German Antarctic Receiving Station (GARS) O'Higgins

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Abstract The German Antarctic Receiving Station (GARS) O'Higgins contributed successfully to the IVS observing program in the years 2019 and 2020. The receiver cold-head and the compressor of the helium cooling system was replaced. A new recording system consisting of a Flexbuff server (Dell PowerEdge) and a Fila10G formatter was installed and tested. A complete integration within the automatized workflow of the observation planning system of the German Aerospace Center (DLR) allows a seamless integration of VLBI observation with the satellite operation program. A new UPS for the hydrogen masers as well as new atmospheric sensors for wind and barometric pressure measurements were installed. The frequency standard had to be switched to the backup hydrogen maser EFOS 11 after the main system, the EFOS 50, failed.

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, 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 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. DLR operating staff and a Chilean team for maintaining the infrastructure (e.g., power and freshwater generation, and technical support) are present at the station the entire year. BKG staff was on site from the end of January to mid-March 2019 and from the beginning of February until mid-March 2020. Within the report time period, the O'Higgins VLBI station was scheduled in a total of 34 IVS sessions. In addition, the O'Higgins VLBI radio telescope participated in three 24-hour BKG sessions.

The carriage of passengers and cargo by air and by ship was organized by the Chilean Antarctic Institute (INACH) in close collaboration with the Chilean Army, Navy, and Air force, and with the Brazilian 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 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 and maintenance and potential repair work is only possible when BKG staff is 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 remotely monitored.

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Fig. 1 View of the 9-m radio telescope.

2 Activities during 2019 and 2020

After more than two years of continuous operation, the cold head of the VLBI receiver as well as the associated helium compressor had to be replaced. After this maintenance, the system was able to again reach a stable cold-stage temperature of 14 Kelvin.

The 9-m radio telescope is controlled by a fully automatized observation planning system of the German Aerospace Center (DLR). Thus, in order to integrate automatically executed VLBI observations, a software for integration of the intended VLBI observations into the satellite operation program was developed. This allows the identification of available observing time slots and allocating them for VLBI observations in advance. Additionally, known satellite contacts can be included in advance to the VLBI scheduling stage as down times. Therefore, the cancellation of VLBI scans can be avoided. In summary, this allows a full automation and remote operation of the VLBI system at GARS O'Higgins.

In order to solve the frequent outages of the anemometer wind sensor due to the extreme weather conditions, this sensor was now replaced by a special ultrasonic one. The meteorologic equipment was also extended with a second barometric pressure sensor. Further enhancements were made to the VLBI recording system. We installed a new Flexbuff server with a Fila10G formatter, which is replacing the existing Mark 5B+ VLBI data recorder as the main recording system. In the time and frequency area we installed a new UPS to extend and secure the power supply of the hydrogen masers in case of a power outage. Since the main maser EFOS 50 fell out of lock in March 2020, the spare maser EFOS 11 took over this task in April 2020. The output frequency of the maser EFOS 11 had to be adjusted after the re-initialization beginning April 2020.

Fig. 2 New wind anemometer.

3 Staff

The members of staff for operation, maintenance, and upgrade of the VLBI system and other geodetic devices are summarized in Table 1. On June 30, 2020 our colleague and friend Reiner Wojdziak died very unexpectedly. He was one of the backbones for the operation of GARS O'Higgins and the most experienced team member, regularly participating in measurement and maintenance campaigns from 1994 onward (see also IVS Newsletter, Issue 57, August 2020).

4 Current Status

Besides the 9-m VLBI radio telescope, which is used for the dual purpose of receiving data from and sending commands to remote sensing satellites and 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, a GPS time receiver, and a Total Accurate Clock (TAC) offer time and frequency. 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, operating in the frame 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.
- 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.

Fig. 3 Reiner on his last O'Higgins campaign.

Table 1 Staff members. [Key: FESG = Forschungseinrichtung Satellitengeodäsie, RTW = Radio Telescope Wettzell, TTW = Twin Telescope Wettzell.]

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	electrical engineer (chief engineer RTW)	O'Higgins, RTW, TTW
Reiner Wojdziak (†30.06.2020)	BKG	software engineer	O'Higgins, IVS Data Center Leipzig
Theo Bachem	BKG	electrical engineer	SLR Wettzell, operator 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	head of the microwave group, VLBI chief	RTW, TTW
Gerhard Kronschnabl	BKG	electrical engineer (chief engineer TTW)	TTW, RTW

5 Future Plans

As the main frequency standard of the VLBI station, the EFOS 50 hydrogen maser needs to be repaired during the next campaign. The IT equipment has to be upgraded by installing new network routers. Also, the time and frequency system will be improved by the installation of new measurement equipment (counters, GNSS receiver).

References

1. D. Behrend, "Coordinating Center Report", In K. D. Baver, D. Behrend, and K. Armstrong, editors, International VLBI Service for Geodesy and Astrometry 2012 Annual Report, NASA/TP-2013-217511, pages 55–57, 2013.