

# Australia continues as telecommunications innovator

SINCE AUSTRALIANS SET UP THE WORLD'S FIRST WIRELESS link with Antarctica in 1912, telecommunications have played a big part in our far-flung Antarctic and Southern Ocean research programs. This legacy of innovation has found expression in modern times with Australia's 'ANARESAT', the world's first Antarctic satellite communications system, and with innovations in transmitting critical research data, much of it from remote transmitters in the field.

Douglas Mawson set the standard very soon after the discovery of wireless when his Australasian Antarctic Expedition set up a transmitter at Commonwealth Bay, Antarctica, and a relay station on Macquarie Island. A rotary-arc transmitter and Morse code were used to send weather information and personal messages to Hobart.

With the first ANARE to Heard Island and Macquarie Island in 1948, stations used 500-watt Morse code transmitters to send weather data and official and personal messages. Similar facilities were installed in 1954 at Australia's new Antarctic station, Mawson.

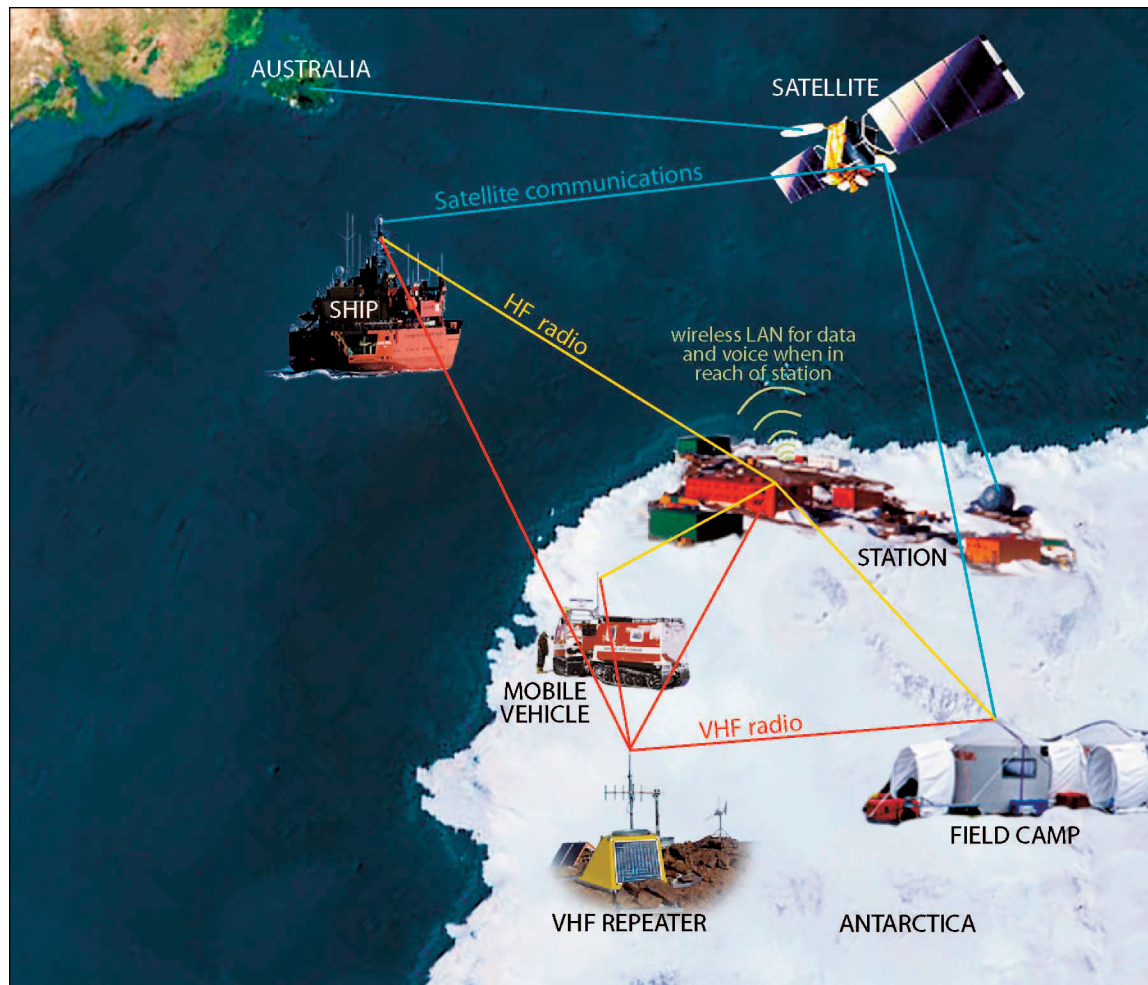
Telex transmissions were introduced in 1962 to handle an ever-increasing volume of scientific, administration and private traffic. Ten-kilowatt transmitters were

installed in 1968 and radio-telephones for official and private telephone calls were introduced at Davis and Mawson in 1969.

In 1978, Australia upgraded its radio telecommunications to HF radio when a leased 50 band telex circuit between Casey and Sydney was opened. This was a full time telegraph circuit which guaranteed error-free data transmissions, except when radio propagation conditions caused total link loss. Casey acted as a relay station for Mawson and Davis.

But HF radio had its problems. Apart from frequent interference from other radio stations, the solar influence on the ionosphere above Antarctica caused major propagation disturbances, including total blackouts due to polar cap absorption. The low-speed HF circuit severely limited the amount of traffic, at a time when there was increasing demand for picture, diagram and document transmission. Perhaps most importantly, Australian Antarctic operations were the last HF service provided by Australia's Overseas Telecommunications Commission (OTC, now part of Telstra), which wanted to close its HF service.

Satellite communications were an obvious alternative,



*A diverse and sophisticated range of telecommunications services is now available for all of Australia's Antarctic activities*

but had not previously been used in Antarctica. Terminals to connect the stations with the marine satellite communications system, Inmarsat, were set up through the mid-1980s. The Inmarsat trial proved that satellite links were more reliable alternative to HF radio for Australia-Antarctica communications. However, it also showed that Inmarsat as it was then, was costly, limited in its data capacity (though a great improvement over HF radio) and required manual connection for Australian calls.

A more acceptable satellite solution was sought and a contract was let in 1986 for OTC to supply and install a private satellite communications network between each Australian Antarctic station and the Antarctic Division's headquarters in Kingston, Tasmania. The network, known as ANARESAT, uses two Intelsat geostationary satellites to provide telecommunication links between Australia and AAD-owned satellite earth-stations at each of the four stations. A team of eight OTC engineers, technicians and riggers installed and commissioned the first satellite earth station at Davis in March 1987. Mawson was commissioned in January 1988, Casey in March 1988, and Macquarie Island in December 1988. Each earth station consists of a 7.3 m dish antenna, mounted inside a 12 m-diameter dome designed to withstand winds up to 325 km/h, and associated fully redundant electronic equipment.

Two separate systems are operated through the satellite terminal at each station – a 64 kilobits per second data circuit for the AAD's internal voice and data traffic, and a 384Kbps circuit carrying five digital voice channels connected to the public telephone network in

Sydney. An additional 64Kbps Casey-Hobart link is used by the Bureau of Meteorology for two-way transmission of satellite and other image data.

Additional satellite bandwidth to cope with larger future demands can be added to the system with minimal equipment additions, as was the case for the ABC-TV broadcast from Mawson for the Millennium celebrations. The bandwidth to Davis is being increased this year to meet additional scientific data transfer demands.

Inmarsat remains an important part of the Antarctic telecommunications system. Inmarsat-B is the primary communications medium for ships and major field camps for both voice and data. Email servers on ships enable all expeditioners to send and receive email via an AAD developed compression system, to minimise satellite costs. Smaller Inmarsat M and Iridium portable satellite phones are now often used by field parties to provide voice and data (email) communications. An Inmarsat M terminal also provides a backup circuit at each station in event of ANARESAT failure.

Phones installed in most sleeping and work areas at a station are connected to a PABX automatic switching system for both local and international (ANARESAT) calls, the latter using AAD-developed software which records all call costs.

Station computers are connected in an Ethernet local area network (LAN) using a switched 100Mbit fibre-optic backbone allowing easy access to email, printers, file servers and the Internet (via ANARESAT). The network is used to transfer batched and real-time scientific data back to Australia.

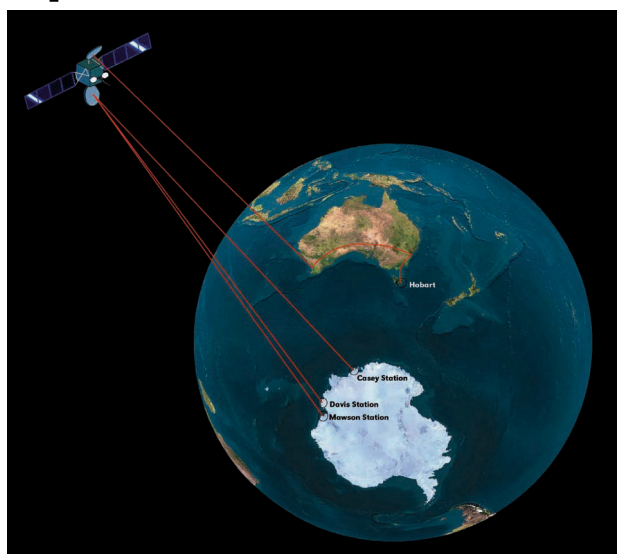
## Remote housekeeping at the press of some buttons

Mawson station, midwinter: there's less than one hour of sunlight each day, winds are blowing to 200 km/h and temperatures dropping to minus 30°C. Of the 17 expeditioners working in this isolated place, only six are tradespeople responsible for maintaining the network of large, hi-tech buildings. But they are not alone. 5000 km away, engineers monitor and control the buildings.

A building monitoring and control system (BMCS) has been installed at Mawson, Davis and Casey to improve energy efficiency (see *Australian Antarctic Magazine #1*). Among other benefits, the BMCS brings:

- reduced energy consumption
- less fossil fuels
- increased comfort and safety

Across the three stations, the BMCS utilises 120 controllers to monitor over 3500 sensors and switches and control almost 500 pumps, fans, valves and actuators. Room temperatures, pump speeds and ventilation systems at the stations are fully



PAULINE DE VOS

controllable both on station and from Australian Antarctic Division's headquarters in Hobart, Tasmania using the AAD's wide area network.

VHF radio remains the main short-range communication medium in Antarctica, with radios fitted to most vehicles, boats, aircraft, and field huts, and handheld units are used as required. Access to the ANARESAT phone system is provided by an interface unit. Solar and wind-powered VHF repeaters located on mountain tops, extend the coverage around the main station areas. A paging system using AAD-developed software has recently been installed at the three continental stations to alert key personnel to alarms and emergency situations. HF radio is still used for field parties, ships and aircraft out of VHF range with the addition of a SELCALL emergency calling system.

The AAD telecommunications group is constantly looking for ways to make an excellent system better. Current investigations and initiatives include:

- use of Iridium modems to provide real time data retrieval from the planned airfield automatic weather station network
- continued improvements to the remote email and data transfer system including the testing of HF data modems.
- ways to provide a high speed data link between Davis

and the Larsemann Hills to provide a service for China's Zhong Shan station, as well as for Australian ASP and tide gauge programs, and a satellite data link to the remote Concordia station for the Dome C astronomy project.

- replacement of ANARESAT's original TWT (valve) stages by solid state units and replacement of valve HF transmitters at the continental stations with new 1Kw solid state transceivers, both initiatives will enhance the reliability and functionality of the systems.
- development of a wireless wide-area network to enable ships to connect into the AAD network when in Hobart or at a station providing for scientific data, email and voice traffic. The system will also provide connections to some field projects. The system will use voice-over internet protocol technology, which may also be used to replace the existing station PABX systems.
- development of an airfield communication and navigation system.
- development of a transportable communications centre for major field operations.

*Peter Yates, Telecommunications Engineer, AAD*

## Safer, greener power supplies for Macquarie huts

A NEW MODULAR POWER SUPPLY SYSTEM promises a safer, more environmentally friendly way of delivering power to Macquarie Island field huts. The system includes solar and wind generation capability to minimise fuel usage in the relatively untouched Macquarie environment.

The modules are a response to a Tasmanian government report on the condition of the island's field hut electrical systems, including fuel storage, and consequent health, safety and environmental issues. The first two modules were installed last summer at Bauer Bay and Green Gorge, and three more will be delivered to Brothers Point, Hurd Point and Waterfall Bay field huts in 2001-02.

The 'remote area power systems' can generate power from three sources – petrol, sun and wind – and store it in batteries. They feature self-contained weatherproof accommodation, external to the huts, for all power needs.

The modules incorporate batteries, petrol generator, fuel storage, refuelling pumps, solar panel, wind generator using a collapsible mast, instrumentation for monitoring battery condition and charging, full electrical protection, and capacity to drop out to protect battery cells from excessive discharge.



ROBB CLIFTON

The modules can easily be transported by helicopters when necessary. An identical unit is kept at the station for training and spares. Installation is easy: they are levelled using adjustable feet, tied down with guys, the mast is raised and cables rolled out to the hut. Maintenance and access are straightforward, with all parts consistent between installations and careful attention to corrosion proof fastenings.

*Glenn Scherell, Electrical Projects Manager, AAD*