Progress and Current Status of the VGOS Project at the Metsähovi Geodetic Research Station

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Abstract We report on the progress of the VGOS radio telescope system construction project in Finland. The new telescope was installed at the Metsähovi Geodetic Research Station during summer 2018. The construction of the signal chain components is moving forward. The installation and integration of the signal chain components is scheduled for spring 2019. It is expected to have first observational tests in the second half of 2019.

Keywords VGOS, radio telescope

1 Introduction

The new radio telescope dedicated to the VLBI Global Observing System (VGOS) was installed at the Metsähovi Geodetic Research Station. Metsähovi is a key infrastructure of the Finnish Geospatial Research Institute (FGI) and one of the core sites of the Global Geodetic Observing System (GGOS). It is located in southern Finland (60.2°N, 24.4°E). Metsähovi is one of the few geodetic stations that has all major geodetic observing instruments co-located. These include satellite laser ranging (SLR), very long baseline interferometry (VLBI), global navigation satellite systems (GNSS), superconducting and absolute gravimeters, and a DORIS beacon. The Ministry of Agriculture and Forestry has allocated a special funding for the renewal of the Metsähovi instruments and infrastructure during 2012–2018.

1. Finnish Geospatial Research Institute

The VGOS project in Finland started at the beginning of 2016. It is funded by the National Land Survey of Finland together with the Finnish Ministry of Forestry and Agriculture. FGI procured the radio telescope system in 2016. It was manufactured and installed by MT Mechatronics. The signal chain components were procured from various manufacturers and will be integrated into the system by FGI.

2 Metsähovi VGOS Radio Telescope Construction

Fig. 1 Foundation construction and installation of the anchor ring.

The preparation for the telescope installation at Metsähovi started in spring 2017. The selected site of the telescope is situated about 150 m away from the main building and SLR observatory. The area was

Fig. 2 Assembly of the steel pedestal.

Fig. 3 Assembly of the radio telescope.

cleared of trees and the upper layer of soil was removed; and after that it was covered with gravel.

The concrete foundation for the radio telescope was built on bedrock, where the steel anchor ring was installed (Figure 1). The anchor ring is part of the steel pedestal design that was developed by the telescope manufacturer.

The manufacturing of the radio telescope started in April 2017. The main technical characteristics of the telescope system are described in Table 1. The manufacturing of the complete system was finished at the beginning of 2018.

Table 1 Telescope technical characteristics.

Title	Description
Antenna mount	Standard azimuth-elevation type
Reflector optics	Cassegrain, ring focus
Diameter of the main reflector	13.2 m
Surf. accuracy of the main refl.	< 0.3 mm rms
Surf. accuracy of the subrefl.	< 0.1 mm rms
Antenna motion	
Velocity in azimuth	12 deg/s
Velocity in elevation	6 deg/s
Acceleration in azimuth	2.5 deg/s^2
Acceleration in elevation	2.5 deg/s^2

The telescope was delivered to Finland in June 2018 and the installation of the telescope at the Metsähovi site started immediately. First, the steel pedestal was mounted and attached to the anchor ring (Figure 2). The assembly and installation of the telescope electronic cabinets, motors, and electrical cabling work in the azimuth and elevation cabins was performed simultaneously with the telescope mechanical construction. The telescope assembling work at different stages can be seen in Figure 3.

The installation of the telescope progressed according to plan and was completed in twelve weeks. Figure 4 shows the new VGOS telescope built at Metsähovi. The telescope commissioning is planned for October 2018 and the final acceptance test is scheduled for December 2018.

3 Signal Chain

Metsähovi selected the Yebes Astronomical Center (CAY/IGN) as the manufacturer of their VGOS-compatible broadband receiver. It is planned to have the front end finished by March 2019. The receiver will use a Quadridge Feed Horn (QRFH) and operate in the frequency range between 2.1 and 14.1 GHz. The

Fig. 4 The VGOS radio telescope installed at Metsähovi.

observed RF signal will be then separated between low and high frequencies and send via optic fiber from the elevation cabin to the server room. The distance from the radio telescope to the main building is about 100 meters. The installation of the digital base band converter (DBBC3-H) capable of full VGOS operations and a data-storage facility, like a Flexbuff, is scheduled for fall 2018.

4 Conclusions

The VGOS project on building a new telescope system at Metsähovi will continue in 2019. It is planned to integrate signal chain components into the system and then start with first observational tests.