# NYAL Ny-Ålesund 20 Metre Antenna

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### Abstract

In the report period (April 1999 - December 2000), the 20 m VLBI antenna at the Geodetic Observatory at Ny-Ålesund has participated in VLBI experiments at the scheduled level. Several maintenance and repair activities were required and changes in station staff have occurred. Considerable work has been devoted to footprint studies including classical surveys and GPS campaigns on the local control network.


## 1. Introduction

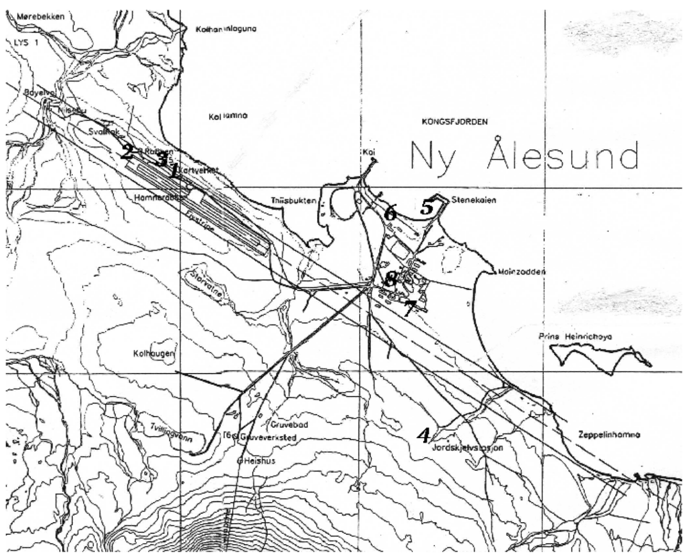


Figure 1. Location of the infrastructure of the Geodetic Observatory in Ny-Ålesund. 1: VLBI antenna; 2: SATREF (real-time GPS), CHAMP (low-latency GPS) and GLONASS receivers; 3: IGS receivers NYAL and NYA1 as well as cryogenic gravimeter and absolute gravity point; 4: Relative LaCoste-Romberg Earth tide gravimeter, also seismic observatory; 5: tide gauge; 6: Tide gauge bench mark; 7: DORIS; 8: Water vapour radio meter and balloon sounding. Scale is approximately 1:25000 and North is up. From [3].

The Geodetic Observatory at Ny-Ålesund is located at 78.9°N and 11.9°E at the west coast of Spitsbergen, Svalbard. Over recent years, the observatory has developed into a fundamental geodetic station with co-location of most of the space-geodetic techniques and additional geophysical instruments (see Figure 1). The VLBI antenna participates in experiments within VLBA/RDV, CORE-B, VLBI-Europe, and NEOS. The different techniques are tied together by means of a control network which is periodically re-surveyed both with classical methods and GPS. This so-called inner network is embedded in an outer control network covering roughly an area of about 50 km in diameter, which is observed in annual GPS campaigns. For a more detailed description of the geodynamic setting and other observational activities at the observatory, see e.g. [1]. For technical details of the VLBI antenna, see [2].

The observatory participates in the Large Scale Facility (LSF) Ny-Ålesund [1]. In the context of this EU-funded programme, 11 research projects have been carried out in the report period at the observatory with participants from several European VLBI groups. For more details, see [3].

## 2. Staff Related to the Space-Geodetic Observatory in Ny-Ålesund

Table 1. Staff related to the operation of the VLBI in Ny-Ålesund.

| | | |
|---|---|---|
| Hønefoss: | Section Manager: | Rune I. Hanssen |
| | Station responsible, Hønefoss: | Svein Rekkedal |
| Ny-Ålesund: | Station manager: | Helge G. Digre |
| | Permanent staff: | David C. Holland |
| | | Roar Kihle (05.1999 - 04.2000) |
| | Rotation group: | Kari Buset |
| | | Bente R. Andreassen (only one shift) |
| | | Kjetil Ringen (only two shifts) |
| | | Tom Pettersen |
| | 6 months contract | Nils Petter Rognstad (10.2000-03.2001) |

The "permanent" staff at the observatory is employed on the basis of renewable one-year contracts. Expecting an increase in experiment activity for 2000, an extra person was employed on a yearly contract in May 1999 (Table 1). With the lack of correlator capacity reducing activity in 2000, this contract was not renewed.

The four members of the rotation group have or had permanent positions at the Norwegian Mapping Authority (NMA). The contract period is three years ending in June 2001. Each member spends 3 months at a time in Ny-Ålesund. It was planned that each member would serve a total of 9 months at the observatory. However, one member resigned from NMA, while another one is no longer available due to internal change of duties. Therefore, a new staff member was employed on a temporary basis to fill the gap.

## 3. Status of the VLBI Antenna in Ny-Ålesund

The overall operation of the VLBI antenna in the report period has been smooth, though some periods posed more problems than normal. The antenna participated successfully in 77 experiments, while for two experiments participation was unsuccessful due to technical problems.

A number of more or less routine upgradings, maintenance and repair operations were carried out. For example, the maser had its scheduled bi-annual maintenance check in June 1999. The field system is now FS 9.4.17. The TAC system has been upgraded to a CNS TAC with monitor, counter and computer. The azimuth gears on the antenna have been checked and repaired. The azimuth brakes have been renovated and are working again. The Peltier elements on the antenna were checked in summer 2000 and worn fans were replaced. In autumn, both Peltier power supplies had to be repaired after failures. In the helium system, the cold head was replaced in June 1999,

[1] see http://www.npolar.no/nyaa-lsf/.

and the compressor in November 2000.

A number of more serious crashes and break-downs happened, which partly are due to a more rapid ageing of parts in the severe weather conditions at the observatory. Problems were caused by fading and eventually disappearing antenna signals. After eliminating the connectors as a source for these errors, it was found that all the signal cables were broken or damaged in the elevation link. The cables have been repaired temporarily by cutting away the bad pieces of cable and replacing them by new pieces of cable.

When one of the running encoders caused increasing problems, it was discovered that the spare encoder was defective. The spare encoder returned from repair after 3 months just in time to replace one of the working encoders, which died totally. Recently, there were severe problems in getting the encoder signal. The source for these problems was located in a short circuit in one cable out of the encoder.

The crash of a rather new hard disk in December 1999 happened at the worst possible time, resulting in the setting up of a new back-up procedure for the disks.

In the often severe weather conditions, safety of staff during operations on the antenna requires particular attention. In particular, a safety report was written in spring 2000, and equipment has been acquired to make the manhole in the antenna safer.

The problem of radio interference (RFI) appears to be mounting even at the remote location of Ny-Ålesund. The VLBI antenna is sheltered from RFI from geo-stationary satellites by mountains to the south. However, local activities of other research institutes and the operator of the research town are increasingly in conflict with the condition of radio-quietness imposed on Ny-Ålesund. For example, the operator of Ny-Ålesund, Kings Bay, operated a local wireless LAN-net in the 2.4 GHz area from February to June 2000. NMA is actively working to protect the important environmental quality of radio-quietness by exploiting legal regulations as well as regular contacts to all other groups active in Ny-Ålesund.

## 4. Site surveys and other activities

In summer 1999, a small instrument house was built above the existing stable platform previously used for absolute gravity measurements. This house was required for the superconducting gravimeter (SCG), which was installed there in September 1999 by Professor Tadahiro Sato, Earth Rotation Division, National Astronomical Observatory, Japan. Daily operation of the instrument is provided by the station staff, while major maintenance work such as annual refill of liquid helium is carried out by visitors of the Japanese team. After some minor initial problems, the instrument is running smoothly and providing high-quality data. The data is accessible to the Japanese team via Internet.

Prior to the building of the house, two GPS receivers (SATREF and NYA1) were operated on steel masts mounted on the gravity platform. For the time being, NYA1 is continuing to operate there. In addition, a semi-permanent receiver was set up at one of the pillars in the control network in order to monitor any changes in NYA1 due to the building activities.

In 1999, a roof was built on an existing foundation about 300 m to the north-west of the VLBI and IGS site (No. 2 on Fig. 1). This new construction provides an appropriate environment for continuous GPS sites. In the centre of the large ground floor room, there is a 4x4x4-meter pedestal with concrete walls, well insulated to reduce any temperature effects. Inside the pedestal, a data room is located, which is connected to the net in the main building by a fibre optic cable. On top of the pedestal, a stable tower reaches through the roof as the monument for GPS antenna.

Among others, a GPS receiver of the GFZ, Potsdam, has been installed at this new location, which contributes to the low-latency network supporting the CHAMP mission.

Several LSF projects provided contributions relevant to the IVS goals. In particular, a GPS antenna was installed permanently on the VLBI antenna. Whenever the antenna is in Zenith position, the GPS data can be used to monitor the tie between VLBI and GPS directly. The VLBI antenna has been surveyed with classical methods twice, providing accurate coordinates of the antenna reference point. The inner control network was reobserved with classical techniques by visiting groups in 1999 and by NMA staff in 2000. Absolute gravity measurements were carried out in summer 2000 providing a calibration of the SCG and, additionally, a remeasurement of gravity after initial measurements in 1998. NMA carried out GPS campaigns on the inner and outer network in 1999 and 2000. Together with the campaign on the outer network in 1998, the analysis results show a stability of the network on the 1 mm/yr level, except for one pillar which apparently is moving [3].

## 5. Outlook

In 2001, the observatory will participate in the CORE-3 experiments as well as other experiments such as the VLBI Europe once. A number of repairs, maintenance, and upgrades are planned. For example, the bi-annual maintenance of the maser is due in summer 2001. The FTS 8400 will be retired and shipped back to Honeywell.

The repair of the azimuth 1 antenna brake was temporary and some parts need to be replaced. The elevation brakes need to be checked, and all signal cables will be replaced in the summer. A re-routing in the elevation link area will be considered. The new encoder will arrive in spring. The azimuth encoder then has to be sent to the manufacturer for check. The formatter will be upgraded to be able to handle the CORE-3 experiments. The Field System will be upgraded to the next Linux version.

Concerning station staff, the experience made with the rotation group arrangement will be evaluated. A decision concerning future employment schemes for the staff at the observatory will be made on the basis of this experience.

## References

[1] Plag, H.-P., 1999: Measurements of vertical crustal motion in Europe by VLBI. Station report for Ny-Ålesund, Norwegian Mapping Authority. In Schlüter, W. and Hase, H. (eds.): *Proceed. 13-th Working Meeting of European VLBI for Geodesy and Astrometry, Viechtach/Wettzell, February 12-13, 1999.* Bundesamt für Kartographie und Geodäsie, Frankfurt, 65-77.

[2] Digre, H. G., Rekkedal, S., Holland, D. C., Hanssen, R. I. and Plag, H.-P., 1999: NYAL Ny-Ålesund 20-metre antenna. In Vandenberg, N. R. (ed.): International VLBI Service for Geodesy and Astrometry Annual Report 1999. NASA, Greenbelt, MD, USA, 80-84.

[3] Plag, H.-P., Bockmann, L., Kierulf, H. P., Kristiansen, O., 2001: Foot-Print Study at the Space-Geodetic Observatory, Ny-Ålesund, Svalbard. In Tomasi, P., Mantovani, F., and Perez-Torres, M.-A. (eds.): Proceedings of the 14th Working Meeting on European VLBI for Geodesy and Astrometry, Castel San Pietro Terme, Sept. 8 - Sept. 9, 2000. In press.