AN ELECTRICAL CREVASSE DETECTOR

Comments on Mr. W. H. Ward's Review*

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The electrical crevasse detector, as mentioned by Mr. Ward in his review, was in service during the United States 1956-57 Antarctic operations. At that time it had its first Antarctic test and first operational use anywhere. Units built by Mr. Cook and his associates at Southwest Research Institute (Texas) were supplied to U.S. Navy and U.S. I.G.Y. parties for their oversnow traverse operations.

Extensive field testing in Greenland during 1955 (described in Mr. Cook's article reviewed by Ward) led to the construction of a prototype model tested in Greenland in 1956. The prototype, although in theory similar to the detector of Mr. Cook's article, bore little structural resemblance to earlier models. All features of the structural design were perfected to the point that the detector's electrodes were easily maneuvered 10-13 m. in advance of and by the weasel. The electrical system included an audio-visual warning system containing a graph recorder, a buzzer, a flashing light, and headphones. All were actuated by the signal intensity fluctuations obtained over a crevasse. The 1956 detector was in actuality two detectors. One system, the "Long" system, extended fore and aft of the weasel. Its electrode spacing was 13-13-13 m. The second system was the "Wide" system that detected crevasses in a 10 meter wide area perpendicular to the path of and 10 m. ahead of the moving vehicle. Electrode spacing in the "Wide" system was 3-3-3 m. The 1956 tests of the prototype led to further changes which were incorporated in the detectors sent to the Antarctica.

The first detector in use in Antarctica was employed by the Army-Navy Trail Party, an eleven man team whose mission was the establishment of a tractor route from Little America Station to lat. 80° S., long. 120° W. The latter point is the site of the U.S. I.G.Y. Byrd Station, by trail some 646 statute miles (1040 km.) from Little America.

Snow density, wetness, and the thickness of a crevasse bridge were known to affect the intensity of the detector signal. Consequently, an initial period of testing and calibration on known crevasses near Little America was conducted. When the trail party moved inland the detector traveled ahead of the other reconnaissance vehicles and the party's two 37 ton D-8 tractors. Any questionable areas were detected and probed before the heavy equipment was endangered.

Aerial reconnaissance revealed that all crevasse areas between the two stations could be avoided except a severely fissured belt at the junction of the Ross Ice Shelf and the Rockefeller Plateau. The severity of this disturbed area prevented adoption of previously developed, perpendicular approach methods of crossing crevasses. Instead, a route 8 to 15 m. wide was selected for travel between two seven mile long crevasses 39 m. deep and 7 to 30 m. wide. Within this narrow lane thirty-six large cracks and crevasses hazardous to tractor travel were encountered. These were dynamited, filled in, and suitably bridged for tractor travel. It is in this crevassed area that the detector had its greatest test and proved its immense value in oversnow trail development.

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Briefly summarized, findings of the Antarctic operation include:

(*a*) The "Long" system failed to produce consistent warning signals on approach to crevasses. No better results were obtained after extensive testing and system overhaul.

(*b*) The "Wide" system consistently recorded crevasse approaches when snow bridges were no greater than 3·3 m. in thickness. Signals obtained over bridges 3·3–5·0 m. thick could be confused with variable snow conditions and/or cracks. Bridges over 5 m. in thickness often went undetected unless a small tension fissure at the edge of a sagging bridge produced a signal.

(*c*) Optimum transmitter output and receiver input levels, i.e., those levels that produced a maximum difference between anomaly and background signal, varied from place to place with changing snow conditions.

(*d*) Study of graph records obtained over thoroughly investigated crevasses led to a series of graph pattern generalizations related to size, thickness of bridge, and direction of approach to crevasses.

(*e*) The detector is sensitive to micro-terrain surface features, e.g., differently shaped *sastrugi*, and to conditions of density, wetness, and granularity. As data are accumulated, it is possible that the detector may become an instrument for glaciological study.

The writer is summarizing the Antarctic tests, and Mr. Cook has prepared a new paper on detector development. Both will appear in American journals.

Mr. Ward erroneously suggests the undesirability of detecting snow bridges thick enough for crossing. Few snow bridges are safe for heavy equipment travel. The tonnages are large. The weight of a tractor with two 20-ton sleds approaches 100 tons. There can be no chance crossings of bridged crevasses in sustained oversnow operation. Herein lies the whole purpose of developing the electrical crevasse detector; it is in the field of large scale overland icecap operations that it makes an invaluable contribution.

Intelligently employed and combined with an aerial reconnaissance program, the electrical crevasse detector provides a rapid method of trail development heretofore non-existent.

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