

NYAL Ny-Ålesund 20-metre Antenna

Helge G. Digre, Svein Rekkedal, David C. Holland, Rune I. Hanssen, Hans-Peter Plag

Abstract

The 20-m VLBI antenna at the space-geodetic observatory at Ny-Ålesund contributes to the IVS as a network station. In the report period (April 1998 - March 1999), the site has operated and participated in experiments at a normal level. Several maintenance and repair activities were required and changes in station staff have occurred.

1. Introduction

The space-geodetic observatory at Ny-Ålesund is a multi-parameter observing site located at the west coast of Spitsbergen, the main island of Svalbard. For a more detailed description of the geodynamic setting and other observational activities at the observatory, see e.g. [1].



Figure 1. The VLBI antenna at Ny-Ålesund. View is approximately from south-west to north-east. The 20-m radio telescope is located on a small plateau approximately 1.5 km west of the village of Ny-Ålesund at about 45 m above sea level. The small green house seen in the middle of the picture is the control building of the airport, with part of the runway visible in the rightmost corner of the picture. The two black pillars to the right of the airport building and in the right lower corner are well-isolated pillars of the local control network. Photo taken in July 1998.

The VLBI station at Ny-Ålesund was established as a result of a cooperation between NASA, NOAA and Norwegian Mapping Agency. Mechanically, the antenna is an azimuth/elevation which is produced by Radiation System Incorporated, now Comsat, and it is almost identical to the

antennas at Green Bank and Kokee (see Figures 1 and 2). The antenna was assembled the summers 1993 and 1994 and first regular experiment was carried out in the autumn of 1994. The station has been operational since 1st of January 1995.

The VLBI technique is one of several observations carried out at the space-geodetic observatory at Ny-Ålesund. Briefly, we will mention: GPS, GLONASS, PRARE, absolute gravity measurements, Earth tide gravity and tide gage. The different measurements are tied together by means of an accurate control network. This network is extended to the local surrounding (30-50 km) to keep track of eventual local deformation



Figure 2. The VLBI antenna and the control building at Ny-Ålesund. View is approximately from west to east. The building in front is the control building of the space-geodetic observatory. Weather condition is dense fog banks (behind the antenna), which is quite common in summer. Photo taken in July 1998.

Table 1. Main site parameters of NYAL

Location:	Ny-Ålesund, Svalbard, Norway.
Latitude and longitude:	78.9 N, 11.9 E
Operated by:	Statens kartverk (Norwegian Mapping Authority)
Contribution to IVS:	VLBA/RDV, CORE-B, VLBI-Europe, NEOS

2. Technical Parameters of the VLBI Antenna in Ny-Ålesund

The antenna in Ny-Ålesund is of similar type to the ones at Green Bank and Kokee Park. The technical parameters of the antenna in Ny-Ålesund are summarized in Table 2.

Table 2. Technical parameters of the VLBI Antenna at NYAL.

Parameter	Ny-Ålesund
owner and operating agency	NMA
year of construction	1993-1994
radio telescope system	Az-El
receiving feed	primary focus
diameter of main reflector d	20m
focal length f	8.58m
azimuth range	0 ... 540°
azimuth velocity	2°/s
azimuth acceleration	1°/s ²
elevation range	1 ... 90°
elevation velocity	2°/s
elevation acceleration	1°/s ²
X-band (reference $\nu = 8.4GHz$, $\lambda = 0.0357m$)	8.1 – 8.9 GHz
T_{sys}	55 K
$S_{SEFD}(CYGNUS - A)$	750 Jy
S-band (reference $\nu = 2.3GHz$, $\lambda = 0.1304m$)	2.2 – 2.4 GHz
T_{sys}	35 K
$S_{SEFD}(CYGNUS - A)$	1300 Jy
VLBI terminal type	Mark IV
recording media	thin-tape only
Field System version	9.8.23

3. Staff Related to the Space-geodetic Observatory in Ny-Ålesund

Until summer 1998, the permanent station staff at the observatory has been three persons. In addition, there are two persons at the Geodetic Institute in Hønefoss directly involved in the operation of the observatory. The “permanent” staff are employed on a yearly basis, with a possibility to continue for two additional one year periods. In 1998, a rotation group was set up from the staff at the main institute in Hønefoss. The members of the rotation group have contracts for three years. Each member spends three months in Ny-Ålesund at a time and totally 9 months over the contract period. Thus, the number of staff at Ny-Ålesund is effectively increased to four. The names of the staff members in the report period are given in Table 3.

4. Status of the VLBI Antenna in Ny-Ålesund

The operation of the station at Ny Ålesund over the report period has been stable. We have had some failures, but these have been mainly due to normal wear and tear.

Mark IV rack: Some work has been done on the Mark IV rack. All the IC sockets on the communication chips on the MAT boards have been changed due to intermittent failures in the

Table 3. Staff related to the operation of the VLBI in Ny-Ålesund.

Hønefoss:	
Section Manager:	Rune I. Hanssen
Group leader:	Svein Rekkedal
Ny-Ålesund:	
Station manager:	
up to 30 April 1999	Leif Morten Tangen
since 01 May 1999	Helge G. Digre
Permanent staff:	David C. Holland
	Roar Kihle
Rotation group:	Kari Buset
	Bente R. Andreassen
	Kjetil Ringen
	Tom Pettersen

communication with the VCs. This work has made things much more reliable, and now this fault rarely occurs. We used good quality gold plated turned pin sockets to replace the original type.

Tape drive: There have been problems with parity errors due to variation of the tape position, which changed with speed and direction. The idler roller was replaced, and solved this problem. We observed that the surface of the old roller was pitted and rough on about 20% of its circumference.

Field System: We are running FS 9.8.23 with the additional software for logging the weather station data during experiments. The Field System with the integrated weather station has worked well, except that the wind sensor mast broke during a violent storm. It has now been replaced with a stronger mast and guying system.

Antenna: We have had failures of the Peltier elements in the receiver heating/cooling system. These devices seem to have a finite life and usually break when the weather is bad (making the replacement more difficult).

We have also experienced problems with our azimuth encoder during colder periods (below -25 C). To improve the reliability, a heated, insulated box has been built to prevent water vapour condensing in the optics.

General: We have now a modern “cherry picker” to replace our elderly International Harvester model. This has made maintenance of the antenna much easier as it is considerably more portable.

Other relevant activities: In 1998, additional geodetic benchmarks have been established in an area with a north-south extension of 30 km and an east-west extension of 50 km. These points enlarge the existing control network consisting of an inner network of 50 by 400 m and some additional points within 5 km of the observatory. The new points were occupied in September 1998 in a five day GPS campaign.

5. Outlook

The maser will have its scheduled bi-annual maintenance check 3 - 10 June 1999. It will be performed by AlliedSignal, Donald A. Rhine.

The azimuth gear boxes have leaking oil seals. They have to be changed during the summer

season. The oil leak has interfered with the azimuth brake systems. The brakes have to be repaired during the summer. The heating elements for the brakes are also defective and have to be changed.

Besides the participation of the VLBI antenna in scheduled experiments, it should be mentioned here that the complete control network will be measured in a GPS campaign in August 1999. The VLBI antenna will be surveyed in August in cooperation with three scientists from Italy and Spain (under the lead of Paolo Tomasi).

We are planning to participate in CORE-3, which will considerably increase the number of experiments per year.

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/Wetzell, February 12-13, 1999*. Bundesamt für Kartographie und Geodäsie, Frankfurt, 65-77.