

British Antarctic Survey Halley VI - Hydraulic Leg Jacking System

Halley VI is a new Antarctic research station being built for British Antarctic Survey. It will be located on the Brunt Ice Shelf in Antarctica. The station consists of a series of modules mounted on hydraulically jackable legs, on skis. M G Bennett and Associates Ltd were responsible for the detailed design of the hydraulic leg jacking system, producing detailed designs for the structure, as well as analysing it and specifying the requirements for the hydraulic and electrical control system.

The legs have been designed to resist the harsh Antarctic environment including temperatures as low as -50°C , as well as the high structural and wind loads that they will experience. The modules are permanently sitting on the hydraulic cylinders which meant that specialist hydraulic valves, as well as a continuous monitoring system, were developed.

- Innovative structure permanently sitting on hydraulic cylinders.
- Designed to cope with the challenging Antarctic environment.
- Modular design of the leg structures to enable easy and quick fitting to the main structure in Antarctica.
- Hydraulic and electrical control system has a number of safety features to protect the structure as well as its occupants.

The British Antarctic Survey has maintained an Antarctic station on the Brunt Ice Shelf since 1956. This location is ideal to enable studies into the Earth's upper atmosphere, magnetic field and geospace to be carried out; this is due to the low levels of atmospheric pollution, background light and electro-magnetic interference. In addition to this, the BAS has also been able to continue some of the original studies into meteorology, glaciology, seismology, radio astronomy started in 1956. This has provided a continuous set of readings from the last 50 years which can be used as a baseline for studies in the future and to help predict atmospheric conditions. It was this baseline information that enabled BAS scientists to discover the hole in the ozone layer.

Maintaining a station on an ice shelf presents a number of challenges. The main problems are the build up of wind blown snow over time, as well as the gradual flow of the ice out to sea. Over the years, a number of different solutions for these problems have been tried, making the buildings either relocatable, or like the current Halley V station, which is vertically jackable. The new station, Halley VI, is the first station to combine both of these features into one station.

The station consists of eight individual modules, linked together to form a long structure. The modules have been aerodynamically designed to minimise the build up of snow. In addition to this, it is possible to jack the modules vertically on their legs, using hydraulic rams built into the structure. Once a year, the legs can be lifted up and snow piled underneath the foot to be able to raise the level of the entire station. The legs are also mounted on skis so that in the future it will be possible to pull individual modules to a new location on the ice shelf and re-assemble them into a station.

M G Bennett and Associates were responsible for designing the hydraulic leg jacking system for each module. This included the detail structural design of the legs, ensuring it was able to resist the weight of the modules, as well as the loads due to the wind and ice movement. They also specified and assisted in the design of the hydraulic and electrical control systems.

This project presented a number of challenges during the design process. It is not common for buildings to continuously sit on a series of hydraulic cylinders and it was necessary to source a specialist type of hydraulic valve that would ensure hydraulic oil was not able to leak out of the cylinders and thus change the position of the module. It was also very important to ensure that there were sufficient safety features within the control system to make sure that when the modules are adjusted, they remain level and cannot distort or bend their structural frame. The legs were also designed in a modular form to make their fitting in Antarctica as easy and simple as possible. This was necessary as the legs were one of the first parts of the modules to be assembled and would need to be done in Antarctic conditions.

All of the legs have now been manufactured, shipped to Antarctica and fitted to the module frames. It is anticipated the station will be completed in 2011.

