

British Antarctic Survey Research Stations



**British
Antarctic Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

Living and working in the harsh and remote environment of Antarctica requires specialist facilities. In order to carry out its ambitious scientific programme, the British Antarctic Survey (BAS) operates four permanently staffed research stations, a summer-only research station and two small logistics facilities.

The research stations are self-contained communities, with satellite links to the outside world, where science and monitoring programmes are carried out. Each station contains living accommodation, laboratories and workshops. They have to provide staff with food, water and washing facilities and deal with the resulting waste.

The larger research stations also support aircraft, ship and field operations and are equipped with state-of-the-art computer and telecommunications technology. BAS research stations are all specially designed for their role and built to ensure minimum environmental impact. Their construction enables them to endure the extreme Antarctic climate and weather.

Past, present and future

British Antarctic Survey has occupied 19 research stations since its inception in 1962. Several of the original BAS research stations have their origins during the Second World War when the Government despatched a secret Admiralty operation, code-named Tabarin, to establish small bases on the Antarctic Peninsula to report on enemy activity and make weather reports.

After the war the project was taken over by the Colonial Office and renamed the Falkland Islands Dependencies Survey (FIDS). This was later re-organised into the British Antarctic Survey.

Many of the original stations have been closed, demolished and removed; others have been preserved. The existing research stations are constantly being improved to meet operational needs.

1 Year-round research stations

Rothera – Adelaide Island, Antarctic Peninsula

Halley – Brunt Ice Shelf, Coats Land

Bird Island – Bird Island, South Georgia

*King Edward Point** – King Edward Point, South Georgia

Summer-only research station

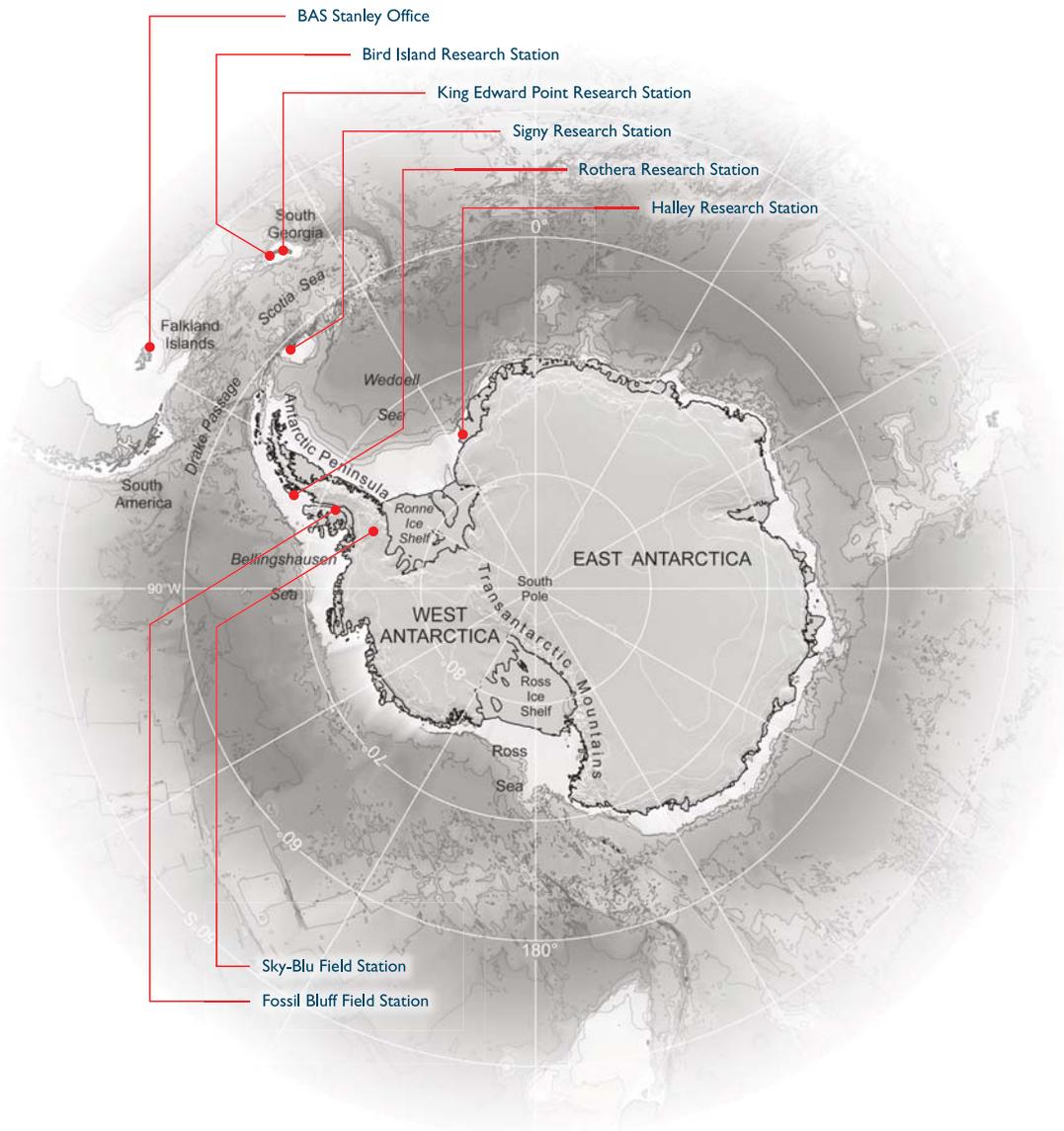
Signy – Signy Island, South Orkney Islands

Field stations

Fossil Bluff – Alexander Island, Antarctic Peninsula

Sky-Blu – Ellsworth Land, Antarctic Peninsula

*Run on behalf of the Foreign and Commonwealth Office and the Government of South Georgia and South Sandwich Islands.



In 2006, BAS commissioned a new research station to replace the previous Halley station (Halley V), located on the floating Brunt Ice Shelf. A competition was held to choose the best design for Halley VI with the winning scheme featuring a new modular station, elevated on ski-equipped, jackable legs to avoid burial by snow. This state-of-the-art science facility was opened in 2012.



Image: Top: Location of BAS offices and research stations. **Bottom:** Halley VI Research Station on the Brunt Ice Shelf.

What does a station need?

Laboratories

Antarctica is a unique natural laboratory and everything BAS does is focused on science. This ranges from studies of the smallest single-celled organism to investigations of the Earth's atmosphere. Each research station is well equipped to ensure the highest standards of scientific research.

Laboratories provide facilities to study the biology of Antarctica, or to analyse ice cores and rock samples. Other buildings house instruments monitoring weather and the atmosphere. Some of the experiments are set up to be monitored remotely from BAS Cambridge.

Communications

In Antarctica adequate communications can be a matter of life and death. Communication systems are therefore a key part of any research station. All stations (and ships) have permanent satellite links to the outside world providing broadband internet and a sophisticated telephone network. Radios and portable satellite phones provide communication with field parties, ships and aircraft. Within the stations themselves, there are telephones and walkie-talkie systems.

However, all these systems can be disrupted by the weather or atmospheric phenomena.

Transport

The larger stations provide a hub for Antarctic transport. There are garages and workshops for snow vehicles such as tractors and skidoos. Rothera Research Station has a gravel runway, aircraft hanger and aircraft maintenance facilities. The station also has a wharf where BAS ships can be tied up for loading and unloading. Much research is concentrated on the marine environment so some stations need boat houses and diving facilities.

The smaller BAS facilities, at Fossil Bluff and Sky-Blu, provide essential staging posts for fuel and equipment required for deep field science projects.



1 From the Rothera diaries

“The synchronous buzz of distant engines and station preparation is upon us, as October sees the return of aircraft to Adelaide Island, activating the summer season and signifying an end, in body and mind, to the wintering period. Excitement permeates the station as thoughts of long-awaited treasures are imminent – gifts and news from friends and loved ones.”

Image: Aircraft hangar at Rothera Research Station.

Making Antarctica a home



Although laboratory facilities, communication and transport are essential, Antarctic research stations are more than just places of work. They have to provide food, water, accommodation and recreation facilities for staff that might be based in Antarctica for up to two years at a time. To these people, the research station is a home from home and even in the darkest depths of an Antarctic winter, needs to feel like a safe and pleasant place to live.

Each station has a Base Commander (BC) who has overall authority on the station.

Food and drink

The diet provided at each station is very similar to the kinds of food eaten at home in the UK. The main difference is that fresh fruit and vegetables are limited in their availability. Vegetables, fruit and meat come tinned, dried or frozen but foods such as bread are freshly baked.

Because they may have to cater for more than 100 people, the larger stations have professional chefs. At others, personnel each take turns to cook. At all stations everyone is expected to help with the washing up, cleaning and dealing with the waste.

Depending on the location, research stations either melt their water from the surrounding snow or extract fresh water from the sea. Rothera has a modern desalination plant which removes salt from seawater. Each station also runs its own bar facilities with a limited supply of alcoholic drinks.

1 From the Rothera diaries

“June is such an exciting time to be in Antarctica. The main reason being that June 21st is Midwinter’s Day, very significant in this part of the world. It is the winter solstice, the shortest and darkest day of winter. On this day, everyone based on this great continent enjoys a day of celebration. Part of the tradition on Midwinter’s Day is the exchange of gifts. Everyone on station makes a present and on the day these are swapped by pulling names out of a hat. I cannot begin to describe to you the amount of effort people put into these gifts, for weeks and even months prior to Midwinter, people are creating bespoke masterpieces.”

Image: Bar and recreation area at Rothera Research Station.



Sleeping

Everyone living on station has their own bunk and personal space. In summer the facilities can be quite crowded but in winter it is usual for people to have their own room.

People sleep and work at different times depending on their job. At the larger stations, there is always someone awake on duty at night in case of emergency. Many science projects also operate over 24 hours, with researchers taking shifts to ensure continuity.

Health and safety

Considering the nearest hospital is in the Falkland Islands and station personnel are completely cut off in winter, it's vital that everyone living and working in Antarctica is fit and healthy. However, if medical attention is required then the larger stations have a fully equipped doctor's surgery which can also double as a dentist's and even, for a worst case scenario, an operating theatre.

Each larger station has a doctor on the staff. Personnel on the smaller stations or operating in the field are fully trained in first aid. Stations staffed in winter also include a doctor on their personnel.

Recreation

Stations are equipped with libraries, gyms, bars and DVD players. And while in good weather people enjoy outdoor activities such as snow sports, bird watching, photography or even jogging, at other times facilities inside are particularly important.

BAS encourages people to have hobbies and at most stations there are accomplished musicians, model makers or artists.

📌 From the Halley diaries

“This month started off with winds of 40 knots and temperatures of -30°C and pretty much stayed the same with the exception of one or two reprieves. This made commuting to work on other platforms or to the garage difficult... The weather doesn't help when it's your turn to dig snow for the melt tank. Some days it's blowing so much that your clothes are covered with frost and the snow will fill every gap in your clothes. Goggles freeze over so that you can't see what you are digging.”

Image: The chef at Rothera Research Station has to cater for over 100 people at the height of the summer season.

Rothera Research Station

Latitude: 67°34'S, Longitude: 68°08'W

Rothera Point is home to the British Antarctic Survey's largest research station. It is situated on a rock and raised beach promontory at the southern extremity of Wormald Ice Piedmont in the south-east of Adelaide Island. It is named after John Rothera, a surveyor with the Falkland Islands Dependencies Survey in the 1950s. Occupied since 1975, the station operates all year with up to 120 staff in the summer and around 21 in winter. A wide range of scientific research including biosciences, geosciences, glaciology and meteorology, is carried out in and around the station. Rothera is also a major logistics centre, supporting all BAS operations in Antarctica.

Rothera can be reached by ship and aircraft, including BAS's de Havilland Canada Dash 7, which flies from the Falkland Islands or from Punta Arenas, Chile. The station has a 900m crushed rock runway, with an aircraft hanger and bulk fuel storage facility. There is also a wharf for the loading and unloading of cargo from supply ships.

The station consists of a number of separate buildings. These include the main facilities block which houses living areas, communication systems and offices. There are two accommodation blocks, equipment stores, generators and desalination buildings as well as garages for vehicles. Across the runway is the aircraft hanger and beside the wharf is the Bonner Laboratory and boathouse.

Bonner Laboratory

The Bonner Laboratory is equipped to an extremely high standard for biological research. Scientists assess Antarctica's role in evolutionary change and the development of global biodiversity, as well as the effects of environmental change on existing ecosystems.



1 From the Rothera diaries

“Rothera is the only station in Antarctica that supports diving through the entire winter period. Most of the winter dives are conducted through ice holes, which are cut with a chainsaw as soon as the ice is thick enough to support the weight of the divers and surface support team. Two dive holes are cut, so if a seal takes residence in one there is always an alternative exit point... A vital part of the diving set up here is a state-of-the-art recompression chamber, which is primed to treat divers with suspected ‘bends’. Diving-related injuries are very much a rarity but the chamber is often used for training purposes and is a necessity when diving in a harsh, isolated environment.”

Image: The Bonner Laboratory at Rothera Research Station.

Rothera plays a vital role in the ground-breaking research undertaken by BAS to better understand Antarctica's history, ice, climate, atmosphere and biology.

The first phase of Rothera Research Station, a small accommodation block, was completed in February 1976. More recent developments have seen improved accommodation buildings in 1996 (Giants House) and 2001 (Admirals House), construction of the operations tower in 1999 and a sewage treatment plant in 2003. New Bransfield House was completed in 2008 and contains the main communal areas on station – kitchen and dining facilities, library, bar, TV and computer rooms.

For the first 15 years of BAS operations at Rothera, Twin Otter aircraft used a skiway 300m above the station on the Wormald Ice Piedmont. With the commissioning of the gravel runway in 1991, air operations became more secure and a larger aircraft, the Dash 7, could be used to provide a direct intercontinental link.

During the summer months, Rothera is the centre of field operations. Most field parties consist of a scientist and a Field Assistant. Glaciologists and geologists will usually be taken to their research area by Twin Otter aircraft or sometimes by ship or helicopter. Once in the field, parties travel using skidoos and sledges for up to three months. They may also receive re-supply flights.

Rothera houses a sophisticated communications centre. Satellite connections operate 24 hours a day, although adverse weather can affect the system, particularly in winter. Field workers keep to a daily radio 'schedule' so a check can be kept on their progress and safety. The station also has an operations tower to control aircraft movements in and around the Antarctic Peninsula.



Image: Layout of Rothera Research Station.

Halley Research Station

Latitude: 75°35'S, Longitude: 26°39'W

Afloat on the Brunt Ice Shelf, Halley is the UK's most isolated station. It is named after the astronomer Edmond Halley and is the sixth British station to be built on the ice shelf. The extreme environment poses huge technical problems, with blizzards and snowdrifts eventually burying everything. Previous buildings disappeared beneath the snow, requiring ever longer vertical shafts to access the outside world.

The first Halley station was established in 1956 by the Royal Society for the International Geophysical Year (1957-58). It had to be abandoned in 1967; subsequent stations were abandoned in 1973, 1983 and 1992 before being crushed by the weight of overlying snow. Halley V sat four metres above the snow on independent steel platforms. Each summer the platforms were raised to compensate for the accumulated snowfall. This method meant Halley V lasted much longer than previous stations – almost 20 years. However, it did not prevent its unrelenting march towards the Weddell Sea as the Brunt Ice Shelf moves northwards at approximately 400m per year before breaking apart into giant icebergs.

The newest station, Halley VI, was commissioned in 2006 and its unique and innovative structure was the result of an international design competition in collaboration with the Royal Institute of British Architects (RIBA). The state-of-the-art research facility is segmented into eight modules, each sitting atop ski-fitted, hydraulic legs. These can be individually raised to overcome snow accumulation and each module towed independently to a new location when the current site gets too close to the edge of the ice shelf.

The station took four years to build and delivered its first scientific data in 2012. Its iconic design houses a cutting-edge science platform and modern, comfortable accommodation.

The central red module contains the communal areas for dining, relaxation etc., while the blue modules provide accommodation, laboratories, offices, generators, an observation platform and many other facilities. Remote scientific equipment, set up for long-term monitoring, is housed in a number of cabooses around the perimeter of the site, which also contains numerous aerals and arrays for studying atmospheric conditions and space weather:



i Relief for Halley Research Station

Each season the ship must find a suitable 'creek' in the ice cliffs at the front of the Brunt Ice Shelf to unload supplies and equipment. Once anchored to the sea ice, relief can take several days as loads are carefully stowed on the ice and towed back to the station using Sno-cats. In 2002, the sea-ice conditions were so bad that the ship couldn't actually unload at all. Vital equipment, supplies and personnel had to flown in by Twin Otter aircraft.

Science at Halley VI provides vital information for a global understanding of ozone depletion, polar atmospheric chemistry, sea-level rise and climate change. Since it was first established in 1956, meteorological and atmospheric data has been continually collected at Halley, providing an unbroken record.

Weather data is sent via satellite to forecasting stations in the northern hemisphere for immediate use. It also provides a climatic database to help in our understanding of climate change. The flatness of the ice shelf provides one of the best natural laboratories in the world for studying the properties and changes in the atmosphere close to the ground.

Ozone Hole: Atmospheric ozone has been measured at Halley since 1956. In 1985, BAS scientists discovered that there was a spring-time 'hole' in the ozone layer caused by man-made CFCs and halons. Ozone is vital to protect the Earth's surface from damaging UV radiation. The discovery of the hole led to an unprecedented international response. Production of the chemicals has been phased out under the international Montreal Protocol agreement. Nevertheless, it will take many years before the ozone layer recovers.

Halley's position at the edge of the southern auroral zone – where magnificent auroras known as the Southern Lights can be seen in the winter sky – is ideally situated for geospace research. Geospace is the region of space where the Sun's atmosphere interacts with the Earth's magnetic field and the station houses a powerful set of instruments to monitor the effects of solar activity in the upper atmosphere.

Halley is also the UK's gateway to the wider region, enabling geology, glaciology, oceanography and ice core field parties to access the eastern Weddell Sea region and East Antarctica. It also provides a platform for extensive autonomous instrument deployment.



Image: Looking along the length of Halley VI Research Station with its hydraulic, ski-fitted legs



Bird Island Research Station

Latitude: 54°00'S, Longitude: 38°03'W

Bird Island is a small rocky island lying off the north-west tip of South Georgia. The island's northern coast consists of sheer cliffs rising up to 365m; the southern coast is more accessible with many beaches. Below 150m the island is covered with tussock grass. Above this altitude there is only moss, rock and scree. There is no permanent snow or ice and the yearly temperature range is from -10 to 10°C.

The island has a rich diversity of wildlife and is afforded special protection as a Site of Special Scientific Interest (SSSI). It is home to around 50,000 breeding pairs of penguins, 30,000 pairs of albatrosses, 700,000 nocturnal petrels and 65,000 breeding fur seals. For every 1.5 square metres there is one bird or seal, making Bird Island one of the richest sites for wildlife anywhere in the world.

The research station is situated in a fresh-water inlet in Jordan Cove and consists of three large buildings. In summer it is home to ten people but only four in winter. As well as living accommodation, facilities include offices and laboratory space. Research programmes centre on seabird and seal biology including studies on their population, ecology and reproduction. Long-term monitoring studies contribute to international environmental conservation. Information is provided to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the international body that manages sustainable fishing in the Southern Ocean.

The first permanent hut was established on Bird Island in 1958. The bulk of the station was built on concrete piers in 1981 and is designed for year-round occupation.

In 2005-06, a major redevelopment provided new accommodation, laboratory and kitchen facilities. All but one of the old buildings were demolished and removed.

1 From the Bird Island diaries

“The wandering albatross decline continued one more year unperturbed by international conservation action and fund-raising campaigns. The numbers of pairs nesting on Bird Island fell a further 8% from last year, and only 845 nests were recorded this year. Work on Bird Island reflects the worldwide trends and concern for these amazing birds.”

Image: Wandering albatrosses nest on Bird Island.



King Edward Point Research Station

Latitude: 54° 17'S, Longitude: 36° 30'W

The applied fisheries research station at King Edward Point, South Georgia, was opened in 2001. Studies here provide sound scientific advice to assist in the sustainable management of the valuable commercial fisheries around South Georgia. The research is carried out under contract to the Government of South Georgia and the South Sandwich Islands.

Scientists at King Edward Point are undertaking biological and ecological research to ensure the conservation of fish stocks. All fishing in the area is regulated by internationally-adopted measures agreed by the Commission for the Conservation of Antarctic Marine Living Resources. This agreement is not only designed to ensure fishing is controlled but that the entire ecosystem is conserved.

South Georgia: *South Georgia is an isolated subantarctic island in the Southern Ocean, some 1,400km south-east of the Falklands. The island is mountainous and glaciated. Below the mountains there is tussock grass, rock, scree, lakes and streams. In winter the island is blanketed with snow. The island was once the home of the whaling industry. Tens of thousands of whales were brought ashore to be rendered down for oil. Many of the beaches are littered with whale bones. The British army occupied a garrison on the island until 2001.*

The King Edward Point Research Station is staffed by up to 18 people in summer and eight in winter. It comprises two single-storey buildings: the James Cook Laboratory and Everson House. The laboratory building includes wet and dry laboratories. There is also a large temperature controlled room which houses re-circulating seawater tanks for live specimens.

Other facilities include comfortable sleeping quarters, computing facilities and a library. British Antarctic Survey also operates three inshore boats from the station, including a fully-equipped eight-metre inshore fishing vessel. This is used for sampling the local coastal waters and to assist with logistical support.

1 From the King Edward Point diaries

“We were re-supplied with all our dried food for the next year and lots of other equipment and supplies. All the over-wintering station members were especially grateful for our personal boxes sent to us from our families and friends back home... The following weeks were like an extended Christmas of opening and unpacking boxes and then trying to find room on station to store a year’s supply of everything!”

Signy Research Station

Latitude: 60°43'S, Longitude: 45°36'W

Signy Island is a small subantarctic island, 6.5km long and 5km wide and named after the wife of Norwegian whaling captain Peter Sørille, who charted the island in 1912. There is a permanent ice cap over a large part of the island. In the summer, extensive areas of moss and some grasses are exposed and there are many freshwater pools and lakes. Because it is intermediate between Antarctic and subantarctic environments, the island contains a diverse range of flora and fauna.

Signy Research Station was first established in 1947, primarily as a meteorological station. It is located in Factory Cove, named after the whaling station originally sited there. Signy was developed in 1963 into a major biological research station with living accommodation, laboratories and diving facilities and was the centre of BAS biological science until 1995, when the marine research transferred to Rothera.

In the 1995-96 season the station was rebuilt as a summer-only research centre to support studies in terrestrial and freshwater biology. Scientists examine how lakes in a pristine environment respond to environmental change and the dynamics of microbiological communities, as well as penguin monitoring. The island has 17 breeding bird species and three species of seal.

The main building has living accommodation, laboratories and offices and the station operates with up to eight staff from November to April. During the winter, an automatic camera records sea-ice conditions in Factory Cove in order to maintain the 50-year record obtained when the station was continuously occupied. Year-round meteorological observations are made by an automatic weather station.



❶ From the Signy diaries

“With the last of the water samples safely analysed, almost all of the island’s lakes froze once more, heralding the onslaught of winter. The fur seals, either by accident or experience, have found that this offers a chance to practise some enviable skills. Running headlong across the ice and sliding full length into their mates appears to be the best way imaginable to instigate a fight.”

Image: Signy Research Station.

Field Stations

BAS operates two 'logistics facilities' at Fossil Bluff and Sky-Blu. These are occupied in summer to provide support to field parties. They act as transit stations for field parties and depots for food, fuel and other supplies.

Fossil Bluff

Fossil Bluff lies at the base of a scree-covered ridge overlooking George VI Sound. The sound is covered by the George VI Ice Shelf which separates the mountainous Alexander Island from Palmer Land. The ice has provided a north-south route for field parties, although at the height of summer the surface can be flooded with meltwater.

Fossil Bluff is operated by Rothera Research Station as a forward facility for refuelling aircraft. There is a 1,200m unprepared snow runway which enables BAS's Twin Otter aircraft to touch down.



Sky-Blu

Sky-Blu is an area of blue ice situated close to Sky-Hi Nunataks in Eastern Ellsworth Land. First established in 1993, the runway can be used by wheeled aircraft. The runway is now vitally important for deep-field operations because it can be used by the Dash 7 aircraft. The larger capacity of the Dash 7 means that fewer flights are required to deliver supplies.

Sky-Blu became fully operational as a logistics facility in 1997. The groomed ice runway is up to 1.2km long and 50m wide and is permanently marked by flags. At the start of each summer season snow drifts have to be removed from the runway.

The support camp for the runway remains year-round and consists of a hut together with a number of tents, garage, food depot and toilet facilities.

📌 Life at Sky-Blu (from the Rothera diaries)

“Life at Sky-Blu is fairly basic. You live in a red submarine-like shell, called a melon hut, and sleep in pyramid tents. Most of your time is spent clearing snowdrifts from the blue-ice runway with a snow-blower and the rest of the time is spent shifting drums. The only concession to comfort is an incinerating toilet, similar to the one at Fossil Bluff. Sky-Blu is a spectacular place but people either love it or hate it. It is affectionately thought of by most as a penal colony!”

Image: The melon hut at Sky-Blu Field Station.

Protecting the past

A conservation survey of old British stations was carried out by BAS and the UK Antarctic Heritage Trust in 1994. As a result, four were selected for conservation and have been designated as Historic Monuments under the terms of the Antarctic Treaty.

The four preserved stations are Port Lockroy, Stonington Island, Wordie House (Argentine Islands) and Horseshoe Island. Another structure, the Reclus hut, was dismantled from Portal Point in 1997 and is on display at the Museum in Stanley, Falkland Islands.



Image: The signpost at Halley Research Station.



British Antarctic Survey (BAS), a component of the Natural Environment Research Council, delivers and enables world-leading interdisciplinary research in the Polar Regions. Its skilled science and support staff based in Cambridge, Antarctica and the Arctic, work together to deliver research that uses the Polar Regions to advance our understanding of Earth as a sustainable planet. Through its extensive logistic capability and know-how BAS facilitates access for the British and international science community to the UK polar research operation. Numerous national and international collaborations, combined with an excellent infrastructure help sustain a world-leading position for the UK in Antarctic affairs.

www.antarctica.ac.uk

British Antarctic Survey, High Cross,
Madingley Road, Cambridge, CB3 0ET, UK

Email: info@bas.ac.uk

© NERC 2014. All rights reserved.



**British
Antarctic Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

