.
- Try to understand the source of the azimuth and elevation gearboxes' oil contamination.
- Try to understand why the antenna will not move in elevation under computer control when first started up on cold mornings.