on their work which has paved the way to such a satisfactory outcome.

The unanimous choice of Montreal as the seat of the Interim Organization was partly the outcome of a desire felt by the delegates to pay a tribute to the outstanding achievement of the group which represented Canada at Chicago and partly a recognition of the convenience of Montreal as a centre for International Aviation. From there now operate through military air routes to all parts of the worl and flights over these routes are of daily and, in many cases, hourly frequency. These will be transformed shortly into routes for peaceful travel and transport. The airport at Dorval is fully equipped with the latest safety devices, including radar; radio of all kinds called for in air navigation; lighting on the latest scale; runways adequate for all types of aircraft now in production; adequate hangar, passenger and freight handling accommodation and service for all types of engines, aircraft and accessories. It is the headquarters, for several Air Transport Organizations military and civil, and its importance as a centre of world air transport will increase rapidly as the world's civil air transport systems are established. There is every confidence that Canada's outstandin contribution to the United Nations War Effort in the air will be continued through into the peace. Our objectives have not changed and will remain, in the words of the Prime Minister, "an overriding interest in the establishemnt of an international order which would prevent the outbreak of another World War."

Science in War and in Peace

By J. B. Brown

THE widely-held opinion that the stimulus given by war to scientific research is of immense benefit to mankind has been challenged by no less an authority than Robert Andrews Millikan, winner of the Nobel Prize in 1923, and recipient of the Faraday Medal and other recognitions of high scientific attainment. In "Think" of August, 1943, writing on the new horizons induced by science since Pearl Harbor, Dr. Millikan said "The basic work of bringing to light the possibilities ahead in these fields had been done in all save one of them before Pearl Harbor, and in my judgment the main prospective advances which I shall predict would have come anyway and presumably more rapidly if the scientific brains and energies of the world had not been so largely diverted by the war to the perfecting of instruments of destruction which are wholly or partially useless for the arts of peace."

While after careful consideration one is likely to agree with Dr. Millikans' general statement, there is nevertheless something to be said on the other side of the case. In the first place, the research and development that are demanded by the immediate exigencies of war are seen to be carried on at an intensity, and with an awareness of their importance, that are seldom attained in peace. The organization of British and American Atomic Research is the outstanding example; as Mr. Churchill said, "The whole burden of execution, including the setting-up of the plants and many technical processes connected therewith in the practical sphere, constitutes one of the greatest triumphs of American—and indeed human—genius of which there is record." (British White Paper). Then, too, some of the objectives of war-

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time research coincide with those of peace, and from some war projects at least part of the results can be salvaged for constructive use.

What, then, has science done in this most scientific of wars, and how much of the research and development of destruction can be translated into higher standards of living and enlarged employment opportunities in peace?

Let us take stock of scientific research as it stands now at the close of hostilities, particularly in the field of physics, where the writer s experience has been.

William Bryant Conant has said that the first World War was a Chemists' War, this one a Physicists' War, and the next would be a Biologists' War. Of course, important work has been done in the last six years by the chemists in synthetic rubber production and metallurgy, for example, and by the medical workers in the use of blood plasma, and the sulfa drugs and penicillin. Nevertheless, in the main Dr. Conant's appraisal has been true, except that it now appears that the biologist may have to wait a little longer than the next war for his innings.

Submarine Techniques

Before examining the more promising scientific developments of the last years, we can write off the flame throwers and glider bombs, the gunnery predictors and the new aerial cannon, the magnetic mines and the acoustic torpedoes, as engines of Mars alone.

Maritimers may recall how a German development, the submarine "Schnorkel," or breathing tube, was responsible for renewed activity in the Battle of the Atlantic in December, 1944. The Schnorkel mast, which is a tube extending from the conning tower roughtly to the height of the periscopes, enables the submarine to run its diesel motors while under water, thus obviating the necessity for surfacing to charge batteries. The captured U-889, recently on display to the public in Eastern Canada, had travelled 1200 miles by Schnorkel on her maiden voyage. There is record of other submarines having lain submerged outside harbour entrances for longer than forty consecutive days. Using this device, the U-Waffe, which had been previously harried by new Allied depth-charge devices and aircraft radar reconnaisance, developed during this war, were once again able to sink shipping practically at the gates of Halifax itself.

At the end of the war our invading armies found already in production, but not yet in operational use, a new type of German submarine which could travel submerged at a greater speed than that now attained by our corvettes and frigates on the surface! Little of the techniques, let alone the results of such research can be salvaged for peace.

It might be thought that even though many of the weapons of war will be useless in peace-time, nevertheless the scientific methods by which war production attained its impressive volume could be applied to industry in the future. Dr. Ralph E. Flanders, president of the Jones and Lamson Machine Co., Springfield, Vermont, and president of the Federal Reserve Bank of Boston, has considered this possibility in an article on "Some Technical Developments of the War and Their Effect in Peace" in the Journal of the Franklin Institute for August, 1945. His own observation "indicates that the improvement is essentially one n war production, with perhaps no more than the usual accretion applicable to the arts of peace." He says further, "Many industrialists are in fact disturbed by the fear that man-hour production will actually be lower instead of higher" in peace time.

Progress in Aviation

Probably the first attempt to develop the aeroplane as a military weapon was made in the Spanish American War. With the sanction of Theodore Roosevelt, the War Department invited the American inventor, Langley, to adapt his flying-machine as an offensive weapon, an appropriation of $50,000 being made for the purpose. While this first attempt ended in total failure in 1903, ever since that time the development of aviation has been of great military interest. Before giving too much credit to military development, however, we should consider the great strides taken by commercial aviation, particularly between the two World Wars. The bombers and transport planes of this war—with the exception of large bombers such as Lancasters and Flying Fortresses—were adapted directly from corresponding commercial aircraft.

World War I saw the aeroplane grow sturdy wings. In World War II there has been development not only of larger, longer range, conventional aircraft, capable of flying at greater altitudes, but also of basically new types using jet propulsion. While the use of jet propulsion itself is at present limited to short-range fighter craft, the closely allied gas turbine may soon have commercial applications as a simple, easily maintained power plant. Ironically, the super high-octane gasolines developed for conventional aircraft engines early in this war may find a rival in low grade fuel such as kerosene, burned in the new jet and turbo engines. It is interesting to note that Canada has begun development work on these new prime-movers at Turbo Research, a Crown Company in Leaside, Ontario.

"Jato," the Jet Assisted Take Off, in use is made of auxiliary jet tubes fastened to a plane's wings, was developed to assist conventional aircraft in taking off from small spaces, such as carrier flight decks. It increases the flying pay-load and may facilitate the use of some smaller, peace-time airfields and harbours by large aircraft.

While on the subject of rockets, one might well wonder what peace-time use could be made of a weapon like the German V-2. Postage stamp collectors know that this question has been somewhat reversed. Several years before the War German engineers had inaugurated a rocket mail service across the Alps, and stamps from this issue are an interesting collector's item.

"Fido" is a new fog-dispersal scheme successfully used at British bomber fields. Although developed strictly as a war-time project, it may assist commercial blind-flying systems just where help is most needed, at the landing.

The operation of Fido consists simply in heating the air by burning large quantities of gasoline along the edges of the airport runway. Since warm air can hold more water vapour than can cold air, the tiny droplets of water forming the fog are turned into invisible vapour, and remain that way so long as the temperature of the air is maintained. There is actually formed a "hole in the fog" that can be seen from thousands of feet in the air. Of course the process is expensive, consuming large quantities of fuel, but it may be well worth its cost at major airports such as Croyden and Laguardia Field.

The effectiveness of this method of dispersing fog was highlighted in a humourous fashion at an R.A.F. Coastal Command Station in 1942. The pilot of a Lysander reconnaissance plane, hopelessly lost in an unexpected fog, chanced on this airfield when Fido was in operation to allow a coastal command plane to take off. Making a successful landing just as the Fido burners were being extinguished, the Lysander pilot is reported to have taken two hours in the ensuing gloom to grope his way from his machine at the edge of the field back to the airdrome control tower.

Radar

The role of radar in locating enemy aircraft during the Battle of Britain is well known. Enemy bombers were detected almost as they left the airfields in France, thus enabling "the few" to whom so much was owed by so many to do their task with an effectiveness that would not otherwise have been possible.

Radar is essentially a scheme for sending pulses of extremely short radio waves in any desired direction and then locating any object which echoes these pulses by measuring the time (and hence the distance) for them to go and return. It is somewhat as though one were to detect the presence of a building across the street in a fog by blowing a short blast on a whistle and then listening for the echo. The difference is that with the radio-waves of radar the direction and distance of objects miles away can be determined with great accuracy and speed, even more accurately, in fact, than is required for the aiming of artillery. Objects at sea, as well as in the air, can be located, as, for example, in the engagement with the battleship Bismarck in the North Atlantic.

It must be remembered that the problem of guiding aircraft in peace-time is different from that of detecting an enemy. Yet even when the aircraft are friendly, radar is a useful supplement to existing radio beams, and Canadian commercial air-lines have already obtained permission to use radar at the Montreal airport at Dorval.

The Press has recently been permitted to publish photographs of a new radar bombsight which literally paints a picture of the landscape on a fluorescent screen of the type used in television. Known as PPI (Plan Position Indicator), this form of radar has also been of great assistance to naval vessels in navigating during fog in convoy, presenting at all times a "picture in plan" of the surrounding ships and shoreline. It could give to commercial shipping, particularly coastal vessels such as have long navigated by whistle echoes, the same assistance it has rendered the Navy.

Several Canadian companies have now been licensed to manufacture for commercial use another device, based on radar principles, called Loran. Loran (Long Range Navigation) equipment is no larger than some mantel radio sets and almost as simple to operate. It has enabled bombers and naval vessels to fix their positions within a fraction of a mile in all weathers, the accuracy attained being far greater than was hitherto possible with conventional radio direction-finders.

A major obstacle to the widespread adoption of radar is its expense. The receiving equipment required for Loran use, however, is much less elaborate, and its installation on even the smaller ships and in aircraft is easily justified. It should be borne in mind, too, that the initial development work having now been done, it should soon be possible to produce the simpler radar sets at reasonable prices.

Much of the apparatus developed for generating and transmitting the ultra-high frequency waves of radar will have an application to television, an industry which will absorb some of the men trained in radar development and maintenance. Most of the training obtained by radar operators in the services, however, will be of very limited value in peace.

Canada's initial venture into the manufacture of radar equipment was made at Research Enterprises Ltd., a Crown Company, at Leaside, Ontario. Optical glass was also manufactured in Canada for the first time at Research Enterprises, such articles as range-finders, tank periscopes and binoculars being produced. Now, with war orders being cancelled, the fate of this rather ambitious Canadian undertaking is still uncertain.

Atomic Energy

Canada has also played an important part in the development of atomic energy. Towards the end of 1942 a proposal was made to the Canadian Government by the British Government that a joint British-Canadian Atomic Research Project should be established in Canada where the work could be carried on in closer touch with that in the United States and in a more suitable location than war-time England. Accordingly, a large research establishment was set up in the University of Montreal under the auspices of the National Research Council of Canada. Here Canadian scientists joined the British experts, working in close collaboration with the American group in Chicago. A large new plant, an off-shoot of the Montreal organization, has recently been placed in operation at Chalk River, near Petawawa, Ontario. There, and at Ottawa, research and development will continue in peacetime.

The most fascinating possibility of atomic development, the creation of a new source of industrial power, is at present the most obscure. Some workers in their field estimate that a large scale programme of at least ten years' research would be necessary. Recently, however, Professor M. L. Oliphant of Birmingham University, one of the earliest members of Britain's war-time atomic energy group, has made the statement that within two years the first industrial applications will be practical possibilities, and that within five years no country which lacks atomic power will rank at all in the industrial set-up of the world. As Professor Oliphant and others have pointed out, the first industrial uses of atomic power will necessitate bulky installations, and will most likely take the form of large, central plants generating electrical energy in heavily populated industrial regions. Considering the ultimate potentialities of atomic power, involving on the one hand its easier application to everyday life and on the other a possible means of interplanetary travel, one feels the thrill of being privileged to live in such an age. Even now it is possible to obtain hitherto undreamed of amounts of radioactive substances for medical use, and research into the basic laws of matter from which come the pure science of to-day and the engineering of tomorrow.

International Co-operation

In peering into the future of science we may have regard to the parts played by the various nations to-day. Germany's basic research in the physical sciences has been crippled by an exodus of her best brains during the last 15 years. Many of the scientists who were left, were forced by political embarrassments to leave university positions for industrial research, to the temporary benefit of German engineering, of course.

British science has pioneered most of our war-time developments. The first radar, the first high-speed aircraft, the new anti-submarine tactics, and much of the initial impetus for atomic bomb research have come from the Old Country. As early as 1935 it had been decided to establish a chain of five radar (then called "radio-location") stations on the East Coast of England. After these stations had taken part in the air operations of 1937 it was decided to build fifteen more, and from then on development continued apace into the war. It was only natural that the war should have brought about the development of high-speed fighter planes and extensive anti-submarine work in England first. England was also in other respects the logical place for early work on the atomic bomb, for the English scientists, particularly the group associated with Rutherford, had made the greatest contributions to our knowledge of nuclear physics. In the beginning of 1940, Dr. Frisch and Professor Peierls of Birmingham University, and Professor Sir James Chadwick of Liverpool University independently called attention to the possibility of producing a military weapon of unprecedented power, and in April of that year a committee was set up under the Air Ministry to co-ordinate work on the development of an atomic bomb.

In the meantime, however, the favoured location and wealth of resources, both in men and materials, of the United States have had their influence, and it is generally conceded that America is now the leader in the World of Science. Even in America, however, grave concern is being expressed by leading organizations such as The American Association for the Advancement of Science and The American Institute of Physics over the impending shortage of scientific personnel following the war-time interruption of training. (cf. M. H. Trytten in The Scientific Monthly, January, 1945, and G. P. Harnwell in The Review of Scientific Instruments, January, 1945).

Recent reports from Russia contain the significant news that Russian scientists played a relatively small part in war research, regarding the continuity of their basic investigations as more important. Dr. Irving Langmuir, who is well known as the inventor of the argon-filled electric lamp used in every home to-day and is a Nobel Prize Winner of 1932, has been particularly impressed by the potentialities of Russian Science. Dr. Langmuir has reported, for instance, the development by the Russians of new photo-electric cells many times as sensitive as any previously known. He has also stated publicly that in any race for the mastery of nuclear physics, such as might result from an attempt to keep the atomic bomb a military secret, he is convinced that the United States would eventually take second place to Russia. It may well be that the younger generation of Russia will take its place with that of America in the leadership of tomorrow's science.

Better Housing for Canadian Farmers

By Frank Shefrin

STUDIES of the standards of Canadian farm homes have indicated that the majority of farm families live in houses that cannot be considered adequate according to any minimum standard. Many houses are beyond repair and replacements are necessary; many need structural improvements and major repairs; many are seriously overcrowded and usually lack the most primitive plumbing facilities and even running water.

The inability of a large section of the farm population to be able to afford what is considered a minimum standard of housing is common to many countries. In Canada, farmers with low incomes are often unable to remedy their housing situation without special subsidies and building arrangements. The reasons are economic to a large degree. Many farmers live on a marginal or subsistence basis as a result of the cultivation of unsuitable land, for example, exhausted or eroded soil—adverse climatic conditions, for example, drought—lack of knowledge of good farming methods or poor management. In recognition of these special conditions, various countries such as the United States and Great Britain have taken steps to assist middle and lower income groups in rural areas in acquiring adequate homes.

In Canada, during the late thirties and the war years, there has been a slow but steady awakening of a housing conscience. This has shown itself as a growing desire on the part of the general public to see housing conditions improved.

Adequate steps to improve farm housing would advance the health and general effectiveness of the hundreds of thousands of rural people. The resulting of new construction and repairs would contribute greatly to employment and general business activity in the next few years.

Facts and Figures

What is the present housing situation? The 1941 census recorded 703,000 occupied farm dwellings in Canada, nearly all single dwellings. Almost half of these were in Ontario and Quebec, a little more than one-tenth in the Maritime Provinces, and approximately one-half in the Western Provinces. Except in Ontario, a large majority of farm homes were frame structures. Over 90 per cent of all farm homes were constructed of wood, in Ontario the proportion being 59 per cent, with brick being the other important structural material used.

Comparing the longer settled eastern provinces with those of Western Canada, farm homes and farm families in the east

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