

## CANADIAN INDUSTRIAL POTENTIAL FOR WAR

29 March 1950

## CONTENTS

	<u>Page</u>
INTRODUCTION--Brigadier General J. L. Holman, USA, Deputy Commandant for Education, ICAF.....	1
SPEAKER--Mr. James R. Donald, O.B.E., President, J. T. Donald & Co., Ltd.; and President, Donald Inspection Ltd.....	1
GENERAL DISCUSSION.....	14
CHARTS--1. Production of Selected Raw Materials, 1935-1945.....	21
2. Value of Canadian War Production in the Major Programs, Half Year Totals 1939-1945.....	22
3. Sources and Disposition of War Man-Power.....	23
4. Estimated Distribution of Canadian Labor Force.....	24
5. Active Service Strength of the Canadian Armed Forces.....	25
6. Distribution of War Employment at Peak 1 Oct. 1943...	26
7. Percentage Distribution of Manufacturing War Employment 1 July 1943.....	27

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GENERAL HOLMAN: During World War II, the United States was frequently referred to as the "Arsenal of Democracy"—the great provider of munitions for all nations waging war against the Axis Powers. What too few people realize is the part played by our northern neighbor, Canada, in providing the allied forces with the sinews of war: food, forest products, minerals and metals, railroad equipment, trucks, ships, ammunition and explosives, training aircraft, and so on. Of even more importance is the present and future economic potential of Canada.

We have been most fortunate in securing as our speaker to talk to us on Canada a man with many years of experience in the industrial world as a chemical engineer and consulting chemist. In the field of industrial mobilization, he was one of the original members of the Joint War Production Board set up under the Hyde Park Agreement and Chairman of the Canadian Section of the Joint Subcommittee on Chemicals and Explosives. Currently, he is a member of the Industrial Defense Board of Canada and adviser to the Minister of Trade and Commerce.

It is indeed a pleasure to welcome to the College, Mr. James R. Donald, who will speak to us on "Canadian Industrial Potential for War." Mr. Donald.

MR. DONALD: General Vanaman, General Holman, members of the College, guests: I want, first of all, to thank General Holman for his very kind introduction.

I was very much flattered, indeed, to be asked to address such a very distinguished audience. I felt justified in accepting the invitation, for a number of reasons. In the first place, as a Canadian, I felt it was an opportunity to tell you something of Canada, both in your interests and in the interest of Canada. In the second place, I realized that, in the event of war, the audience I am addressing would have very vital and heavy responsibilities. Finally, it permits me, in a very small way, to express my appreciation of the assistance and cooperation I have always received from many of the supply officers of your armed forces, particularly during the 1939-1945 war period. If time would permit, I could tell you some very interesting happenings which took place behind the scenes.

Our subject today is "Canadian Industrial Potential for War." As you know, Canada is a relatively small country in point of numbers, although large in terms of territory. I need hardly tell you that a population of 13 million can mobilize only a relatively small army,

particularly when compared with that of the United States, although the requirements of such an armed force are very numerous and complex. Moreover, the Canadian economy is largely based on primary products, with a relatively small percentage of the primary products consumed in Canada. Our secondary industries, while extensive and important, are nothing like as varied as yours, and many of our requirements, consequently, are imported from the United States. As a matter of fact, it is generally assumed, as a rough, over-all figure, that Canadian production has a United States dollar content of about 15 percent. The economies of the two countries are closely integrated, and many of our larger industries have been developed by American capital and are subsidiaries of or closely connected with American corporations. An independent war effort by Canada, without the economic support of the United States, would, therefore, be subject to very severe limitations.

In our discussion today, I think it is necessary to make a number of assumptions. In the first place, I think we must assume that any major war will inevitably involve both Canada and the United States as allies. Secondly, we must assume that any such war will be total warfare, requiring all the resources the two countries can provide. Thirdly, from our joint experience in the last war, I believe we should assume that, in the final analysis, the limiting factor in the war effort will be manpower and supply of primary materials--more particularly, metals, fuels, rubber, cellulose, basic chemicals such as sulphuric acid, ammonia, alkalies, chlorine, and certain basic organic chemicals obtained from the coal-tar industry and the new petro-chemical industries.

As a first step in our discussion of the Canadian industrial potential for war, I think we can, with advantage, review the Canadian economy in general, and I would like to do so by referring to this large-scale map of Canada (exhibiting). (Map was not reproduced.)

The greater part of the population of Canada is settled along a relatively narrow strip immediately north of the United States border, stretching from the Atlantic to the Pacific. Within this strip of varying width are to be found most of Canada's industrial plants. To the North are to be found some of the major primary producers, notably pulp and paper and mining. However, the greater part of Canadian industry, especially secondary industry, is located within this strip. The geographic reason for this distribution lies in the fact that the more northern part of the country east of the Rockies lies within the area of the Pre-Cambrian shield, much of which is rough, rugged country not particularly adapted to agriculture, but which is good mineral-prospecting country.

On the extreme east lies the Island of Newfoundland, which recently became the tenth province of Canada. Some of you probably

know Newfoundland very well as a result of war service there. Its strategic position, as the most easterly part of North America at the entrance to the Gulf of St. Lawrence, is obvious and well demonstrated by the bases you have established there.

Industrially, Newfoundland is basically a supplier of raw materials. The Wabana iron deposits, located on an island just off the Avalon Peninsula, constitute a large reserve of hematite iron ore containing about 52 percent iron. This ore can be directly loaded into ocean vessels and shipped by water. The reserves are large and are estimated at not less than 3 billion tons, with a present annual mining capacity of about 1.5 million tons. Normally, this ore finds a market in Europe and in Canada.

In the center of Newfoundland, at a place called Buchans, there exists an important mining operation producing lead, copper, and zinc concentrates, which are shipped by rail and ocean transport to world markets.

There is also an important pulp and paper industry supporting two large mills producing newsprint and sulphite pulp. The plant at Corner Brook on the west coast is reputed to be the largest newsprint mill in the world, with a daily capacity of something over 1,000 tons.

In addition, there are important fluorspar deposits and some other minerals of importance.

The secondary industries are minor in character, as would be expected with a total population of only some 350,000, the majority of whom are dependent upon fisheries.

The Island of Newfoundland is deficient in fuels, and, except for the local timber supply, all fuels must be imported.

Immediately west of Newfoundland and south of the Gulf of St. Lawrence lie the Maritime Provinces--Nova Scotia, New Brunswick, and Prince Edward Island. Bordering on the State of Maine, their geographic and climatic conditions are not dissimilar to those found in northern Maine. Their population comprises some 1.3 million persons.

On Cape Breton Island, at the extreme northeast of these provinces, is situated the important steel-producing center of Sydney, utilizing the coal deposits also found in this area and iron ore from the Wabana deposits of Newfoundland. Steel ingot capacity of these operations is in the order of 825,000 tons per year, and at Sydney and New Glasgow well-equipped rolling mills and foundries produce a wide variety of steel products. This is the only steel capacity which derives both fuel and ore from Canadian sources.

Coal-mining operations at Sydney and at other points in the Maritimes, more particularly at Pictou and Springhill, are the only Canadian source of coal east of the Prairie Provinces and constitute a most important factor in the Canadian economy. Maximum coal production from existing operations in this area is generally considered to be some 7 million tons per year. This coal finds its market in eastern Canada via the St. Lawrence Waterways. The industrial area of eastern Quebec draws upon this source, and some of this coal moves up the St. Lawrence as far west as Toronto. Coal production of the Maritime Provinces is, however, inadequate for the needs of Ontario and Quebec, which are in the order of 30 million tons a year. Over 90 percent of this requirement has come from the United States in recent years.

A large pulp and paper industry is also established in the Maritime Provinces, and there are salt and gypsum deposits which can be made the basis of certain chemical production.

Secondary industries based on the steel production also exist and are important suppliers of secondary steel products.

The Maritime Provinces also contain the important shipping centers of Halifax and St. John, which are open all winter when the St. Lawrence Waterways route is closed. There is also a shipbuilding industry at both these places.

To the north of the Gulf of St. Lawrence lies the large undeveloped area of northeastern Quebec and Labrador. In this area are to be found the newly discovered and extensive high-grade iron-ore deposits, which promise to become an important source of iron ore for this continent. The latest figure on proven reserves is in the order of 360 million tons of 60 percent iron content, with much larger reserves of somewhat lower grade. Immediate plans call for commencement of production in about five years' time at the rate of 5 million tons per year. If the St. Lawrence Waterways were completed, a doubling of that production to about 10 million tons per year would be anticipated.

In this same area, at Lac Allard, are the new, large titanium-ore deposits, which are being made the basis of the development of titanium oxide production at Sorel. This operation--the mining of the ore and the recovery of titanium from it--is commencing this year. The plant consists of five electric furnaces of 18,000 kw capacity and will produce 1,500 tons a day of titanium slag containing 75 percent titanium oxide and, as a by-product, about 6,700 tons a day of pig iron for steel. The first furnace is coming into operation in October of this year, and the balance will be in operation in about a year's time.

As we proceed westward, we come to the Lake St. John area in Quebec, which is famous for its large aluminum and pulp and paper industries based on the large hydroelectric developments of that area. Plants of the Aluminum Company of Canada here located have an annual-rated capacity of some 500,000 tons of aluminum. During the last war they achieved a maximum annual capacity of some 496,000 tons, which represent a substantial proportion of the total world capacity for aluminum. I believe United States capacity is in the order of 800,000 tons a year. The raw material for this aluminum production is bauxite, imported largely from British Guiana. New deposits are now being developed in Jamaica by the Aluminum Company as an alternative source of supply. The maintenance of this bauxite supply, as you can readily see, becomes of vital importance in the event of war.

Farther to the west and in the St. Lawrence Valley, reaching from Quebec on the east to Lake Huron on the west, is to be found the great industrial area of Canada, with a population of some 7.5 million. This area is well supplied with hydroelectric energy, has a sound agricultural industry, and in this general area are located many of Canada's largest industries, both primary and secondary.

Based on the hydroelectric power and pulpwood supplies, there is a large pulp and paper industry, producing mainly newsprint but also high-grade pulps of different types, and fine papers.

South of the St. Lawrence, not far from the United States border, are located the well-known asbestos deposits, which produce a large percentage of the world's asbestos supply.

Potential hydroelectric power sites on the St. Lawrence and elsewhere insure future supplies of electric energy.

At Hamilton, on Lake Ontario, there is established a large steel industry with an ingot capacity of some 1,105,000 tons a year and mills equipped to produce many of the secondary steel requirements. This plant is largely dependent upon both American ore and American fuel.

In this area are also to be found copper refineries, rolling mills, chemical plants, automobile and aircraft factories, and the diverse production of modern industry.

Large oil refineries are located at Montreal, Toronto, and Sarnia, supplying eastern Canadian requirements of fuel oils and refinery products. All these operations are dependent upon imported oil. The refineries at Montreal draw their oil supply from world markets via the St. Lawrence Waterways and the pipeline from Portland to Montreal. At Toronto and Sarnia, crude oil imports are mainly from the United

States. The Sarnia plant of Imperial Oil Limited is connected by pipeline with the pipeline systems of the United States to the South.

Important chemical developments in this area include sulphuric acid plants, alkali and chlorine plants, synthetic fiber plants, a large synthetic rubber plant at Sarnia based on raw materials from the oil refinery there, cyanamide and synthetic ammonia plants, fertilizer plants, and so on. The sulphuric acid industry makes use of pyrites produced in Canada as a by-product of other mining operations and of elemental sulphur imported from the Texas area in the United States. The alkali and chlorine industries utilize salt from the Niagara Peninsula deposits, which are a continuation of the salt deposits also found under Detroit.

At Sorel, as I already mentioned, just east of Montreal, is the new titanium production.

At Shawinigan Falls is located a large chemical industry based on production of calcium carbide, making use of the relatively cheap hydroelectric power available at this point. The present rated capacity for calcium carbide is in the order of 200,000 tons per year. Also at Shawinigan Falls there is located, so far as I know, the only plant in North America for the production of acetylene black, an essential ingredient of modern dry batteries.

Another important unit of chemical industry is the plant at Niagara Falls in Canada, utilizing cyanamide as a raw material and producing nitroguanidine, as essential constituent of the new type of flashless propellants. This plant, also, so far as I am aware, is the only source of this important chemical in North America.

At Valleyfield, near Montreal, is located the large military explosives plant erected during the war, which is now being maintained as part of the Canadian defense program. This plant is equipped to produce propellants and high explosives. At Quebec, east of Montreal, we have an arsenal producing small-arms ammunition. Just outside Montreal we have a large shell-filling plant, which is also being maintained as part of the Canadian defense program.

To the north of this large industrial area lies the important mining territory containing some of Canada's most important metal producers. In northwestern Quebec are to be found copper, zinc, and gold producers, with a large copper smelter located at Noranda. Copper from this smelter is refined in the Montreal area.

At Sudbury, farther west, are the large mines and smelting operations of the International Nickel Company, which supply some 90 percent of the world's requirements of nickel, as well as a large

production of copper. Also recovered from these operations are important quantities of the platinum group of metals.

At Sault Ste. Marie, lying between Lake Superior and Lake Huron, is established Canada's third large steel plant, with an ingot capacity of some 1 million tons a year.

North of Lake Superior lies rough Laurentian country dotted with lakes, sparsely settled, but containing important pulp and paper mills and some important mining operations. Its industrial potential, from a war standpoint, is mainly in its pulp and paper industry. There is also some iron-ore production at Steep Rock, which is becoming increasingly important in making Canada less dependent on imported iron ore.

To the west of the lakes and east of the Rockies, stretching north from the United States border, lies the great prairie basin, long noted for its agricultural production, and with a population of about 2.7 million.

The prairies are bounded on the north by the Pre-Cambrian shield, in which important mineral resources are located. For example, some 1,100 miles north of the United States border and just outside the Arctic Circle on Great Bear Lake are to be found the famous Eldorado uranium mines, the most important source of uranium on this continent.

In Saskatchewan and Alberta is found one of the large coal reserves of the world. The coal varies in quality from lignites in the East to high-grade bituminous and semianthracite in the foothills of the Rockies to the West.

For many years Canada's only major oil field was located at Turner Valley in southern Alberta. However, more recently, in the Edmonton area a little farther north, extensive new oil fields have been discovered, which constitute the greatest postwar industrial development in Canada. Although only under development for some three years, it is now believed that these oil fields will rival those of east Texas. In addition to the oil fields, the oil sands, some 300 miles north of Edmonton, constitute a further important potential petroleum reserve.

In Alberta there also exist large quantities of natural gas, and proposals are now being made for the transmission of this gas east, west, and south. While various estimates have placed the present known natural gas reserves at some 7 trillion cubic feet, potential reserves are considered to be very much larger.

The Province of Alberta, bounded on the west by the Rocky Mountains, is unusually rich in natural resources. In addition to the prairie

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agricultural land, coal, and oil referred to, hydroelectric power is available from the rivers on the eastern watershed of the Rockies, and also various economic minerals are to be found.

The industrial development of the prairie Provinces to date has not been great. The city of Winnipeg in Manitoba, the third largest city of Canada, is a great transportation center, one of the largest on the continent. In and around Winnipeg are to be found substantial industrial developments. Flour-milling and packing-house industries constitute the largest units, but there is also a large secondary industry supplying the needs of the prairie Provinces.

During the war, a large propellant plant erected adjacent to Winnipeg was very effective in operation, but it has since been dismantled.

At Flin Flon in northern Manitoba, on the border of Saskatchewan, is located the Hudson Bay Mining and Smelting Company, an important producer of copper and zinc.

In general, the industrial development of Saskatchewan is relatively limited, but occurrences of salt beds and potash deposits in the prairie basin are potential sources of new industry.

At Calgary in Alberta is a synthetic ammonia plant established during the war, using natural gas as a source of hydrogen. This plant, now a fertilizer producer, is an important asset in Canada's industrial war potential.

The availability of petroleum, coal, electric power, and salt, together with hydroelectric energy and low-priced natural gas, provide the necessary foundation for a wide range of industries. It seems probable that the natural resources of Alberta will lead eventually to an industrial development paralleling that in your Southwest, provided that the markets for the products exist.

West of Alberta lies the Pacific Province of British Columbia, which in recent years has seen the most rapid growth in population of any part of Canada. British Columbia is noted for its fishing industry, its forest resources, and its mining. It has a large pulp and paper and lumber industry located on the mainland and on Vancouver Island. An important shipbuilding industry also exists in Vancouver.

At Trail in the interior of British Columbia, near the United States border, are to be found the large smelting operations of Consolidated Mining and Smelting Company of Canada, based on ore produced at the Kimberley mine near-by, where one of the great lead and zinc deposits of the world is located. This smelter has a production

capacity of some 250,000 tons of lead a year and some 165,000 tons of zinc, with production of smaller quantities of various other metals found in the lead-zinc ores. Large hydroelectric installations supply these operations with power, and there is a large water-power reserve in the general area.

In addition to its metal production, Consolidated Mining and Smelting Company has built up a large chemical operation, with sulphuric acid production in the order of 1,200 tons a day and ammonia production of some 250 tons a day. While these products normally find their way into the fertilizer markets, they constitute an important potential war capacity. Part of the ammonia is manufactured from electrolytic hydrogen, which makes this plant an important source of heavy water.

In and around Vancouver on the Pacific coast, the largest city in British Columbia, are to be found substantial secondary industries supplying the needs of the province.

British Columbia has large reserves of water power, and these are presently being considered for a possible expansion of our aluminum industry.

To sum up:

We have in Canada three steel plants, located at Sydney, Nova Scotia, and Hamilton and Sault Ste. Marie, both in Ontario, with a total ingot capacity of some 3 million tons a year, and a milling capacity to convert to secondary products--rails, sheets, structural plates, forms, and so on. The plants located at Hamilton and Sault Ste. Marie are dependent upon American coal and largely dependent upon American iron ore. The over-all raw-material picture has been that we export some 2.25 million tons and import some 3.5 million tons of ore a year, mainly for geographic and transportation reasons.

Our zinc refineries, using Canadian ore, produce some 210,000 tons a year.

We are one of the main lead suppliers of the world, with a capacity of some 250,000 tons of lead a year.

We are supplying some 90 percent of the world's nickel requirements from the Sudbury ores.

Our aluminum industry, with a capacity of some 500,000 tons a year, represents some 25 percent of the world capacity.

Our asbestos mines are one of the world's main sources of supply, with a production in the order of 700,000 tons a year.

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The uranium ore resources at Great Bear Lake are a vital factor in the North American atomic energy program, whether for peace or war.

We are an important producer of the platinum group of metals and also of gold and silver, although the latter are not usually considered as vital to war production.

Our pulp and paper production exceeds any probable wartime demand which may be made upon it.

In the basic chemical field, we have a large production of sulphuric acid, in the order of 800,000 tons a year; a synthetic ammonia capacity of 220,000 tons a year; and an alkali industry producing substantial quantities of caustic soda, chlorine, and sodium carbonate.

Based on hydroelectric energy, we have a large electrochemical industry. Our calcium carbide production is large, and we produce substantial quantities of ferroalloys and other electric furnace products.

We also have a synthetic rubber production, with a capacity of some 50,000 long tons a year.

Many of these primary industries are based on export, the Canadian demand being only a small portion of the total.

In eastern Canada we have a coal-mining capacity of some 7 million tons a year, which, however, is insufficient to supply eastern Canadian requirements. In Saskatchewan, Alberta, and British Columbia we have enormous reserves of coal, but mining operations are limited to the demand from British Columbia and the prairies and a small export demand from the United States. Our deficiency of coal in Ontario and Quebec amounts to some 28 million tons a year and is made up largely by imports from the United States. Currently, oil is replacing some of this coal demand.

Until recently, practically all Canada's petroleum requirements, now amounting to some 110 million barrels a year, were imported. The discovery of the new oil fields in Alberta is rapidly reducing our dependence upon foreign sources of oil. There is reason to believe that the oil resources of western Canada may prove to be one of the great oil reserves of this continent. The significance of this development in relation to world petroleum supplies and war potential is self-evident.

The natural gas reserves of Alberta provide a large source of cheap fuel, which can be made the basis for an expanded industry or be distributed by pipeline to other areas.

We have a large secondary manufacturing industry, mainly centered in the Provinces of Ontario and Quebec and principally supplying Canadian requirements but also a substantial export demand. It was mainly this secondary industry which produced the large volume of munitions which Canada supplied to the allied cause in the recent war and also the supplies of all kinds required in the war effort.

To attempt to detail this secondary production is too large a subject for a lecture of this type. In the last war the munitions manufactured included merchant and naval vessels, aircraft, mechanical transport, armored fighting vehicles, guns and small arms, gun ammunition, small-arms ammunition, chemicals, explosives, instruments and signals, miscellaneous military stores, and so forth. At our peak production, the estimated total value of these munitions ran to 3 billion dollars a year.

Combined with the resources outlined, we have two transcontinental railway systems, with a network of connected railway lines serving the populated areas and the primary industries, and connected with the American railway systems to the South. An extensive system of highways is found throughout the country. In addition, we have the St. Lawrence Waterways and the Great Lakes, a common transportation system to both Canada and the United States. Other rivers and canal routes connect New York State and the New England States with Quebec and Ontario. Our air transport system provides a trans-Canada service and adequately serves the population as a whole. The strategic importance of Canada's airfields in Newfoundland and elsewhere in relation to world air transport is generally recognized.

During the last war, the transportation system successfully met the heavy demands placed upon it.

Above all, we have an energetic, intelligent, and skilled population, with an industrial machine far in excess of the Canadian consumptive capacity. Moreover, Canadian industry uses common engineering standards with the United States, and most of the production is interchangeable.

I would now like to show you a few charts throwing some light on Canada's munitions capabilities as shown in the last war. Charts are assembled back of lecture in same order as reference is made to them.

First chart—"Production of Selected Raw Materials"—summarizes some of the primary production we have been talking about. You will note how sharply, for instance, the aluminum production fell off when the wartime demands disappeared. A great deal of our other production, however, has pretty well held up.

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Second chart—"Value of Canadian War Production in the Major Programs"—shows the dollar value of Canada's war production in the major programs by half-year totals.

Third chart—"Active Service Strength of the Canadian Armed Forces"—shows the active service totals we developed—Navy, Air Force, Army, and the grand total. It illustrates the point I made about the relatively small armed force Canada can raise, as related to the United States figures.

Fourth chart—"Estimated Distribution of Canadian Labour Force"—shows the distribution of the labor force during recent years. You will notice war manufacturing coming up from 1939 to a peak in 1943 and then tapering off.

Fifth chart—"Sources and Disposition of War Man-Power"—shows how our manpower was mobilized: armed forces, war industry, civilian industry, unemployed, and increase in labour force. A good deal of the last item was made up, of course, of female labor that was not employed in peacetime.

Sixth chart—"Distribution of War Employment at Peak"—shows that the armed forces and manufacturing are pretty well even.

Seventh chart—"Percentage Distribution of Manufacturing War Employment"—shows the distribution of manpower in actual manufacturing during the war, by various provinces. In British Columbia, on the Pacific, we had a large shipbuilding demand. In the Maritimes, we had the same. Shipbuilding in the prairie Provinces was practically nil, as you would expect.

In our discussion today, I have endeavored to outline Canadian resources and the Canadian industrial war potential as it was demonstrated in the last war, based on the assumption that the war effort will be a joint war effort with the United States and will involve total war.

I am not one who believes that the war effort required in the next conflict will necessarily duplicate that of the last. I am convinced that the demands will be radically different. However, I think that we can safely assume, as I have already stated, that the limiting factors will be manpower and primary materials. Under these conditions, it seems to me that planning to obtain Canada's maximum war production in conjunction with that of the United States would envisage:

1. Maximum production from our primary industries.

2. Maximum production from our basic chemical industries.

3. Maximum secondary production, following maintenance of the first two items.

Any joint planning would also undoubtedly demand increased production of primary materials, notably petroleum. Longer-range planning would also envisage greater use of Canada's hydroelectric power facilities.

Assuming total war and an immediate cutback in civilian requirements, we would have available in the industrialized areas of Canada, particularly in the Provinces of Ontario and Quebec, a large secondary manufacturing industry with skilled labor forces capable of undertaking a large munitions program. This secondary industrial capacity would be directed into the fields which a war effort would demand--ships, aircraft, mechanical transport and armored fighting vehicles, guns, ammunition, and the diverse chemical requirements, ranging from explosives to plastics, solvents, poisoned gas, insecticides, and so on.

To maintain this industrial war effort, however, it will be necessary, as already stressed, for the Canadian economy to draw upon the American economy for many of the varied requirements of modern industry. Canada's dependence upon the United States for fuel in the central region has already been pointed out. Expansion of Canadian industry in many fields will be dependent upon the availability of equipment from the United States. A specific example of this is stainless steel equipment, which is largely used in the chemical industry and is available only to a limited extent in Canada.

That we were able to develop such a relatively large production of munitions in the last war was due to two facts:

1. We built up our munitions industry before the United States entered the war, drawing heavily upon the United States for equipment and general assistance.

2. After the United States entered the war, the Hyde Park Agreement established the principle of common supply effort, utilizing the resources of both countries to the greatest common advantage.

Much of the Canadian industry created for the war effort has been absorbed into our peacetime economy. I believe a similar condition exists in the United States; namely, that there is no large industrial capacity surplus to current requirements.

When the question is asked, "What is Canada's industrial potential for war?" it raises the second question as to what will be required over and above present industrial capacities. A rapid expansion of

metal production, involving increased mining and smelting capacity, is not easily arranged. If increased fuel supplies are required, we can readily expand coal production in western Canada, and our petroleum and natural gas need only pipelines to insure their availability. Chemical industry can be readily expanded. Our hydroelectric power in the East is especially favorable to electrochemical industries, and in Alberta we have the wide range of raw materials which can support a large and varied chemical industry.

Our experience of the last war demonstrated our ability to produce munitions of all types in our central and highly industrialized area. It is in this most densely populated area that our major manpower supply lies.

To obtain the maximum industrial war effort from Canada, I think it is very clearly evident that joint study and planning by the United States and Canada should endeavor to lay down the basis of a common production effort before the emergency arises, and in this way permit Canada to develop its industrial potential in conformity with such plans and over-all requirements. Such plans should take into consideration (1) new conditions of warfare which require dispersal of industry, for which Canada is well suited; (2) the heavy fuel and power demands of certain industries, which can be readily supplied if located in Canada; (3) the advantages of utilizing primary materials as near their source of supply as possible.

In the last war, Canada achieved a production effort far beyond expectations, both in quantity and variety of production. I am convinced, if and when the emergency arises, we can again exceed any objectives that may be set. May I add that I am equally sure that Canada and the United States together can far outstrip the productive effort that any other such unit can produce.

I hope my remarks provided you with some of the information you desired. If you want more specific information on any phase of our industrial capacity, I am sure we can arrange for you to receive it.

May I again thank you for the opportunity of addressing you.

COLONEL SMARTT: Mr. Donald is now ready for your questions, gentlemen.

QUESTIONER: Mr. Donald, give us a few words in more detail about the prospects as you see them, for the Labrador iron ore.

MR. DONALD: I talked with the Labrador iron people the day before I came down here. They have to build a railway from the Gulf about 200 miles in to the ore.

The area in which the deposits are located is well supplied with water power. They are building a power plant there for electricity for the mining operations and they expect to start shipping, as I stated, in about five years' time.

One of the difficulties, of course, lies in the fact that we do not have year-round transportation in the Gulf. A second difficulty is that until the St. Lawrence Seaway plan is carried out, the large ore carriers cannot get up the river through the canals. They are both transportation difficulties.

There is undoubtedly a very large reserve of high-grade iron ore, and its development is entirely a question of marketing and transportation.

QUESTION: Sir, what are the principal difficulties with the St. Lawrence Seaway—political, financial, or geographic, or all three?

MR. DONALD: I am afraid I am not so familiar with the political scene as I should be, but my understanding of the matter is that Canada has signified a desire to go ahead, and has been waiting on the United States. I think that is the general picture.

QUESTIONER: Mr. Donald, would you care to discuss the dollar problem that Canada is having at this time?

MR. DONALD: I am not an economist, but I think the situation is a relatively simple one. Our economy, as I have stated, is based on the production and export of primary materials, and of these our agricultural production (wheat), metal production, pulp and paper and lumber are large items. A large percentage of our exports formerly went to Europe as, for example, our wheat shipments went to Great Britain.

Our money is tied to your money. We are not in the so-called sterling bloc, and consequently the countries outside this continent to whom we export are having great difficulty in finding ways and means of paying us in United States or Canadian dollars, and our imports from these countries do not offset our exports. At the same time we are large importers from the United States.

I think there is another very important factor, which is sometimes overlooked, in the Canadian economy; that is a great deal of the money paying for our exports came in the form of capital for new developments. Much of that formerly came from Europe. Capital for new developments is now coming from the United States, but the economy of the United States in so many ways parallels our own that there is not a demand for our exports. The result is that we are unable to sell to the United States enough to balance what we purchase there, and we are unable to purchase from Europe enough to balance what we sell there.

RESTRICTED

GENERAL HOLMAN: Mr. Donald, I think members of the College would be very much interested in some of the work of the Joint War Production Board--some of the problems that confronted the board, the way they were solved jointly, the combined efforts of the two countries, the way they got together, particularly in the ammunition field. Would you discuss those?

MR. DONALD: Yes. Pretty good stories come out of that.

I was looking after the explosives and chemical program in Canada. We started in 1939, of course, and in 1940, with the fall of France, our effort became very intense, and we were getting demands for all sorts of things from Europe. I remember one incident in particular which has always seemed to me to highlight the relations between Canada and the United States.

One morning I found on my desk a cable indicating that Great Britain wanted us to provide a very large volume of fixed ammunition. We had never filled high-explosive shells in Canada on a large scale and we knew practically nothing about the operations. It was a pretty big order. I didn't know exactly what to do with it, but I knew there was no use sitting and looking at it.

So I came to Washington to see the head of your ammunition division. I told him all my troubles--how I had a big job to do and I didn't even know where to begin. We discussed the various technical factors involved--whether we were going to use TNT or whether we were going to use pressed fillings of amatol, and that sort of thing. Finally, I asked if I could visit Picatinny. He said, "Yes, there is no objection."

I went up to see Picatinny. I wandered around there for a day and finally got back in the commandant's office and discussed my problems with him--how I didn't know where to start, and what I needed were some plans to build a plant and somebody to teach us how to run it. Finally, he said, "Mr. Donald, do you see that chest of drawers over there?" I said yes. He said, "There is in that chest of drawers exactly what you want, but," he said, "I can't give it to you." He said, "I don't want you to tell anybody I told you so."

I went back to Washington and ended up in the same office again, with the head of your ammunition division. I said I understood he had a lot of plans prepared and I wanted to know if I could use them. He said he could not give them to me; they would have to go through diplomatic channels. So I headed off for the diplomatic channels and stated my case before them, and I think it was within two or three weeks' time that I was notified we could have these plans.

This was a pretty important thing, gentlemen, because, as you will remember, France had collapsed, Britain was on her heels, and

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we didn't know which way to turn. It was just the difference between getting something done and not getting it done. I understand that the request had to go to pretty high quarters to get cleared, but, in any event, the word came through.

I said to my minister, "Mr. Howe, I have finally got this thing fixed. We had better send a plane down there to pick up these plans." He said all right. I thought about that a little and decided that was only going to make a show of it; so we sent a couple of fellows down, they came back with two trunks full of plans, and, based on them, we proceeded to erect filling plants.

That kind of cooperation is the thing that means more than all the written treaties, arrangements, or anything else you can make. We had a number of incidents of that sort which kept cropping up, and we received much help and assistance from your supply officers.

Before we came into this meeting, I was mentioning Colonel J. P. Harris, your commandant at Picatinny, who formerly was looking after your explosives program in the Pentagon Building.

When you came into the war, we had built up a large program of explosives and chemicals for the British. But the British plants had not been bombed, so we were sitting with, for example, in the case of ammonia, a large productive capacity and no place for the ammonia. I was wondering what to do about this when I got a call from Colonel Harris. He said, "How much ammonia can you give me?" I said, "How much do you want?" He said, "We will take all you have." That meant about 25 cars of ammonia a day. I said, "How soon do you want it?" He said, "I'd like to get it right away." I said, "All right. I'll see if we can start shipping the stuff tomorrow." Then I suddenly thought about payment. I said, "Wait. Who is going to pay for this?" He said, "What do you want for it?" I said, "I don't know." "Well," he said, "we will pay you what we are paying our own people, plus 10 percent. How is that?" I said, "That's all right, so far as I am concerned."

So I got busy on the phone. The next day we started that ammonia rolling. I don't think the paper work on that caught up for at least six months.

The point I am trying to make is that it was not a matter of business; it was a matter of complete good faith between two people who were confident the other fellow would see the thing through. And I think that is the thing that we have between Canada and the United States that probably provides a solution to most of the problems that we have been talking about today.

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I remember another one. The British wanted nitroguanidine for their flashless cordites. This was another incident of a cable arriving at my desk telling us they needed I think it was 100 tons a day of this stuff. Frankly, I didn't even know what nitroguanidine was. I found out that it came from cyanimide. So I came down to the States, got hold of the American Cyanamid officials, who were friends of mine, and talked this over. I wanted to know if they would come up to Canada and build a plant. They eventually did. What is more, they built that plant for us on a nonprofit basis. That is, they charged all the expenses, and so on, in connection with it, but there was never any profit or fee involved in building that plant. And that plant came into production, from an unknown process based on their work, in about six months' time. It was a marvelous job; it was completely beyond Canada's ability to do without that assistance.

Of course, there were a few things that were in reverse. We were able to do a few things and carry out a few things that you were not in a position to do. But, generally speaking, it is the integration of effort between the two countries based on a common viewpoint and common trust which I think is the important thing.

COLONEL SMARTT: I want to extend an invitation to our guests to ask questions here, along with the students and faculty.

QUESTION: Sir, I wonder if you could tell us to what extent the railway systems of Canada and the United States are interlocked and how much each system could operate over the other in case of emergency.

MR. DONALD: Our railways are laid out essentially for east-west traffic; that is for Canadian traffic. Our lines north and south are not so well laid out, possibly, as the lines east and west. But, as you would expect, there is a tremendous volume of traffic moving north and south all the time across the railways, and they work together very closely. For example, our Canadian Railway Commission works under the same general regulations and rules as your Interstate Commerce Commission; that is, as to the classification and handling of materials.

I would say, offhand, that it is just as easy to ship something from Montreal to San Francisco as it is from Montreal to Vancouver. Freight, so far as I know, is completely interchangeable. We endeavor in Canada, of course, to use Canadian transportation, for dollar reasons.

QUESTION: Mr. Donald, could you tell us something of your plans and intentions for the development of the St. Lawrence Waterways and how big a job is it?

MR. DONALD: I cannot give you that now. It is a large development, and I do not have the figures at hand. Hydroelectric development, of course, is tied in with it.

I don't regard the problems as too serious. Canada built its present canal system when Canada's population was about 4.5 million people, and I cannot see, with the population having grown to 13 million and the changes that have taken place, that it is much of a trick to enlarge it.

QUESTION: How far will the south end of the new railroad that is being built into the ore deposits of Labrador for a distance of 200 miles be from the transcontinental railhead?

MR. DONALD: Its southern end is north of Anticosti Island. There will be no rail connection with anything. It will simply be a line from the mines to the harbor. There is no connection with any of the railroad systems.

QUESTION: Could you tell us something about what progress has been made between your mobilization planning group in Canada and our National Security Resources Board, and whether you think it is satisfactory?

MR. DONALD: I am supposed to know something about that. Perhaps all I can say is that we have a number of committees that are now working, and these committees are bringing to the surface a good many of the factors that we have been talking about today and are trying to clear a great many of the problems which we think will arise. I would say that we are just in the initial stages.

QUESTION: Mr. Donald, there is a difference of opinion about the development of the oil fields and the gas in Edmonton area, as to whether industry will come into that area or the raw materials will go out. What is your view about the development of the Edmonton area?

MR. DONALD: The oil refining development will be limited to the local requirements. I think that is obvious. I think we will have a development in Alberta which will tend to parallel the development in the Southwest of the United States. I don't mean it is going to be anything as big, but, in proportion to the Canadian population, I think it will be similar to the development of the American Southwest.

The thing that prevents it from becoming a huge industrial development is the United States tariff. In other words, an interesting situation exists that is causing a great deal of concern to Canadians and also to westerners.

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Take the position of natural gas; it is close to the United States border. You can move that natural gas over the United States border to a plant, and it won't cost you a nickel more than it will in the Canadian plant on the other side. If you make all those products in the United States, you have the whole United States market at your door--no tariff, no restriction. Come back two feet over the Canadian border, and the plant cannot ship into the United States because of the high tariff.

In all this industrial mobilization and looking ahead, that economic factor of the inability of Canadian manufactured goods to enter the United States is one of the problems which prevents an increase in potential.

Take calcium carbide. If I remember rightly, the duty on calcium carbide entering the United States is \$40 a ton. That is more than it costs to make it. The same situation occurs in many other things. Canada gets backed up to either the Canadian demand or the export demand other than that of the United States.

Those are the politico-economic factors which somehow or other are going to have to be solved eventually.

QUESTION: Mr. Donald, do you have any thoughts as to the use likely to be made of the Alberta oil? Is it possible that this oil might serve to relieve the requirements in central Canada for American coal?

MR. DONALD: I think so, yes. I think Canada's position in oil is becoming quite satisfactory in some ways.

The Canadians are building a pipeline from the Alberta fields to Superior alongside Duluth, on Lake Superior. They are then going to pick the oil up in tankers, and I understand the Imperial Oil plant at Sarnia is expected to replace most of its American imports with that Canadian oil. Via the St. Lawrence we are also starting to draw, by tanker, oil from the Middle East.

So our fuel dependency on the United States will undoubtedly continue to decrease, although we cannot get away from the large import of coal, except to the extent that coal is replaced by oil.

COLONEL SMARTT: Mr. Donald, I think that the entire class and the visitors have obtained a clear picture of the industrial potential of Canada and how that potential ties in with that of the United States.

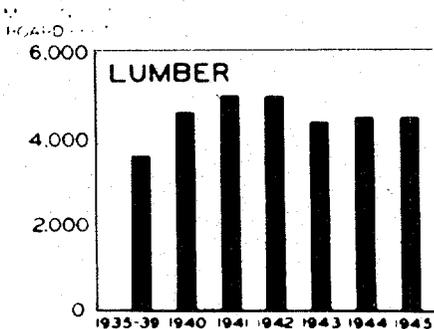
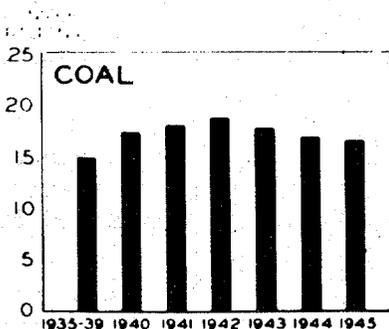
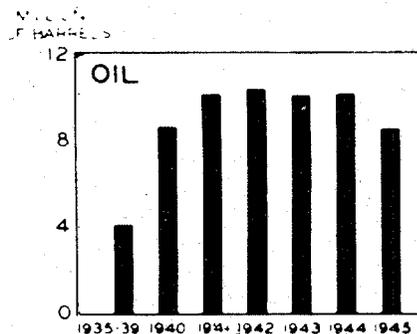
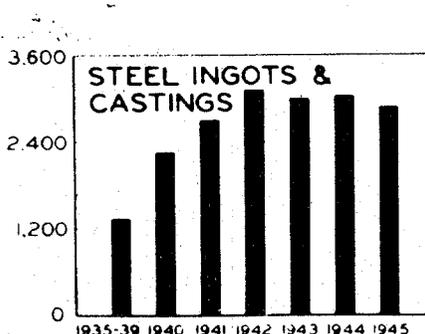
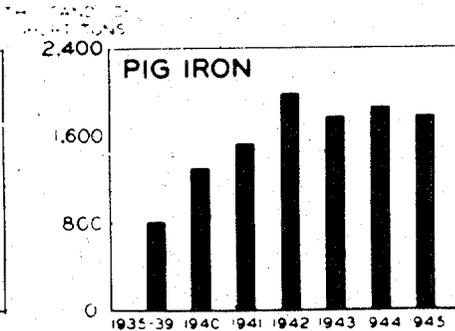
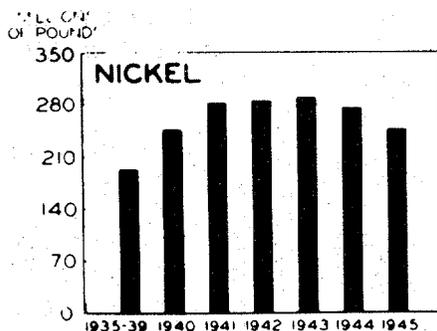
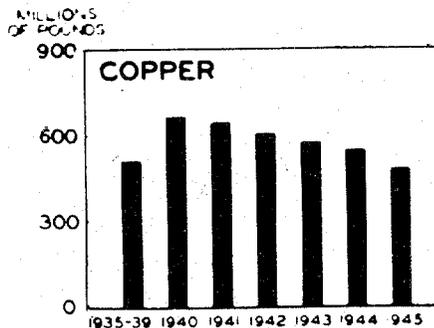
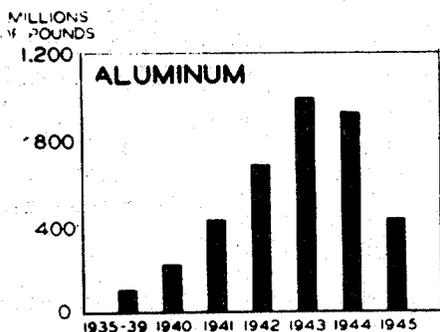
On behalf of the Commandant, the students and faculty, and the guests, I thank you for bringing this message to us this morning. Thank you.

(12 May 1950--650)S

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Chart 1

**PRODUCTION OF SELECTED RAW MATERIALS  
CANADA  
1935-1945**



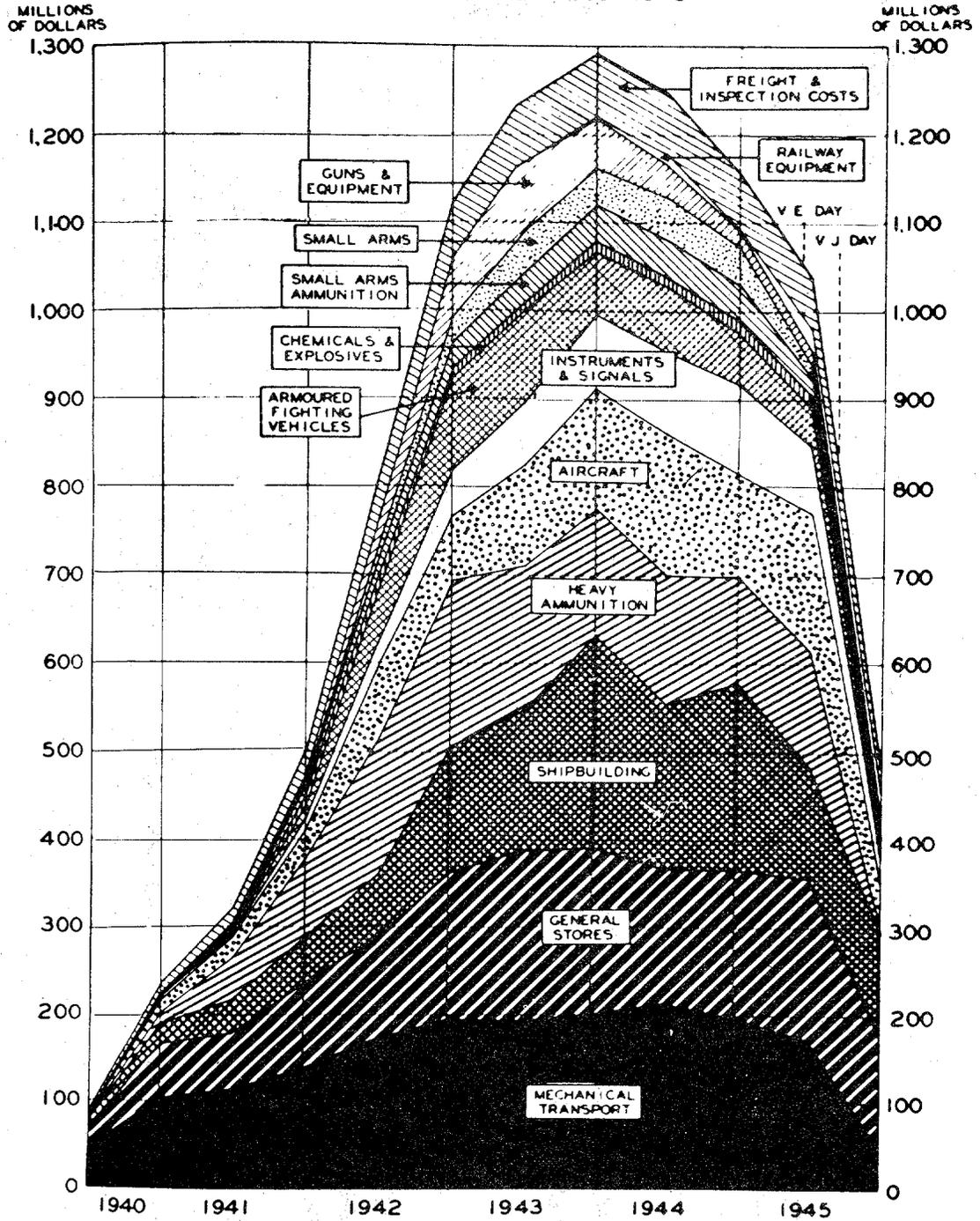
-NOTE-  
1935-39 BAR SHOWS THE AVERAGE ANNUAL  
PRODUCTION DURING THE FIVE YEAR PERIOD

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Chart 2

VALUE OF CANADIAN WAR PRODUCTION  
IN THE MAJOR PROGRAMS

HALF YEAR TOTALS 1939-1945



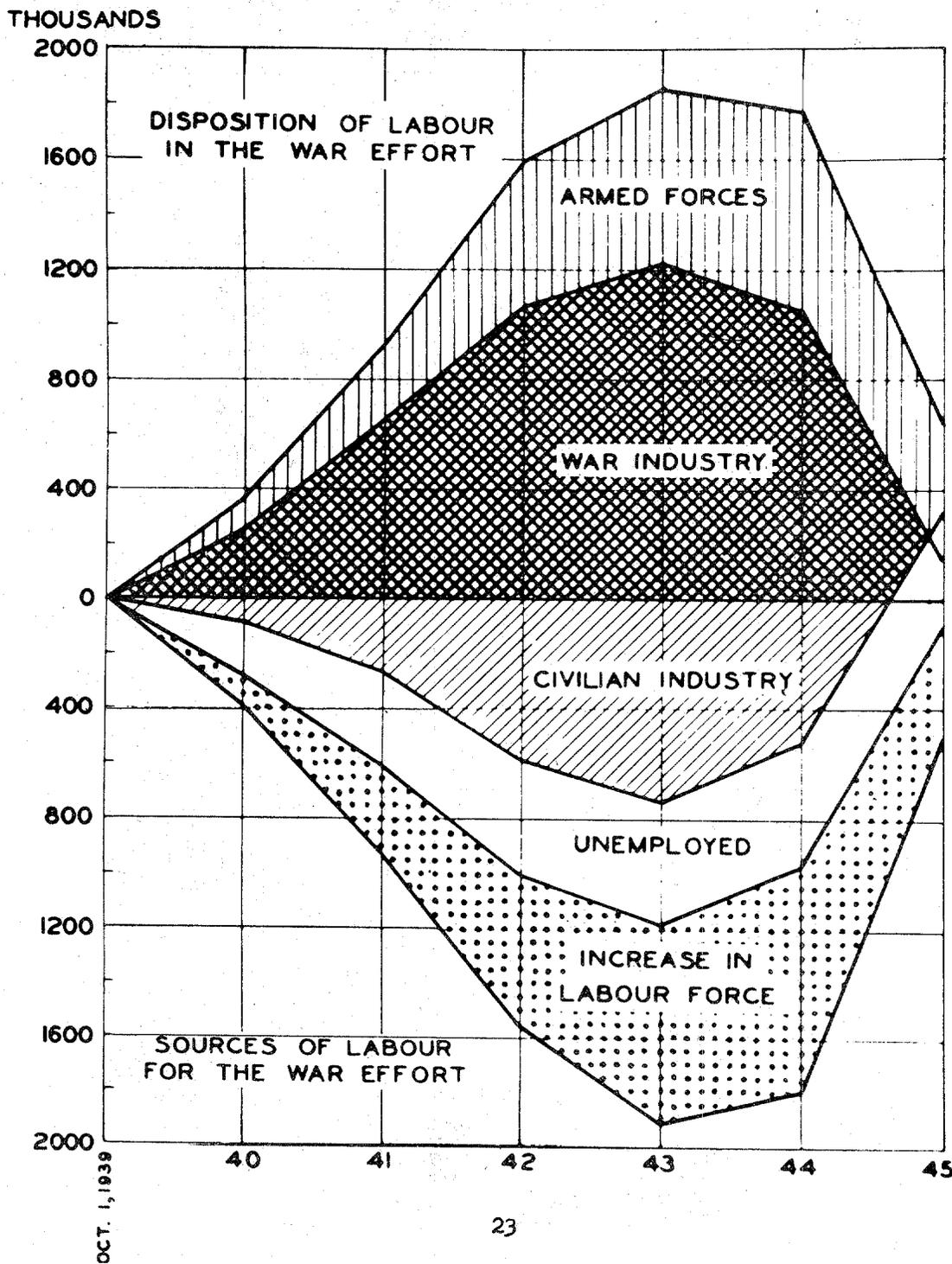
NOTE: "CHEMICALS AND EXPLOSIVES" REPRESENT PRODUCTION FOR EXPORT ONLY. PRODUCTION FOR AMMUNITION-FILLING INCLUDED IN "HEAVY AMMUNITION" AND "SMALL ARMS AMMUNITION."

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Chart 3

# SOURCES AND DISPOSITION OF WAR MAN-POWER 14 YEARS AND OVER



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Chart 4

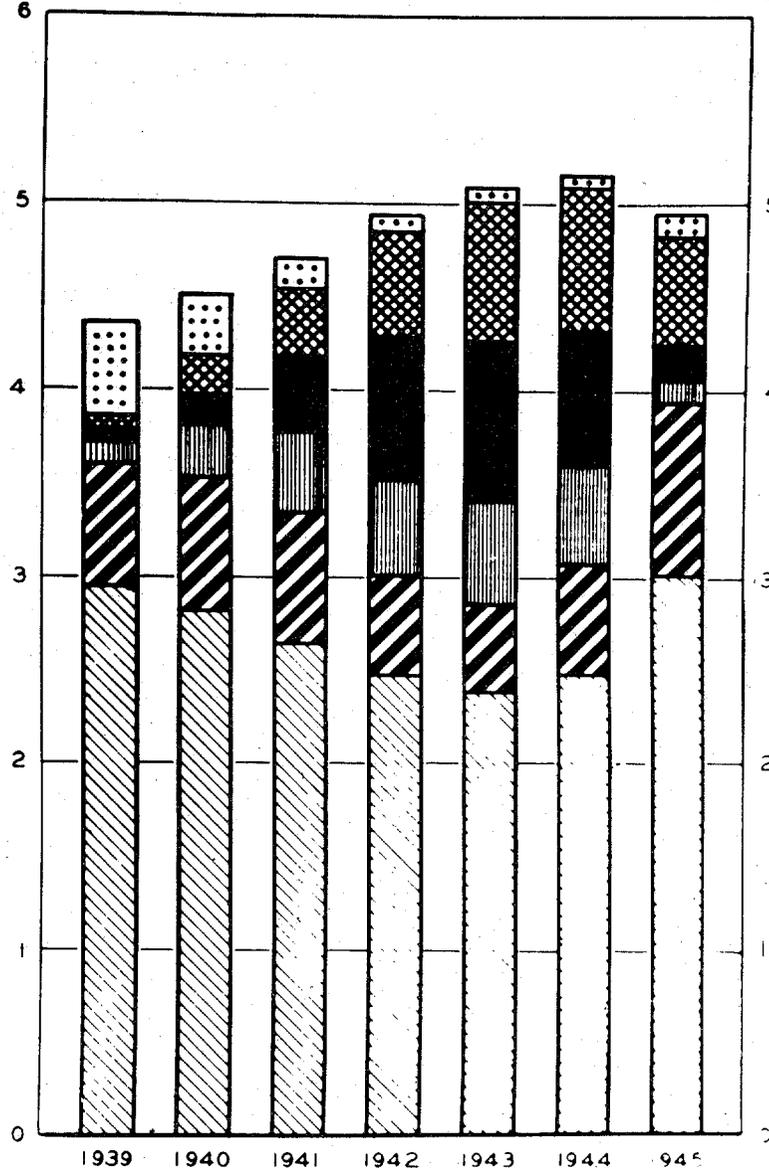
ESTIMATED DISTRIBUTION OF  
CANADIAN LABOUR FORCE

AS AT OCTOBER 1 IN EACH YEAR

MILLIONS  
OF PERSONS

1939 - 1945

MILLIONS  
OF PERSONS



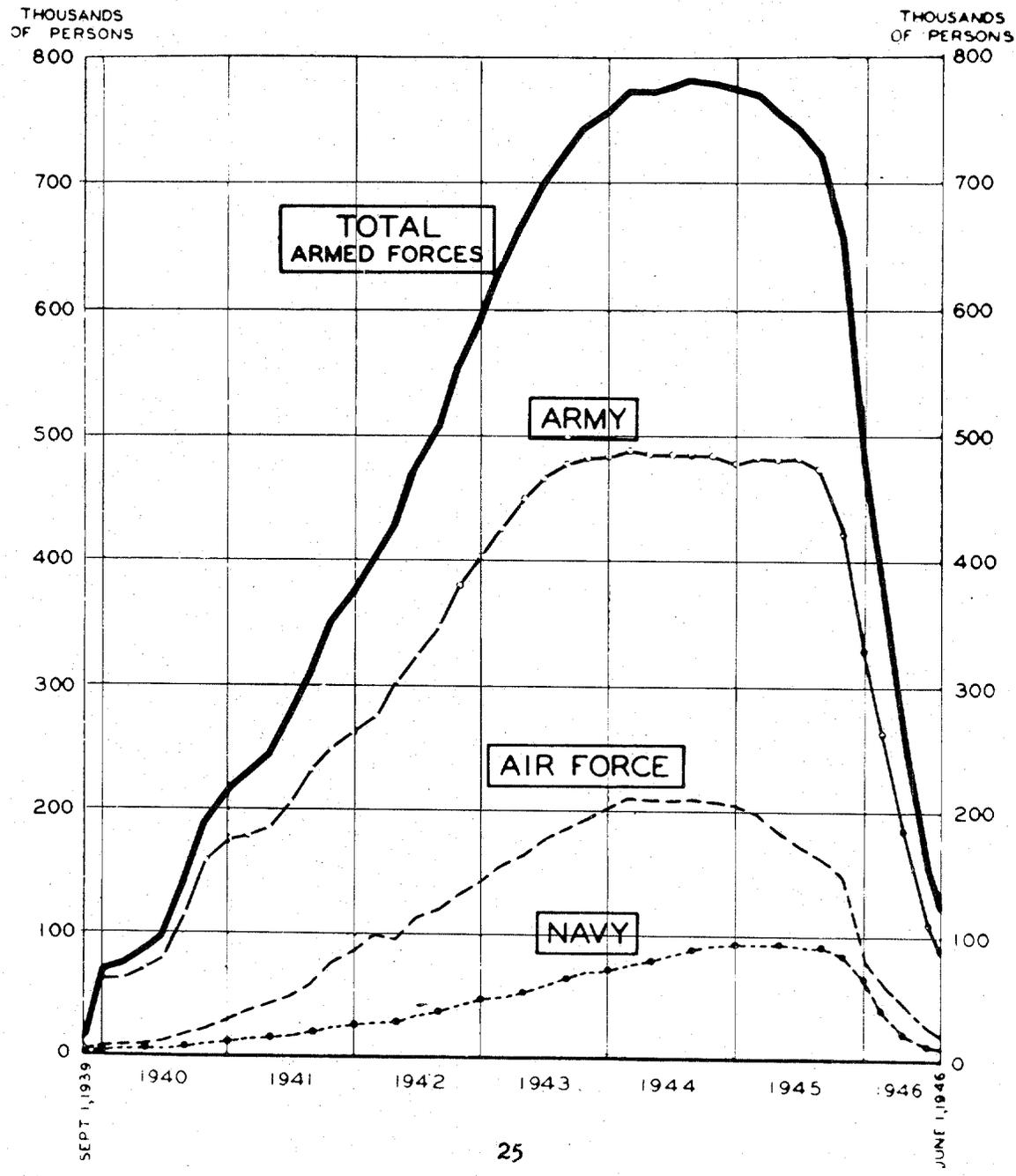
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Chart 5

# ACTIVE SERVICE STRENGTH OF THE CANADIAN ARMED FORCES

SEPT. 1, 1939 - JUNE 1, 1946

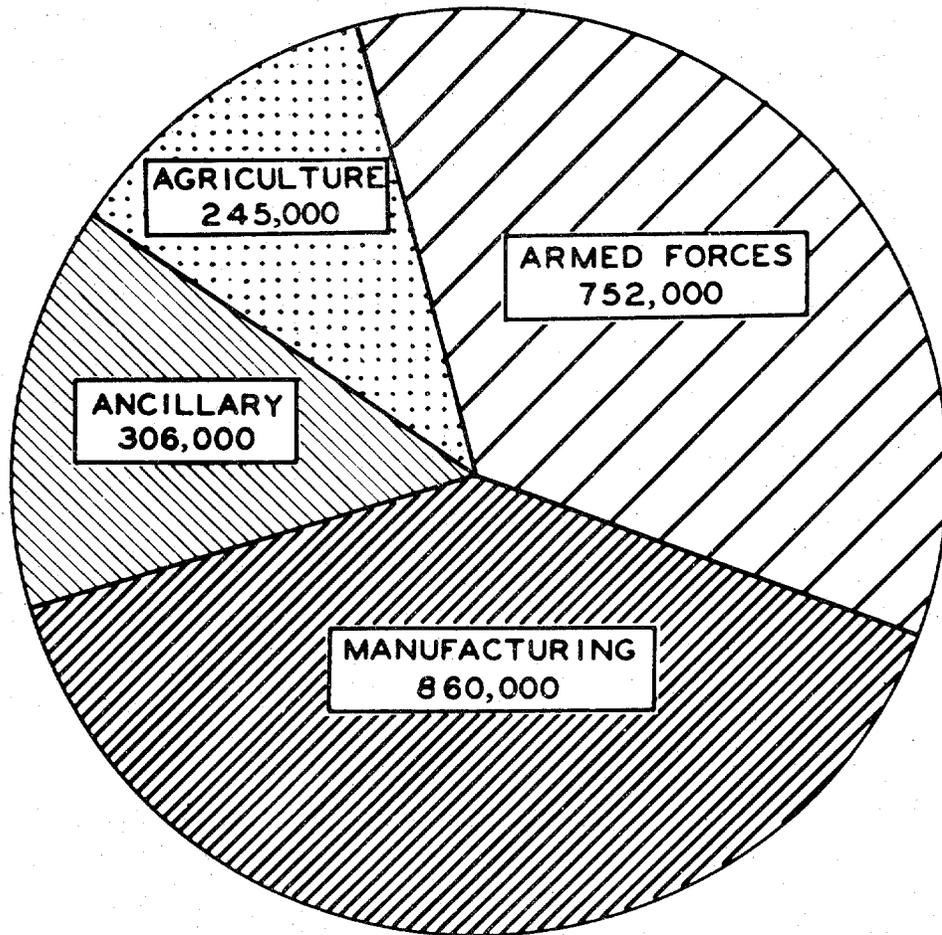


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Chart 6

**DISTRIBUTION  
OF WAR EMPLOYMENT  
AT PEAK  
OCTOBER 1, 1943**



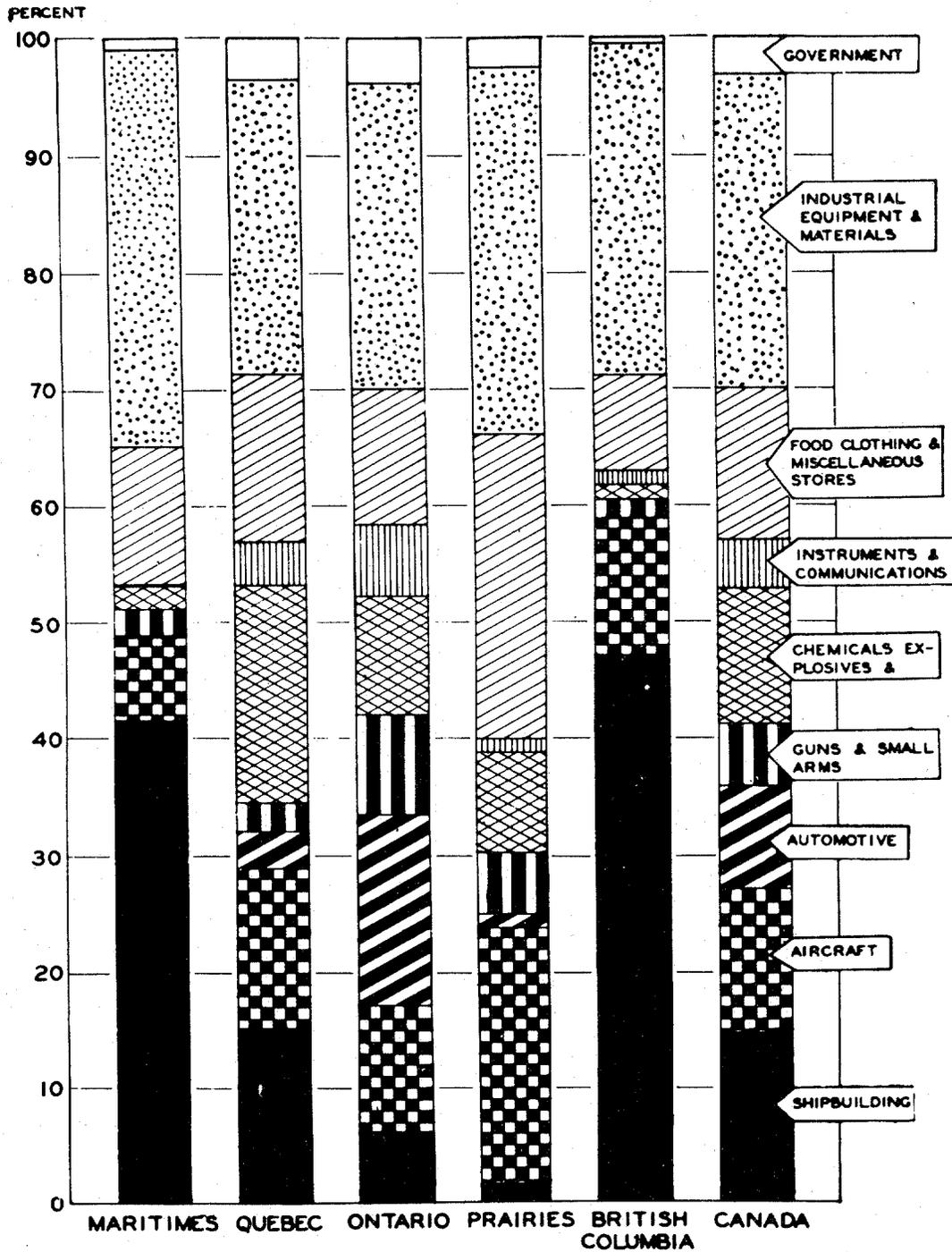
**TOTAL 2,163,000**

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Chart 7

# PERCENTAGE DISTRIBUTION OF MANUFACTURING WAR EMPLOYMENT BY MAJOR PROGRAM GROUP JULY 1 1943



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