procedures, although involving certain mathematical manipulations, depend in the final analysis upon the forecaster's judgment of anticipated future weather developments. His construction of a prognostic chart is based upon a very careful consideration of the current diagnostic chart, and a historical sequence of similar charts, but the process of filling in the features of the prognostic chart is not entirely a mathematical computation, but is partially a matter of judgment. The day when human fallibility is completely eliminated will come only when the determination of future weather has been reduced to a mathematical process. When that becomes practicable, forecasting will have made a giant stride forward.

Role of Mathematics

Although it has been said that if expert mathematicians were to devote their talents to the problem of the weather we should soon obtain perfect forecasts, it should be realized that every weather service has excellent mathematicians on its staff—each Canadian forecaster is an honour science graduate, and most of them have majored in mathematics and physics. One fact which must be faced is that we still have a very imperfect knowledge of the state of the atmosphere at this very moment, much less of its future state. Huge voids in the weather reporting network still exist. Before mathematical formulae and techniques can be applied to day-to-day forecasting problems, we must have much more precise data concerning the horizontal and vertical distribution of the several weather variables; from this starting point we should soon be able to determine accurately the laws governing the movements and processes which take place in the atmosphere. Having satisfied these two conditions, the mathematical computations required to produce the forecast still must be capable of solution in less time than the time interval for which the forecast is valid.

Lines of Progress

These three conditions may well be solved; technically, little appears to be impossible in modern society if funds and international co-operation are freely made available. However, it is still impossible to estimate whether precise perfect mathematical forecasts will be achieved in ten or in one hundred years.

Meanwhile, progress will be made by improving present methods through research on the application of the increasing amount of available data to the problems of daily forecasting. Also, it is likely that as we improve forecasts for one or two days in advance, we shall also make headway with the problem of issuing forecasts for periods of five to ten days in advance. However, in weather forecasting the further afield we go in the matter of time the further we must range in space. Consequently, long period forecasts will only be feasible when all countries are eager and willing to work together for the common good. Even in days as foreboding as these, meteorologists are confidently looking forward to the high level of international friendliness which will facilitate their task and, of course, enable all men to enjoy the benefits of scientific planning based on accurate weather forecasts.

Research Helps Develop Industries in Nova Scotia

By H. D. Smith

THIS article is concerned with the part research is playing in the development of industries in Nova Scotia, but it will deal primarily with the functions which the recently established Nova Scotia Research Foundation has to perform in the program carried out by various governmental and private

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agencies. An attempt will be made to show how this new organization is co-operating with other Provincial and Dominion Government bodies already established in the Province, and how every effort is being made to utilize to the fullest extent the many excellent research facilities available in the Maritimes and in the nation's capital.

The scope and functions of the Research Foundation are best appreciated against the background leading to its organization. An important part of this background is the work of the Nova Scotia Economic Council which was carried out from 1936 to 1941. A great deal of credit for the excellent results achieved by this group must be given to the first secretary of this organization, Mr. Stewart Bates, present Deputy Minister of Fisheries at Ottawa, and his successor, Mr. George Haythorne. The Council has taught Nova Scotians to appreciate the value of scientific and economic research.

In 1944 the late Dr. H. M. Tory, founder of the Alberta Research Council and first President of the National Research Council of Canada, studied the reseach requirements of his native Province and reported that there was an outstanding need for an organization to coordinate and direct scientific and economic studies. In his report, Dr. Tory emphasized the need for more research of all kinds both in Canada and in the individual provinces to enable Canadian industry to keep pace with world economic progress. He stressed the importance of organized research in Nova Scotia in view of the predominance of small scale industry and the relative inability of small companies to finance intensive research.

From a purely monetary point of view, the importance of research to industry is amply illustrated by statistics made public by Canadian and United States firms in recent years. In many cases can tremendous increases in business activities be traced directly to the research of a few years. One large chemical firm for example, states that 70 per cent of its business is due to research of the past ten years, while a well-known Canadian firm gives a figure of 40 per cent for present business arising from research of the past five years. Again, a large manufacturer of petroleum products states that their laboratories were responsible for a return of 15,300 dollars for every thousand dollars put into research. One could give scores of examples such as these. The efficacy of the research laboratory in increasing the profits of an industry can hardly be doubted. In certain industries, this is as true for a small firm as for a large one.

Over 24,000 Canadian companies employ less than 50 employees. It is essential for their future prosperity that they keep to the forefront of scientific developments in their particular fields. While various federal and provincial laboratories may provide a scientific service and act as consultants for them, it is definitely to their advantage that they employ one or more research men trained to appreciate and take full advantage of the tremendous developments being made in scientific laboratories throughout the world.

The Act of 1946

To return to our topic—the new Nova Scotia research body was established under the Research Foundation Act of April, 1946. Broadly, the purpose of the Foundation is to coordinate, promote and carry out, in co-operation with established research organizations, scientific and industrial research on behalf of the Province of Nova Scotia. The general direction and control of the Foundation comes under a Board of Governors who are appointed by the Governor-in-Council for a period not exceeding three years and who serve without remuneration. The President devotes his full time to the work of the Board and the Foundation, as does the Vice-President. Included in the personnel of the Board are men well known in the fields of lumbering, textiles, steel

manufacturing, fishing, mining, agriculture and education.

Whereas the Foundation under the Act may build, equip, and staff laboratories and a library for the efficient performance of its work, its immediate policy has been to stimulate the use of available research facilities already established in the Province. To this end the Foundation has cooperated with Provincial and Federal government departments, industries, and the universities and colleges of the Province. In a number of instances, this has included the acquisition of new equipment for established laboratories. For example, the installation of the latest type of spectrographic apparatus in the laboratories of the Nova Scotia Agriculture College will render possible the rapid quantitative determination of essential trace elements in soils and crops. This powerful tool will be made available also for use in metallurgical and biological investigations and should prove of inestimable value to the industries of the province.

The Act further specifies that the Foundation may undertake research for an individual company or groups of industries wishing to avail themselves of its facilities. Financial arrangements in such instances are made according to circumstances. No final policy has been laid down but it is generally accepted that where the investigations are applicable to industry at large or offer the prospect of new industries in the Province, they may be undertaken either without or at nominal charge. It is to be hoped that industries will take advantage of the facilities of the Foundation and of the section of the Income Tax Act which provides for subscriptions to specific researches such as the Foundation might undertake on their behalf.

Close liaison is being maintained not only with other Provincial organizations but with the National Research Council of Canada. Direct contacts have been many and one member of the Board of Governors of the Foundation is also on the governing body of the National Research Council. At the inaugural meeting the Board of Governors of the Foundation has passed a resolution declaring it as highly desirable that the National Research Council locate a regional laboratory at Halifax. The Council has complied with this request, a decision which was most welcome to the Foundation. It represents a most vital contribution to the development of scientific research in the Maritimes.

Committees

During the past year, most areas of the Province have been visited and a large number of consultations held with Industrialists and business executives. These contacts have been extended at various industrial and professional conferences both in the Maritimes and elsewhere. Again, studies have been made of research organizations in the British Commonwealth and in the United States with a view to selecting and adapting the most valuable practices developed by actual experience. As part of this general program of determining research programs, the Board at a recent meeting decided to recommend to the Governor-in-Council the creation of a number of research committees. The personnel of these committees will be representative of industry, Federal and Provincial departments of government and the universities of the Province. At the present time associate research committees are contemplated covering aerial photography and mapping, coal, fisheries, forestry and agriculture. These committees will suggest problems of the various industries which should be studied and advise on the priority which should be given in various researches. In addition, a number of project committees have been initiated. They include committees on mine ropes, communication systems and hydraulic cement. These committees function on an ad hoc basis, their members are more directly concerned with the actual research than those of the associate committees.

Coal

Several meetings have been held by the Associate Committee on Coal under the chairmanship of Dr. R. D. Howland, Vice-President of the Foundation. The personnel of this committee includes representatives of labour and the coal companies of the Province, Dominion and Provincial Departments of Mines, the Geological Survey of Canada, and the universities of Nova Scotia. It may well be cited as an example of the useful and harmonious relationship that should exist in a cooperative research enterprise pledged to do its utmost for a particular industry. This capable group has planned an extensive program of research in problems of mining methods, physical and chemical surveys, the preparation and efficient combustion of Nova Scotian coals. Cognizance is being taken of the rapid progress made in the development of processes for the conversion of coal into other gaseous and liquid fuels. It is highly probable that great benefits will accrue from the investigations sponsored by this committee.

Fores ry

It is expected that the associate committees on fisheries, agriculture and forestry may enjoy a like spirit of cooperation and that great strides may be made in these industries. In forestry in particular, it is hoped that the group of experts chosen from the industry, the Provincial Department of Forestry, the Forest Products Laboratory, and the universities will outline a program of research in sawmill practice, the utilization of waste products, forest conservation and marketing of forest products, that will lead to an expansion of this industry which is so vital to the welfare of the Province. Plans are being made to take advantage of the facilities of the Institute of Public Affairs in making market surveys for this industry. The quality of the work carried out by this organization is well known, and the Foundation looks forward to continued cooperation with Dr. Richter and his colleagues.

In cooperation with the various groups mentioned above and employing facilities placed by them at the disposal of the Foundation, work has begun on some dozen projects during the past year. Personnel consisted mainly of Nova Scotia college graduates who were proceeding to advanced degrees at various Canadian and United States universities. Many of the projects were supervised by professors in departments of chemistry, physics, biology, biochemistry and engineering in the colleges of the Province. Projects were undertaken in several fields which included mining and metallurgy, agriculture and fisheries.

Mine Ropes

It is felt that worthwhile results have already been achieved in some of the studies undertaken. For example, a great deal has been learned from a study of the steel mine ropes used in the coal fields of Industries in Nova Scotia Galey 40. the Province. A group of physicists, employing facilities kindly placed at their disposal at St. Francis Xavier University, led by a former member of the staff of Acadia University, and working in collaboration with university staff members and with members of the Provincial Department of Mines, have undertaken the problem of determining the useful life of a mine rope, using the latest types of electronic equipment. Tests are now being carried out in the Sydney, Cumberland and Pictou coalfields, and efforts are being made to establish criteria for determining the safety factor of these cables and thereby render an important contribution to the mining industry in Nova Scotia. Savings of tens of thousands of dollars annually may result from these studies.

Fisheries

Gratifying results were also obtained in the problem of determining the moisture content of dried fish, a problem of great importance to the salt fish industry and of considerable financial concern to exporters to the West Indies, United

States and South American markets. Standard methods now employed in obtaining the moisture content of substances such as wood, flour, grain and other non-conductors of electricity cannot be used in the case of salt fish since the salted flesh is an excellent conducting medium. Methods now employed are time consuming and wasteful of the fish being tested. While the problem of the rapid determination of the average moisture content of the whole dried fish was not completely solved considerable progress was made in devising a means for obtaining the water content of a minute section taken from the fleshy part of the dried fish. In this case the outward appearance of the fish is not noticeably changed. Work will be carried out this summer on an attempt to correlate the readings now readily obtainable for this small section with the average moisture content of the whole fish. Attention is also being given to the question of evolving new criteria by which the moisture determination of a small section may be used to classify the fish on a quality basis. Such an investigation would of necessity be linked up with a study of all factors contributing to the delivery of a high grade product to the various southern markets.

Other Projects

A biological and economic study was undertaken at Acadia University of the extensive diatomite deposits at Digby Neck. Chemical analyses and microscopic examinations of a very large number of samples were carried out to determine the quality and quantity of diatoms present in the deposits. Economic studies included an estimate of production costs and a comprehensive analysis of potential markets. Enquiries were sent out to a large number of users of diatomaceous earth and analyses of the replies received are now being made. The necessary scientific work should be completed early this summer and it is hoped results achieved will lead to an expansion in the present industry.

Studies in collaboration with members of the staffs of Dalhousie University and the Nova Scotia Technical College, were made on moisture penetration through masonry, and the question of vapour barriers in walls. A project on the chemical composition and nutritional value of various seaweeds found in abundance along the shores of Nova Scotia is being carried out in the Department of Biochemistry, Dalhousie University. Economic studies in the fields of taxation and pensions were also made. out. A close relationship has been established with the Provincial Department of Industry and Publicity and the Foundation is rendering all possible assistance to this department in its quest for new industries for the Province.

At the request of the government, the Foundation accepted responsibility for aerial surveying and mapping in the Province. It was apparent that although some government departments used aerial photography extensively in their work, there was also great scope for its increased use by all departments and for various research purposes. An extensive survey of about 12,000 sq. miles was made during 1947 and the latest types of equipment were obtained to ensure the utmost use of the photographs. An interesting experiment being carried out in this work consists of a study of under-water conditions in shallow coastal areas. An attempt will be made to use the pictures obtained to determine the seaweed resources along our shores.

The above may serve to indicate the type of work being carried out by the Foundation. An extensive program of investigations both economic and scientific, are being undertaken by some thirty workers during the coming year. It is hoped that their efforts combined with the work of others striving towards the same goal may contribute materially to the welfare of the people of Nova Scotia.