

Arctic Engineering for the Seventies: A Philosophy

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In the past the Naval Arctic Research Laboratory has been a base of operations primarily for biological and physical scientists and has only occasionally functioned as a base for engineering research. In spite of the sparsity of engineering research performed at the Laboratory, the results have been significant. Harold Peyton's sea ice studies, carried out over a period of four years, have provided him with the knowledge necessary for him to give important advice on the designing of many of the Cook Inlet oil drilling platforms which have made possible the beginnings of the State of Alaska's leap into world prominence as a petroleum giant. The benefits of his research work at NARL during the late 1950's and early 1960's are today proving to be of major value as the Northwest Passage concept for super tankers is pursued.

In the autumn and winter of 1968, Pipe Line Technologists, Inc. in conjunction with University of Alaska engineers, directed by Professor George Knight, located a large pipe 40 inches in diameter and 1,000 feet in length near NARL for the purpose of studying the effects of permafrost on a petroleum pipe and of the pipe on the permafrost. This work is continuing at present and will certainly provide many of the criteria necessary for the design and construction of the giant of pipelines in the western world: the Trans Alaska pipeline. This project has been essentially a group effort on the part of Pipe Line Technologists, the University of Alaska, and NARL.

Having briefly discussed some of the very significant engineering research which has been carried on at NARL, I would like to philosophize for a time about arctic research. It must be borne in mind that the philosophy is that of an engineer, with regard to engineering research, and though I feel it may apply to other research — in the physical and biological sciences — professionals in some of those areas will probably not agree with me.

Recently I attended the Arctic Institute of North America's Symposium on Arctic Transportation held at Montreal. Though I found the conference extremely stimulating, I was continually appalled by the northern transportation engineering questions being posed by arctic experts from Washington and Ottawa. It was painfully obvious that so many of the experts involved in arctic programs had really not lived for very long in the country in which they profess so much interest. They actually have only a professional interest and not a living interest in the North. They and their families do not daily come to grips with the real problems of that part of the world and they and their families do not reap the fabulous personal rewards of the North. They play golf on the weekends, their children play

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football, father and son perform the loud, often exasperating ritual of watching the program on television each Sunday afternoon. So, though their professional work has to do with the North, it is seldom *in* the north and certainly their *lives* evolve around more southerly climes than that place which Robert Service spoke of as, "the great, big broad land way up yonder".

I am convinced that in the area of arctic engineering research it is absolutely necessary for the investigator, together with his family, to live in the North. After all, engineering is nothing more than problem-solving, and how can an engineer know the real extent of arctic problems if he does not acquire that true appreciation of the Arctic that is best developed by living in it, battling it, enjoying it himself. I believe that, as Alaska and northern Canada leap boldly forth into world economic prominence, the immense quantity of engineering research that must be performed in the next several years can only be performed by engineers who live daily with the problems they are attempting to solve. The magnificent new Naval Arctic Research Laboratory is certainly destined to implement this philosophy by being one of the prominent catalysts for bringing arctic engineers and arctic problems more closely together.

Now let me, having philosophized probably too much, indicate very briefly a few areas in which I feel significant engineering research must be performed and in which NARL will undoubtedly play a dominant role. Before men and families can live, as opposed to exist, in the North, it is necessary that better housing be available. We have attempted historically to use California architectural techniques, and materials, with some modifications, for latitudes of 60° and 70°. This has obviously resulted in expensive and inferior housing. Were it possible to construct a 1,200-square-foot home at Barrow for the same price per square foot as that of the new laboratory, it would cost approximately \$50,000. Certainly such a home would be extremely modest by more southerly standards. Those of us who live in the North are well aware that protected space to spread out in, particularly during darker winter months, is much more necessary here than in more temperate climates.

Obviously then, vast engineering and architectural research work must be embarked upon in an attempt to find better, more suitable designs, and more appropriate materials together with much less costly fabrication methods. NARL is an ideal base for these engineering and architectural efforts.

Recent oil discoveries in arctic Alaska and the promise of even more significant discoveries in arctic Canada, have suddenly brought renewed interest in the Northwest Passage. There is, of course, one flaw to the Northwest Passage: sea ice. If the super tanker tests planned for the summer of 1969 show the route to be feasible, 250,000-ton ice-breaking tankers will undoubtedly be constructed for year-round operation through the Northwest Passage. Such questions as large ship structural requirements, power requirements, most-economic routings taking into account distances and ease of passage, mooring requirements, oil spill difficulties, must each be studied. Though there are, perhaps, those who at present feel they have solutions to most of these problems, engineering experience shows that when a new venture of this uniqueness initially becomes operational, un-anticipated, significant problems arise and the previously anticipated problems

become dwarfed in significance. Certainly NARL and the super ships will provide excellent bases of operations for the study of and the solutions to problems associated with the very broad areas which I have indicated.

Lying ahead is more basic work on the physical and chemical properties of sea ice, perhaps with some emphasis on the possibilities of chemically changing some of the ice's physical properties; a better definition of the significance to shipping of various types of ice conditions is also needed. Finally, even the psychological factors involved in the operation of extremely large ships under unbelievably adverse weather and ice conditions during virtually continuous night should also prove to be boundlessly exciting. These problems represent difficult challenges for NARL-based arctic engineers over the next several decades.

Such problems as I have posed cannot be solved at desks, but will require combinations of field and analytical work. The existence of NARL at Barrow will continue to make it possible for the engineer and scientist to perform his field work in the Arctic, but the new structure will make more attractive the performance of the analytic work in the same area as the natural laboratory. Harking back to my earlier plea, it will keep the engineer and the problem much closer together during all phases of study and should result in satisfactory solutions to the pressing, real arctic engineering problems of the next several generations.