German Antarctic Receiving Station (GARS) O'Higgins

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Abstract In 2014, the German Antarctic Receiving Station (GARS) O'Higgins did not contribute to the IVS observing program, due to extended maintenance work on the receiver front-end. The receiver with the dewar was dismounted and updated at the IVS Centro de Desarrollos Tecnológicos de Yebes in Spain. It will be installed in the coming 2015 campaign.

1 General Information

The German Antarctic Receiving Station (GARS) is jointly operated by the German Aerospace Center (DLR) and the Federal Agency for Cartography and Geodesy (BKG, belonging to the duties of the Geodetic Observatory Wettzell (GOW)). The Institute for Antarctic Research Chile (INACH) coordinates the logistics. The 9-m radio telescope at O'Higgins is mainly used for downloading remote sensing data from satellites such as TanDEM-X and for the commanding and monitoring of spacecraft telemetry. It is also used for geodetic VLBI during dedicated campaigns in the Antarctic summer. In 2014, the station was again manned by DLR staff and by a team for the maintenance of the infrastructure (e.g. the power and freshwater generation), lasting an entire year. BKG staff was on site from January to the beginning of March. No IVS sessions were run during this time period. The transport of the new maser EFOS-50 from Concepción, Chile to Punta Arenas and on board the "Aquiles" to O'Higgins was one of the main tasks. The installation of the maser was done on location by T4Science. The complete replacement of both tide gauges was also one of the tasks during this campaign besides the installation of a new operator desk and the setup of the network infrastructure. There was no campaign between November—December 2014.

Over the last few years, special flights using "Hercules C-130" aircrafts and small "Twin Otter DHC-6" aircrafts, as well as transportation by ship, were organized by INACH in close collaboration with the Chilean Army, Navy, and Airforce, and with the Brazilian and Uruguayan Airforce in order to transport staff, technical material, and food for the entire stay from Punta Arenas via Base Frei on King George Island to O'Higgins on the Antarctic Peninsula. The conditions for landing on the glacier are strongly weather dependent and involve an increasing risk; in general, transport of personnel and cargo is always a challenging task. Arrival and departure times strongly depend on the climate conditions and on the logistic circumstances.

After each Antarctic winter, the VLBI equipment at the station must be initialized again. Damages resulting from the winter conditions or strong storms have to be identified and repaired. Shipment of each kind of material, such as spare parts or upgrade kits, has to be carefully prepared in advance.

Besides the 9-m VLBI antenna, which is used for the dual purposes of receiving data from and sending commands to remote sensing satellites and performing geodetic VLBI, the following are other geodetic-relevant instruments also operated on site:

- currently two H-masers (EFOS-10 and EFOS-50), an atomic Cs-clock, a GPS time receiver, and a To-

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Fig. 1 The Webcam image of the VLBI antenna.

tal Accurate Clock (TAC), offering time and frequency.

- two GNSS receivers (OHI2 and OHI3), operating in the framework of the IGS network while both are Galileo enabled. The receivers worked without failure.
- a meteorological station providing pressure, temperature, humidity, and wind information, as long as the temporarily extreme conditions did not disturb the sensors.
- a radar tide gauge, which was established in 2012 and reinstalled in 2014. The radar sensor itself is space referenced by a GPS-antenna mounted on top and Earth referenced via the local survey network. The radar gauge is operated only during the Antarctic summer.
- an underwater sea level gauge for permanent monitoring of water pressure, temperature, and salinity (also updated in 2014).
- two SAR corner reflectors, which were installed in March 2013 as part of a network to evaluate the localization of the accuracy of the TerraSAR-X mission.

2 Staff

The members of staff for operation, maintenance, and upgrade of the VLBI system and other geodetic devices are summarized in Table 1.

Table 1 Staff members.

Name	Affiliation	Function	Mainly working for
Torben Schüler	BKG	head of the GOW	GOW
Christian Plötz	BKG	electronic engineer (chief engineer RTW)	O'Higgins, RTW, TTW
Christian Schade	BKG	geodesist	O'Higgins operator, SLR
Reiner Wojdziak	BKG	software engineer	O'Higgins, IVS Data Center Leipzig
Andreas Reinhold	BKG	geodesist	O'Higgins operator
Thomas Klügel	BKG	geologist	administration laser gyro/ local systems Wettzell
Rudolf Stoeger	BKG	geodesist	logistics for O'Higgins, GNSS
Alexander Neidhardt	FESG	head of the VLBI group and VLBI station chief	RTW, TTW
Gerhard Kronschnabl	BKG	electronic engineer (chief engineer TTW)	TTW, RTW, TIGO

3 Observations in 2014

GARS did not participate in any IVS sessions in 2014 due to extended maintenance work on the receiver front-end.

4 Technical Improvements and Maintenance

The extreme environment conditions in the Antarctic require special attention to the GARS telescope and the infrastructure. Corrosion frequently results in problems with connectors and capacitors. Defective equipment needs to be detected and replaced. The antenna, the S/X-band receiver, the cooling system, and the data acquisition system have to be activated properly. A problem is the low transfer rates on the communication line, which reduces Internet and phone access. Also, the Web cams are regularly maintained.

An extended maintenance was performed on the dismounted receiver front-end. The maintenance included a complete redesign and rearrangement of the receiver hardware at the IVS Centro de Desarrollos Tecnológicos de Yebes in Spain. The down converter unit and the receiver monitoring were replaced by a completely newly developed 19" mountable system, which was installed in the original frame structure. It

is connected to a modular power supply. New local oscillators, a new noise calibration unit, and new front and back plates were also part of the redesign of the receiver front-end. The dewar, which was revised in the labs at Yebes in 2013, is also installed now into the existing frame structure. The dewar should fulfill the specification to hold 20 K in a vacuum of $5 * 10^{-7}$ mbar for more than one year without maintenance. For the new hardware, new monitoring software is also available and must be integrated into the NASA Field System setup for O'Higgins. The new hardware will be installed during the first campaign of 2015. The goal is the realization of an almost remotely controllable, autonomous, stable, and service-reduced system for the future challenges.

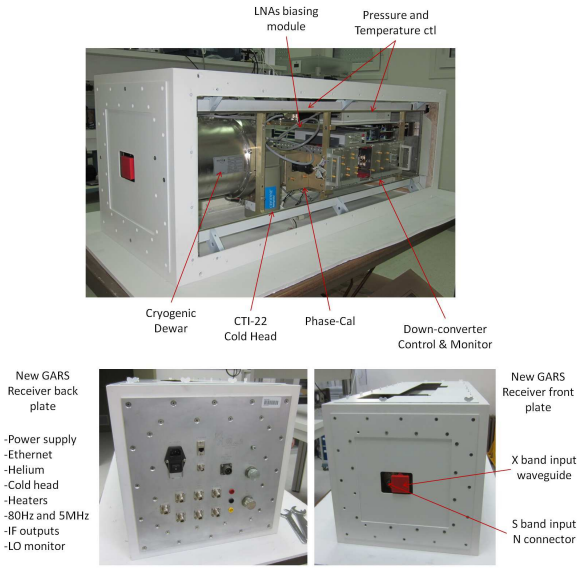

Fig. 2 The new receiver front-end at O'Higgins, which was maintained at the IVS Centro de Desarrollos Tecnológicos de Yebes, Spain.

Additionally, the new maser EFOS-50 from T4Science was shipped from TIGO Concepción to O'Higgins, where it has been running parallel to the old EFOS-10 since February 2014. All existing GNSS receivers were upgraded with a Galileo-enabled system. The tide gauges were completely reinstalled during the 2014 campaign. A new control room with a new operator desk was also installed and built-up during this campaign so that additional equipment, such as a digital baseband converter and a new Mark 5B+, can be installed before the first campaign of 2015. The operator room is jointly used by DLR and BKG. The goal is to extend the autonomous and remote operability of the site to enable the requirements for more observation sessions over the whole year. It is a key feature to extend the operation periods in GARS O'Higgins without increasing the presence of staff on site.

Fig. 3 The new control room with the operator desk for VLBI work of the BKG and satellite tracking of the DLR.

It is further planned to use the gaps between the satellite downlinks and commanding periods for geodetic VLBI. This requires a suitable communication with the scheduling and control software of the DLR, which still has to be done.

In 2014, a common paper with the title "Earth and space observation at the German Antarctic Receiving Station O'Higgins" was published in *Polar Record*.

5 Future Plans

The plan is to install a new Field System PC, a new Mark 5B+, and a new digital baseband converter ADS3000+ in the first campaign of 2015. After the installation of the receiver, the system must be brought back into operation again. A dedicated plan should offer a shared and interleaved observation of satellites (DLR) and VLBI sources (BKG) during the whole year.