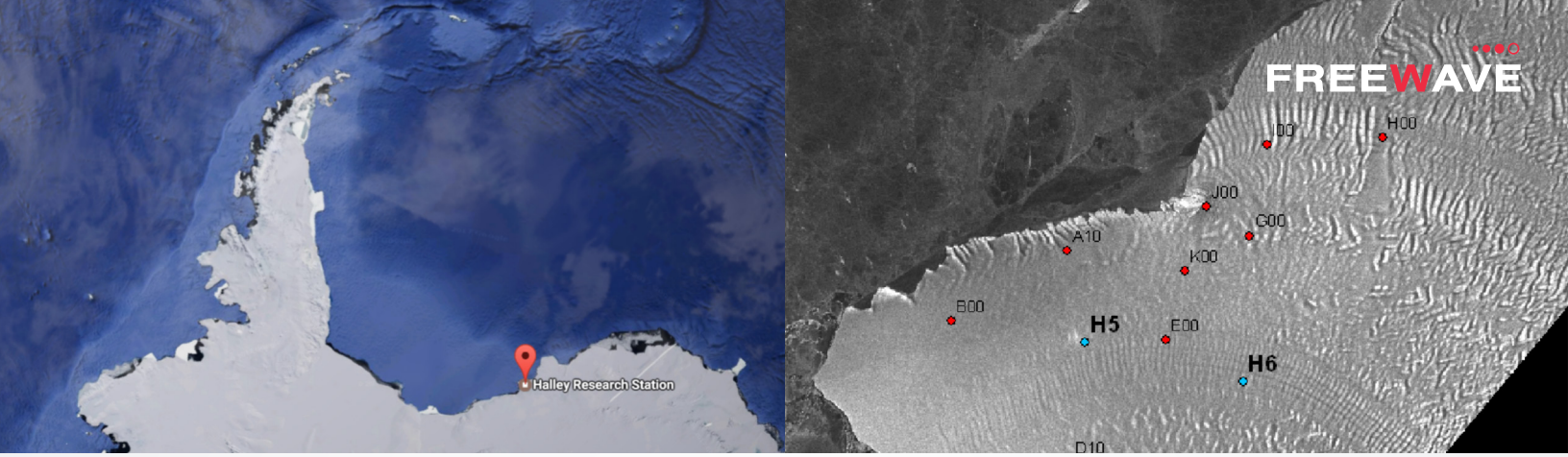


Google Maps representation of the location of the Halley VI Research Station and a satellite image (from 2011) shows the first 9 of the remote GPS systems in relation to Halley VI.

FREEWAVE: RUGGED, RELIABLE AND PRECISE WIRELESS DATA

British Antarctic Survey

Ruggedness, reliability and precision are coded into FreeWave's DNA. From the depths of the Atlantic Ocean to the top of Mount Everest and from the Alaskan tundra to the volcanoes of Ecuador, FreeWave radios have performed in the world's most unforgiving environments. With new solutions like ZumLink and WavePro, FreeWave can take your Industrial Internet of Things applications to unique and unimaginable places... even to the bottom of the earth itself (or top, depending on your perspective).

Our Customer: British Antarctic Survey

The mission statement of British Antarctic Survey (BAS) is to be a "world-leading centre for polar science and polar operations." Entrenched in this brutal region for over 60 years, BAS endeavors to gather data on the polar environment and search for indicators of global change. BAS's studies of sediments, ice cores, the polar atmosphere and ever-changing ice shelves are vitally important and help predict the global climate of the future. Indeed, BAS is one of the most essential research institutions in the world.

In addition to 2 research ships, 5 aircraft and 5 research stations, BAS relies on state of the art data gathering equipment to complete its research. From GPS equipment to motion and atmospheric sensors, BAS deploys only the most precise and reliable equipment available to generate data. Reliable equipment is vital because of the exceedingly high cost of shipping and repair in such a remote place.

To say the Antarctic studies of BAS are ground-breaking would be to put it mildly. As the research institution responsible for the 1985 discovery of a hole in the earth's ozone, the data collected by the BAS is earth-changing. And the brightest minds on earth rely on FreeWave for real-time wireless data transport.

The Application

Halley VI Research Station is a highly advanced platform for global earth, atmospheric and space weather observation. Built on a floating ice shelf in the Weddell Sea, Halley VI is the world's first re-locatable research facility. It provides scientists with state-of-the-art laboratories and living accommodation, enabling them to study pressing global problems from climate change and sea-level rise to space weather and the ozone hole (Source: BAS website).

BAS monitors the movement of the Brunt Ice Shelf around Halley VI using highly accurate remote field site GPS installations. FreeWave radios are used at

these locations to transmit data from the field sites back to a collection point on the station.

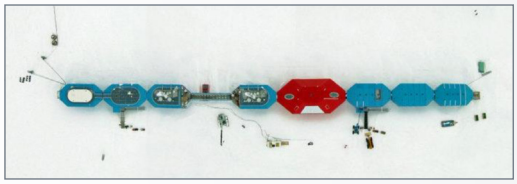
Once there, the data undergoes post processing and is sent back to Cambridge, England for analysis.

The Problem

Data transport and collection at Halley VI requires highly ruggedized, yet precise and reliable wireless communication systems to be successful. Antarctica is the highest, driest, windiest and coldest region on earth and environmental condition are extremely harsh year round. Temperatures can drop below -50°C (-58 °F) during the winter months.

Winds are predominantly from the east. Strong winds usually pick up the dusty surface snow, reducing visibility to a few meters. Approximately 1.2 meters of snow accumulates each year on the Brunt Ice Shelf and buildings on the surface become covered and eventually crushed by snow. This part of the ice shelf is also moving westward by approximately 700 meters per year. There is 24-hour darkness for 105 days per year when Halley VI is completely isolated from the outside world by the surrounding sea ice (Source: BAS Website).

Additionally, the components of the wireless ecosystem need to be low power due to the region's obvious lack of power infrastructure. These field site systems have been designed from 'off the shelf' available parts that have been integrated and 'winterized' by BAS for Antarctic deployment.



Views of the Halley VI Research Station

The Solution

BAS uses FreeWave for radios that ensure uptime and that can transport data over ice—typically a hindrance to RF communications. Currently, the network consists of 19 Freewave 900 MHz radios, each connected to a remote GPS station containing sensors that track the movement of the Brunt Ice Shelf near the Halley VI Research Station.

The highly advanced GPS sensors accurately determine the Shelf's position and dynamics, before reporting this back to a base station at Halley VI. Throughput consists of a 200 kilobit file over 12 minutes, and the longest range between a field site and the research station is approximately 30 kilometers.

Deployment of the GPS field site is done by teams of 3-4 staff using a combination of sledges and skidoo, or Twin Otter aircraft, depending on the distance and the abundance of ice features such as crevassing. As such, wireless equipment needed to be lightweight and easy to install and configure because of obvious human and material resource constraints.

In addition, the solution has to revolve around low power consumption. FreeWave radios have more than two decades of military application and many of the technical advancements made in collaboration with our military partners have led to innovations around low power consumption and improved field performance. The below image shows an example of a BAS remote GPS site, powered by a combination of batteries, a solar panel and a wind turbine.

CONCLUSIONS

- FreeWave has been a supplier to BAS for nearly a decade and has provided a reliable wireless network ecosystem in spite of nearly year-round brutal weather conditions.
- Although FreeWave's FGR2 family of 900 MHz radios are specified to work at -40°C, the transceivers perform to expectations at the Halley VI station where temperatures often go well below that threshold. Moreover, the radios perform reliably in high wind, blowing snow and RF-adverse weather conditions.
- Equally as important, the ease of setup and configuration of FreeWave radios is a big plus in an area where resources are scarce and timing is vital. The compatibility with commercial off-the-shelf accessories like antennas and cables also makes wireless install and maintenance easier for the Halley VI team.

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