Fig 2.11: Contact with the environment
(looking to the South - approximately from station's living room)

Staff

The main station building is designed for use by 12 people. This number optimises the energy efficiency of the building. The use of a station "extension", however, will make it possible to accommodate another 8 to 18 people. The extension consists of stand-alone heated shelters used for sleeping only. The station's main facilities such as kitchen, sanitary installations and offices are designed to cope with the larger numbers. The minimal support team will be 4 people, including:

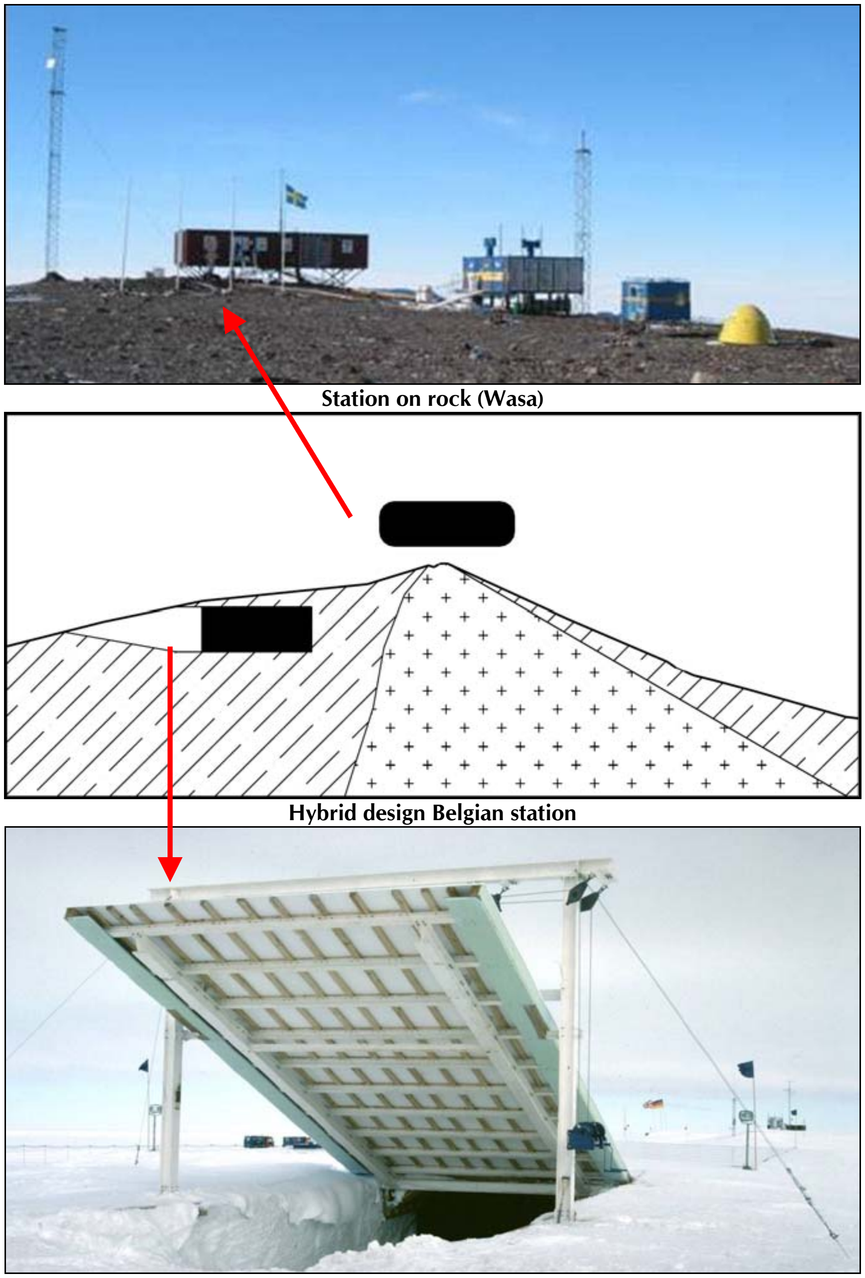
- Station leader/physician
- Electrical engineer/electrician
- Mechanic/cook
- Field support guide

Visitors will receive a briefing on arrival on the guidelines and rules of the station. The typical visitor may stay a week or more. In this period they may leave with a field party or remain at the station.

2.4.2. Station design

Development of building type

The combined characteristics of rock anchoring, natural snow-free conditions and nearby snow-covered surfaces, all present on the Utsteinen North ridge, make it possible to have under-snow surface facilities very close to the station's above-ground main building; the result being a hybrid design maximally exploiting the on-site potential.

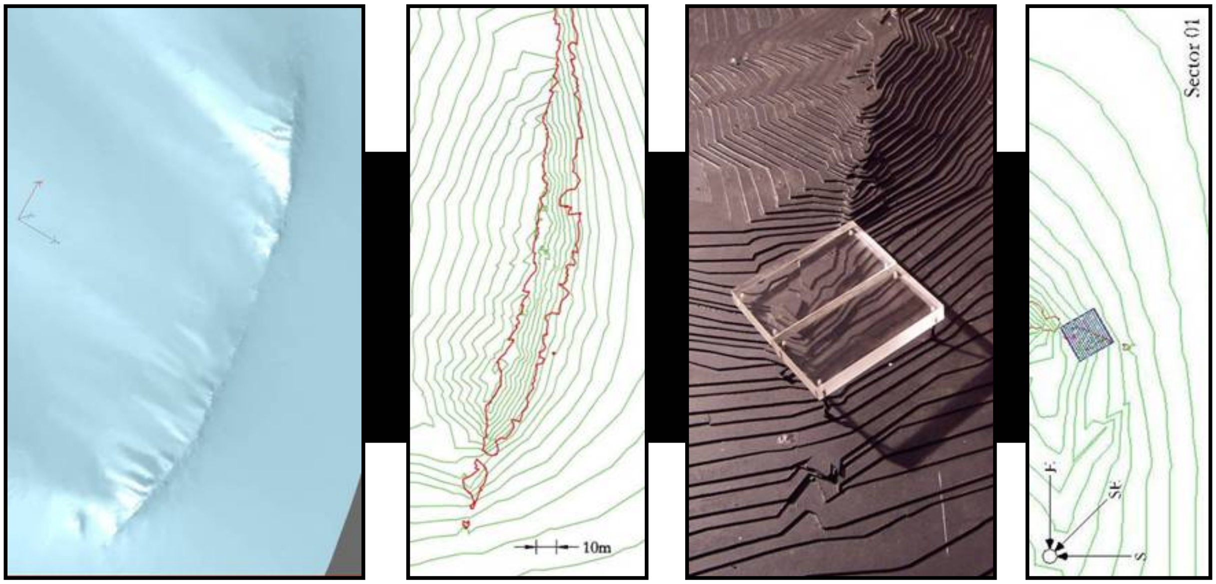


Station on ice/snow (Neumayer II)

<u>**Fig 2.12**:</u> Hybrid concept of the proposed new Belgian station:
a combined design of a rock anchored station and a station built directly on the snow/ice surface.

In the process of defining possible building designs for the main building 11 alternatives were identified (both integrated on and above the ground). All the designs answered the minimum requirements as defined by the programme. For these proposals a total of 37 options were mapped and evaluated using a trade-off concentrating on accessibility for construction and dismantling, anchoring conditions, orientation versus prevailing wind, orientation versus sun, compactness, energy efficiency (based on preliminary simulations), operational accessibility and expected snow accumulation. From this first study six solutions were selected for further evaluation, mainly focusing on the snow accumulation characteristics of the buildings that were assessed by means of wind tunnel simulations (models at 1/100 scale). The prevailing wind at Utsteinen is from the sector E-SSE (see **Section 4.4.2**). The prevailing direction for wind speeds higher than 15 m/s, lies within the sector E-

ESE. The wind tunnel test showed that symmetrical building designs with above-ground integration gave the best overall performance, and three building designs were selected. Since these designs mainly differed in the use of one or two storeys and were almost symmetrical, further selection concentrated on the orientation of the building versus the prevailing wind and the number of storeys to be used.



3D D-GPS Model | Snow boundary | Position | Orientation

<u>Fig 2.13</u>: Development of building type study.
The step by step approach identified 11 building designs and 37 terrain integration alternatives.

The overall building concept is also defined by the integration of the energy systems. A solution was found in a 1.5 storey type of building with an almost symmetric footprint. This design incorporates the principal characteristics of the remaining proposals. The final alignment of the building (45° orientation) will be the outcome of the final wind tunnel testing. Regardless of these test results the final selection of the building geometry is a design that provides an answer to various often contradictory requirements and is unavoidably a compromise.

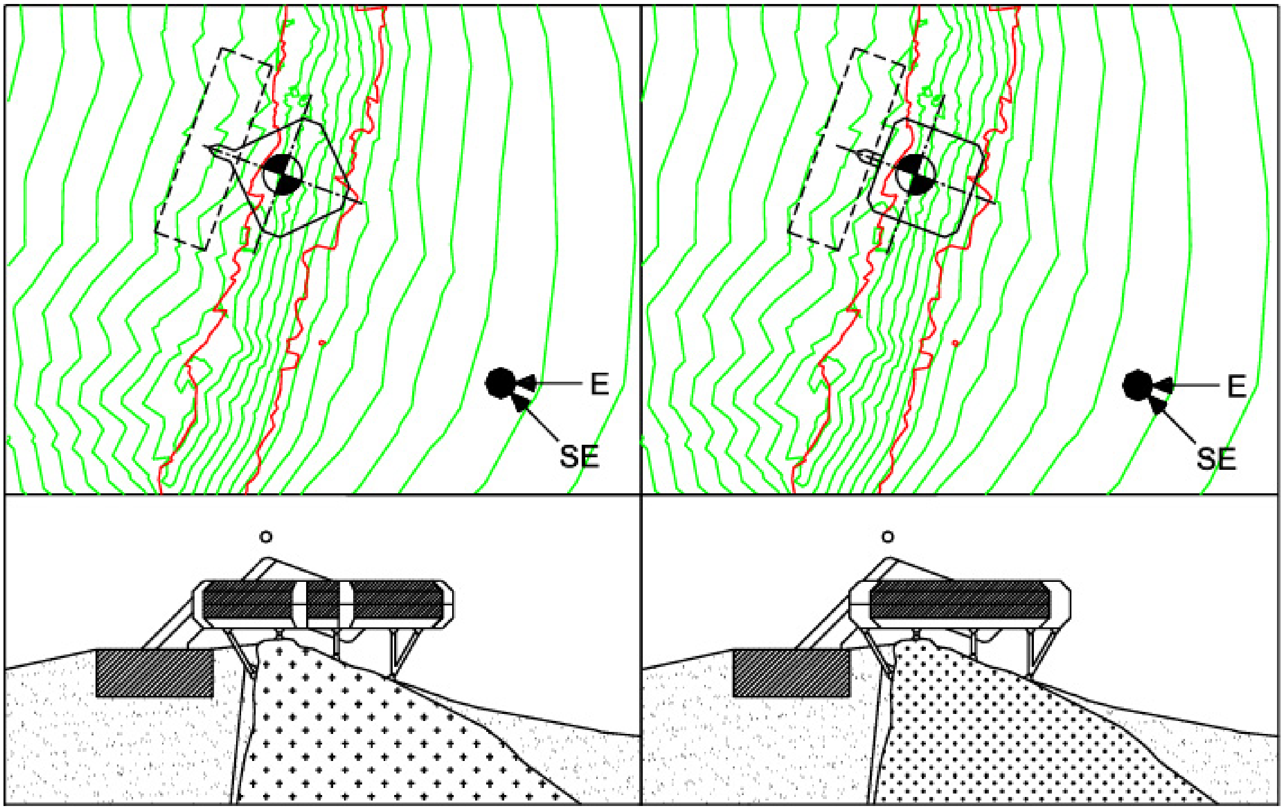


Fig 2.14: Main building integration variants.
The variant with 45° angle versus prevailing wind (left) is the preferred solution.

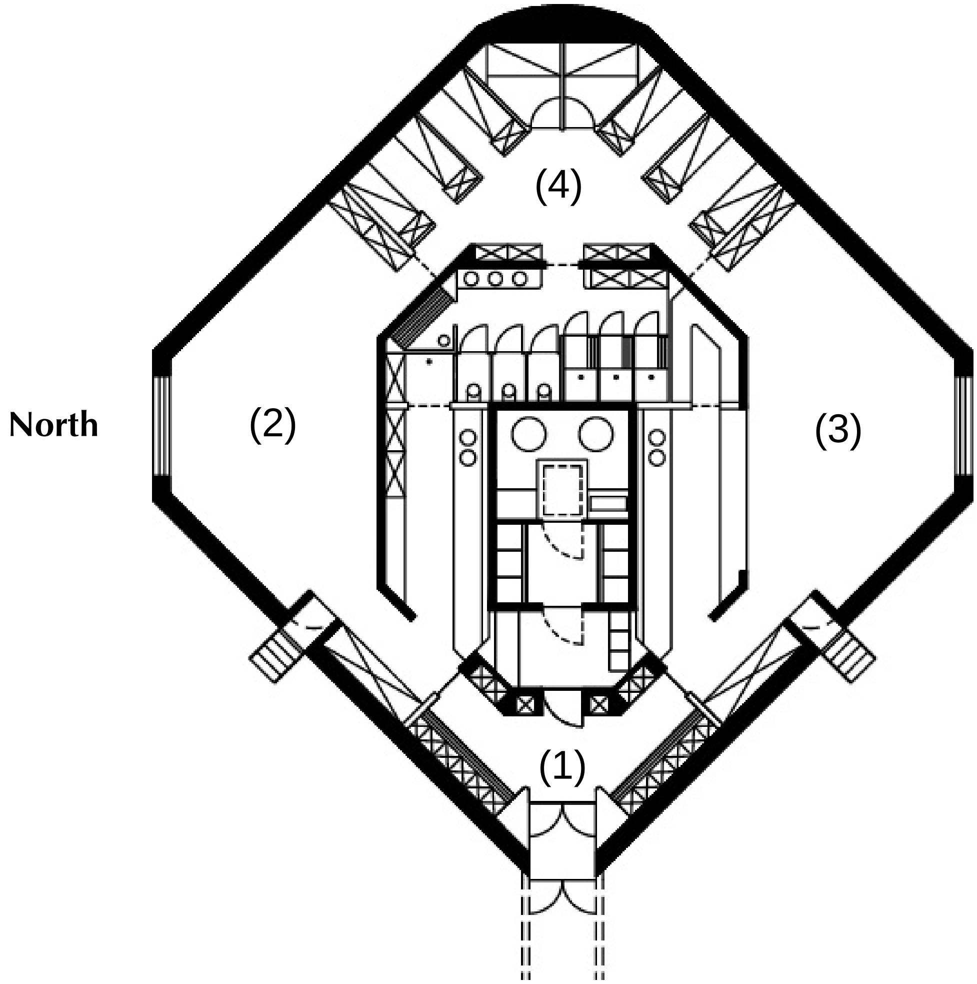
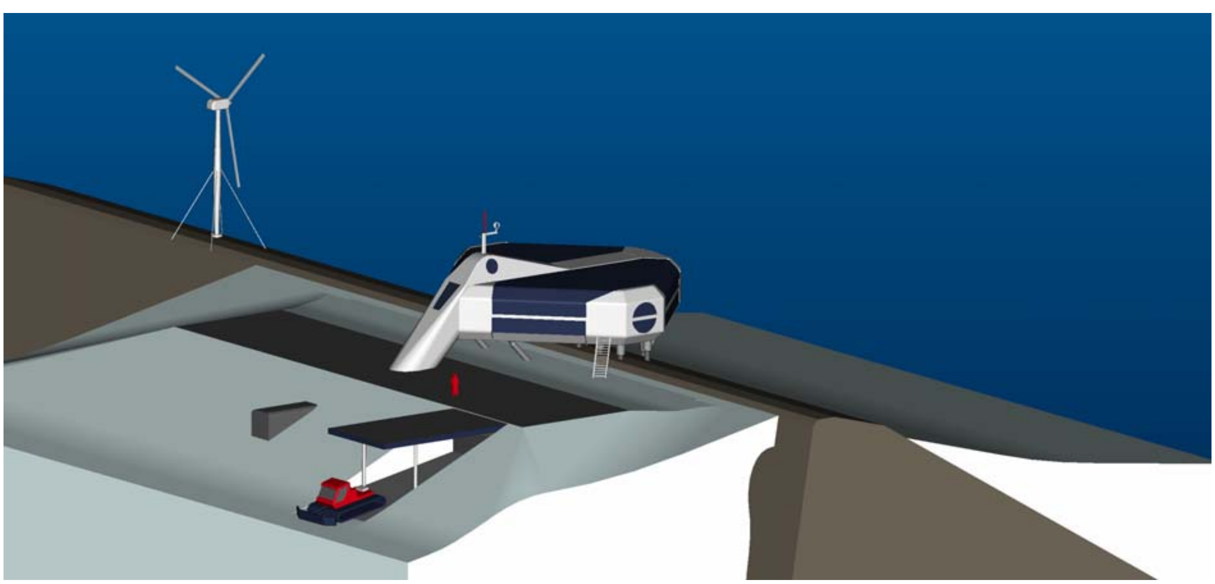


Fig 2 15: Main building programme – preliminary layout for 45° integration variant garage/storage building (under-snow): (1) Entrance wardrobe and laundry + access to technical area; (2) Office area + lab; (3) Living area with kitchen; (4) Noise-buffered sleeping area + bathroom.



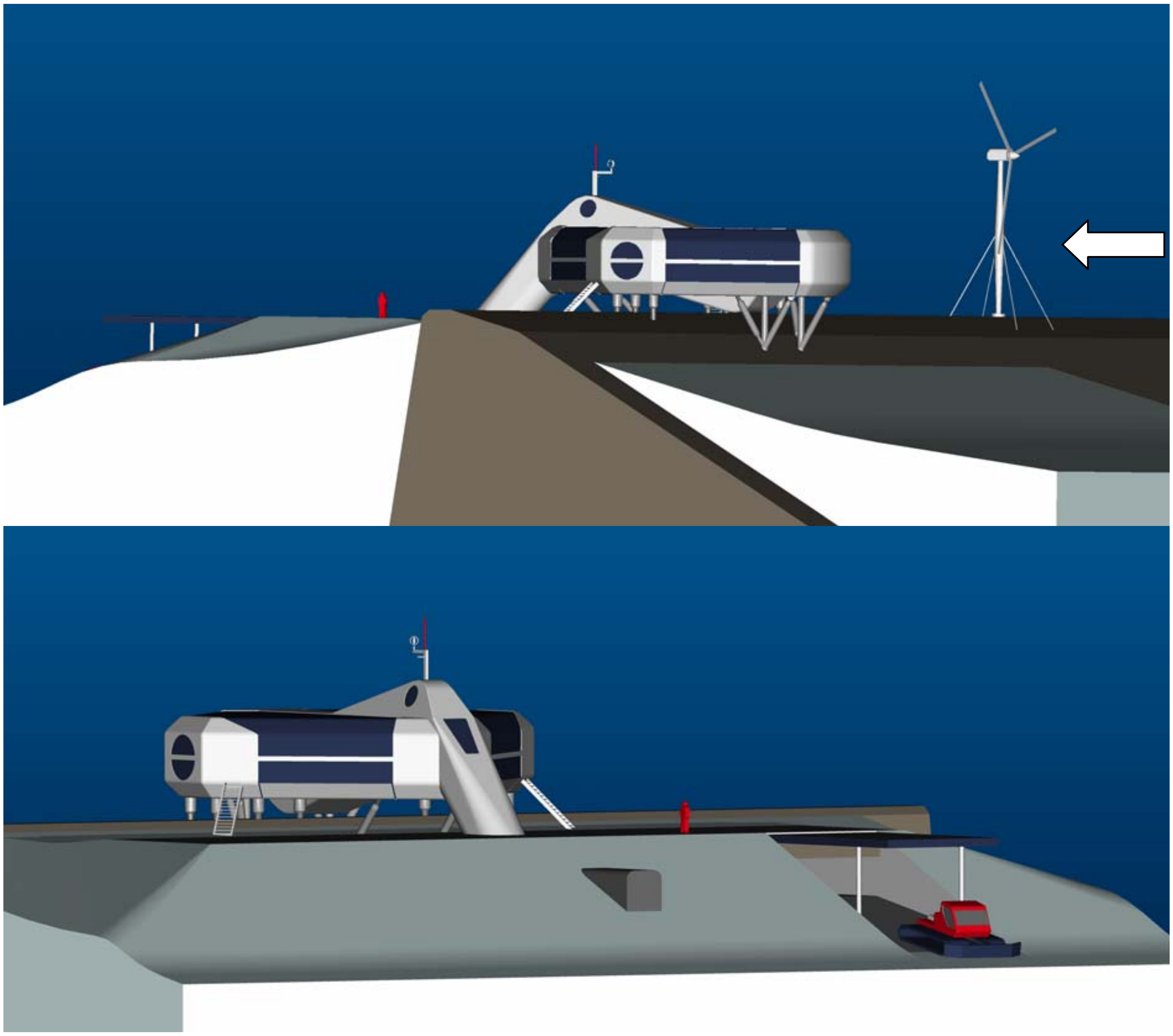


Fig 2.16: Building concept: impression of buildings integrations on-site.
Black areas on the main building are solar collector areas combined with windows
(arrow indicates prevailing wind direction)

2.4.3. Anchoring the building

A detailed survey of the selected construction area was conducted during Belare 2005 (see **Section 2.2.2**) to map the site for anchoring. **Fig. 2.17 and 2.18** show the boundary of the exposed rock surface and a typical cross section through the ridge and adjacent snow/ice area. Consistent with the sustainable character of the project the baseline for selecting anchoring points was to favour direct anchoring in the bedrock making best use of the available exposure. Making use of 3D measuring equipment - with 5 mm precision - the team identified 74 bedrock anchoring surfaces. These articulated surfaces are integrated into a 3D CAD system to define definitive anchoring points and minimising as much as possible the impact on the terrain (**Fig. 2.19**).