

by Jonathan Eberhart

Illustrations: M. J. Sites and NSF

The opening of the International Geophysical Year in 1957 turned the frozen expanses of Antarctica from a deserted wasteland into a slightly populated wasteland. A few dozen scientists and a few hundred support personnel set up shop in a matter of weeks, and today more than a dozen nations send researchers to the bottom of the world, armed with communications equipment, measuring devices and other instruments.

There is a dictum in science, however, that the simple act of trying to study a phenomenon can often cause changes in the phenomenon itself, as well as in the methods required to study it further. A thermometer placed in water can itself cause small temperature changes in the very water it is measuring, forcing researchers to take the thermometer's presence into account in their investigation.

Antarctica is no exception, particularly at McMurdo Station, which besides being a U.S. research installation is also the staging area for most other

countries' Antarctic expeditions as well, and at New Zealand's Scott Base about two and a half kilometers away. To see just how serious manmade disturbances have become, one U.S. and one New Zealand researcher joined forces to measure radio noise levels at various sites within about 100 kilometers of McMurdo. What they found, reports Michael J. Sites of Stanford University's Radioscience Laboratory, was "contamination not only with radio waves, but also with lights, vibrations, earth currents and other types of interference."

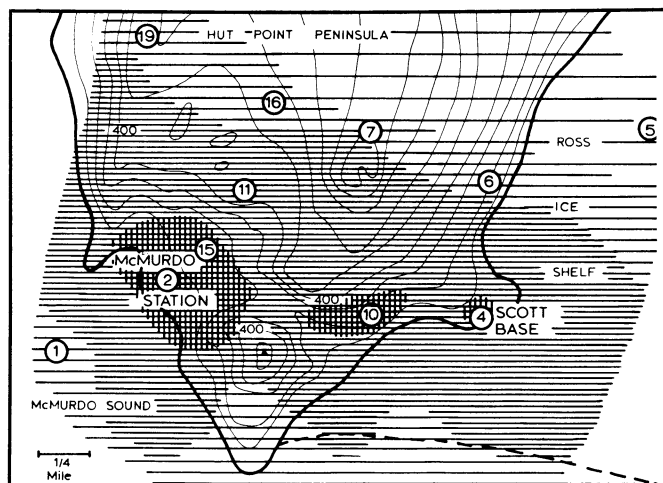
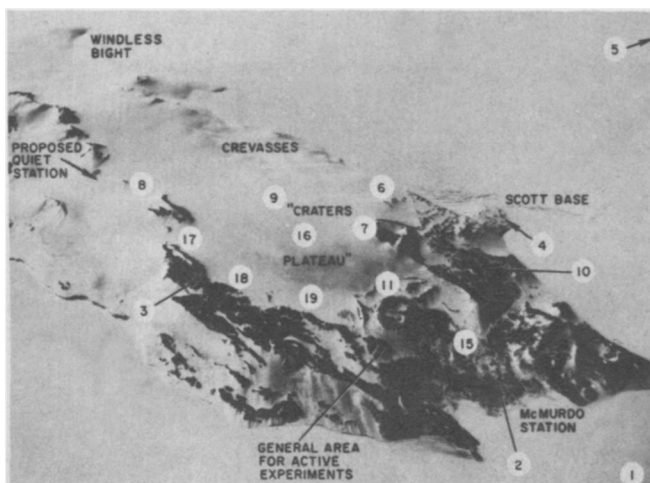
The McMurdo-Scott area is essentially a complete small town. But because of its strictly functional purpose, it is much more densely packed than an ordinary town with communications gear, nuclear and diesel power generators, welding equipment, automotive shops, power lines and other apparatus, much of it capable of producing radio interference. To make matters worse, the permafrost that passes for soil there is a poor electrical conductor, and thus provides only an inefficient ground for

the equipment.

One major noise source is the power lines, according to Sites and to George F. Stuart of the New Zealand Department of Scientific and Industrial Research. One site in the survey, a building used for cosmic-ray studies (site 10 in the illustrations), added further to the problem at the time with an apparently ill-maintained power transformer.

The vast array of communications equipment, much of it long-distance gear run by the U.S. Navy, has the most pronounced effect on the scientific instruments, but the instruments also affect communications as well as other instruments. An auroral radar installation at McMurdo caused enough interference on a cosmic-ray absorption detector called a riometer that the radar had to be confined to a fixed timetable of operations.

The survey also revealed that some of the large signal bursts detected by the riometer antenna coincided with the opening and closing of relays and



Noise level chart shows peak concentrations at McMurdo Station, its cosmic ray building and Scott Base.

solenoids in the instrument's receiver building, even though the antenna was about 15 meters away and there were no local power lines leading to the battery-operated receiver. Apparently, the noise hunters believe, much of the blame was due to poorly shielded and filtered equipment. Almost anything electrical in such a quiet part of the world can make its presence known on sensitive scientific instruments: one supposedly malfunctioning communications receiving antenna turned out to be picking up noise from a faulty refrigerator. Fluorescent lights need special insulation to prevent stray radio frequency noise. The poor grounding of the permafrost can let stray voltages flow between instruments. Vibrations from such sources as generators can be picked up by seismic monitors like those in New Zealand's Scott Base.

In 1967, New Zealand even opened a station, called Vanda, 100 kilometers from Scott and McMurdo at a site carefully chosen for its lack of unwanted radio noise and powered only by batteries charged from a wind-driven

generator. Yet even there, the surveyors discovered, some of the laboratory equipment used electrical inverters in its power supplies, which can act as sources of noise. Furthermore, the wind-driven generator has turned out to be a greater noise source than the inverters, sometimes producing peaks of more than 45 decibels above one microvolt per meter, a level which might show up as static on a commercial radio station if it were in a very quiet part of the United States.

Sites and Stuart suggest that an automatic, unmanned station in a quiet location could do away with much of the noise produced around human habitations, possibly using a synchronous satellite to relay data. (Just such a telemetry link was used last year at McMurdo with Intelsat 4.) For such a link to be truly quiet, however, would require the use of relatively low power, possibly limiting its effectiveness. An alternative would be a station with long-term data storage that could be collected periodically, but the data storage equipment likely to be available for

such an installation would probably restrict the eligible experiments to ones with low rates of measurement.

Still a third possibility would be a manned outpost designed from the ground up with quietness in mind. But tight funding will probably keep any of these approaches from fruition, at least for several years. Some scientists who have worked there, however, feel that the lack of a new quiet station is not a great problem. The really serious noise is largely confined to the McMurdo-Scott area. At other installations where the noise is evident, most experiments are not sensitive enough to be severely affected. "For the cost of that survey," says one researcher, "I'd rather have another experiment."

The cost and logistic difficulties of simply getting around in Antarctica also restrict the choice of research sites. "It is improbable," according to one polar researcher for the National Science Foundation, which sponsors the U.S. Antarctic effort, "that there are places we could reasonably move to that are that much better." □

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