Observatorio Astronómico Nacional

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Abstract

This report updates the description and details of the OAN facilities as a network station in IVS. The 14 meter radiotelescope at Yebes participates regularly in the geodetic VLBI campaigns (EUROPE and CORE), as well as astronomical VLBI experiments as part of the European VLBI Network (EVN). The institute staff is also involved in technical development and geodetic research.

1. The OAN Facilities

The Observatorio Astronómico Nacional (OAN) of Spain operates a 14 meter radiotelescope at Yebes (Guadalajara, Spain; see location in Fig. 1). This facility is a network station in IVS, and participates regularly in the geodetic VLBI campaigns to study the tectonic plate motions in Europe (project EUROPE), Earth rotation, and pole motion (project CORE).

The institute is currently involved in the construction of a new 40 meter radiotelescope (Fig. 2) which is expected to be available for geodetic VLBI observations in 2004.

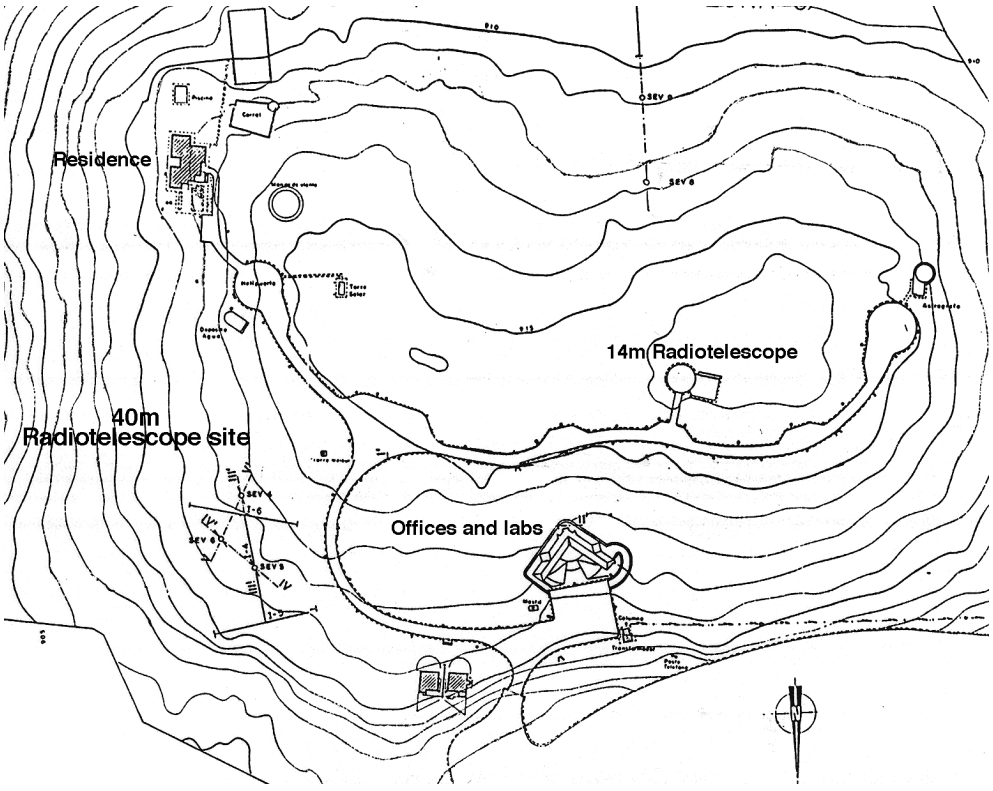

Figure 1. Map of the Yebes site, showing the location of the current 14 m and future 40 m radiotelescopes.

Figure 2. Status of the construction of the new 40 meter radiotelescope of OAN at Yebes (Guadalajara, Spain). The finished concrete pedestal is shown.

2. Description of the OAN Station at Yebes

The main instrument at OAN is nowadays the 14 meter radio telescope used for VLBI. There have not been any substantial changes in the equipment since the last IVS Annual Report in 1999. Relevant changes are listed in Table 1.

Table 1. Characteristics of the VLBI equipment.

VLBI terminal type	VLBA4 (Mark IV formatter, VLBA-G rack and VLBA recorder)
recording media	thick and thin tape, 1″ wide
Telescope control computer	HP1000 + HP2100
VLBI system computer	Pentium II/350
Operating system	Debian 2.1r3 (kernel 2.0.34)
Field System version	FS 9.4.6
H-maser frequency standard	KVARTZ CH1-75
GPS receiver	6 channel TrueTime XL-DC-602
Meteorological station	SEAC-300

On the other hand, the OAN engineers have been continuously working since 1985 in the development of cryogenic HEMT amplifiers to be used in receivers at Centro Astronómico de Yebes (CAY), and in other radio astronomy observatories. One of the last products is the low noise amplifier at X-band (centered at 8.3 GHz) designed and built for ESA tracking stations.

The CAY laboratories are completely prepared for the fabrication and test of cryogenic amplifiers with modern equipment. The workshop uses CNC milling machines for the preparation of chassis. The microwave printed circuits are engraved on soft substrates using an LPKF CNC milling machine or photolitographic techniques. Chassis and circuits are also gold plated in our laboratories. As HEMT devices in chip form are employed in the amplifiers, special equipment has to be used for their assembly (ultrasonic wire bonding and welding machines, stereo microscopes and metallurgic microscopes). For noise and gain measurements, and stability analysis at cryogenic temperatures, a dedicated cryostat with a CTI 350 cryogenic refrigerator is used. Noise temperature is measured with a computer controlled noise figure meter, with special software to obtain adequate accuracy at cryogenic temperatures (using the cold attenuator method). A vector (up to 50 GHz) and a scalar (up to 110 GHz) network analyzer are also available for gain and reflection measurements. Spectrum analyzers and power meters are used to check the stability. Finally, a computer controlled quad power supply is used for DC analysis of active devices.

Finally, we will mention that the reference station of the permanent GPS network in Spain (coded "YEBE") is operated at Yebes by the Instituto Geográfico Nacional (IGN) of Spain, host institute for OAN. The data are analysed and sent weekly to the coordinating center of EUREF in Frankfurt. More information can be found at the URL `http://www.geo.ign.es/`.

3. OAN Staff Working in VLBI

There have been no changes in OAN staff for VLBI since our 1999 report. Contact information is provided at the URL `http://www.oan.es/vlbi/`.

4. Status of the Geodetic VLBI Activities at OAN

The main contribution of OAN to IVS is the realization of geodetic VLBI observations in the EUROPE and CORE projects: the OAN radio telescope at Yebes has participated in eight EUROPE and six CORE experiments since March 1999. Problems with the antenna control system, plus failure of an element of the MKIV formatter, prevented successful participation in the experiments of the last quarter in 2000. The institute also participates in the European VLBI Network (EVN) for astronomy, taking part in its logistics and carrying out technical development.

On the other hand, several projects of geodetic scientific research are being developed:

- Combination of geodetic space techniques (VLBI and GPS) to investigate the potential of new analysis techniques that could provide a better estimate of the parameters of interest: a combination of GPS estimates of the tropospheric delay into the VLBI data analysis. If proven successful, the technique would have a large impact also in astronomy, making possible longer integrations at millimeter wavelengths.
- Determination of the phase-center of a VLBI antenna (Ny Ålesund 20m), comparing the VLBI and GPS results (which differ in particular in the vertical component). Two epochs of observations are planned to study the stability of the antenna structure.

5. Outlook

The OAN radio telescope at Yebes continues participating regularly in the campaigns for the EUROPE and CORE projects.

We foresee the upgrade of the VLBI equipment to high capacity by installing the needed hardware (second headstack and electronics for high speed tape operation at the recorder, new firmware, etc.). We are also working on the upgrade of the telescope control system, to replace the current HP2100 computer by a VME programmable computer.

Finally, the construction of a new 40 meter radiotelescope at Yebes is progressing well. The concrete tower, that will serve as pedestal for the instrument, is finished. This telescope is expected to be operational at S/X bands in 2004.

References

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