Ny-Ålesund Geodetic Observatory

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Abstract In 2015–2016 the 20-m telescope at Ny-Ålesund, Svalbard, operated by the Norwegian Mapping Authority (NMA), took part in 241 out of 248 scheduled 24-hour and 97 one-hour sessions of the IVS program.

1 General Information

The Geodetic Observatory of the Norwegian Mapping Authority (NMA) is situated at 78.9° N and 11.9° E in Ny-Ålesund, in Kings Bay, at the west side of the island Spitsbergen. This is the biggest island in the Svalbard archipelago. In 2015–2016, Ny-Ålesund was scheduled for 248 24-hour VLBI sessions, including R1, R4, EURO, RD, T2, and RDV sessions, and it participated in 97 one-hour sessions within the Intensives program. In addition to the 20-meter VLBI telescope, the Geodetic Observatory has two GNSS receivers in the IGS system and a Super Conducting Gravimeter in the Global Geodynamics Project (GGP) installed at the site. The French-German AWIPEV research base in Ny-Ålesund operates a DORIS station. In October 2004, a GISTM (GPS Ionospheric Scintillation and TEC Monitor) receiver was installed at the Mapping Authority's structure in the frame of ISACCO, an Italian research project on ionospheric scintillation observations, led by Giorgiana De Franceschi of the Italian Institute of Volcanology and Geophysics (INGV). Another Real-Time Ionospheric Scintillation (RTIS) monitor was set up by the NMA in November 2012.

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Fig. 1 Geodetic observatory, 20-m telescope, and the GFZ's satellite station.

2 Component Description

The antenna with a 20-m diameter is intended for geodetic use and receives in S- and X-band. Its design and construction are similar to those at Green Bank and Kokee Park. A rack with 14 video-converters, a Mark IV decoder, and a Mark 5 sampler streams the data to a Mark 5B+ recorder. Another Mark 5B+ unit is used to transfer data via network to the correlators. Alternatively, a DBBC2, (purchased in 2014) is connected in parallel to gradually replace the analog rack. Timing and frequency is provided by a NASA NR maser, which is monitored by a CNS system.

3 Staff

The staff at Ny-Ålesund consists of four people employed at 75%, which means that three full-time positions are covered (see Table 1 for an overview). Each position goes with a three-year contract that can be extended up to 12 years, but on average people stay three–four years. The observatory is part of the Geodetic Division of the Norwegian Mapping Authority with its main office in Hønefoss (near Oslo).

In April 2015, Geir returned from his sabbatical, and Axel Meldahl joined as a new engineer, after Anita and Alex returned back home. A year later, Kent did not extend his contract after three-and-a-half years. Moritz stepped down one level, and Stig Pedersen became the new station manager in August 2016.

Fig. 2 Changes in staff during 2015: Alex Burns and Anita Titmarsh (images: Bjørn-Owe Holmberg).

Table 1 Staff related to VLBI operations at Ny-Ålesund.

Hønefoss	Section Manager	Reidun Kittelsrud
	Assisting Section Manager	Frode Koppang
	Technical Manager	Leif Morten Tangen
Ny-Ålesund	Station Manager	Stig Pedersen ($\geq$ Aug. '16)
	Station Manager	Moritz Sieber ($\leq$ Aug. '16)
	Engineer	Alex Burns ($\leq$ Mar. '15)
	Engineer	Geir Mathiassen ($\geq$ Apr. '15)
	Engineer	Axel Meldahl ($\geq$ Apr. '15)
	Engineer	Kent Roskifte ($\leq$ Jul. '16)
	Engineer	Moritz Sieber ($\geq$ Sep. '16)
	Engineer	Anita Titmarsh ($\leq$ Apr. '15)

Fig. 3 Core team: Moritz Sieber, Axel Meldahl, and Geir Mathiassen.

Fig. 4 Changes in staff during 2016: Kent Roskifte and Stig Pedersen (image of Kent: Bjørn-Owe Holmberg).

4 Current Status and Activities

4.1 Maintenance

19 of the 34 sessions listed in Table 2 can be related to a telescope well up in its years. Some problems are easy to spot and expect, such as replacing worn-out signal cables in August 2015. Others are more subtle; the gearbox that was changed in 2013 never seems to be properly adjusted, and wear and tear resulted in loosening of some of the mounting bolts. Although they were being refitted on a daily basis, things got worse, resulting in broken bolts, torn-out threads, and finally the complete damage of the pinion with the loss of all

of its teeth. Luckily, the old gearbox got overhauled in the meantime, and things seem to have been done properly when it was mounted. Nevertheless, the maximum wind-speed for observations was reduced to lower the load on the structure.

One of the two RF-switches in our IF3-distributor got stuck in the "in"-state. Haystack had a spare and shipped it; in the meantime the advice from Rich to just toggle it a few times proved to be very successful.

The LO power supply for the receiver gradually drifted to higher voltages. Thanks to Brian we had a plan ready when it was finally unlocked in November. Most recently, a switch for the cable wrap sector broke and had to be replaced.

4.2 Monitoring

Good monitoring and routines will be an important part for the upcoming years, with parallel observations of old and new telescopes and no increase in staff.

The status page of data transfers (Figure 5) collects information from the current session's logfile (scan numbers and names) and the Master Schedule (correlator). A BASH script that wraps around Harro's "m5copy" (similar to tsunami autocontrol) both checks and claims bandwidth from the Bonn correlator's transfer page, toggles the status flag of the local information page, sends mails on starting, interruptions, and the end of the transfer, and checks if all data were transferred correctly.

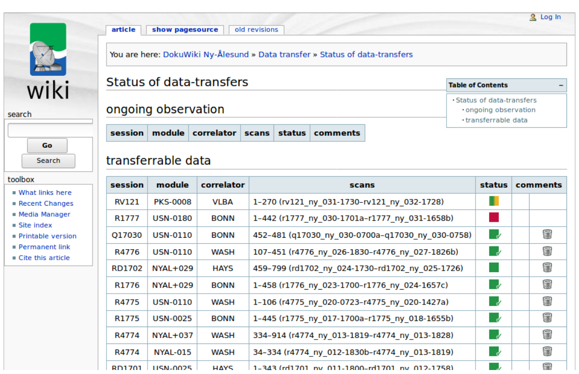

Fig. 5 Information page on transferable and transferred data.

4.3 Session Performance

Of the 248 scheduled 24-hour sessions during 2015 and 2016, Ny-Ålesund observed 241, as well as 97 one-hour Intensives. A broken Az gear was responsible for the non-observation of three sessions. Getting much more conservative with regard to wind speed limits, the threshold was lowered to $20\,\frac{\mathrm{m}}{\mathrm{s}}$; once the wind is higher, observations will be stopped. That caused R1766 not to be observed. During the following T2 session, the wind decreased, but the LO voltage had to be adjusted before any meaningful measurements could be done.

In 2015, the receiver dewar heated up just before R4698. It was decided to wait until it got cooled down again, which was after the session. The T2106 data was erased on site by mistake before it could be transferred to the correlator. A summary of all sessions with completion of 98% or less can be found in Table 2.

Table 2 Sessions with trouble (recorded 98% or less).

Session	Comments
R4718, R4720, R1765, R1766, T2114, R1768, R1772	stopped observation due to high windspeed ($> 20\,\frac{\mathrm{m}}{\mathrm{s}}$)
R4695, R4698, RD1605, R1759, R1764, EUR144	receiver dewar: taking measures to prevent further warming up and/or cooling down
R1697, R1699, R4744, R4764	power outage
R1747, RV118, R4747, R1748	stopped during unmanned hours (bolt of Az gear broken)
R1750, R4750, R1751, R4751	Az gear crashed
R1766, R2114	LO unlocked
R1672 RV120	loose sensor wires causing motor errors faulty cable wrap limit switch
R4735 T2106	lost at correlator, overwritten before re-transmission erased module before data was transferred
R1686 R1713 R4749	DIMino not started faulty disk module Mark 5 trouble

4.4 New Observatory

In May 2015, the fiber cable to Longyearbyen, the former endpoint of high connectivity to the mainland, was established. Not necessarily part of the new observatory, it is a crucial requirement for its usability.

Due to limitations of the aviation authorities, the new telescopes could not be built close to the existing site (which is next to the airfield: the blue building in Figure 1 is the tower), but 2 km further out. Work on the station building lasted throughout 2015, and in 2016 the two MT Mechatronics 13.2-m telescopes were established.

Fig. 6 Main reflector installation on the north telescope of the new observatory.

The signal chain will have a tri-band feed to begin with; considering the state of the 20 m we do not want to wait too long to start parallel observations. DBBC3s and flexbuff are scheduled to arrive in early 2017.

Three pillars on the new site were equipped with GNSS receivers in late 2015; five more followed in 2016 after local movements in the terrain were detected.

4.5 New Instrumentation

The DBBC2 was gradually taken into operation, first alongside observations as a test, then, as the need arose due to a broken RF switch in the IF3 distributor, as a replacement for low X-band channels for EUR/RD/T2-sessions. After no further objections, Ny-Ålesund went fully DBBC in 2017.

Of all the toys for the new station, the T4Science iMaser 3000$^{\mathrm{TM}}$ arrived first. Since July 2016, it ticks happily away in its temperature-stabilized little room. A CNS system, analogous to the existing one, waits to be wired up.

5 Future Plans

2017–2018 will be the years of transition. The twin-telescopes will become operational, and one of the two will start parallel observations with the legacy system. Knowledge will have to be passed on, both from the project group to the operations staff and internally, because both Geir and Moritz will not extend their contracts. New routines will have to be established, and existing ones modified or further improved — it is not intended to increase the staff, and the 20-m system will not cease from demanding its (increasing) share of attention.