

Communications from Remote, Hostile Environments

Multi-Band South Pole Communications Terminal

L-3 Satellite Networks designed, integrated and delivered the South Pole Communications Terminal (SPCT) equipment for the National Science Foundation's (NSF) South Pole Renewal Project.

The Situation

The Amundsen Scott South Pole Station, located at the geographic South Pole, is one of three continuously staffed United States Antarctic Program research stations. The most isolated of the three stations, South Pole Station is accessible by air from the larger McMurdo Station only four months of the year. Manned by the U.S. Government National Science Foundation (NSF), South Pole Station hosts scientific research in a range of fields including global change environmental monitoring, astronomy and high-energy astrophysics.

In 2000, the NSF began a multi-year upgrade to its aging facility. Reliable communications were an essential component in the program. As in any enterprise, there has been an increasing demand for bandwidth, driven by modern scientific research and the "wiring" of the world at large. Reliable, high-bandwidth communications break the isolation of the South Pole Station to enable a productive and advanced research program, while facilitating the administrative management and human safety and welfare at such a remote outpost.

As part of its plan, the NSF decided to procure an earth station to enable communications over two highly inclined satellites, a 20+ year old MARISAT satellite (MARISAT F2) and a GOES satellite (GOES-3). The objective was to enable communications at an outbound rate of 5 Mbps during the limited period that the satellites are visible.

The Solution

NSF selected the U. S. Navy's SPAWAR facility in Charleston, SC. as project manager. In turn, SPAWAR selected L-3 Satellite Networks to design and implement the **earth station**.

The SPCT equipment, consisting of a 9 meter antenna subsystem and related equipment including HPAs (high power amplifiers), synthesized up and down converters and a band-switchable test translator, operates in



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conjunction with the MARISAT-F2 and GOES-3 satellites during the roughly 10 hours a day that the satellites are visible. The system must be highly reliable while operating in the difficult South Pole environment and operation is performed on both L-band and S-band frequencies. The system supports outbound (South Pole to CONUS) data rates up to 5 MBPS. The SPCT provides standard TCP/IP services, PSTN voice communications, remote data collection, video conferencing, email, voice mail and facsimile transmittal. These services support a range of mission-critical applications, including telemedicine, remote command and control of science experiments and transfer of scientific data.

The Benefits

- Rugged. The **earth station** is capable of operating in temperatures as low as -82.8°C with winds to 50 mph.
- Accurate tracking and acquisition at extremely low look angles. Although each satellite is highly inclined, and each is only visible for about 5 hours a day, the periods of visibility slightly overlap, so there are about ten hours of total communication time per day. The terminal must acquire each satellite as it rises above the horizon, and maintain tracking at low look angles.
- Autonomous operation. Because the satellite rise time varies over the course of the year, the period of satellite visibility will occur outside of the normal work day. Since there is no dedicated operator for the satellite system, the terminal must be capable of turning on and acquiring a satellite while unattended. Since power consumption must be minimized, the turn-on procedure includes activating a series of heaters prior to the actual satellite rise above the horizon.
- Flexible frequency band coverage. The MARISAT and GOES frequency bands cover the L- and S-bands. In addition, the MARISAT satellite is circularly polarized, while the GOES Satellite is linearly polarized. These two factors required customization of many of the system components.
- Speed. The South Pole Combined Terminal project was implemented under a tight time schedule, given the limited time during which construction activities could be completed.



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