LEDOVEDENIYE I LEDOTEKHNIKA (Ice physics and engineering). By I. S. PESCHANSKIY. *Leningrad: Morskoy Transport. 1963. 9 x 6 inches. 345 pages. 65 tables, 99 figures. 88 Kop.*

"The problems caused by ice must now be discussed, and for this it is first necessary to have a thorough and detailed understanding of ice and of its origins". This sentence, which sounds as up-to-date as tomorrow's newspaper, is not a quotation from Dr. Peschanskiy's book, although it appears on the fly-leaf. It was written in the eighteenth century by the great Russian scientist and scholar, Mikhail Lomonosov, who must surely have been the first man to engage in a scientific study of sea ice. It is a sober comment on the slow progress of the art that we are still only on the fringes of such a "thorough and detailed understanding", the final attainment of which is, alas, still over the hill. Dr. Peschanskiy, who is director of the ice physics laboratory at the Arctic and Antarctic Institute in Leningrad, provides in this book a good review of present knowledge, and a few ideas for the future.

The book is written for students of Marine Engineering Institutes in the Soviet Union, where it is used as a textbook for a special course on sea ice. I have translated the title as "Ice physics and engineering" since that is in the main what the book deals with. Actually however the word "ledovedeniye" means the whole study of ice in all its forms and aspects, or "glaciology" in its broad and proper sense, but I hesitate to use the word owing to the still prevalent confusion as to its exact definition. The author is himself perhaps guilty of a slight misuse of the term, as after a preliminary section on the properties of water and the freezing process, and a brief discussion of the classification of ice, he settles down to deal with one class only — ice forming on water surfaces. However, as he makes this intention very clear in the first paragraph of the introduction there is really no confusion.

The book deals with ice as a physical body, the properties, growth processes, etc. of natural floating ice covers, methods of studying ice, both in the laboratory and in the field, the behaviour of ice under load and the use of its load-bearing properties, and methods of breaking or otherwise removing ice. The author stresses the importance of studying ice in its geographical environment as well as in the laboratory and he is clearly a scientist of considerable field experience. He illustrates many of his points by actual examples.

Comparison is perhaps inevitable with N. N. Zubov's classic work "Arctic Ice" (1945), which has recently been translated by the U.S. Naval Oceanographic Office. The difference, apart from twenty years of experience, is that, whereas both books deal with the physics of sea ice, Zubov approaches the subject from the oceanographer's viewpoint and Peschanskiy from that of the engineer. Thus Peschanskiy does not touch on water circulation or the question of drift theory, which Zubov develops at some length, but he does deal with growth and decay of ice covers and includes a very interesting section on the mechanics of pressure phenomena. He also goes into some practical detail on such matters as the best use of explosives on ice, how to build ice roads and railways and how to apply dusting and bubbling techniques for melting ice or preventing its formation. Both freshwater and saltwater ice are covered.

An interesting section deals with future developments in breaking and removing ice, including a description of a new type of vessel designed by the author and two of his colleagues, Z. I. Shvayshteyn and F. D. Sokolov, for cutting channels in fast ice. Two different types have been designed and models of these tested successfully in the tank of the Arctic Institute. One, intended for such areas as the Baltic, where fairly thin ice has to be cut repeatedly during the winter, uses mechanical saws to cut a strip of ice rather wider than the vessel. The strip is then lifted up a sloping bow on a sort of conveyor belt, breaking into pieces by its own weight, and deposited on the ice on each side. The second type is intended

for the Arctic, where in early summer it is desired to break fast ice up to 2 metres thick, which will not, however, reform. It works on a similar principle but moves the ice under the vessel instead of over and deposits the pieces under the ice bordering the channel. Here the suggested cutting device is a supersonic water jet. This has apparently yet to be developed, but the author argues that if supersonic gas jets can be used in hard-rock mining it should not be impossible to develop a water jet that would cut ice.

These "ice-cutting vessels", whether they prove practical or not, represent the first serious attempt to improve ice-breaking techniques in many years and are of interest for this reason alone. They are strictly for fast-ice conditions, where conventional icebreakers are least effective.

The book is well provided with clear and useful diagrams and tables and lists fifty works of reference, of which the non-Russian examples range from Stefan (1891) through Malmgren and Barnes to Glen and Tabata, but include no recent American or Canadian works. Like virtually all Russian books it lacks an index, a deplorable omission which, however, one has come to accept philosophically as a national idiosyncracy.

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