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Studies of ice properties were initiated by this Laboratory in 1950 with seismic measurements of its elastic properties in the Beaufort Sea. This work was continued with the discovery of an air-coupled flexural wave in ice, the development of the physical and mathematical theory of this wave, and the experimental use of an air-droppable seismograph for determination of ice thickness from aircraft. The research on T-3 continued studies of fresh-water ice properties for many years.

In late 1954 a requirement was received from the Northeast Air Command (later absorbed into Strategic Air Command) for determination of ice thicknesses and strengths necessary for safe operation of aircraft on ice, and for a method of airborne determination of these conditions. A pilot program was started at Hopedale, Labrador, to determine and make the necessary investigations to satisfy this requirement, and was conducted jointly with the U. S. Army Snow, Ice and Permafrost Research Establishment and the U. S. Navy Hydrographic Office. This program was transferred after two years to Thule, Greenland, to study the thicker and colder ice typical of the higher Arctic. It was climaxed by test landings in March 1957 of C-97, C-124, and F-89 aircraft on an airstrip prepared on the sea ice of North Star Bay at Thule according to our research results and recommendations. The results of this program were a more realistic and valid tabulation of ice thickness requirements for various USAF aircraft and an impressive start on scientific understanding of the roles of salinity, heat conductivity, crystal structure, and loading factors on sea ice growth and strength.

Since that time we have been studying the properties and treatment of ice as an engineering material, including such factors as the use of additives to increase strength, the techniques of flooding ice surfaces to produce accelerated growth and thickness, the possibilities of making structures or airstrips from compacted, finely-ground ice particles, and methods of protecting ice surfaces from melting and erosion caused by solar radiation. Much of this work has been done in cooperation with the U. S. Naval Civil Engineering Laboratory and the Arctic Institute of North America. Field investigations have been conducted at Point Barrow, Alaska, the underwater pool at the U. S. Navy Electronics Laboratory, several lake areas in South Dakota and Houghton, Michigan, and the Climatic Laboratory of the Air Proving Ground Center, Eglin Air Force Base, Florida. We have recently initiated a contract with Massachusetts Institute of Technology for theoretical and experimental study of ice properties by their experts in metallurgy and ceramics, to guide and supplement the field studies, and a contract with Onondaga Associates, Inc., to develop an intriguing method of application of foams for preservation and protection of ice and snow surfaces from solar radiation.