German Antarctic Receiving Station (GARS) O'Higgins

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Abstract The German Antarctic Receiving Station (GARS) O'Higgins successfully contributed to the IVS observing program in the years 2021 and 2022. At the end of 2022 we were able to carry out the first maintenance cycle since the beginning of the Covid-19 pandemic. As part of the maintenace work, the receiver dewar and the coldhead of the helium cooling system were replaced. The time and frequency systems were also updated with new devices such as a new NTP time server and TCP/IP-capable multipurpose counters. The backup hydrogen maser EFOS-11 is still operational, because repairing the EFOS-50 as the main system was not yet successful. The Flexbuff recording system was extended by a second server and a tape library device. Furthermore, the defective VLBI cable delay ground module was replaced. The station IT network was prepared for an upgrade, beginning with the installation of new router devices.

1 General Information

The Antarctic station GARS O'Higgins is jointly operated by the German Aerospace Center (DLR) and the Federal Agency for Cartography and Geodesy (BKG; it is under service of the Geodetic Observatory Wettzell (GOW)). The Institute for Antarctic Research Chile (INACH) coordinates the logistics. The 9-meter radio telescope at GARS 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. The DLR operating staff and a Chilean team for maintaining the infrastructure (e.g., power and freshwater generation, technical support) were at the station for the entire period. BKG staff was on site from mid-November to mid-December 2022. Within the report time period, the O'Higgins VLBI station was scheduled in a total of 33 IVS sessions. In addition, the O'Higgins VLBI radio telescope participated in two 24-hour BKG sessions.

The carriage of passengers and cargo by air and by ship was organized by INACH in close collaboration with the Chilean Army, Navy, and Air force. All technical material and food for the entire stay are delivered from Punta Arenas via Base Frei on King George Island to O'Higgins on the Antarctic Peninsula. The conditions for landing on the glacier or accessing the base via ship are strongly weather dependent. In general, transport of staff and cargo is always a challenging task. Arrival and departure times strongly depend on the current meteorological conditions and on the logistic circumstances.

The VLBI system is continuously operational. However, maintenance and potential repair work are only possible when BKG staff are present. Frequent damages resulting from the rough climate conditions and strong storms have to be identified and repaired, e.g., wind sensors. Shipment of each kind of material, such as special tools, spare parts, or upgrade kits, has to be carefully prepared in advance. The most important station and system parameters are permanently monitored remotely.

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Fig. 1 View of the 9-meter radio telescope at GARS.

2 Activities during the Years 2021–2022

The restrictive policy and obvious difficulties and risks with performing an on-site campaign during the Covid-19 pandemic were the main reasons why the first visit since March 2020 did not happen earlier than November 2022. Due to this delay, it was necessary to spend some extra time to work on completing all safety regulations. Therefore, the main objective of this campaign was to repair or exchange the most important system components to put the station into an operational state for at least one year.

After more than three years of continuous operation, the cold head of the VLBI receiver, as well as the dewar itself had to be replaced. After this maintenance, the system was able to reach a stable cold-stage temperature of 16 Kelvin.

Another important task of this visit was to find the reason for the defective hydrogen maser EFOS-50, which is actually the main system. It failed shortly after the last campaign on site before the Covid pandemic. Unfortunately, this was not achieved and had to be postponed to the next visit. The replacement of the GNSS NTP time server was more successful. It became necessary due to the end of the support cycle in combination with the GPS week number rollover problem of the old device.

3 Staff

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

4 Current Status

Besides the 9-meter VLBI radio telescope, which is used for the dual purpose of receiving data from and sending commands to remote sensing satellites, and

Table 1 GARS related staff members.

Name	Affiliation	Function	Mainly working for…
Torben Schüler	BKG	head of the GOW	GOW
Thomas Klügel	BKG	deputy head of the GOW	administration laser gyro/ local systems Wettzell
Christian Plötz	BKG	head of VLBI	VLBI correlator, RTW, TTW
Theo Bachem	BKG	electrical engineer	SLR Wettzell, operator O'Higgins
Michael Seegerer	BKG	IT engineer	VLBI correlator, O'Higgins
Robert Wildenauer	BKG	IT engineer	VLBI correlator, O'Higgins
Swetlana Mähler	BKG	geodesist	survey, SLR Wettzell, logistics O'Higgins
Olaf Lang	BKG	electrical engineer	local systems/ SLR Wettzell, logistics O'Higgins
Alexander Neidhardt	FESG TUM	head of the group for microwave techniques, chief of operations group	RTW, TTW
Gerhard Kronschnabl	BKG	electrical engineer (chief engineer TTW)	TTW, RTW

performing geodetic VLBI, other geodetic-relevant instruments are also operated on site:

- Currently two H-masers (EFOS-11 and EFOS-50), an atomic Cs-clock, and a GPS time receiver realize the time and frequency basis. Due to a failure of the main EFOS-50 maser, the frequency standard had to be switched to the backup system (EFOS-11).
- Two GNSS receivers, OHI2 and OHI3, both being Galileo enabled, operate in the frame of the IGS network. 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.
- Two SAR corner reflectors, which were installed in March 2013 as part of a network to evaluate the localization accuracy of the TerraSAR-X mission.

5 Future Plans

The main frequency standard of the VLBI station, the EFOS-50 hydrogen maser, needs to be repaired during the next visit. The upgrade of IT equipment needs to be continued in order to achieve a reliable and performant IT infrastructure on site. The concrete pillars and base of the GNSS antennas need to be repaired.