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DEFENCE RESEARCH IN CANADA

A C.B.C. broadcast by Dr. O. M. Solandt,
Director General of Defence Research,
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Science emerged from World War II with a new importance and with vastly increased responsibilities. The Axis forces were finally overcome by the courage, skill and endurance of the fighting men of the United Nations, but it is quite clear that this victory was only possible because the scientists and engineers, who supplied the weapons to our forces, proved superior to those of the enemy. The dominant role of science in war was forcefully demonstrated in the Battle of Britain. This epic victory was made possible by the efforts of the small group of scientists who discovered in the early efforts to probe the ionosphere, the principles that led to the development of radar. The later victory against the flying bomb was similarly due to a series of important scientific developments of which the most spectacular was the Radio Proximity Fuze. Finally came the atomic bomb which forced the early surrender of Japan and which, by the very horror of its destructive power, has made all mankind seek again for some means of eliminating war.

Because of this widespread appreciation of the importance of science in war, all nations now regard research as an essential part of their national defence. Canada has given official recognition to this new place of science in war by the formation of a Defence Research organization within the Department of National Defence. As Director General of Defence Research I have been given the same status as the Chiefs of the Armed Forces.

Prior to 1939, the Canadian Armed Forces had no research organization. However, General McNaughton, a former Chief of the General Staff, was then President of the National Research Council and had already begun to direct the efforts of the Council toward war problems. Under the stress of war, research groups and organizations were formed wherever the need arose. The National Research Council, under its wartime President, Dr. C. J. Mackenzie, was active in the formation, guidance and co-ordination of nearly all these research groups, but the actual administration of many of them remained in the hands of other departments. This entire wartime research structure was set up under the Emergency Powers Act and consequently has no permanent basis.

Wartime Groups Taken Over

The first task of the new Defence Research organization has been to take over those parts of the wartime groups that should be continued in peace; to put them on a permanent basis; and to re-mould them to meet the needs of the future. I shall try to give you a broad outline of the place of this new research organization in national defence and of the factors that will determine Canadian Defence Research plans.

Try to picture the supply of new weapons to the Armed Forces as a continuous chain which begins in the laboratory and ends in battle. This chain is a complex one. In its simplest form it begins with research and progresses through design, development, manufacture and inspection, to end with use in training or in battle. It is especially necessary for engineers

to keep clearly in mind this concept of the continuity from research to use, because they are the only group who are likely to play a part in the forging of every link in the chain.

During the war, all nations were forced to draw on existing scientific knowledge and to shift the emphasis toward the later links in this chain. In Canada, because we are a young country, we have tended to do this even in times of peace. We are no longer under such great pressure to apply existing knowledge as we were during the war or in pioneering days, so we must plan for an increasing amount of relatively fundamental research in the science and engineering faculties of our universities and in industry. This emphasis on the search for new ideas is equally important in planning our Defence Research policy.

Small Organization

Canada is not a war-like nation and Canadians will not tolerate a policy which keeps a large part of the nation continually involved in preparations for war. Our primary aim in Defence Research must therefore be to set up a small organization which will make available to the Armed Forces in peacetime, all the scientific resources of Canada and of other friendly nations and which will be prepared to undertake the rapid mobilization of all these resources should war occur. In addition we will operate research establishments dealing with those aspects of military research which have little direct commercial application. This includes most applied research on weapons, explosives and military equipment. Although this function is of secondary importance, it may well use more of our peacetime Defence Research budget than does the first function because the facilities needed for research of this kind are relatively costly.

In carrying out our primary function, we will work in the closest collaboration with the Services on the one hand, and the National Research Council, the universities and industry on the other hand. The universities are the main reservoir of scientific knowledge and the source of our trained scientists. They are the foundation upon which all the other research groups of the nation are built. The relationship of Defence Research with industry must be equally close, not only because of the importance of the results of research in industry, but also because our entire research policy will be to some extent conditioned by the capabilities of industry.

Efforts To Be Limited

The choice of actual fields for research will be determined by the following factors: Canada is a relatively small country and our research resources are not unlimited. We cannot do first class research in all fields that are of interest to the Armed Forces. Our efforts must therefore be limited to a relatively small number of fields in which we can hope to do work of really first rate quality. Second rate research is not worth doing at all since its results will always be replaced by those of better work done elsewhere. Canada can safely follow such a policy of specialization because it has no aggressive intentions, and it is impossible to conceive of Canada fighting except as a member of a larger group of nations.

Having accepted the fact that Canada can safely limit her military research to a few selected fields, it follows that the fields chosen should be ones in which Canada has some important or unique resources. The resources that must be considered in this connection include the research background in our universities, skilled manpower, special industrial capabilities, distinctive experimental establishments, important natural resources and unusual features of climate and geography.

The most unusual resource of all is an original idea, and the greatest emphasis must be put on exploiting new ideas originating in Canada

Seek Peacetime Applications

It is also important to choose fields for research in which the results may have important peacetime applications. The maintenance of standing armies in peacetime is rightly justified as a form of national insurance. It is nonetheless considered by economists to be a largely unproductive use of national income. The same cannot be said against Defence Research since it produces, both directly and indirectly, much that adds to the wealth and happiness of the world. The most important peacetime benefits are indirect, but some of the direct ones are easier to comprehend and more spectacular.

Among these might be mentioned the discovery and production in Canada of an effective vaccine against Rinderpest, a deadly disease of cattle. This discovery alone may well contribute enough to the food supply of a starving world to justify the whole of Canada's wartime expenditure on research. British Anti-Lewisite was developed as an antidote for the war gas Lewisite and has proven to be most effective in the treatment of Arsenical Poisoning. The disease, Leukaemia, is now being treated by another war gas, Nitrogen Mustard. The methods and even some of the agents of chemical warfare have been applied with great success to the control of insect pests. Even the humble household moth is now the target of unrelenting chemical attack with DDT.

Arctic Research Needed

You can easily visualize the sort of research programme that will result from the application of these general principles. One example is research on the problems of the Arctic, a general field which meets all the requirements that have been laid down. A thorough knowledge of the Arctic and its problems is essential, both to the regional defence of North America, and to the normal peaceful development of the Canadian North. This knowledge can only be obtained by a well-planned long-term programme of research and exploration. Such a programme must include further mapping and charting of the little known areas of the North, investigation of ice and snow conditions, of flora and fauna, geology, mineralogy, and archeology. There is also much still to be learned concerning the general problems of living and moving and working in the Arctic.

One of the most important fields for research is that of geophysics. This includes meteorology, magnetic observations and studies of radio wave propagation. It is of great importance to us, and to other nations of the earth to know more of the meteorology of the Arctic, for it is there that much of the world's weather originates. The Soviet Union has already established many meteorological stations in the Arctic and is supplying the results of their observations to the world. There is a large gap in this system of weather stations between the Canadian mainland and the North Pole. It is hoped that this gap will soon be filled and thus complete the weather reporting system of the Northern Hemisphere. Much of this work is already going on or will be undertaken in the normal course of the work of the many government and commercial agencies interested in the Arctic. The role of Defence Research will be to co-ordinate and where necessary, to initiate work to ensure that the research needs of the Services are met.

Human Element Important

I have discussed only the direct application of science to the production of new weapons. There are two other fields of research of great importance to the Armed Forces which must be included in our Defence Research plans. The first of these is the vast field of research that deals with the human element in war. This field includes not only the prevention of disease and the care of the sick and wounded, but also the problems of the selection and training of men and women for the complex tasks of war.

Much can also be done toward adapting the machines of war to the limitations of their human operators and increasing the efficiency of the use of manpower in war. The second is the direct application of the fundamental principles and methods of science to the study of war conditions. This work, which was usually called "Operational Research" or "Operations Analysis" greatly increased our understanding of war and strongly affected tactics and even strategy. There is a great need for the application of the same methods to many social problems in peacetime.

To summarize, Canada should include research as an important element in her plans for National Defence. Research for defence should be directed toward relatively fundamental problems so that the results will be of value whatever the future may hold. The fields of research should be chosen to make use of special Canadian resources and capabilities and should, where possible, produce results of peacetime value. Such a programme will make an important contribution to national strength, but will in no way increase the likelihood of war. It is a positive attempt to foster and maintain a healthy, prosperous and secure peace and to increase the safety of the nation and of mankind in a world that is threatened by vast new forces for mass destruction.

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