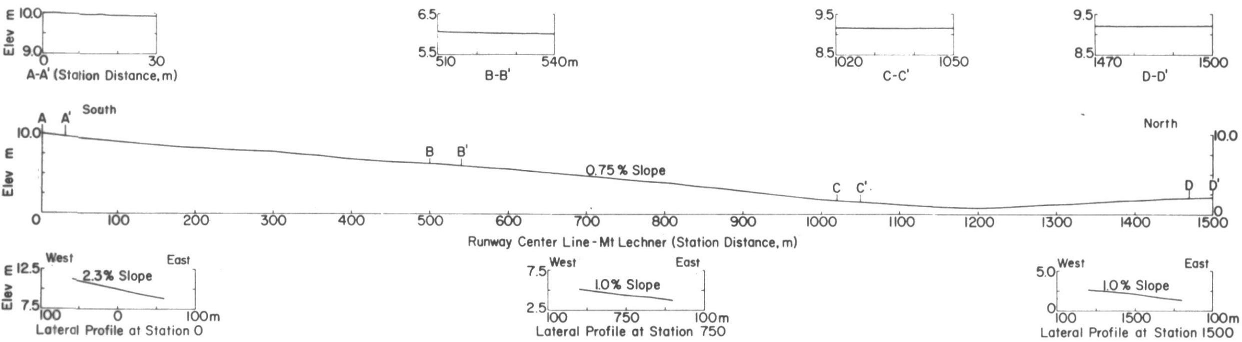

Figure 5. Elevation profiles of ice surfaces at site of runway survey, near Mount Lechner.

require a 6 percent increase in length relative to the basic required runway length of jet aircraft. At Mount Lechner, the increase in the basic required runway length would be 20 percent.

A power spectral density analysis of the two sites' ice surfaces was performed. This analysis indicates that there are weak spectral peaks of limited significance in the Rosser Ridge profile at approximately 100- and 65-meter intervals; the surface is similar to a rough road. The spectral analysis of the Mount Lechner data showed a strong peak at 75 meters; here, too, the amplitude of the roughness was not large (on the order of 1 to 2 centimeters). In short, the ice surfaces are similar to field runways.

We acknowledge the field assistance of Mr. George Erlanger. The power spectral data analysis was done by Dr. William D. Hibler, III, and Mr. Floyd Kugzruk. The field study was performed under National Science Foundation interagency agreement NSF–CA95.

Reference

Day, C. F., R. Sweeney, and T. T. William. 1973. Zero base II analysis. RMC Research Corporation. *Report*, UR–213.

Crevasse detection using an impulse radar system

A. Kovacs *and* G. Abele
U.S. Army Cold Regions Research and Engineering Laboratory
Hanover, New Hampshire 03755

During the 1973–1974 austral summer, an impulse radar system was evaluated for use as a crevasse detector. The system, a prototype of the GSSI–3000 series of down looking radar systems (Geophysical Survey Systems, Inc.), consisted of a pulse transmitter, a transmit-receive switching section, a receiver, and a graphic recorder. These components were mounted inside a tracked vehicle and occupied about one-half cubic meter of space. The antenna was incorporated into a hull that was towed over the snow surface. The beam of the antenna was designed to be broadest in the forward and aft plane of the hull (i.e. the direction of travel).

The radar output frequency of this system is 1 to 100 megahertz. In theory, a short pulse of electromagnetic energy is radiated from from the antenna into the subsurface and then is reflected from one or more subsurface horizons back to the antenna. The number of horizons penetrated depends on their electrical characteristics (i.e. their dielectric constant or conductivity). The two-way travel time then is displayed in real time on a continuous stripchart recorder in the same manner as a single-trace acoustic profiling system used for sub-bottom profiling of marine sediments. The return times may be equated to distance if the effective dielectric constant of the medium between the surface and the sub-surface reflector is known.

When used for crevasse detection, the forward-directed electromagnetic signal is least attenuated and radiates fastest through the lower density (lower dielectric), near-surface snow cover. In the case of a crevasse, therefore, the first return is reflected from a near-surface crevasse wall.

A field trial of this radar system was made on the McMurdo Ice Shelf at a 3 meters wide, snow-bridged crevasse. The antenna was pulled at a slow walk from one side of the crevasse to the other. During this trial the antenna was pulled perpendicular to the crevasse from 9 meters on one side to 12 meters on the opposite side. A graphic record of the reflected radar signal is shown in fig. 1. This record shows that the crevasse was detected when the antenna was at least 9 meters away from either wall. Similar results were obtained when the antenna was moved from any angle up to the crevasse.

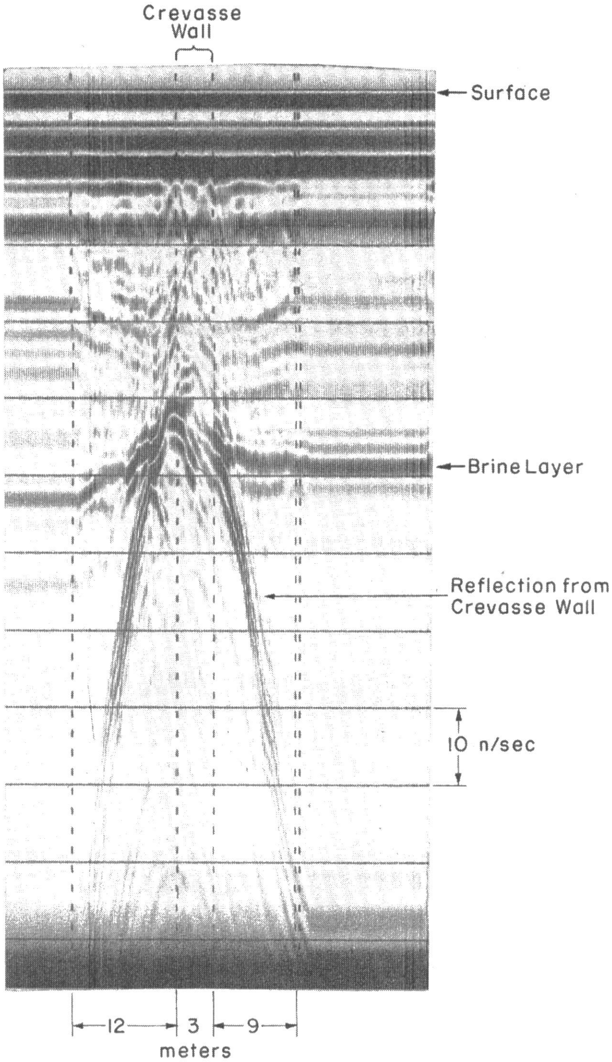

Figure 1. A graphic record of the reflected radar signal obtained with the GSSI impulse radar system when the antenna approached, passed over, and moved beyond a 3 meters wide snow-bridged crevasse. The record also shows the return from the well known brine layer in the McMurdo Ice Shelf.

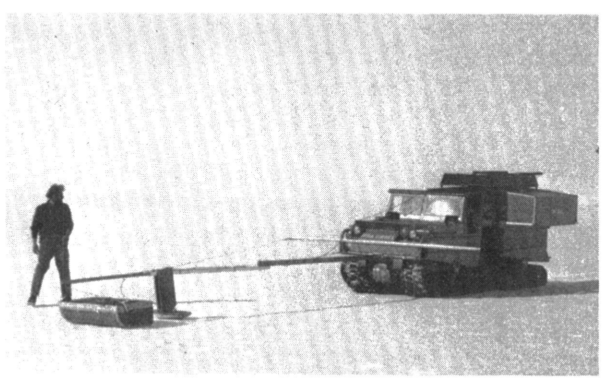

Figure 2. Radar antenna system as configured for crevasse detection during a field traverse.

When the radar system was used during a field traverse in the Pensacola Mountains, the antenna was positioned 9 meters in front of a tracked vehicle (fig. 2). This distance, combined with the radar's early detection capability, enabled the system to warn of crevasses at least 12 meters ahead of the tracked vehicle. This was sufficient time to halt the vehicle well before encountering a crevasse (vehicle speed averaged about 5 kilometers per hour). Increasing the distance between the vehicle and the antenna also increased the distance between the vehicle and the crevasse, permitting higher vehicle speeds and greater stopping distances.

While our experience with this impulse radar system was limited, the system appeared to consistently detect crevasses or cracks at least 3 meters ahead or to the side of the antenna. For this reason we think that this radar system is adequate for field party use, especially when operating heavy vehicles in potentially crevassed areas. It is suggested, however, that the system be modified to include two antennas positioned 3 meters apart and extended to distances at least 9 meters in front of vehicles. This would provide better radar coverage of crevasses being approached at angles to travel routes.

We thank Mr. George Erlanger for operating the impulse radar system, and Messrs. Frank Brier and Joe Barthelemy, Civil Engineering Laboratory, Naval Construction Center, for their field assistance.

This study was performed under National Science Foundation interagency agreement NSF–CA95.

Air operations, *Deep Freeze '74*

VERNON W. PETERS
U.S. Naval Support Force, Antarctica

With the departure of LC–130R Hercules airplane number 159131 from Williams Field, McMurdo Station, on February 22, 1974, Antarctic Development Squadron Six (VXE–6) completed its 19th year of providing support to the U.S. Antarctic Research Program. The last of five LC–130s touched down at the squadron's home—Naval Air Station, Point Mugu, California—on February 26, thus ending a seasonal deployment that began on October 29, 1973.

Austral summer 1973–1974 air operations were augmented by three new Hercules purchased for the

---

Commander Peters was commanding officer of U.S. Navy Antarctic Development Squadron Six (VXE–6) during 1973–1974.