

The Growth of the Naval Arctic Research Laboratory

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“It is my pleasure to speak at the closing session of this symposium which has done so much to illuminate past achievements of the Navy and national research programs at the Naval Arctic Research Laboratory. The meetings have been stimulating and informative, the hospitality outstanding and my entire experience in Fairbanks and College most interesting.

“This is my second visit to Fairbanks, and tomorrow, 12 April, will be my first to Point Barrow and the Naval Arctic Research Laboratory. None of my predecessors has visited the Laboratory and Admiral Owen is only the second Chief of Naval Research to inspect a facility now with twenty-two years of history behind it. This fact indicates no lack of interest on the part of our respective offices and I assure you the research programs and other exciting developments at the Laboratory, and within the entire Arctic Basin, are followed with both interest and pride — and usually with approval. It is always gratifying to participate in the celebration of such tangible marks of progress as the opening of new and modern facilities, whatever their function. This is doubly true when the cause is that of research in an area of the world where so much had had to be done with so little. It is earnestly hoped that Parkinsonism does not now set in.

“Greatest pride, of course, must be reserved for the research accomplished; we must not let veneration of things override thought of the results and of the people who both conduct and support research. The record of the Laboratory in all respects is outstanding, and I am mindful of the hundreds of journal publications, research volumes and reports which have emerged from the program, and of the important roles so many have played to the credit of the Navy — and I hope mutually to the scientific community. This symposium has commemorated the Dedication of NARL, displayed many representative achievements, and provided guidance as to the research needs of the future. It is regrettable that not all sciences and fields of engineering which have made significant contributions could be included in the program. Time simply did not permit inclusion of all, but we have heard from a good representative sample of the sciences and the others are not forgotten.

“Co-sponsorship of this symposium by ONR, the University of Alaska and the Arctic Institute of North America is most appropriate. The University has a long and honoured history in arctic and subarctic research and many of its scientists and engineers have made outstanding contributions to Navy programs at NARL and elsewhere. Since 1954, the University has operated NARL for ONR under contract. During that time the Laboratory has made its most rapid and significant growth.

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"On behalf of the Department of the Navy, I wish to express thanks and congratulations for a job of excellence. The Institute provides the advice and guidance of its Board of Governors, Research Committee and its entire membership as needed and has, since 1953, conducted a substantial subcontract program of research for ONR. The Institute, too, has our thanks and a hearty 'well done.'

"I also wish to acknowledge and express gratitude for the fine and helpful relationships which exist between NARL and the Army, Air Force and other government agencies in Alaska. Especially, I wish to thank the Alaskan Air Command which is charged with the responsibility of operating the Base Camp at Barrow. The fine support given by the Air Command, and its civilian contractor, to the Laboratory is appreciated; in a very real measure, it supports the total national research interest, renders the tasks of NARL notably easier and, we may as well admit, results in accomplishments of research at much less direct cost to the Navy. I hope my thanks will be conveyed to the many officers and men at Elmendorf Air Base who give so generously of their time, energy and interest in assisting NARL.

"Now, I should like to turn to what I feel are a few important points to be made relative to the history and growth of NARL. Dr. Reed has given an excellent review of historical facts concerned with the development of the Laboratory. I have no wish to be repetitive or to dwell on history, but a few things should be said. From the beginning of NARL, the ONR policy has been to:

- 1) Provide facilities at Point Barrow for fundamental research in all appropriate scientific fields related to the arctic environment.
- 2) Afford facilities within the Laboratory and also facilities as a base for field studies in arctic Alaska.
- 3) Stimulate and promote basic research in the interest of national security.

"Those simple statements of policy cover a broad field and have served as excellent guidance over the years. They remain as guidelines today. For one reason or another, program emphasis has changed and will continue to do so in the years ahead, but the role of NARL is very likely to remain that of providing working facilities for research ashore and as a base for investigations in the field both at sea and on land.

"The relative weight given to the sea and land programs by the Navy can surely be stated as favouring the sea and this has always been the goal.

"Funding of NARL in FY 69 is slightly less than \$1,500,000, the highest in its history and representing a ten-fold increase over the past decade. Never has the Laboratory been sufficiently funded to handle adequately the large number of tasks assigned to it and this is no less true at this time. Yet, noteworthy growth and scientific achievement have resulted even though often with considerable hardship and excessive austerity. While growth has largely benefited the marine sciences, especially the drift station programs, others, including terrestrial research, have not been entirely neglected. Parochial views are frequently expressed in favour of one scientific field or another receiving more thorough support at the expense of others. Such hard decisions have been made on occasion and there will inevitably be others, but characteristic of the ONR policy is the attempt to share resources with all sciences and all federal agencies which sponsor or support them.

“Probably nothing has contributed so much to the growth of arctic research in the United States as the simple existence of a laboratory, which can and does attract users. This growth has been enhanced by the ONR policy of participation in the research of other agencies through the mechanism of the ONR contribution taking the form of non-reimbursable logistics services at NARL. After many years of this practice, which has in effect been a pump-priming effort for the good of all, there are signs of changing times, but I shall come back to the point later.

“It is easy to pick out deficiencies in programs and it must be acknowledged that there are many in arctic research. In a more positive sense, we can cite the many accomplishments of this research, and other attributes of the program, which place the Navy and the Nation in a much more knowledgeable position than it enjoyed 25 years ago. Although I have no intention of reciting long lists of accomplishments, a few highlights will be indicated, some of these having demonstrated pay-off of a nature unforeseen when the research was started and that, of course, is the beauty of basic research.

“Not all of the examples I cite relate to ONR or NARL attainments — other parts of the Navy also are involved in the Arctic. For example, improved sonar techniques developed at the Naval Undersea Warfare Center have enabled the Navy safely to operate nuclear-powered submarines beneath the ice. Such successes are, however, based upon many different kinds of knowledge and much of it is attributable to the basic programs at NARL and elsewhere. I am reminded of the fact that Dr. George MacGinitie, in conducting his marine biological program, was the first to find and partially describe the Barrow Sea Canyon which notches the Continental Shelf off Barrow. This valley system was used by SSN *Nautilus* in 1958 as a route of access to deep water of the Arctic Basin. Caught between the thick over-lying ice and the shallow bottom of the Chukchi Sea, penetration to deep water would have been impossible except for knowledge of the position and configuration of the Sea Canyon. Progress in determination of bathymetry and bottom topography has generally been good within the Basin and enables both improved bottom navigation and hydroacoustic applications.

“Among other Arctic Basin studies which may greatly improve operational capabilities of the Navy are physical, chemical and biological oceanography; details of ocean bottom heat flow and thermal structure of bottom water; acoustic properties and biological, climatic and ice histories as derived from the investigation of sediments; aeromagnetic and gravity surveys; surface circulation and ice drift; and many features of underwater, under-ice acoustics including long range propagation, effects of ocean bottom and ice reflectivity, signal attenuation and transmission loss in ice, ambient noise effects and biological relationships of deep scatter layers.

“Especially significant has been the determination of the arctic radiation balance. Through the research of Dr. Untersteiner and his colleagues, the relationship of heat balance to the annual ice budget is sufficiently known to enable development of a numerical model which permits computation and prediction of ice thickness and temperature for given assumptions of atmospheric and oceanic heat flux. Further refinement of this model will lead to many applications to naval operations. It has been most useful in challenging the belief existing in some

quarters that the pack ice may melt out of the Arctic Basin within a few years or decades.

"While on the subject of ice, the accomplishments of Dr. Harold Peyton of the University of Alaska should be mentioned. His studies of basic ice properties and their relationship to engineering strength have many applications to Navy and Coast Guard ship operations and design. Furthermore, his results and expertise have been widely sought and used by the oil industry in the construction of drilling platforms in ice-infested Cook Inlet. I also understand he is kept very busy by the oil interests and the Department of Transportation in their attempts to devise transportation systems for moving oil from the north coast of Alaska. All such applications resulting from Navy-sponsored research are to be applauded.

"Other research with large economic pay-off beneficial to the Navy, other military departments and to the economy, shifts our attention to the land. The extensive investigations of Dr. Robert Black, Dr. Brewer and Dr. Arthur Lachenbruch with reference to perennially frozen ground have been of immeasurable value to rational engineering practices related to the construction of buildings, roads and airstrips. Although I shall not discuss here the large number of important physical and biological programs that have taken place on the North Slope of Alaska, their importance is recognized. We are dealing with large environmental systems which do not stop at shorelines, and the understanding of these, whether atmospheric or terrestrial, is essential. Even the Navy must know much of environments over land, especially for those surfaces bounding the Arctic Basin, as many of its operations also take place ashore.

"It is predictable that current developments on the North Slope of Alaska will result in problems of pollution, and it is certainly known that, at a minimum, activities there desirable though they be are disruptive to the natural physical and biological processes of that landscape. The investigations at present conducted may provide the only record of natural, tundra environmental systems prior to the massive advent of new human intrusion. Such studies no doubt provide the only guidelines for protection of the last great frontier in the northern hemisphere. If an understanding of ecological systems and their tenuous balance effects the preservation and protection of natural systems, as I am sure it does, the Navy, as well as other agencies, will be repaid many times over for NARL's research into these matters.

"It is probable that in the course of time these attributes of our programs may yield the most in furthering the welfare of the United States. I have been told the Navy, too, has contributed its share to disruption of the tundra surface. If this is so, we have the obligation to do our share in investigating the impact of our sins and, learning by experience, to correct the old errors and avoid them in the future. We hope to continue to do our part and encourage others to do the same.

"And there are accomplishments other than those of a purely scientific nature which should be mentioned. Hundreds of people have received their first experience with the arctic environment at NARL and other northern field stations. Many have faithfully returned year after year to extend our knowledge. With them resides the principal body of expertise in arctic science, engineering and operations, and upon them the country is largely dependent for any peacetime or other

exploitation of the North. The Navy, no longer responsible for icebreaker operations, with no manned bases within the Arctic, and with only rare submarine transits under the ice, lacks any substantial training ground for personnel for arctic duty. Training received in antarctic service is no doubt transferable to northern operations in some degree, but it appears that the civilian cadre of experts is the principal resource available in time of need. It is essential that this training be continued and expanded. It is interesting that the principal Navy toe-hold in the Arctic is a research laboratory. Its record of positive response to large research support problems, efficiency of operation, magnificent safety record and maximum utilization of native manpower resources are worthy of admiration.

“During the Symposium, speakers have individually charted courses for future research in their respective disciplines. All of these are worthy of our attention and support. The course the program of any given agency may take is reasonably, but not always, predictable. Within the Navy which has its own goals and missions, it is only realistic to assume major effort must be given to the oceans. Understanding of the oceans, however, requires knowledge of interactions with the land and atmosphere and, for many compelling reasons, the Navy cannot ignore the ionosphere. This gives us considerable scope for broad and diverse programs. All aspects of dynamic environmental systems must be investigated on a continuing, long-term basis. Full application must be made of automatic, unmanned stations, additional manned stations as well as remote sensing, airborne and satellite systems which can provide required synoptic data.

“Oceanography in general, and probably no less true for the Arctic Ocean specifically, has progressed to the point that research must be based upon experiments designated to answer specific questions. A case in point is concerned with ice behaviour. One accomplishment under the ONR program is a model of ice drift relating the several forces operating on ice. A serious deficiency of the model is the lack of quantitative terms for the internal stress of the ice. Under consideration at this time is a large experiment to measure both the external forces and the resultant behaviour of the ice. Essential to this experiment is an array of three or four pack-ice stations separated by distances of 100 to 150 kilometres, furnished with all necessary equipment for measurement of environmental and ice stress as well as instrumentation for precise navigation, probably by satellite. It is hoped this experiment can be conducted within the next year or so and that several agencies and academic scientists will participate. The results of such a study will not only answer important scientific questions but will greatly improve the accuracy of ice forecasting.

“Other examples of research that are very likely to be initiated or accelerated are: 1) refinement of knowledge of the arctic radiation balance and ice budget in order to evaluate the trend of ice equilibrium thickness; 2) a major effort, probably necessarily international in scope, to determine the magnitude of mass and energy exchange between the Arctic and other oceans; 3) determination of the ratio of ice to open water throughout the ice pack and at all times of the year, such data being badly needed in support of submarine through-the-ice surfacing operations and communications, and for further evaluation of the effect of open water thermal transfer on the annual heat budget; 4) all aspects of under-ice acoustic propaga-

tion which will improve numerous applications to naval operational problems; 5) investigations of the basic physics of sea ice and development of techniques for through-the-ice communications.

"The few ideas I have expressed before digression regarding future research, and others mentioned in the course of the Symposium, all involve considerable outlays of money. The magnitude of the job to be done clearly indicates the need for increased funding, but it is well known that competition for R and D funds is very keen and there are many pressing and often conflicting demands.

"The total Navy budget for arctic work of any kind is modest, for basic research even more modest. The latter mostly resides in the ONR Arctic Program, supplemented somewhat by other ONR programs such as Oceanography. Speaking only for the ONR Arctic Program, the total expenditure, exclusive of Military Construction funding, during the 1969 financial year amounts to \$2,425,000. Of this amount, approximately \$1,440,000 provides for the operation of NARL, including operation of Drift Station T-3, and \$985,000 for research contracts and some logistics costs paid directly by ONR to other government agencies. It must be remembered, however, that ONR participation in support of research of other federal agencies is furnished through the University of Alaska budget for NARL. During the past few years, those programs have about equalled in number those funded by ONR contracts and Arctic Institute/ONR subcontracts. It must also be borne in mind, as previously mentioned, that the Alaskan Air Command furnishes the basic camp support at Barrow; this is a real and appreciable contribution to logistics costs. I shall not at this point attempt to predict the future of budgets but I do recognize the very apparent need for additional resources.

"Among the encouraging signs for the future is the modernization of the physical plant at Barrow. The dedication represents a first step, not in expansion, but in modernization and replacement of the old. The second step is already under way as pilings are now being set for the construction of an Aviation Maintenance Facility and a Radio Communication Facility. Erection of these structures will start with the late summer arrival of materials on the annual, barge resupply.

"I should like to mention that communication functions of the Navy, including NARL, will be taken over by the Naval Communications Station, Kodiak, beginning in FY 70 and at Fletcher's Ice Island T-3 in FY 71. The Navy Military Construction submission for FY 71 includes a badly needed Power Plant and Electrical Distribution System for the Barrow Camp and the Second Increment of the Laboratory Building. We shall have to wait to see how these fare with the Congress. Plans are being made for other annual improvements over the next several years and earnest effort is being devoted to the provision of suitable family living quarters. The latter constitutes a difficult problem and no estimate can be given at this time as to our probable success. I have been informed of the desperate need for family quarters and I look forward to getting first-hand information on this.

"There are several lines of evidence, both within and outside the Navy, indicative of widespread interest in arctic research. Certain of these may be taken as holding at least a promise of increased programs although some may represent only realignment of resources and changing goals. A few of these will be cited:

1) At the suggestion of the Chief of Naval Research, I requested both an evaluation of Navy arctic research and the preparation of a long range plan. Dr. Waldo Lyon of the Naval Undersea Warfare Center, San Diego, was assigned this task and I surmise many of you have played some part in the accomplishment of this plan. Dr. Lyon's report has just been received in my Office and awaits critical review and evaluation. It is expected that this report will furnish valuable guidance to future programs and will have broad implications to the research of both academic and Navy in-house laboratory scientists and perhaps NARL as well. I regret that the time is premature for further comment on this report.

2) Last year, the National Science Foundation was given the responsibility of organizing the Interagency Coordinating Committee for Arctic Research. Participation by representatives of all government agencies having arctic research interests and programs provides the means of maintaining an annual inventory of research in progress and its coordination. Other functions will be planned and assumed by the Committee as needs become apparent.

3) The National Science Foundation is planning the initiation of an Arctic Research Program as soon as the funding picture permits. We hope the Foundation will find this possible as early as FY 70. I am sure Dr. Louis Quam who, for many years, gave such good guidance to Navy arctic research and to the development of NARL will enjoy equal success in his new role with NSF. We wish him well!

4) The Committee on Polar Research of the National Academy of Sciences, has in progress an appraisal of the status of arctic research and the development of long range plans for each of the major scientific disciplines. The Glaciological Panel has published its report, including many valuable suggestions with reference to sea ice. All other Panel reports are expected within a few months and it may be fully expected that all will be sources of scholarly opinion and judgement for the guidance of program planners.

5) As a result of the exciting oil developments on the North Slope of Alaska the Department of Transportation has made a statement of policy with respect to transportation. This policy provides for "development of a transportation system in Arctic Alaska requiring public and private investment." Studies are in progress on the means of providing access to Arctic areas and to systems "capable of transporting passengers and both bulk and general cargo" as well as "the feasibility of extending the shipping season so as to permit development of ocean transportation to and from Arctic Alaska." Both government and private investment will provide a great stimulant to additional long range research.

6) The National Council on Marine Resources and Engineering, composed of officers of the Executive Branch, was formed by the President in response to Public Law 89-454, the Marine Resources and Engineering Development Act of 1966. In its annual report of 15 January 1969, the Council included statements as a point of departure in consideration of a National Arctic policy which if adopted will have broad implications with respect to Alaska and the Arctic in terms of scientific, economic, transportation, political and other interests. The report was forwarded to the Congress by the President on 17 January 1969.

7) Public Law 89-454 also directed the President to establish a Commission on

Marine Sciences, Engineering and Resources. The Commission, composed of leaders from industry, universities, laboratories, federal and state governments and others engaged in marine sciences and technology, was charged to recommend an overall plan for an adequate national oceanographic program that will meet present and future national needs. The Commission's final report, made as directed to the President, via the Marine Council, to the Congress, was submitted 9 January 1969. It makes extensive recommendations related to marine sciences, perhaps the most significant being the proposal for organization of a new agency.

"All of my foregoing examples are illustrative of increasing focus on the Arctic and of intense, new and exciting interest on the part of both government and private enterprise. To these may be added the *purely* scientific interest of those who increasingly stimulate and accomplish research. As funding proceeds on a broader national base and with greater assurance of long term continuation, there is even greater need to train the students who will carry the future research burden. In the past, there has been all too limited opportunity to bring graduate students along to fruitful arctic careers in the absence of assured futures in that area. Perhaps we will soon see some alleviation of this problem.

"In any event, there is ample evidence of ferment in the North, and in behalf of the North, and we all know of the wonderful products resulting from that process — by both biological and intellectual avenues. The impact of all developments, real or potential, in terms of the Department of Navy, the ONR Arctic Program and of NARL specifically is uncertain. The future role of the Laboratory is sure to undergo change. The Chief of Naval Research receives much advice on this score and it runs the gamut from large expansion of a valuable Navy asset to its complete abandonment as a Navy research facility. It is unlikely that either of these extreme options is in the offing. Rather I think we can expect modest growth, increased attention to programs of basic research most relevant to the Navy mission, and greater participation of other agencies, including those with their own missions as frames of reference. Perhaps the National Science Foundation can accommodate those areas of investigation unfettered by relation to any mission other than competent research.

"I have alluded several times to the fact that NARL has been operated in the past essentially as a national facility. I repeat that this policy has been effected by the generous participation of ONR in the programs of other federal agencies by furnishing the services of NARL. There are now many signs of erosion of this philosophy in these changing times. Demand has long out-stripped resources, funding is short and any responsible agency must look to its own objectives and how best to meet them. Already there is increasing necessity of reimbursement for the services of NARL and, if the broad nature of research programs so characteristic of the past is to be preserved in the future, broader funding support of those receiving the benefits will be essential. With appropriate arrangements between funding agencies NARL could conceivably become a national laboratory in fact and serve the needs of all. Such mutual participation could do much to speed the growth of facilities, including family housing and other adjuncts to civilized living which would permit longer tenure of personnel and enhance opportunities for more resident scientists and continuing programs. In this connec-

tion it has also been proposed that NARL be established as a naval facility and be operated as an in-house laboratory, but this problem has not yet reached a serious decision level. Perhaps a mix of in-house and contract research would also afford a mechanism for improved research.

“There will be many decisions to be made, but no matter what the course of events may be, prospects appear bright for the University of Alaska, the Arctic Institute of North America, the Naval Arctic Research Laboratory, scientists and engineers, and state and federal agencies — perhaps even including the Department of Navy. We shall do our best in the common cause.”

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