German Antarctic Receiving Station O'Higgins

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Abstract

This report gives an overview about the technical parameters and the organizing structure of the German Antarctic Receiving Station O'Higgins. It shows the activities since 1992 and gives an outlook about the developments to a Mark IV station during the next years.

1. The GARS O'Higgins at the Antarctic Peninsula

The antenna of the German Antarctic Receiving Station (GARS) O'Higgins is jointly used by DLR (German Aerospace Center) for SAR Data Acquisition of different remote sensing satellites (in priority ERS1 and ERS2) and by BKG (Bundesamt für Kartographie und Geodäsie – formerly IfAG, Institute for Applied Geodesy) for international VLBI experiments. The DLR – as owner of the station – is also responsible for management, infrastructure and logistics. The responsibility for all geodetic observations is in the hands of BKG.

The GARS is located at the site of Chilean Base General Bernardo O'Higgins (Antarctic Peninsula) and was founded in 1989. The antenna and the subsystems were installed in southern summer 1990/91 and the first VLBI experiments were carried out in January 1992. With that O'Higgins was the first VLBI station in operation in Antarctica.

The receiving system is used in campaigns, generally in two campaigns of six to 10 weeks each per year. During the previous campaigns three to seven VLBI sessions were planned per campaign and realised in general.

Figure 1. Geodetic Observatory O'Higgins – Antarctica : INMARSAT antennas at the station roof, PRARE Ground Unit (preliminary mounted in 1995), radome with GPS Turbo Rogue antenna and ERS/VLBI antenna. (October 1995)

In addition to the VLBI equipment other geodetic systems are available at O'Higgins (Figure 1).

Since February 1995 a Turbo Rogue GPS receiver has been permanently working at the station. An underwater tide gauge sensor was installed at the same time and since February 1996 a PRARE ground unit is in communication with the remote sensing satellite ERS2 for precise orbit tracking.

2. Technical Parameters of the VLBI Equipment at O'Higgins

The main instrument of the technical equipment at O'Higgins station is the 9 m antenna (Figure 2) used for both remote sensing satellite data acquisition (DLR) and geodetic VLBI (BKG). The construction of the antenna is laid out to resist wind speeds up to 300 km/h. The antenna system is solidly founded on a site free of ice on bedrock.

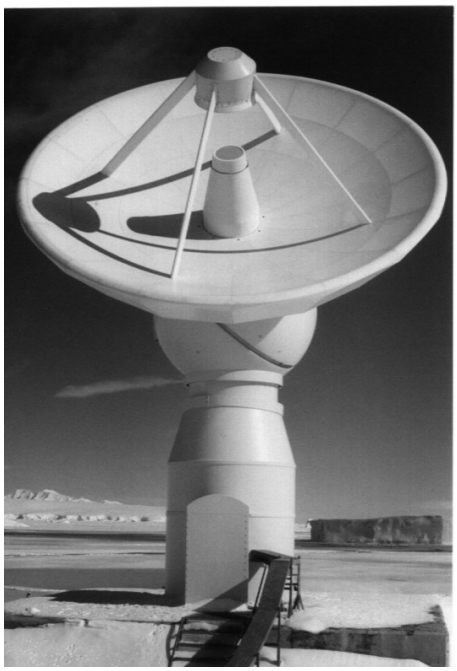

Figure 2. The 9 m–antenna at GARS O'Higgins in operation mode (1997).

The technical parameters of the radio telescope are summarised in Table 2. When the German station O'Higgins is unmanned the equipment is in sleeping mode. It takes about seven to ten days to restart the equipment at the beginning of a VLBI campaign. The organization structure is given in Table 1.

3. Technical Staff Working at O'Higgins Station

Table 3 lists the staff which is working during VLBI campaigns in Antarctica and is preparing the VLBI bursts for O'Higgins. There exists a close cooperation and support by the staff of the Fundamental Station Wettzell in case of technical problems or for further technical developments.

Table 1. Location and addresses of GARS–VLBI antenna at O'Higgins

Longitude	57.90° W
Latitude	63.32° S

Bundesamt für Kartographie und Geodäsie
Außenstelle Leipzig
Karl–Rothe–Straße 10–14
D-04105 Leipzig, GERMANY

during campaigns:
German Antarctic Receiving Station O'Higgins
VLBI team
Base General Bernardo O'Higgins
Territorio Antartico Chileno, CHILE
ar@leipzig.ifag.de rw@leipzig.ifag.de

4. Status of the VLBI Equipment

Since 1992 the VLBI equipment at O'Higgins has been involved in 44 internationally scheduled VLBI experiments for determination of a southern hemisphere reference system, Earth orientation parameters, crustal dynamics and coordinates of southern hemisphere quasars together with 11 other VLBI stations.

After an interruption of continuous observation in 1998 the last VLBI burst at O'Higgins took place in January/February 1999. This campaign was not totally successful due to some technical problems. The problems – for example leaky helium supply (dewar) – are caused mainly on by the extreme climate conditions in this part of the world. The complicated logistical possibilities prevented a short term repair. Only one of seven planned VLBI experiments could be realized (COHIG 5) with results.

The next burst at O'Higgins is in preparation for October/November 1999. All the necessary spare parts are available to repair the cooling system.

The station time system has been controlled by a Cesium until now. During the next campaign it will be replaced by a Totally Accurate Clock (TAC).

5. Outlook

VLBI at O'Higgins depends very closely on a stable hardware configuration because it is not a permanently used station. But it is an important station in this part of the world with a small number of permanent stations. The importance of O'Higgins as a reference station will increase when TIGO will be taken outside of Germany (to the Southern Hemisphere).

It is planned to develop O'Higgins as a station with Mark IV/VLBA equipment. The time table is as follows:

- obtaining of a VLBA/Mark IV suitable DAR (3rd-4th quarter 1999)
- test of O'Higgins–Mark IV/VLBA modules inside new DAR at Wettzell – with equivalent TIGO modules (1st quarter 2000)
- obtaining new FS computer, update FS 9.xxx and Linux at Wettzell (1st quarter 2000)

Table 2. Technical parameters of the radio telescope at O'Higgins for geodetic VLBI

Parameter	**O'Higgins–VLBI**
owner	DLR
operating agency	BKG
year of construction	1990/91
radio telescope system	Cassegrain
receiving feed	primary focus
diameter of main reflector d	9 m
focal length f	3.6 m
f/d	0.4
surface contour of reflector	$\pm$ 0.25 mm RMS
azimuth range	$-290^\circ \ldots + 290^\circ$
azimuth velocity	11°/s
azimuth acceleration	$7^\circ/s^2$
elevation range	$0 \ldots 90^\circ$
elevation velocity	5°/s
elevation acceleration	$5^\circ/s^2$
X–band	8.0 ...8.6 GHz
T_{sys}	65 K
S_{SEFD}	6300 Jy
G/T	31.1 dB/K
S–band	2.0 ...2.4 GHz
T_{sys}	93 K
S_{SEFD}	12500 Jy
G/T	21.4 dB/K
VLBI terminal type	VLBA
recording media	VLBA–recorder normal tapes
Field System version	8.21
attended VLBI observations	24 h during campiagns mode C

Table 3. Staff working at O'Higgins VLBI project

Name	Background	Dedication	Agency
Andreas Reinhold	geodesy	75%	BKG
ReinerWojdziak	computer science	20%	BKG

- joint tuning of DAR, FS and ACU as a complete system at Wettzell (2nd quarter 2000)
- fringe test, test experiment at Wettzell (2nd-3rd quarter 2000)
- shipment of the Mark IV equipment to O'Higgins (3rd-4th quarter 2000)
- removal of head assembly from recorder at O'Higgins, shipment for thin tape upgrade to

Haystack (4th quarter 2000)

- upgrade to Mark IV, installation of thin tape assembly and FS 9.xxx and system test at O'Higgins (1st quarter 2001)

Campaigns at O'Higgins are planned for 10/11 1999; 01/02 2000; southern spring 2000 and southern summer 2000/2001.