

I couldn't find any North Pole stories for the December issue, but this excellent article shares all the cold, ice, and snow one could want.—K2EEK

Living, Working, and Amateur Radio On An Antarctic Base

BY JAMES MILLNER*, WB2REM, AND ANDRE PHILLIPS, VP8MAP, ZL3AW

Life on an Antarctic base, to outside eyes at least, is viewed as being harsh and isolated. The cold, dark winter nights are foreboding. André, VP8MAP, however, enjoys both the surroundings of his two-year home at Halley Base, Antarctica, as well as the company he keeps. André is employed as an electronics engineer and is part of a scientific team responsible for maintaining ongoing geophysical experiments on base.

There are many talented people who work at Halley Base. For recreation, some play musical instruments, while others pursue the fine arts. André is an avid photographer and an innovative amateur radio operator.

During André's time at Halley Base, amateur radio has provided a crucial link between him and the outside world. André's communication with other amateurs, such as myself, has given us a view of what life is like living on an Antarctic base. His operations on PACSATs (packet satellites) provided both the text and the photography upon which this article is based.

Halley Base, Antarctica (75°35'S, 26°24'W) was named after the English astronomer Edmund Halley (1656–1742), who also discovered the periodicity of Halley's Comet. The United Kingdom currently operates several scientific bases in the South Atlantic and on the Antarctic Peninsula, including Bird Island (South Georgia), Signy (South Orkney Islands), Faraday, and Rothera (on the Antarctic Peninsula). During the Antarctic summer a number of other temporary field bases are also established.

Halley is the most southerly and coldest UK Antarctic base. In fact, the station is located on the Brunt Ice Shelf at a point where the ice is about 600 feet (200 meters) thick. The ice shelf itself is floating on about 1500 feet (500 meters) of sea water, and at the location of Halley Base, the whole ice shelf is moving approximately 6 feet (2 meters) westward per day. In about 15 years the ice on which the base is currently built will have moved to the coast, and ultimately it will "calve" off to form an iceberg.

Because the temperatures at Halley remain below freezing all year, there is no melting of the snow in the summertime. Therefore, the snowfall accumulates, raising the surface level by about 6 feet (2 meters) per year. The snow packs down to nearly the density of water, so it doesn't take long for the pressures on buried



Here is André Phillips, VP8MAP, in his Antarctic gear. Check out the icicles on his beard and mustache. It must be perfect antenna weather at Halley Base.

structures to become enormous. Coupled with an approximate (annual) 1:1000 shear in the ice, buried stations are crushed and torn apart after a few years. Therefore, to keep a base operational in this area of the Brunt Ice Shelf, Halley needs to constantly be rebuilt.

The current structure, built in the early 1990s, is actually the fifth Halley Base to be built in the area. (The first was built in the late 1950s for IGY, the International Geophysical Year.) The four previous Halley Bases were under-ice bases, and Halleys one and two have completely disappeared, now probably encased in a giant iceberg. The buried remains of Halley three are currently protruding from an ice cliff at the edge of the Brunt Ice Shelf and probably will break off and float away within the next year or so.

Halley 5 is different from earlier bases in that it is built above the snow surface. The three main buildings at Halley (accommodation, space science, and meteorology) are built on steel legs. Each summer the buildings need to be jacked up approximately 6 feet (2 meters) to allow for the rising snow surface. The main Accommodation Building (the "ACB") is supported on 20 steel legs and weighs approximately 350 tons. During the summertime a two-person, hand-operated jack is placed on each leg of the ACB, and over a period of three to four days the entire structure is raised by human muscle alone. As you can imagine, there are a lot of people involved. It's quite a spectacle to watch 40 people pumping their

hardest, raising the large building millimeter by slow millimeter.

In addition to the above-ground buildings, deep under the snow surface there are extensive "tunnels"—large, steel-clad tubes that house the fuel and stored water. Making water is a daily chore. Teams of five to six people spend about 20 minutes shoveling snow into the Snow Melter. During blizzards and total darkness this can be a demanding job, but one which has to be done daily, as the base consumes about 2 tons of water per day.

You may not have heard of Halley Base, but you probably have heard of Halley's greatest claim to fame, the discovery of the Antarctic Ozone Hole. During the 1980s ultraviolet (UV) flux observations from Halley were compared with satellite observations and confirmed the existence of substantially reduced amounts of stratospheric ozone over Antarctica, especially in the Austral springtime. The discovery of the ozone hole is an interesting story, as it highlights the danger of dismissing scientific data which don't fit expected observations. For several years satellite observations had shown a significant decrease in the total ozone thickness over Antarctica, especially in the local springtime. Unfortunately, the large "hole" over Antarctica was attributed to a problem with the satellite's detector (at high latitudes), and the data were ignored. However, eventually these "false" data were matched with ground-based observations from Halley, and the rest of the story is history.

A UV-measuring Dobson Spectrophotometer is still operated at Halley, although this year probably will mark a significant improvement in ground-based measurements of UV flux. Last summer a new type of UV photometer was installed (named "UVIZ," run by Jon, VP8CRV), one which can use starlight to measure the absorption of UV in the stratosphere. At the latitude of Halley, the sun slips below the horizon for the winter at the beginning May, and it doesn't return until mid-August. Using conventional techniques it is difficult to measure UV transmission through the atmosphere during total darkness, so this new instrument will greatly increase our knowledge of stratospheric ozone levels during the winter months. The most recent measurements (*Nature*, 1995) suggest that the ozone layer over Antarctica continues to thin, and that the ozone "hole" is enlarging northwards to have effects in more

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This is a photo of the Accommodation Building at Halley Base, Antarctica. The legs of the building need to constantly be jacked up to keep the building above the rising snow level. The amateur radio station is located in a smaller but similar building known as the Space Science Building, or SSB—an apt place to be. In this view you can see the sun's rays forming a mystical effect around the building.

populated regions. In 1994 the thickness of the ozone layer continued its downward trend, and the October ozone-thickness measurements fell to about one third of those measured in the late 1950s.

There are seventeen people wintering at Halley Base, eight of whom have their VP8 (Falkland Island) calls. Wintering base personnel include a doctor, plumber, electrician, diesel generator mechanic (Joe, VP8CRW), vehicle mechanic (Martin, VP8CRX), cook, steel erector (Richard, VP8CRI), three met observers (including Jon, VP8CRV, and Barry, VP8CRF), general assistant², radio operator (John, VP8CRD), two scientists, and three engineers (including André, VP8MAP). 1995 was the last year that there were no women wintering at Halley, a welcome policy change!

The food served at Halley Base is the ordinary type that one might eat at home in the UK, although there is of course nothing in the way of fresh fruit and vegetables. Some Antarctic bases have hydroponics facilities, but not Halley. At one time many Antarctic bases had these facilities and grew tomatoes, cucumbers, and even carnations. These days, as part of an international agreement not to import foreign plant and animal species into Antarctica, home-grown hydroponics is banned, or at least frowned upon. André thinks that some aspects of this ruling are mildly ridiculous, as he thinks there is little chance that cucumbers will escape the glasshouse and colonize the continent!

In their spare time Halley base personnel have a number of hobbies and interests to keep themselves amused. High on the list are photography, reading, playing musical instruments, and working-out in the gym. Perhaps even higher are watching movies and playing computer games.

During midwinter darkness the opportunities for traveling off-base are limited. However, as soon as the sun returns, there are expeditions mounted to visit penguin colonies and ice formations. André is hoping to visit the buried remains of Halley Base number three before it breaks off and becomes part of an iceberg.

André's main private activity this year has been writing a chronology of his father's life and career, and one of the reasons he journeyed south was to have some (relatively) interruption-free time to complete this task. Also, chatting with people on the amateur PACSAT satellites absorbs much of his spare time.

The local animal life consists of penguins, seals, and birds. During the winter cold most of the animals, except for the incredibly hardy Emperor penguins, head north. The Emperor penguins (which are up to 3 feet [1 meter] tall) breed in April and lay their eggs in July when there is almost complete darkness and the temperatures hover around -40°F (-40°C). In the Austral summer the smaller Adele penguins (1 foot [.3 meter] tall) hatch their chicks. During the late summer a few adult Adeles walk the 10 miles (16 kilometers) from the coast to the base, where they congregate to molt. During that time they look quite bedraggled and sorry for themselves and there are feathers everywhere!

During the Antarctic spring the Weddell seals return from the sea to have their pups on the vast sea of ice. Like most Antarctic wildlife, Weddell seals have never seen humans before, and they are normally quite approachable. At Halley base, mainly two types of bird are seen: the big Skua birds (which look like dirty seagulls) and the pearly white Snow Petrels.

André has also wintered on the Australian Antarctic base of Mawson ($67^{\circ}36'\text{S}$, $62^{\circ}52'\text{E}$) and has spent some time in Alaska and the Canadian Arctic. For the last few years he had been living in VE5-land, Saskatoon, Saskatchewan, Canada. He found that living on the Prairies in the wintertime look much the same as the terrain around Halley, although the temperatures and winds in Antarctica are much more severe. Wintertime temperatures at Halley are typically in the range -20° to -40°F (-30° to -40°C), with occasional rare descents into the -50°C range. During 1995 the coolest temperature was -65.7°F (-54.2°C).

The clothing worn at Halley is mostly fairly standard equipment that can be bought in out-

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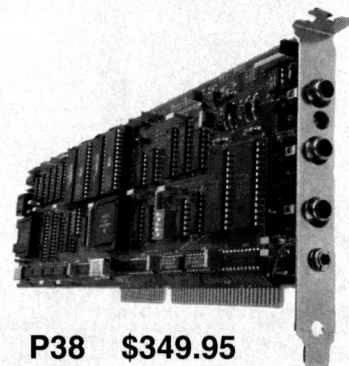
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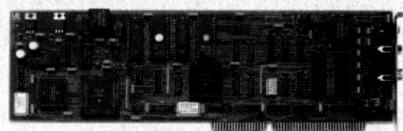
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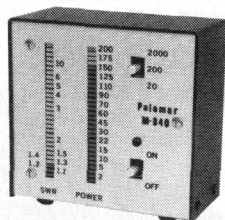
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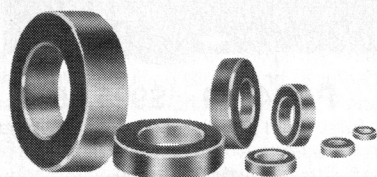
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A group shot of the amateurs stationed at Halley Base. Left to right in the back row are Joe Nemeth, VP8CRW, generator mechanic; Martin Bell, VP8CRX, vehicle mechanic; John O'Sullivan, VP8CRD, radio operator; Jon Evans, VP8CRV, met observer; and André Phillips, VP8MAP, engineer. Seated in the front row on the left is Barry Morton, VP8CRF, met observer/engineer, and on the right Richard Parsley, VP8CRI, cook and steel erector.

doors shops back home. Some items are traditional and have been worn on bases for many years—in particular the outer garments known as "Windies" (on British bases). These are a loosely fitting pair of pants and a hooded jacket made of a tightly woven, windproof cotton fabric known as "Ventile."

Having lived in cold climates for some time, André brought some of his own clothing down with him, including his very photogenic Eskimo parka. This garment was handmade for him by his amateur friend Julie Ewing, VE8JE. Julie is now living at virtually the opposite side of the world from André, in the Inuit (Eskimo) village of Paulatuk in Canada's North West Territory. One of the great attractions of amateur PAC-SAT communications is that distance is of no importance. Julie and André regularly communicate with each other via their relay in eastern Canada, Darrell, VE1ALQ. They exchange letters as well as images showing life at the opposite poles of the earth.

Halley is isolated. The resupply ship calls twice in the summer (Christmas and March). There is a fixed-wing aircraft operating here during the summer season, but it departs shortly before the last ship leaves. After that the base is very much on its own. The main communication link is an INMARSAT (International Maritime Satellite) ground station. Unfortunately, this equipment is very expensive to use and at \$8US (UK£5) per minute, people aren't exactly queuing up to use it. There is a fax machine connected to it, but the low baud rate of the link makes fax transmission fairly slow. HF radio is also used, but generally long-range propagation is poor because of Halley's high geomagnetic latitude, and also because of the decreased reflectivity of the ionosphere (during the wintertime the F-region of the ionosphere is in total darkness).

Halley Base is one of the most isolated places left in the world, and that's why the advent of reliable amateur digital satellite links represents quite a breakthrough for personal communications. Through the kindness of a few amateurs, during the year Halley was amply supplied with football and other sports results.

Vehicles at Halley include several Tucker "Snowcats" (manufactured in Medford, Oregon), two Caterpillar D4 bulldozers, and numerous Bombardier Skidoos. During the 1970s there were husky dogs living at Halley, but they were removed, as Halley is perhaps a little too cold and dark to utilize them to their full potential. During the worst of the winter darkness and cold the Halley huskies were lowered by rope to deep under the snow surface, and they spent the winter in the relative warmth of the "tunnels." André was lucky enough to work with huskies in Antarctica when he was living at Mawson. Now all the huskies of Antarctica have been removed to comply with an international agreement restricting the importation of foreign animal species onto the continent. This is perhaps understandable, but the dogs are sorely missed, and Mawson's famous huskies are now in retirement at an outdoor education center in Minnesota. There is still one "Nansen" dog sled at Halley, a relic of when the dogs were there. There are also many other Nansen sleds which have been slightly modified to be pulled by Ski-doo.

One way to keep fit on base is to try towing the sleds by man power, the way it used to be done. There are special hauling harnesses for the purpose, and Steve (our Wintering Base Commander) can occasionally be seen towing a sled loaded with 150 lbs. (70 kg) of flour, trekking around the base.

Over the last few years André has held several amateur calls. He lived in New Zealand

(Christchurch, call ZL3AW), as well as Australia (Adelaide, VK5AAP) and Canada (Saskatoon, ZL3AW/VE5). André's satellite station consists of a Kenwood TS790A, PacComm Tiny-2/ NB96 modem, homebrew three-element vertically-pointing "quagis," an IBM laptop computer, and of course, WiSP (the Windows Satellite Program, written by Chris, ZL2TPO/G7UPN). Things are still not working as well as André would like, but development of better antennas will have to wait for warmer summer temperatures. His satellite antennas are fairly simple, but they have to survive there. The "quagis" (loop antenna Yagis) are made of heavy steel wire firmly secured onto a frame of thick timber (glued and screwed construction and roped down to the roof). The equipment stays warm inside, but the outside antennas require a little attention. Antennas can often go out of tune due to the buildup of "rime" ice on the elements. This ice has a dielectric constant of approximately 2, so not much of it is needed to start changing the electrical characteristics of an antenna. The high winds, cold, and accumulation of ice are one reason why any sort of large or mechanically-driven antenna is not very practical in the Antarctic environment.

Communication with André in 1995 showed the power of amateur PACSAT satellites in

maintaining a reliable communication link with a remote part of the world which is normally very difficult to contact via HF techniques. The ability to transmit images, computer programs, data, and even sound via digital techniques has meant that a reliable and quite educational dialogue has been possible between André, myself, and many others. DXpeditioners and others wishing to operate from remote sites should be aware of this power. And for those intending to operate from high-latitude sites, André has written some notes that were presented in the *AMSAT-UK Oscar News*, August 1995.

It takes an unusual person to live happily under the conditions that André and his colleagues encounter daily. Their dedication to their work assists the gathering of scientific data, which increases our knowledge of the Antarctic continent. André can be contacted anytime on the satellites KO-25 or UO-22 (VP8MAP) and will be happy to answer any further questions you might have about life on an Antarctic base.

About The Authors

André, VP8MAP (ZL3AW), has been a licensed amateur since the age of 14. He has been working at Halley Base since December 1994 and



A story of Antarctica just wouldn't be complete without a cute shot of a mother and baby Emperor Penguin.

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will likely remain there until March 1997. André enjoys both cold and warm weather activities. He is a keen scuba diver as well as a private pilot. André has also wintered at the Australian Antarctic base of Mawson and has lived in Canada. Although trained as a scientist, his current work title is "engineer," and his job is to maintain and operate several geophysical monitoring experiments at Halley. He has only operated his 9600 baud amateur PACSAT station from Antarctica.

Jim, WB2REM, has been licensed since he was 11 years old. He is a child psychologist and an avid satellite operator. Jim met André in April 1995 on the Korean satellite, KO-25. Through numerous communications between him and André, this article was written. In January 1995 Jim published an article in *QST* entitled "The WB2 'REMOte Link.'" This is one of the first articles totally conceived of and written through the use of amateur satellites. The pictures in the article were also transmitted via KO-25 and UO-22 satellites.

Footnotes

1. Faraday is to be handed over to the Ukraine in early 1996.
2. The General Assistant position is a mountaineer, or someone with considerable outdoors and guiding experience. It is this person's job to look after the field gear and accompany groups into the field, especially during the summertime.
3. A De Havilland "Twin Otter" aircraft.

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