

## Construction site Ekström Ice Shelf

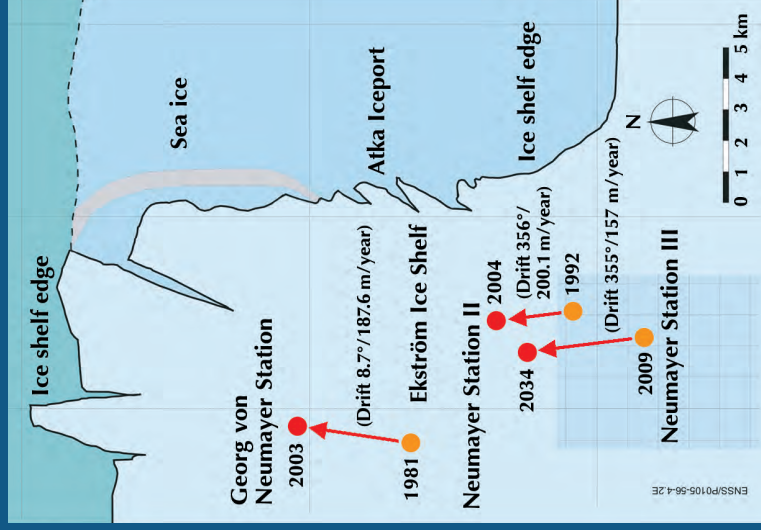
### A challenging location

A primary feature of the new station is its ability to compensate for adverse effects of snow accumulation and ice deformation by means of hydraulic installations, and to achieve this without leaving parts of the construction permanently buried in the snow. The latter satisfies one of the major requirements of the Protocol on Environmental Protection. The design is considered to be the best technical solution to the complex challenges posed by the drifting ice shelf and high accumulation rates of snow. In order to find the most suitable site on the Ekström Ice Shelf, GPS measurements were conducted in the region over several years to determine ice drift and shear movements along the flow lines the pre-elected sites would follow in the 30 years of desired lifetime of the new station. The finally selected construction site, drifting 157 metres per year, is approximately six kilometres south of the current Neumayer Station position and will not reach this present position during 25 years. The ice deformations along the flow line remain the lowest in the whole area.

Additional studies were necessary to determine the load-bearing capacity of the snow and, accordingly, the optimal sizes of the foundations for a building of approximately 2,300 tonnes. The building is designed to absorb shear forces associated with ice deformation and stresses caused by wind. The optimum aerodynamic shape of the outer hull of the station has been determined in a series of wind channel investigations. The hull shape of the building, in combination with the rigid garage roof, reduces snow deposition near the building to a minimum.



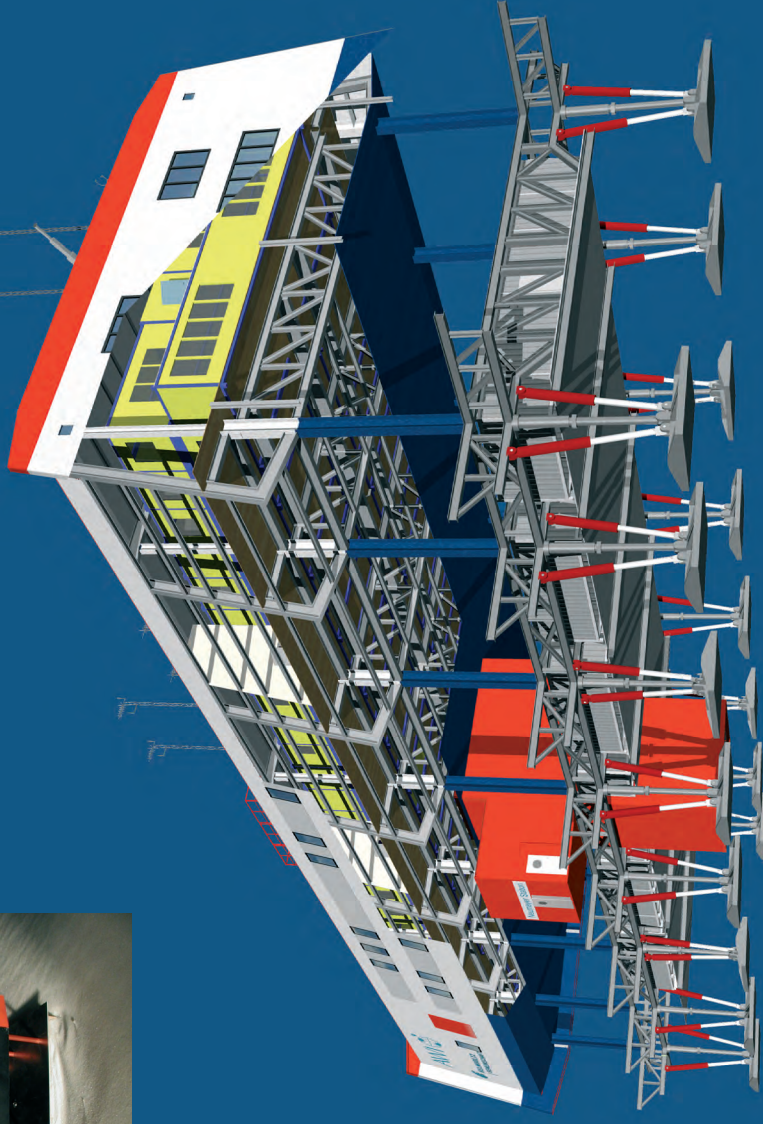
A model of the Neumayer Station III in the wind tunnel of the Meteorological Institute, University of Hamburg



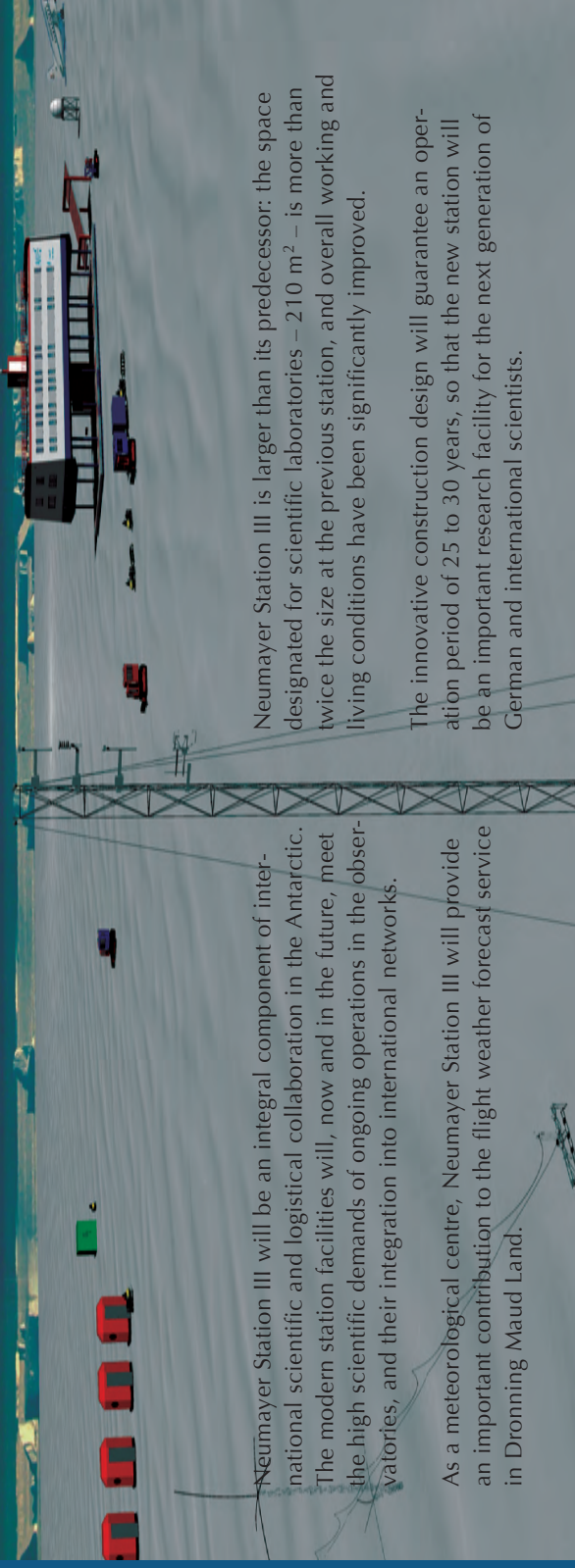
Locations of Neumayer Stations on the Ekström Ice Shelf. The continuous ice flow changes the stations' positions over the years.

### Environmental conditions on site

Temperature:	max +4.3 °C, min -48.1 °C (recorded since 1981)
Max. recorded wind speed: (1 min. mean)	37.1 m/s = 133.6 km/h (recorded since 1981)
Snow accumulation:	80 to 100 cm/year
Ice flow:	157 m/year
Ice shelf thickness:	approx. 200 m
Polar day:	November 19 to January 24
Polar night:	May 19 to July 27



## International cooperation

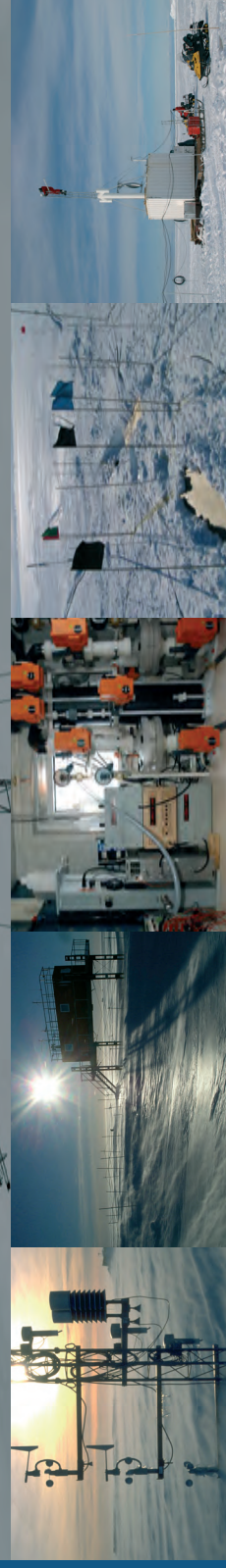


Neumayer Station III will be an integral component of international scientific and logistical collaboration in the Antarctic. The modern station facilities will, now and in the future, meet the high scientific demands of ongoing operations in the observatories, and their integration into international networks.

As a meteorological centre, Neumayer Station III will provide an important contribution to the flight weather forecast service in Dronning Maud Land.

Neumayer Station III is larger than its predecessor: the space designated for scientific laboratories – 210 m<sup>2</sup> – is more than twice the size at the previous station, and overall working and living conditions have been significantly improved.

The innovative construction design will guarantee an operation period of 25 to 30 years, so that the new station will be an important research facility for the next generation of German and international scientists.



### Meteorology

The meteorological observatory at Neumayer Station has been providing meteorological and radiation data relevant for climate research since 1981. The observatory serves as a weather forecasting centre for all of Dronning Maud Land.

### Geophysists

The geophysical observatory began operating in 1982. Long-term changes of the Earth's magnetic field are measured here, and earth quakes, local as well as anywhere on the globe, are recorded continually.

### Atmospheric chemistry

Since 1983, green-house gases, such as water vapour, carbon dioxide, methane and ozone, have been recorded continuously at the air chemistry observatory. The optical and chemical properties of aerosols are investigated here as well.

### Infrasound

The infrasound system I27DE was established in 2002. As one of 60 stations worldwide, it represents Germany's contribution to ensuring compliance with the Comprehensive Nuclear Test Ban Treaty (CTBT).

### Marine acoustics

North of Neumayer Station III, the hydroacoustic observatory PALAOA (the Perennial Acoustic Observatory in the Antarctic Ocean) has been operating since 2005. It records the natural sound spectrum of the ocean by help of underwater microphones. These data are used to investigate the behaviour of marine mammals.

# Neumayer Station III

The new German Research Station in the Antarctic

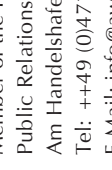
Ekström Ice Shelf | 70° 40,8' S 008° 16,2' W



The construction of Neumayer Station III is supported by the German Federal Ministry of Education and Research (BMBWF) within the context of long-term funding for polar research. It is realised during the International Polar Year 2007-2009.

Alfred Wegener Institute for Polar and Marine Research  
Member of the Helmholtz Association of German Research Centres  
Public Relations  
Am Handelshafen 12 · 27570 Bremerhaven  
Tel: ++49 (0)471 - 48 31 - 11 12 · Fax: ++49 (0)471 - 48 31 - 13 89  
E-Mail: info@awi.de · www.awi.de

Photos: Alfred Wegener Institute





## Neumayer Station III

### Continuation of a success story

With the construction of Neumayer Station III the conditions necessary to fulfil scientific and logistic tasks associated with long-term research operations in the Antarctic will be met. The new station, built to modern standards and with state-of-the-art technology, will enable the continuation of long-term measurements by the scientific observatories for meteorology, geophysics and atmospheric chemistry, as well as the establishment of new research projects. The present Neumayer Station on the Ekström Ice Shelf was completed in 1992. Just like the first Georg von Neumayer Station of 1981, it is a permanently occupied research station, run by nine over-wintering staff. Until now the Neumayer Stations were constructed using the formerly common, so-called 'tube' design, also employed by other nations. The station facilities are located in adequately sized steel tubes which, over time, are deformed by the moving ice shelf and continuous accumulation of snow. After 15 years of operation, the current Neumayer Station has already been buried twelve metres deep in the ice and will have to be abandoned within a few years.

### An innovative concept

Neumayer Station III, which will also be operated year round, represents a complex construction, connecting a platform above the snow surface with facilities in a trench below the surface. All features relating to both technical and research operations are integrated into this building. Compared with its predecessors, Neumayer III is larger and provides more comfortable working and living space, combined with a high technical standard. The building is mounted on 16 columns with hydraulic lifting devices so that it can be jacked up as a unit in order to compensate the annual snow accumulation. The station will thus remain operational for many years. The architectural concept also meets all binding requirements of the Protocol on Environmental Protection.

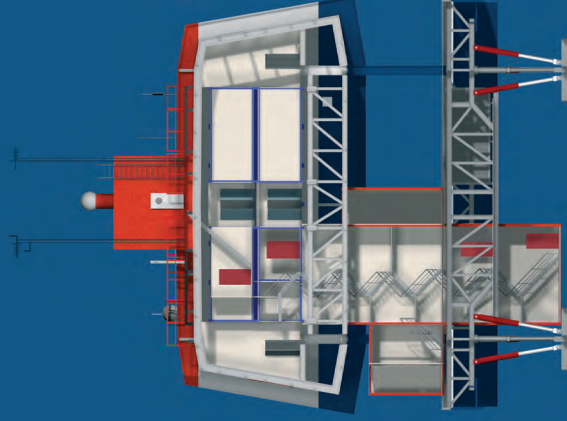
### Science and logistics

Like its precursors, Neumayer Station III will have to satisfy a variety of demands. Scientific activities will continue to require a powerful infrastructure with modern laboratory equipment. In addition, the station will serve as a logistic base for deep field expeditions and aircraft missions. An air transport connection to Cape Town has been established jointly by 11 nations within the Dronning Maud Land Air Network (DROMLAN) since 2003. Now Neumayer Station can be reached by plane in only two days. Construction of the new station represents an extraordinary logistical challenge. Approximately 3,500 tons of materials, machinery and construction equipment have to be transported by ship to the Ekström Ice Shelf. Roughly 45 technicians and engineers will reach their work place by air.



### Milestones of the construction project

1999-2004	Concept development
2004/2005	Comprehensive Environmental Evaluation
2005/2006	General design
2007/2008	Manufacturing and construction phase I
2008/2009	Construction phase II
February 2009	Commissioning of the new station



Cross section through the station building. A staircase and lift connect all four decks of the station, from the garage to the balloon shed.

### Technical data

Protected area	4,473 m <sup>2</sup> across four decks
Air-conditioned area	1,850 m <sup>2</sup> across three decks
Weight	approx. 2,300 tons
Accommodation	15 rooms, 40 beds
Laboratories and offices	12 rooms
Power supply	3 Diesel generators (150 kW each) 1 Wind power plant (30 kW)



The present Neumayer Station

Transport from the ice shelf margin to Neumayer Station

Unloading of RV Polarstern at the ice margin

DROMLAN: Air bridge into Antarctica

## Antarctic architecture of the future

### Power station

An intelligent sophisticated management system controls the electrical and thermal energy supply from diesel generators. The electric power supply is supplemented by wind power. By integrating additional wind generators, the proportionate contribution of alternative energy will be increased gradually over the coming years.

### Balloon shed

Meteorological balloon-borne sensors are launched from the hangar on the outer deck of the station.

### Outer deck

Various scientific instruments and antennas are installed on the roof. Further equipment can be added as required.

### Extreme demands require innovation

Neumayer Station III will be the first research station in the Antarctic to integrate research, operational and accommodation facilities in one building which is situated on a platform above the snow surface and connected to a garage in the snow. The two-level, heated section of the building is mounted on a 68 by 24 metres platform inside of a protective hull. The platform itself rises 6 metres above the snow surface. The trench below the station is 8.20 metres deep. The overall height of the structure, from the floor of the garage to the roof of the balloon shed, is 29.20 metres.



### Access

The garage will be reached via a ramp covered by a lid which can be opened and closed.

### Garage

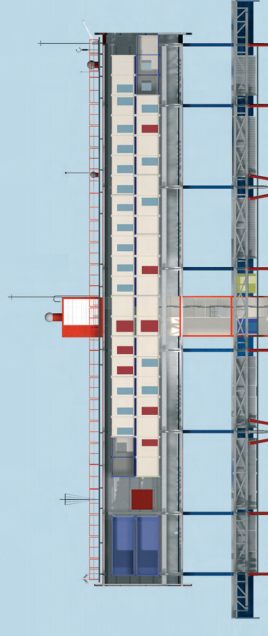
There is sufficient space in the garage for the entire motor pool (tracked vehicles and ski-doo's). Additional storage and station service rooms are included in deck U1.

### Foundation

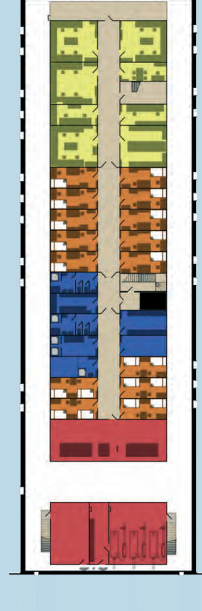
The overall weight of 2,300 tonnes is distributed onto 16 foundation slabs. To compensate for the snow accumulation, the station will be raised at regular intervals by means of hydraulic jacks.

### Water supply

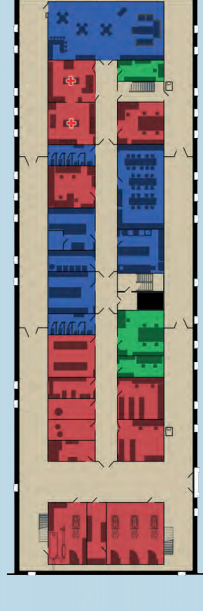
A snow-melting facility provides the station with drinking water.



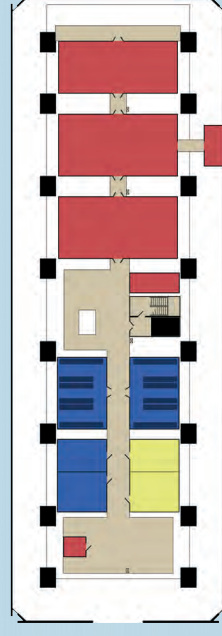
Longitudinal section through the station. Living rooms, office and laboratory spaces and workshops are located above, garage and storage rooms below the ice surface.



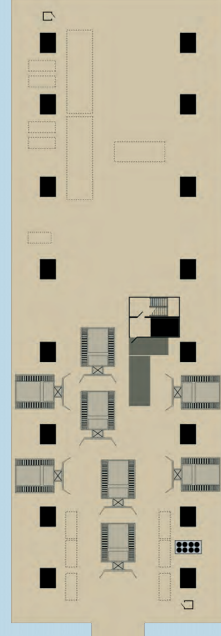
Deck 2: Station services, accommodations and laboratories



Deck 1: Station services, communications, social rooms and hospital



Deck U1: Station service rooms and storage



Deck U2: Garage

- Station service rooms and hospital
- Offices for station operation
- Living and bed rooms
- Scientific laboratories
- Kitchen, mess, lounge and lavatories
- Corridors, stairs, parking spaces



An over-wintering team at Neumayer Station



The 'Library on Ice' by artist Lutz Frisch will be part of the new station also.