UNITED STATES DEPARTMENT OF COMMERCE

JESSE H. JONES, *Secretary*

The St. Lawrence Survey

PART VII

Summary Report of the St. Lawrence Survey
Including
The National Defense Aspects of
The St. Lawrence Project

N. R. DANIELIAN, *Director*
ST. LAWRENCE SURVEY

Reports of the St. Lawrence Survey

PART I.	History of the St. Lawrence Project.
PART II.	Shipping Services on the St. Lawrence River.
PART III.	Potential Traffic on the St. Lawrence Seaway.
PART IV.	The Effect of the St. Lawrence Seaway Upon Existing Harbors.
PART V.	The St. Lawrence Seaway and Future Transportation Requirements.
PART VI.	The Economic Effects of the St. Lawrence Power Project.
PART VII.	Summary Report of the St. Lawrence Survey, including the National Defense Aspects of the St. Lawrence Project.

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UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1941

NOVEMBER 3, 1941.

The PRESIDENT,
The White House,
Washington, D. C.

DEAR MR. PRESIDENT: I have the honor to transmit Part VII of the reports of the St. Lawrence Survey which contains a summary of findings and conclusions, including the National Defense Aspects of the St. Lawrence Project.

Very sincerely,

WAYNE C. TAYLOR,
Acting Secretary of Commerce.

LETTER OF SUBMITTAL

OCTOBER 30, 1941.

The HON. SECRETARY OF COMMERCE,
Washington, D. C.

DEAR MR. SECRETARY: I have the honor to submit herewith Part VII of the St. Lawrence Survey reports which contains a summary of the findings and conclusions of the Survey, including the National Defense Aspects of the St. Lawrence Project.

I wish to take this opportunity to express my deepest gratitude for the sympathetic support and cooperation which the Survey has received from Mr. John M. Carmody, Administrator, Federal Works Agency, Brigadier General Thomas M. Robins, Assistant Chief of Engineers, United States Army, Rear Admiral George H. Rock (ret.), Chief Constructor, United States Navy, Rear Admiral Emory S. Land, Chairman, United States Maritime Commission, Rear Admiral Henry Williams, Administrative Assistant, Office of the Secretary of the Navy, Col. M. E. Gilmore, Commissioner, Public Works Administration, Mr. Malcolm Kerlin, Administrative Assistant to the Secretary of Commerce, Mr. Theron B. Morrow, Assistant to Mr. Kerlin, and the Trustees of the Power Authority of the State of New York.

Very truly yours,

N. R. DANIELIAN, *Director,*
St. Lawrence Survey.

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Section 1

The Seaway Viewed in Historical Perspective

The common impression is that the St. Lawrence Seaway is a new project. It is, as a matter of fact, merely a series of improvements on an already existing inland waterway.

The possibility of a deep-water route from the Atlantic to the ports of the Great Lakes has occupied the attention of commercial interests almost from the beginning of the settlement of the New World. Ever since Jacques Cartier, in 1535, came upon the rapids just outside Montreal in his effort to find a route to China, appropriately calling the rapids LaChine Rapids, explorers, pioneers, traders, and finally the Governments of the United States and Canada have been interested in the development of a waterway into the interior of the North American Continent. As a result, a number of canals have been constructed on the route from the Great Lakes to Montreal. The first of these attempts was made as early as 1700 when an 18-inch waterway was undertaken.[1] It was not until 1882, however, that a 14-foot canal to by-pass the Rapids of the upper St. Lawrence River was undertaken by Canada. Completed in 1901, the 14-foot system has become one of the major waterways in the world, carrying some 9,000,000 tons of cargo in 1938.

In 1932 the Welland Ship Canal was completed as the first step toward improving the 14-foot canals in the direction of a through deep-water seaway. Constructed wholly by the Canadian Government, it has a limiting depth of 25 feet,[2] and is a major engineering achievement.

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[1] *Canada and Its Provinces.* Printed by T. & A. Constable, Toronto, 1914, pp. 504–11.
[2] The locks have a depth of 30 feet over the sills.

It permits ships to scale the Niagara escarpment of 323 feet, allowing passage of ships between Lake Erie and Lake Ontario.

It should be pointed out that construction of the Welland Ship Canal was no local improvement but rather an integral part of the proposal for a deep waterway from Montreal to the Lakes. While it is true that the Welland Ship Canal enables lake carriers at present to travel from the upper lakes to Lake Ontario and on through the Thousand Island Section of the St. Lawrence River to Prescott, Ontario, it is to be remembered that navigation beyond Prescott under present conditions is still limited by the dimensions of the 14-foot canal system authorized in 1882.[8]

Since the construction of the 14-foot channel, the Middle West has grown from an outlying agricultural province into one of the most important producing regions on earth. This growth can be measured in many ways. Perhaps the growth of the cities of the region constitute a fair index of the increase. The population of its eight largest cities as of 1880 and of 1940 is, therefore, given:

City	Population		City	Population	
	1880	1940		1880	1940
Rochester	89,366	324,975	Toledo	50,137	282,349
Buffalo	155,134	575,901	Chicago	503,185	3,396,808
Cleveland	160,146	878,336	Milwaukee	115,587	587,472
Detroit	116,340	1,623,452	Duluth	3,483	101,065

The extraordinary growth indicated by these figures is due in large part to the industrialization of the Middle West. While in 1880 the relatively small steel industry had hardly extended beyond the Appalachians, by 1940 its capacity had become some 85 million tons—more than that of all of Europe—and many large plants were located in regions tributary to the Great Lakes. Furthermore, 84 percent of the iron ore which fed this great industry originated in Minnesota and Michigan. Similarly, 85 percent of the automobile industry, nonexistent in 1880, and capable of producing over 5,000,000 cars a year, is located in the Great Lakes region. Table 1, reproduced from Part III and covering a few of the more important facts, is submitted here in order to indicate the economic importance of the Great Lakes area.

[8] The St. Lawrence canals by-pass the several rapids at the International, Soulanges, and Lachine Sections of the river. There are 22 locks, the smallest controlling dimensions being 14-foot depth, 270-foot length, and 42-foot width.

TABLE 1

Economic importance of the Great Lakes area,[1] 1937

Item	United States total	Total, Great Lakes area	Great Lakes area as percent of United States total
Population [2] thousands	131,410	[3] 40,284	30.7
Total manufacturing:			
Value of products thous. of dols.	60,712,872	25,179,795	41.5
Value added do	25,173,539	10,486,359	41.7
Wage earners:			
Average number thousands	8,569	3,147	36.7
Wages paid millions of dols.	10,113	4,289	42.4
Steel: Ingot capacity 1,000 gross tons	70,983	[4] 53,438	75.3
Iron ore production do	72,094	[10] 60,502	83.9
Bituminous coal production 1,000 net tons	445,531	[11] 182,075	40.9
Motor vehicles and parts:			
Value of products thous. of dols.	5,176,236	[5] 3,802,938	73.5
Value added by manufacture do	1,506,894	1,226,681	81.4
Machinery: Value of products do	5,891,599	[6] 2,909,840	49.4
Chemicals, n. e. c.:			
Value of products do	932,750	[7] 332,899	35.7
Value added by manufacture do	477,688	171,305	35.9
Drugs and medicines:			
Value of products do	345,918	[7 8] 139,517	40.3
Value added by manufacture do	247,097	103,502	41.9
Paints, pigments, and varnishes:			
Value of products do	538,461	[7 8] 227,755	42.3
Value added by manufacture do	226,375	95,961	42.4
Fertilizer:			
Value of products do	195,759	[9] 29,245	14.9
Value added by manufacture do	65,678	11,595	17.7
Power:			
Capacity of generators 1,000 kw.	37,032	[12] 11,514	31.1
Production of electric energy 1,000,000 kw.-hr.	121,050	[13] 33,029	27.3
Farm property:			
Value of all farm property, 1930 millions of dols.	57,246	24,417	42.6
Value of land and buildings, 1935 do	32,859	13,404	40.8
Foodstuffs:			
Wheat production 1,000 net tons	26,270	[13] 9,516	36.2
Corn production 1,000,000 bu.	2,651	[13] 1,774	66.9
Flour:			
Value of products thous. of dols.	856,310	[14] 366,485	42.8
Value added by manufacture do	133,600	56,311	42.1
Meat packing:			
Value of products do	2,787,358	[14] 1,575,192	56.5
Value added by manufacture do	401,267	[15] 230,065	57.3
Creamery butter, factory production 1,000 lb.	1,623,971	[13] 1,083,850	66.7
Whole-milk American Cheddar cheese: Factory production do	492,041	[13] 337,819	68.7
Egg production millions	36,647	[13] 14,385	39.3
Chickens, production thousands	577,701	[13] 216,151	37.4

[1] Includes: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, South Dakota, Nebraska, northern New York, and western Pennsylvania. [2] 1940 Census figures. [3] Includes New York counties—St. Lawrence, Clinton, Franklin, Lewis, Jefferson, Fulton, Oneida, Oswego, Onondaga, Cayuga, Yates, Ontario, Monroe, Orleans, Niagara, Erie, Genesee, Wyoming, Livingstone, Steuben-Allegany, Cattaraugus, Chautauqua, Seneca, and Wayne.
Pennsylvania counties—Warren, McKean, Potter, Cameron, Elk, Forest, Venango, Crawford, Mercer, Lawrence, Beaver, Washington, Allegheny, Butler, Armstrong, Clarion, Jefferson and Westmoreland.
[4] Annual capacity, 1935, includes:
New York counties—Cayuga, Chautauqua, Cortland, Erie, Niagara, Oneida, and Onondaga.
Pennsylvania counties—Allegheny, Armstrong, Beaver, Butler, Crawford, Erie, Lawrence, Mercer, Venango, Washington, Westmoreland, Warren.
[5] Does not include Pennsylvania and includes only Buffalo Industrial Area for New York; also Kansas.
[6] Minnesota business group omitted to avoid disclosures.
[7] Includes Buffalo and Rochester Industrial Areas for New York, and Pittsburgh Industrial Area for Pennsylvania.
[8] South Dakota not specifically shown.
[9] Minnesota; Rochester, N. Y.; and Pittsburgh, Pa., not specifically shown.
[10] Michigan and Minnesota only ones specified.
[11] Northern New York excluded but includes Pennsylvania counties—Allegheny, Armstrong, Beaver, Butler, Clarion, Clearfield, Elk, Fayette, Greene, Indiana, Jefferson, McKean, Mercer, Somerset, Venango, and Washington.
[12] Includes only New York counties—Clinton, Franklin, Fulton, Herkimer, Jefferson, Lewis, Oneida, Oswego, St. Lawrence, Erie, Niagara, Orleans, Seneca, Steuben, Wayne, and Monroe.
[13] Does not include New York or Pennsylvania.
[14] Includes Buffalo and Pittsburgh Industrial Areas.
[15] North Dakota not specifically shown.

An interesting aspect of this industrial development is its uniqueness. The Middle West is the only geographical region distant from tidewater which has been highly developed industrially under the free, or relatively free, working of economic forces. It is true the Great Lakes push long fingers into the "hinterland," and intercommunication by water in the Great Lakes region is convenient and economic. But except for a few shallow canals, the Middle West is cut off from cheap, deep-water transportation. As a result, most of its foreign trade, both outgoing and incoming, has had to be handled more than once. Unlike the trading centers of the past—those of the ancient world, as well as the more recent trading centers in Italy, Germany, Spain, Holland, and England—the cities of the Middle West have grown and developed without benefit of low-cost transportation to the markets of the world.

One may explain this phenomenon on the basis of rich natural resources and soil fertility. But other regions have comparable abundance of resources. One may explain it on the basis of continental unity. One may account for it by pointing to the mingling of many customs with a consequent weakening of traditional taboos and other inhibiting factors. One may account for it by postulating some peculiar American genius for applying science to useful ends and coordinating men into effective working units. The explanation is not important in respect to the Seaway. What is pertinent, however, is the following speculation: If the Middle West has attained such a high degree of industrial progress without benefit of direct access of deep-water transportation to the ports of the world, what might the Middle West become were it transformed into a maritime community bordering on the Great Sea?

There is another broad consideration involved in opening up the interior to sea-borne commerce. The world today is divided roughly into two factions, one of which believes in maximizing national self-sufficiency and exchanging disposable products only for such commodities as can be produced at home with difficulty or not at all. The other faction—the faction to which the United States and Canada belong—believes in the desirability of expanding international commerce to its feasible economic limit so that each community can concentrate on the production of those commodities which it can economically produce to the end that costs will be reduced and the standard of living enhanced.

It is evident that transportation costs constitute a limiting factor on international commerce. As a result, the more the cost of transportation can be lowered, the better chance the democracies will have to accomplish their program of commerce and amity, and thereby justify their faith in democratic institutions and a free way of life.

The projected St. Lawrence Seaway will materially reduce the cost of transportation between the Great Lakes and the principal ports of the world. Not only would its utilization remove the necessity of handling foreign products, or Great Lakes products destined for overseas consumption twice—from rail to ship, or vice versa—but it would even reduce the carrying cost of certain products which originate and terminate at Lake and American ocean points, as the analysis in Part III indicates.

These broad considerations explain why explorers, traders, and statesmen have striven for 150 years to find a way to bring the carriers of world trade to midcontinental fields and factories. The logic of cheap deep-water transportation is compelling, making it almost unnecessary to prove the case by labored argument and statistical documentation. The factors which bring greatness to nations and well-being to millions are not always measurable; sometimes qualitative considerations obscure the quantitative datum. Statesmanship consists in part of the ability to perceive consequences that are not projected on the drafting board, and to inspire enthusiasm for undertakings, the total effect of which cannot be foreseen.

In the case of the St. Lawrence project, the two governments involved have come to the conclusion on many occasions that the Seaway would be advantageous to the nations. Beginning with Woodrow Wilson, every president, every national administration, and both political parties have approved the project. Yet sectional and special interests have defeated congressional approval once, and continue to maintain a powerful opposition even in this moment of crisis.

Certain commercial interests in Buffalo, New York, Philadelphia, Baltimore, and New Orleans oppose the project because they fear the tolls collected at transshipment points would be reduced by the Seaway. The railroads oppose it because they fear that cheaper water transportation will draw traffic and revenue away from them. The coal producers object because they fear that the projected hydroelectric development and a reduced rail traffic will curtail the consumption of coal. The lake carriers fear they will be displaced by oceangoing vessels. They make this assertion even though they claim, inconsistently, that lake carriers are more economical than the deeper-draft ocean carriers. Reduced to essentials, one and all insist that products should be carried from source to market, both imports and exports, in the more expensive way.

It is true there is nothing novel about the opposition of special interests to socially desirable innovations. Canal interests of former times opposed the development of the railroads. Locomotives were pictured, in posters and slogans, as murderers of women and chil-

dren, as heinous monsters despoiling the benign civilization of our fair cities. The stagecoach interests managed to keep steam wagons off the high roads for decades by passing a law that a man with a red flag had to run before them. When Edison invented his carbon filament electric bulb, the gas lighting interests paraded experts on platform and pulpit declaiming the impossibility of electric lighting. And, when the Panama Canal was proposed, the railroads mustered all the arguments they could think of in order to prove its impracticability and undesirability, just as they are doing today in the case of the St. Lawrence Seaway.

Nevertheless, the railroads were built, the steam wagon evolved into the automobile, electric lighting became ubiquitous and the Panama Canal finally joined the Atlantic and the Pacific. In each case the benefits have exceeded expectation and the predicted disasters have failed to materialize. Thus it will be in the case of the St. Lawrence project. Its accomplishment is but a matter of time.

However, in our representative form of government, every section and every special interest has the right and the opportunity to express its views and to air its grievances before decisions concerning national policy are taken. It is not enough to indicate the desirability, in terms of national well-being, of lowering transportation costs and of providing a new source of electric power by constructing the Seaway. It is not enough to indicate that the certain large national benefits will more than compensate for the possible small individual hardships. It is also necessary to take up one by one the interests of those affected by the project and to analyze the specific hardships which they envisage.

The St. Lawrence project is among those projects which reduce the expenditure of human energy per unit of product produced. With such projects there are inevitably certain temporary dislocations. Eventually, however, new openings are made available, both for the displaced labor and the superseded managements. And society, in the end, enjoys more goods and leisure. Our economic history abounds in examples of this process. For instance, the automobile displaced the stagecoach; nevertheless employment increased a thousandfold. Electricity displaced gas lighting, but the country is none the worse for it. With government aid the railroads displaced toll roads and canals, but the ensuing growth of the country's economic activity does not leave room for regret.

Each of these progressive innovations caused considerable anxiety to particular segments of our economy. For this reason the St. Lawrence Survey undertook not only to investigate the broad implications of a seaway from the Great Lakes to the ocean, but also to scrutinize the specific problems involved in thereby altering—it is true to some slight degree only—the direction and flow of Middle Western traffic.

As the research developed, it became evident that the desirability of the project depended upon the answers to the following questions:

1. Is the Seaway physically a feasible undertaking?
2. Will shippers use the Seaway?
3. How much will it cost?
4. Does it provide a cheaper form of transportation than alternative routes?
5. Will the project cause such violent short-term maladjustments that the cost of obsolescence and unemployment will never be made up by the gains accruing from it?
6. Is the power cheaper than the alternative sources?
7. Is there a market for this power?
8. Does either the power or the Seaway contribute to national defense?
   (a) In the near future?
   (b) In the years to come?

On the basis of its careful studies, the Survey has concluded that the harmful economic effects resulting from the utilization of the Seaway will be few and inconsequential, and the advantages many, and of vast importance.

Section 2

What Is the St. Lawrence Project?[1]

It is generally known that the Great Lakes provide a vital system of inland transportation to the landlocked civilization of the Middle West. Reference to the statistics of water-borne commerce on the Great Lakes reaffirms the importance of this traffic. In 1938, water-borne commerce traversing the Lakes amounted to 108,000,000 tons, almost one-fourth of all the water-borne commerce of the United States, including the Atlantic, Gulf, and Pacific coasts. Iron ore, soft and hard coal, various kinds of grains, and stone comprised nearly three-fourths of this water-borne commerce.[2] The Great Lakes fleet consists of 850 vessels of all descriptions, with total gross tonnage of 3,300,000, of which by far the largest proportion, 559 vessels with 2,572,000 gross tons, belong to United States registry.[3]

Unfortunately, this great body of water, which acts as a channel of transportation for the products of rich mines, agriculture, and industry, is sealed to the outside world by obstructions in the St. Lawrence River, which carries the flow of the Lakes to the Atlantic Ocean. These obstructions now hinder but a short interval in the 2,350 miles of waterway from Duluth to the entrance of the St. Lawrence River at Belle Isle, near Newfoundland. Unobstructed navigation is now possible over the 1,164 miles of the total distance which lie in the Great Lakes. Canals and locks at St. Mary's Falls between Lake Superior and Lake Huron, the removal of obstructions from St. Clair River, Lake St. Clair, and Detroit River, and the construction of the Welland Ship Canal to scale the Niagara escarpment between Lake Erie and Lake Ontario, have created an uninterrupted course from Duluth, Minn., to Ogdensburg, N. Y., and Prescott, Ontario. The upper part of the St. Lawrence River from Lake Ontario to Prescott, a distance of 64 miles through the Thousand Island Section, provides 27-foot navigation. Only in a short distance of 119 miles, from Ogdensburg, N. Y., and Prescott, Ontario, to Montreal, are there obstructions preventing ordinary oceangoing vessels from navigating into the heart of the American Continent.

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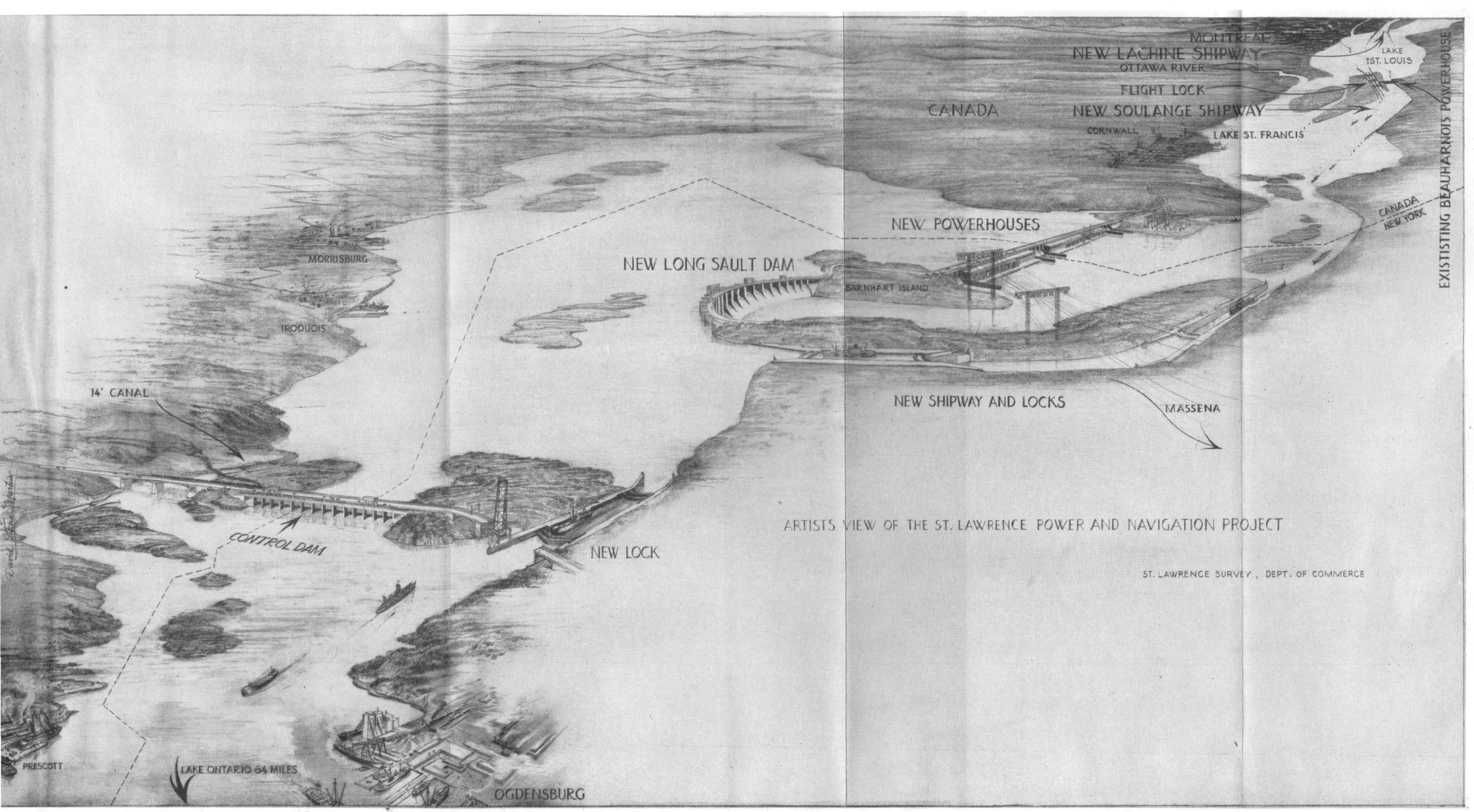
[1] St. Lawrence Survey, Part II, Section I.
[2] Lake Carriers' Association, *Annual Report*, 1938, p. 41.
[3] *Ibid.*, p. 46.



ARTISTS VIEW OF THE ST. LAWRENCE POWER AND NAVIGATION PROJECT

ST. LAWRENCE SURVEY, DEPT. OF COMMERCE

The distance of 1,003 miles from Montreal to the Straits of Belle Isle is navigable for oceangoing vessels. From Montreal to Father Point, a distance of 351 miles, the channels have a minimum depth of 32 feet and are now being deepened to 35 feet. Through the lower St. Lawrence River and the Gulf of St. Lawrence for the remaining 652 miles to open ocean, there is deep-sea navigation.

Even the stretch of 119 miles between Prescott and Montreal is not completely blocked; 70 miles of it is navigable in open waters, 31 miles in Lake St. Francis, 16 miles in Lake St. Louis, and the rest in the broad and calm stretches of river channels. The remaining 49 miles consist of a succession of rapids: The Galop and the Long Sault Rapids between Prescott and Cornwall, Ontario; the Soulanges Rapids between Lake St. Francis and Lake St. Louis; and the Lachine Rapids from Lake St. Louis to Montreal Harbor. The waters of the St. Lawrence River descend 224 feet over these rapids between Prescott and Montreal. These rapids are interspersed by calm stretches of water which are navigable for vessels up to 14- or 15-foot draft. The rapids themselves are circumvented by canals. Unfortunately these canals, built entirely within Canada and with Canadian capital, have navigable depths of only 14 to 16 feet and are, therefore, inaccessible to deeper draft oceangoing vessels.

The principal objective of the St. Lawrence Seaway project is the improvement of the channels between Prescott and Montreal to admit deep-draft oceangoing vessels, thereby creating uninterrupted passage from the Atlantic into the Great Lakes. This is to be accomplished by the construction of dams, locks, and canals at the International Rapids, the Soulanges Rapids, and Lachine Rapids, and the dredging of connecting channels. The initial depth will be 27 feet, with locks 30 feet deep over the sills, in order to overcome the difference of 224 feet in the water level between Lake Ontario and Montreal.

In greater detail, the St. Lawrence project first proposes the following changes: A new lock will have to be built at St. Mary's River in the same dimensions as proposed for the St. Lawrence, 30 feet over the sills, and the St. Mary's River, St. Clair River, and Detroit River will be dredged to 27 feet. The 324-foot drop in the Niagara River has already been overcome by the construction of the Welland Ship Canal which Canada completed in 1932 with an initial depth of 25 feet and locks 30 feet deep. This canal will require deepening to 27 feet.

In the 48 miles of the International Rapids Section, under a so-called two-stage or two-dam plan, one dam would be built at Crysler Island (or Ogden Island) and another at Barnhart Island;

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under a "single-stage" plan, which is now preferred, only one dam would be built—at Barnhart Island—with a control dam farther up the river. This section would require three locks to overcome a drop of 92 feet between Chimney Point and Lake St. Francis. In the wholly Canadian section of the river the required dam has already been built, at the foot of Lake St. Francis, in connection with the Beauharnois power development. This dam will become a part of the new Soulanges Canal development. Provision has been made for the installation of twin flight locks to scale a drop of 83 feet in water levels over the 18 miles between Lake St. Francis and Lake St. Louis. The river drops 48 feet in the Lachine section between the foot of Lake St. Louis and Montreal Harbor, over a distance of 24 miles. Ten miles of canals and three lift locks are necessary to circumvent the Lachine Rapids.

The development of the International Rapids Section is the most important part of the project. The specific geological and engineering factors involved in this project will not here be discussed, as they have been exhaustively treated in previous studies.[4] The United States Army Engineers have been working since November 1940 on final plans for the development of the project.

The map of the Great Lakes-St. Lawrence Project facing page 12 presents the essential features of the project diagrammatically. It shows clearly that the St. Lawrence Seaway project is designed to *complete* a system of transportation started by Canada and the United States over a century ago, by constructing the essential links in a brief stretch between Ogdensburg, N. Y., and Montreal, Quebec. With these links established, the mid-Continent of North America will become accessible to ocean transportation, permitting more economical utilization of its resources for peace and war.

A coordinate and equally important feature of the Seaway project is the hydroelectric power which will become available at the International Rapids Section of the St. Lawrence River. In order to bypass the 92-foot drop in the water levels at the International Rapids between Ogdensburg, N. Y., and Cornwall, Ontario, the River will be dammed up, thereby creating a lake above Cornwall on the same level as Lake Ontario and the Thousand Island Section of the River. The main dam will be constructed between the head of Barnhart Island and the American mainland, and a powerhouse structure between the foot of Barnhart Island and the Canadian mainland just above Cornwall will complete the necessary works in raising the level of the waters in the International Rapids to the level of Lake Ontario. The canal will bypass the main dam, with two locks to scale

[4] *Survey of the Great Lakes—St. Lawrence Seaway and Power Project*, Sen. Doc. 116, 73d Cong., 2d Sess., Vol. 1, pt. 1.

the drop of 92 feet between the new pool and Lake St. Francis. The drop of 92 feet will be utilized for the generation of electricity in the new powerhouse. The total installed capacity of generators will be 2,200,000 horsepower (1,640,000 kw.) and the annual average output of electricity will be about 13,200,000,000 kilowatt-hours, to be divided equally between New York State and the Province of Ontario. In magnitude of installed capacity this power plant will be surpassed only by Boulder Dam and Grand Coulee projects, and in annual output of electricity, the largest project of its kind in the world. Nearly 75 percent of the output will be firm power, an unusual feature for a hydroelectric project, due in this instance to the even flow of the river.

The works in the International Rapids Section are the principal features of the St. Lawrence project now before Congress. It is here that the interest of the United States and the State of New York is centered. The accompanying artist's conception of the St. Lawrence project gives an understandable view of the essential works. This drawing was prepared by David S. Martin, an artist recently with the Tennessee Valley Authority. The artist's view is not in scale because of the necessity of compressing space without sacrificing details of the proposed works.

Section 3

Is the Seaway Navigable?

Before taking up several economic problems pertaining to the St. Lawrence project, it is desirable first to dispel all doubt in respect to the feasibility of constructing a Seaway and of navigating it with oceangoing vessels. So many eminent private and public engineers have reviewed the engineering features, and passed upon their practicability and soundness, that this aspect of the project is not controversial. The consensus of informed opinion maintains that the International Rapids Section can be dammed up; that canals and locks can be constructed at the International Section as well as at Soulanges and Lachine; and that the various sections as planned will readily accommodate oceangoing vessels.

However, certain critics, though they do not dispute these claims, contend nevertheless that the course of the Seaway will be so tortuous, rock-lined, fog-ridden, and narrow, that it will be hazardous to navigation.[1] Ship owners, it is said, will not risk their ships in so dangerous a channel. Were these claims true, the construction of the Seaway would obviously not be worthwhile.

None of these contentions, however, withstands even a superficial scrutiny. The engineering plans call for a minimum curvature radius of 5,000 feet[2] which provides for ample visibility around the bends. Such a channel cannot be called tortuous. In regard to fog, it happens that fog is less frequent on the upper St. Lawrence than in New York Harbor. In respect to width, the plans call for channels with a minimum width of 450 feet, and the canalized section with a bottom width of 200 feet. This compares very favorably with, for example, the Hudson River channel up to Albany which has a normal width of 300 feet, widening to 400 feet in rock cuts.[3] Furthermore, only a short distance of the Seaway will consist of restricted channels.

That the St. Lawrence route holds no terror for seafaring men is indicated by the frequent use made of the existing shallow channel.

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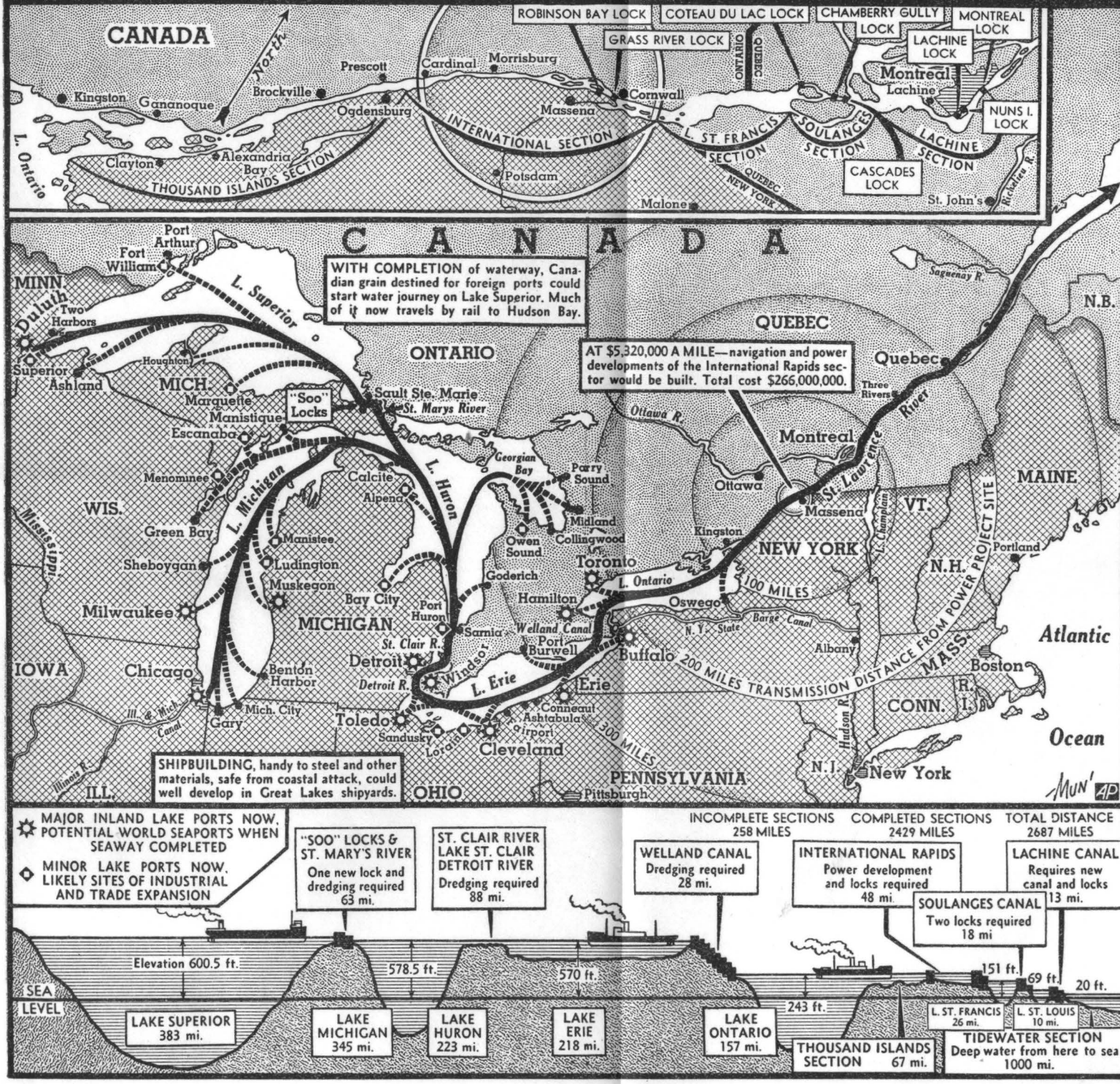
[1] Silcox, L. K., *Inland Ocean*, 1941, p. 28; R. V. Fletcher, vice president and general counsel, Association of American Railroads, address before annual board meeting of Atlantic States Shippers Advisory Board, Jan. 9, 1941.

[2] St. Lawrence Survey, Part II, p. 23.

[3] *Annual Report of the Chief of Engineers*, United States Army, 1939, p. 259.

...THE GREAT LAKES—ST. LAWRENCE PROJECT...



426328—41 (Face p. 12)

In 1938 there were 5,898 through-transits by vessels traveling between the Great Lakes and Montreal or points beyond. These vessels carried 8,285,000 tons of cargo. Way- and through-transists numbered 9,889 and there was, on the average, one transit every hour of the day during the season.[4] Of these transits, 119 consisted of direct service between Great Lakes ports and European ports, and 110 other trips were to and from the Eastern Maritime Provinces of Canada.[5] All these ships were restricted, of course, to 14-foot draft while passing through the canals.

If the route were hazardous, the accident record would reflect it. The records show, however, that during the 1938 season there were only 28 accidents—19 of them in clear weather and 3 in foggy weather. Twenty-three of the accidents consisted of stranding; total damage was $70,386. When we recall that there are 22 locks on the existing route, this record is seen to be quite remarkable. A comparison of the accident records of the St. Lawrence and Panama Canals during the years 1935–39, inclusive, indicates that the accident record on the St. Lawrence between Lake Ontario and Montreal, a distance of 183 miles, was much better in fact than that on the Panama Canal. On the St. Lawrence there were 2.3 accidents per 1,000 transits, as compared with 5.7 on the Panama[6] during those 5 years.

Another assertion has been made, namely, that a 27-foot channel would accommodate but a small part of the oceangoing fleet of the world, and a negligible (usually stated as 5 percent) portion of the American merchant fleet. To arrive at this figure critics start by reducing the effective draft of vessels that can use the Seaway to 24 feet, on the theory that the difference between salt-water and fresh-water buoyancy will take up 6 inches, and a clearance of 2½ feet is required between keel of ship and channel bottoms.[7] This last point is based upon misinformation. The usual authority given for that statement is the requirement of the port warden of Montreal for sailing permit.[8] In giving this reference, it is not stated, however, that the port warden's requirement is for out-bound vessels for which the channel depth is 32 feet. The requirements for canal-bound vessels are entirely different. According to the Department of Transport, Dominion of Canada, the clearance required in entering a lock is 3 inches, and in the canals, 1 foot.

If it be said that such small clearance would be dangerous over rocky channels, it is well to remember that when a channel is de-

[4] St. Lawrence Survey, Part II, p. 7.
[5] *Ibid.*, pp. 10–11.
[6] *Ibid.*, pp. 24–5.
[7] Harold G. Moulton, Charles S. Morgan, Adah L. Lee, *The St. Lawrence Navigation and Power Project*, Brookings Institution, 1929, p. 37.
[8] *Ibid.*, p. 36.

scribed as being 27 feet deep, this is the minimum controlling depth, usually over soft bottoms and in the canals. According to the accepted practice of the Army Engineers, the actual depth is dredged deeper at other parts of the channel where the bottom is rocky or the course is not straight.[9]

It is clear, then, that the draft of vessels that can utilize a 27-foot channel is not 24 feet, but more nearly 25½ feet.

An examination of the ocean-going freight ships of the principal maritime nations of the world, as of December 31, 1939, indicates that 70.91 percent of the vessels and 59 percent of the gross tons were in the group with 25 feet or less draft. Of the freight ships under American registry, 64.71 percent of the vessels and 55.8 percent of the gross tonnage was in this category.

Taking into consideration the further fact that ships use up fuel, water, and stores on a long voyage which may make a difference in actual draft upon arrival at Montreal of as much as 2 or 3 feet, and that many vessels start on a trip with less than full cargo, and further that light density cargo does not bring the vessel down to full registered draft, it appears probable that many vessels even of deeper draft can utilize the St. Lawrence Seaway.

Much is also made of the seasonality of the St. Lawrence route. Admittedly the channel will be closed to navigation between December 1 and May 1. The same is usually true of the Great Lakes on which one-fourth of the water-borne commerce of the United States is economically carried. Furthermore, certain critics assume that the time of profitable employment of vessels is measured from Montreal westward into the Lakes. They forget that oceangoing ships are in use not only from the moment they reach Montreal, but from the moment they leave their ports of origin. Similarly, on the last voyage out, the ships are still in use after clearing Montreal until they reach their destinations. Thus, the useful operating time of vessels is extended by at least 2 weeks each way; that is to say, from April 15 to December 15—to and from North European ports. The time of useful employment would be extended commensurately to and from Mediterranean points, South America, and the Orient, and the period of idleness, if there is any, would be shorter. Considering the fact that ships are often tied up almost a month out of every twelve for repairs, the idle period would be reduced to 3 months in the case of North European service, 2½ months in the case of South American service, and 1½ months in the case of ships oper-

[9] St. Lawrence Survey, Part II, pp. 27–30.

ating to and from the Orient, even if it is assumed that no other routes would be open to these vessels during the winter season.[10]

There are no physical or climatic reasons why the St. Lawrence Seaway should not be used by shipping lines a good part of each year. Moreover a large portion of the cargo ships of the world will be able to navigate this waterway.

[10] *Ibid.* p. 15.

Section 4

How Much Will the Seaway Cost?

The question of the cost of the Seaway has been obscured by ten dential speculation. According to the estimators' predilections an prejudices, the estimates have varied all the way from $180,000,00 to $1,450,000,000. The larger figure was computed by Hugh L Cooper & Co., in December 1920, and presented in a brief before th International Joint Commission on behalf of the Aluminum Co. o America, General Electric Co., and E. I. du Pont de Nemours an Co. Cooper's tentative estimate of cost has often been quoted a the cost of the St. Lawrence project.[1] It must be pointed out tha Hugh L. Cooper & Co.'s brief was a plea for private developmen of power resources on the St. Lawrence River between Lake Erie an Montreal, and is not comparable with the St. Lawrence project a now defined by the Canadian-American agreement of March 19, 1941

On January 16, 1934, Senator Arthur Vandenberg of Michiga introduced into the Congressional Record a telegram from Col. Hug L. Cooper stating the difference between the coverage of his estimate and those of the Army Engineers:

> Answering your telegram regarding alleged differences between my estimated cost of St. Lawrence project and War Department estimates, my estimate of $1,450,000,000 made in December 1920 after several years of intensive field and office study included cost of developing 6,600,000 horsepower between Lake Erie and Montreal, whereas the War Department estimate you probably refer to takes in only the two-stage power development aggregating 2,200,000 horsepower in the International Rapids division of the St. Lawrence River.[2]

The 1920 estimate is interesting today only because it indicate that private interests, as represented by Hugh L. Cooper & Co., wer apparently willing to invest $1,300,000,000 in order to secure th rights to all the water-power resources of the upper St. Lawrenc River, and to make a gift of the Seaway to the two Governments which according to their offer could obtain a complete waterwa

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[1] Statements of Hon. Bennett Champ Clark, *Congressional Record*, Vol. 78, Part I (Jan uary 12, 1934), p. 533, and Hon. Robert R. Reynolds, *ibid.* (January 19, 1934), pp. 931–2

[2] *Ibid.* (January 17, 1934), p. 795.

for an additional investment of only $150,000,000 for locks and canals.[3]

In 1926, Hugh L. Cooper & Co., representing the same interests, made application to the New York Water Power Commission for a license to develop the International Rapids Section of the St. Lawrence River for power purposes only. On this occasion they estimated the cost of the International Rapids Section development of the power (2,400,000 h. p.) at a little over $237,000,000.[4] This estimate is not radically different from those of the Army Engineers in 1926, 1932, and 1941, nor from that of the New York State St. Lawrence Power Development Commission of 1931.[5]

Another device used by opponents of the project to discredit the estimates of the Joint Board of Engineers is to cite the overrun in the cost of other canal projects. The usual arguments run thus:

> *Experience shows that great waterway projects have practically never been completed within original estimates of cost.* This is no doubt in part attributable to the fear that popular support will be difficult to obtain if the cost figures are of staggering dimensions. There is hence an inevitable tendency in the direction of conservatism in the making of estimates. Despite the fact that estimates for the Manchester Ship Canal were presented "with a fullness of detail seldom equalled," the canal cost more than twice the amount of the original estimate. The actual cost of the Chicago Drainage Canal when completed was $53,000,000, compared with an estimated cost of $16,000,000. The Suez Canal, which it was thought could be built for $30,000,000, cost $80,000,000. At the time of the passage of the bill for the construction of the Panama Canal it was estimated that the cost would be approximately $140,000,000, and that in no case would it exceed $160,000,000. Yet this canal cost $375,000,000, the increase being in part due to a change in plans as the work progressed.[6]

These points are repeated with few changes of wording by all other critics of Army Engineers' estimates.[7]

It is not the intention here to defend the Army Engineers' estimates of the cost of the St. Lawrence project. It is only necessary to point out that the official estimate of the Army Engineers and of

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[3] Hugh L. Cooper & Co., *Report to International Joint Commission on Navigation and Power in the St. Lawrence River*, 1920, p. 15.

[4] *Report of the New York State Water Power Commission* for the year ending Dec. 31, 1926, p. 30.

[5] *Report of the St. Lawrence Power Development Commission*, State of New York, 1931, p. 21.

[6] Moulton et al., *op. cit.*, p. 89.

[7] Statements of Hon. Robert R. Reynolds and Hon. J. Hamilton Lewis, *Congressional Record*, Vol. 78, Part I (January 19, 1934), pp. 931–2; Niagara Frontier Planning Board, *The St. Lawrence Seaway Project*, 1940, p. 32; testimony of John L. Lewis before Committee on Rivers and Harbors, *Hearings on H. R. 4927*, 77th Cong., 1st Sess., No. 16, p. 1579; also statement of L. K. Silcox, *ibid.*, No. 17, p. 1903.

the Joint Board of Engineers are the only authoritative estimates extant. Theirs are the only ones based upon thorough, on-the-spot investigation. And few public works have been studied as exhaustively as the St. Lawrence project over the past 20 years.

The irrelevance of the opposition's arguments with respect to cost can best be shown by scrutinizing the examples assumed to be analogous to the Seaway.

De Lesseps in 1856 estimated that the Suez Canal would cost $14,000,000 in gold currency. On the basis of this estimate, Moulton and associates stated that "the Suez Canal, which it was thought could be built for $30,000,000, cost $80,000,000."[8]

This comment is misleading. An examination of the history of the canal indicates that political obstacles made it impossible to carry out the original plans of de Lesseps. At first de Lesseps supposed that it would take 6 years to complete the canal, and his estimates of cost were based on the belief that forced Egyptian labor would be available for his use. Both of these expectations were nullified as a result of the political interference of the Porte at Constantinople. Foreign Minister Nubar of Egypt and Premier Palmerston of Great Britain did their best to place handicaps in the path of de Lesseps. As a result, the 20,000 forced fellahin labor with which work was started in 1859 was reduced to 6,000, and de Lesseps had to bring in 15,000 free workmen, consisting of Frenchmen, Italians, Dalmatians, Arabs, and Syrians, whose wages were higher. It was also necessary to use machine equipment in place of forced labor, which increased capital investment. As a result de Lesseps spent between $10,000,000 and $12,000,000 for excavating machinery alone. Also the project was further delayed by interruptions when the forced labor was withdrawn, which increased the interest charges.

Another work stoppage was caused near the end of the project when the company ran out of funds and had to revert, by authority of the French Government, to a lottery. Thus the final cost of the canal when it was opened to traffic in 1869, was $83,000,000, divided among: Construction, 58.2 million; interest, 16.5 million; commissions, 2.2 million; management, 2.8 million; and sundries, 3.3 million.

It is evident that an experience of this kind cannot be used as a guide to the St. Lawrence project or as a standard whereby modern engineering estimates of highly qualified specialists can be measured. It is unthinkable that deliberate political interference by either party to the St. Lawrence agreement will cause a repetition of the conditions that handicapped de Lesseps.

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[8] Moulton, *op. cit.*, p. 89.

Similarly it is asserted in respect to the Panama Canal that the original estimates ranged between $140,000,000 and $160,000,000, although the actual cost of the canal amounted to $375,000,000. Again the assertion is misleading, since the $160,000,000 figure applied to one set of specifications, and the final cost was the result of an entirely different set of specifications.

The significant fact is that the final cost of the Panama Canal was less than the estimate of the Army Engineers which was approved by Congress. This fact is made explicit in a letter dated January 16, 1934, from Gen. E. M. Markham, then Chief of Engineers, United States Army, to Senator Arthur Vandenberg, in which he wrote:

> Possibly the most outstanding example of the reliability of estimates prepared by the officers of this Department is that of the Panama Canal. When the final designs for this canal with increased dimensions for locks and with the widening of the channel through the Culebra Cut were adopted in 1908, Colonel Goethals, in charge of the construction, had an estimate prepared of the cost of the canal. The amount of this estimate was $375,201,000. On June 30, 1918, after the canal was opened and in permanent operation, the actual cost was $372,391,853.92.
>
> These records show conclusively, I believe, the reliability of the estimates prepared by the officers of this Department.[9]

A further point to be kept in mind in evaluating such assertions as those made by Moulton and associates and the Niagara Frontier Planning Board, is that the concept of cost in terms of dollars which they use is very elusive in view of the fact that prices and wages often vary in time. It is necessary to make allowances for the change in the value of money (or the price level) over the period of construction. The opponents of the St. Lawrence project fail to do this.

In short, the suggestion that the Army Engineers habitually underrate the cost of major projects must be forthwith rejected as unworthy of serious consideration.

The engineering features of the St. Lawrence project have been intensively investigated. It is far-fetched to find an analogy between the political tribulations that beset the Suez Canal, and the present careful estimates of the Army Engineers.

The official estimates of the United States and Canada are the only estimates ever made based upon thorough and lengthy investigation of the site, the geological composition of the river bed, the hydrological characteristics of the river in winter and summer. All other

[9] New York Power Authority, *Third Annual Report*, 1934, p. 100.

figures publicized by opponents of the project are based upon convolutions of these official figures, upon the assumption that the engineer officers of the two governments will be wrong by a wide margin. Contrary to assertion, the United States Army Engineers were not wrong in their estimates of the cost of the Panama Canal, as the letter of General Markham quoted above shows. In the case of the St. Lawrence, at least two extensive surveys have been undertaken by Joint Boards of Engineers of the two governments, one in 1926 and a recent one under way at this writing. Both of these surveys were thorough, and followed the standard techniques of the United States Army Engineers.

In 1926 the Joint Board of Engineers arrived at an estimate of cost of $468,271,000, with a two-stage development at the International Rapids Section.[10] The cost of a single-stage development, preferred by the United States representatives on the Board, was set at $438,625,000. The project contemplated a 25-foot channel, and the cost estimated included 12½-percent allowance for contingencies. In 1932 the Joint Board was reconvened in connection with the negotiations of the St. Lawrence Treaty, and revised the estimates in the light of changed economic conditions. The 1932 estimate for a two-stage, 27-foot project was $499,338,000.[11]

These estimates included the total cost of new work to be undertaken by both governments, considering not only the improvements on the St. Lawrence River, but also dredging operations on the Welland Canal and the connecting channels betwen the Great Lakes.

The principal interest of United States' citizens is in the cost to their Government. In 1926 no allocation was made between the two Governments. In 1932 such allocation was made, and the United States' share of the costs amounted to $272,453,000, including the self-liquidating power project. Canada was given credit for the cost of the Welland Canal, an essential link in the system, on which the Dominion had already spent some $130,000,000. Out of the total cost of $272,453,000, the State of New York came forward to assume all of the cost of works primarily for power and one-half of the United States' share of the cost at the International Rapids Section, amounting to $89,726,250. This was approved by a joint resolution of the House of Representatives on April 26, 1933.[12] Deducting New York State's share from the $272,453,000 estimated to be the United States' share of the total costs, the Federal Government's obligation would be $182,726,250.

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[10] *Report of the Joint Board of Engineers, With Supplements* (Canadian Print, 1927), pp. 44–5. The two-stage development contemplated two powerhouses at the International Section, utilizing the 92-foot drop in the water level in two steps.

[11] *Ibid.*; also *Report of Joint Board of Engineers (Reconvened) on the International Section*, Canadian Print, 1932, p. 9.

[12] H. J. Res. No. 157, 73d Cong., 1st Sess., p. 9.

This is the estimate of Federal costs that has been in the forefront since 1932, until a more recent estimate was made this year and presented to the House Committee on Rivers and Harbors during its hearings on H. R. 4927. This 1932 figure has been completely ignored by the critics while they wrote and talked about billion-dollar costs. Even allowing interest during construction, one of the points emphasized by the critics, computing the interest at 3 percent during 4 years of construction, the total cost would still have been less than $200,000,000.

Since November 1940, the United States Army Engineers, under the supervision of Brigadier General Thomas M. Robins, Assistant Chief of Engineers, and Colonel A. B. Jones, District Engineer, St. Lawrence District, have been making a field survey, and reestimating the cost. The results of this most up-to-date and extensive survey were presented by General Robins to the House Committee on Rivers and Harbors.[18] Table 2 presents the United States Army Engineers latest estimate of cost.

TABLE 2

Estimate of cost of St. Lawrence Seaway

	Canada	United States	Total
Great Lakes Section:			
New lock at Sault Ste. Marie with approach channels		$8,000,000	$8,000,000
Connecting channels		66,029,000	66,029,000
Welland Canal	$133,000,000		133,000,000
St. Lawrence River:			
Thousand Island Section	772,000	516,000	1,288,000
International Rapids Section:			
(a) Works solely for navigation		48,857,000	48,857,000
(b) Works primarily for power	37,950,000	78,550,000	116,500,000
(c) Works common to navigation and power	22,414,000	100,210,000	122,624,000
Canadian Section:			
St. Francis Lake channel	1,330,000		1,330,000
Soulanges Reach	25,785,000		25,785,000
LaChine Reach	55,630,000		55,630,000
Total	277,080,000	302,162,000	579,252,000
Expenditures to date	132,672,000	17,105,465	149,777,465
Cost to complete	144,418,000	285,056,515	429,474,515

SOURCE: *Hearings on H. R. 4927*, statement by Brig. Gen. Thomas M. Robins, Assistant Chief of Engineers, United States Army, No. 12, p. 966.

According to this estimate, the total cost of a single-stage, 27-foot project, including the powerhouses and the electrical equipment for the New York portion of the power, and including also the improvements in connecting channels and a new lock at Sault Ste. Marie, would be $429,474,515. This figure allows 25 percent for contingencies. The United States' share, giving Canada credit for $132,672,000 already spent, mainly on the Welland Canal, would be $285,056,515. Again the New York Power Authority has come for-

[18] For testimony of Brig. Gen. Robins, see *Hearings on H. R. 4927*, Nos. 3, 4, 12.

ward and offered to pay the total cost of the power-house structure and equipment on the American side, and a portion of the American share of the joint costs at the International Rapids Section. This has been estimated at $93,375,000.[14] Deducting this from the United States' share of the total costs, the ultimate Federal liability becomes $191,681,515, not including interest during construction, but including 25 percent for contingencies. The Federal Government is able to borrow on long term at three percent or less. Allowing actual interest costs at this rate during a 4-year construction period would still leave the total cost to the United States Government at approximately $200,000,000. The annual cost to the United States Treasury of the Great Lakes-St. Lawrence Seaway is estimated to be approximately $9,500,000 including interest, amortization, maintenance of channels, dikes, etc., operation of locks, and added expense of aids to navigation.

[14] See H. R. 4927, sec. 2, reproduced in appendix F.

Section 5

Will Shippers Use the Seaway?

For an annual cost of $9,500,000 for overhead maintenance and operating expenses the Federal Government could make it possible for oceangoing cargo vessels to come into the industrial and agricultural center of this Continent, and to dock at any of the larger Great Lakes cities such as Buffalo, Cleveland, Detroit, Chicago, or Milwaukee. It is no longer questioned that ships will travel where they can enter, if there are offerings of cargo. Not even the opponents make a plausible case now, as they attempted in Senate committee hearings in 1932, to prove that operating difficulties would prevent ship owners from sending ocean vessels into the Great Lakes.[1] Their real reason for opposition, in fact, is based upon the assumption that the St. Lawrence will carry a large tonnage, thereby taking away from the lake carriers, the railroads, and existing ports profitable cargoes.

Along with the assertion that ocean ships would not travel into the Great Lakes, the coordinate theory was propounded by opponents that shippers would not use Seaway transportation. Several questions then must be answered: Will shippers use this service? Will there be any savings in transportation costs? Will there be sufficient cargo, incoming and outgoing, to make it profitable for shipowners to send their ships into Great Lakes ports?

These questions can be answered in several ways. In general terms, for example, it seems reasonable to maintain that an area inhabited by 40,000,000 people and producing $25,000,000,000 worth of manufactured goods a year (42 percent of the national total) and over 50 percent of the Nation's agricultural produce, will supply the 10,000,000 tons of additional United States freight which the deepened St. Lawrence system could handle. Countries in other parts of the world with smaller populations and with less productive capacity and purchasing power, sustain greater shipping services.

Such an approach, however, is too general to satisfy the professional critic. It has been superseded over the years by various and

[1] Hearings before a subcommittee of the Committee on Foreign Relations, United States Senate, on S. Res. 278, 72d Cong., 2d Sess., statements of G. H. Pouder, executive vice president, Baltimore Association of Commerce, pp. 127, 131, 134–35, 155, 158; Report of Chamber of Commerce, State of New York—presented by Marcus H. Tracy, pp. 270, 679.

more complex analyses. One approach has been to prove by statistical analysis that there is enough movement of goods in and out of the Great Lakes tributary area which may be diverted from existing means of transportation to the Seaway.

This approach is open to criticism since it postulates a static economy. The American economy is far from static. If such an approach had been used in the past the continental railroad system would not have been constructed. It is evident that the bison and Indians then inhabiting the Western Plains did not promise to provide enough goods or produce to warrant the construction of even one trunk line. The railroads were built in the expectation that transport facilities would lead to population, open the vast resources of the West to human exploitation, thereby creating commerce and traffic for the rails, an expectation that has been more than justified.

Similarly, it would be reasonable to suppose that even were the 40,000,000 people in and around the Great Lakes self-sufficient, with the result that no commerce with other regions existed, nevertheless the opening up of a new and cheaper form of transportation would create commerce to the mutual advantage of everyone concerned.

However, the fact is that a great commerce already exists between the Great Lakes region and the rest of the world. It is not enough, however, to estimate the quantity of freight—existing and potential—which could use the Seaway, but it is also necessary to scrutinize the composition of this traffic in order to discover whether the Seaway would service it more economically than other means of transportation, such as the railroads.

The usual approach to this problem has been to compare rail to water-carrier rates. On the basis of these studies, certain writers have concluded that the Seaway would not be a good investment because not enough tonnage would use it, or there would not be enough savings;[2] others, on the contrary, that it would be a good investment, that it would provide more economic transportation for a large amount of traffic.[3]

The St. Lawrence Survey, in order to resolve this controversy, undertook a study more exhaustive than any heretofore available.[4] This study has been made according to the basic principles employed by the Corps of Engineers, United States Army. In determining the economic feasibility and desirability of waterway projects, the Corps of Engineers bases its judgment on the potential

[2] Niagara Frontier Planning Board, *op. cit.*

[3] A. H. Ritter, *Transportation Economics of the Great Lakes-St. Lawrence Ship Canal, 1926*; *Survey of the Great Lakes-St. Lawrence Seaway and Power Project, op. cit.*

[4] St. Lawrence Survey, Part III.

tonnage and savings to shippers and consumers which may result from the construction of the waterway.

In submitting this study, the Survey does not concede that the availability of traffic on the basis of alternative transportation rates is either the most important or the determining factor in the decision as to the desirability of the Seaway. Other factors are more fundamental and important. The cost of water transportation as compared with land transportation is, for example, certainly more basic than a comparison of rates. Again, future transportation requirements are more relevant, though less measurable, than past movements of freight. The Seaway as a source of power and a defense asset in shipbuilding is certainly more crucial than comparisons of freight rates on specific commodities.

Results of Traffic Studies.

To settle once and for all the question of available traffic on the basis of freight rates, however, the Survey undertook an intensive study of origins, destinations, and freight rates of a selected list of commodities. The commodities studied were the following: Motor vehicles, grain, soybeans, dairy products, green coffee, citrus fruits, bananas, alcoholic wines and distilled liquors, crude rubber, tin, sulfur, vegetable fats and oils and vegetable-oil seeds, machinery, iron and steel products, woodpulp and newsprint, packing-house products, burlap and jute. This list was not exhaustive, but was inclusive enough to give a fair sample and wide coverage. Several important commodities were left out of consideration because upon a preliminary examination of the available data it was found that the effect of the Seaway on their transportation was indefinite. Coal, petroleum, lumber, and sugar are among these products.

Furthermore, in the very assumptions underlying these commodity studies, trade in entirely new products, or in products that do not now enter into interregional or international trade, was left out of consideration. Among these one may mention fruits and vegetables from Michigan and fish and other sea food from eastern Canadian ports.

Again, a large number of commodities in which interregional trade is practically certain to exist, and which may well utilize the St. Lawrence Seaway, were not studied separately because of limitations of time and resources. Such important commercial products as canned goods from the West coast, leather goods from New England, cotton products from the South, cottonseed and oil, flaxseed, linseed oil and cake from Minnesota and the Dakotas, will probably utilize the Seaway under varying conditions. Similarly, products from foreign countries, such

as fruits and nuts from the Mediterranean countries, kaolin from England, pottery products from different parts of Europe, could well utilize Seaway transportation.

The reason why these products were not treated exhaustively for our purpose is very simple. In the commodities that were studied, there is sufficient justification in the amount of transportation savings, conservatively estimated, to prove the feasibility and the economic justification of the Seaway. Any further extensions of these commodity studies would be merely contributory and supplemental, and would add nothing further to the economic reasoning upon which the justification of the Seaway must be based.

It must be clearly understood, therefore, that the results herein described apply only to a partial list of commodities selected for special treatment.

The results show that during the average year in the depression decade of 1928–37 or 1929–38, there was traffic of over 4,600,000 short tons, which might have been carried over the Seaway, had it been in existence, with a saving in freight rates of 14 to 17 million dollars, after allowing for any additional insurance charges. The individual commodities to which these savings apply are shown in table 3. The average savings would be nearly $4 per ton. In individual cases the savings would vary from time to time and from place to place. If the Seaway is utilized by American interests to the extent of 10,000,000 tons of traffic annually, these savings in freight rates will be as much as $36,000,000 a year.

Taking the total annual cost of the Seaway estimated by the United States Army Engineers as between 9 and 10 million dollars, including operating costs, interest, depreciation, and amortization, it becomes evident from this limited sample of commodity studies that there has been a large volume of annual traffic even during a decade of business conditions as depressed as have been experienced in the recent past, on which the savings in freight rates would have amply justified the construction of the project upon a commercial basis.

Caution must be exercised in interpreting the facts in this study. First and foremost, these results are not predictions or forecasts of what the total traffic will be in the future. In view of the many other commodities which are not analyzed in detail, such as sugar, lumber, hides and leather, cottonseed and cottonseed oils, etc., which may utilize this new route, and in view of the probability that this nation is unlikely to allow the conditions of the early 1930's to be repeated again, actual traffic in the future is indeed likely to be of much greater magnitude.

TABLE 3

Summary of potential tonnage and savings on selected list of commodities [1]

Item	Domestic		Export		Import		Total		Average savings per short ton
	Tonnage	Saving	Tonnage	Saving	Tonnage	Saving	Tonnage	Saving	
	Short tons		*Short tons*		*Short tons*		*Short tons*		
Autos and parts	359,000	$3,993,000	201,000	$2,863,000			560,000	$6,856,000	$12.24
Grain and flour	585,000	626,000	708,000	1,458,000			1,293,000	2,084,000	1.61
Soybeans			148,000	154,000			148,000	154,000	1.04
Dairy products	314,000	743,000 / 952,000					314,000	743,000 / 952,000	2.37 / 3.03
Green coffee					131,000	$612,000	131,000	612,000	4.67
Citrus fruit	97,000	449,000	15,000	110,000			112,000	559,000	4.99
Bananas					163,000	1,196,000 / 1,849,000	163,000	1,196,000 / 1,849,000	7.34 / 11.34
Wines and liquors					15,000	145,000	15,000	145,000	9.67
Crude rubber					151,000	757,000 / 1,105,000	151,000	767,000 / 1,105,000	5.08 / 7.32
Tin					25,000	113,000	25,000	113,000	4.52
Sulphur	179,000 / 307,000	185,000 / 317,000					179,000 / 307,000	185,000 / 317,000	1.03 / 1.03
Vegetable oils and seeds					116,000	629,000	116,000	629,000	5.42
Machinery			167,500	769,000 / 2,071,000			167,500	769,000 / 2,071,000	4.59 / 12.36
Iron and steel	389,000	535,000	208,000	664,000	75,000	758,000	672,000	1,957,000	2.91
Woodpulp and newsprint	50,000	100,000			310,000	385,000	360,000	485,000	1.35
Packinghouse products	58,000	286,000	139,000	408,000 / 874,000			197,000	694,000 / 1,160,000	3.52 / 5.89
Burlap and jute					28,000	116,000	28,000	116,000	4.14
Total	2,031,000 / 2,159,000	6,917,000 / 7,258,000	1,586,500	6,426,000 / 8,194,000	1,014,000	4,721,000 / 5,712,000	4,631,500 / 4,759,500	18,064,000 / 21,164,000	3.90 / 4.45

[1] The figures bracketed together indicate alternative totals based upon different assumptions as explained in corresponding appendices in Part III.

SOURCE: Summarized from Part III, appendices A to Q.

In the second place, in making the individual commodity studies, traffic through the existing 14-foot canal was not included in the calculations. Possible trade with Canada, and with other countries such as Oceania, and United States possessions, with which direct shipping services are not very likely, was likewise left out of consideration. Hence the figures here given are conservative estimates of new potential traffic for the Seaway.

Thirdly, this new traffic, available even during a period of depression, will not necessarily shift from existing modes of transportation to the Seaway within a year or two after completion. The development of Seaway traffic will probably be a matter of years and decades. The Suez Canal was built by de Lesseps upon the assumption that it would carry 3 million tons of traffic, and that at that level it would be a self-liquidating and even profitable enterprise. In fact, however, it was not until 10 years after completion that traffic reached 3 million tons. Thereafter traffic continued to increase, until in 1929 Suez carried 34½ million tons. A similarly slow growth in traffic occurred in the case of the Panama Canal which now exceeds the volume initially estimated. The same experience may be expected in the case of the Seaway. Over a period of years, commerce expands with the development of new industries, new services, and new shipping facilities. Traffic studies such as the present only show that inter-regional and international trade between the mid-continent and other areas already exists to justify the new facilities. The actual traffic that will be realized in future years will not consist *in toto* of a transfer of this traffic from existing channels to the St. Lawrence. Instead, it will consist in large part of future new interregional and international trade both in quantity and in kind of goods. This has been the experience at Suez and Panama. It will surely be the case on the St. Lawrence.

Cost of Seaway Transportation.

Besides its commercial justification, the Seaway also stands the test of a more fundamental economic analysis—one based not upon the savings in rates by shifting existing traffic from other systems of transportation to the Seaway, but based upon a comparison of the costs involved in carrying new increments of traffic. With the growth of the country's industry and commerce, new investment will undoubtedly be required in additional transportation facilities. Part V of our studies proved this to be the case for the railroads. The question then becomes: Which of the alternative possibilities of expanding transportation facilities is the most economical for the country to undertake?

To answer this question, the Survey has made an exhaustive analysis of the comparative costs of rail and water transportation as applied to the type of traffic that the St. Lawrence Seaway may carry. The results are given in Chapter IV of Part III. Assuming an incremental new traffic of 10,000,000 long tons achieved by 1955, the study reveals that new capital costs of railroads, not including fixed plant (trackage and terminal) facilities, would be from 311 to 340 million dollars as compared with $235,000,000 for the Seaway. On an annual basis, including fixed charges, amortization and depreciation on the foregoing investment as well as rail and ship operating costs, the annual costs would be, for high-efficiency traffic, $92,000,000 via rail as compared with $21,000,000 via the Seaway, and on low-efficiency traffic, $86,000,000 on the railroads, as against $57,000,000 through the Seaway. There is no question but that in terms of total *national cost* the Seaway would provide a more economic method of carrying its portion of the increase in the traffic of the future.

Future Prospects.

One final question must be answered: What are the future prospects of world trade? Obviously it would be presumptuous to give a categorical answer to this question. The value of the Seaway can only be judged in relation to various hypotheses of future world conditions.

A brief survey of possibilities indicates that if Great Britain survives and war conditions continue, exports in agricultural products and luxury goods will remain at a low level, while heavy products, largely military supplies and equipment and machinery—all in major part produced in the Middle West—will grow to larger proportions. Hence Seaway traffic in these products would acquire greater significance.

World peace established under democratic auspices, carrying with it the responsibility of economic rehabilitation and reconstruction of devastated areas of Europe, Africa and Asia, would certainly lead to an unprecedented expansion of exports and imports. If this happens, the St. Lawrence Seaway would take care of a small portion of the added traffic; but to the extent that it does, it will be more economical than any alternative route to and from the Middle West.

Finally, if the conflict abroad should be resolved unfavorably to American interests, if this country and Canada should find themselves surrounded by hostile powers in control of the high seas, then of course the commercial and economic advantages of the Seaway would acquire secondary importance. Military and strategic values

would predominate in the judgment of this project. Under such circumstances, the weight of expert and official opinion is that the St. Lawrence Seaway would be of immense advantage, because it will make available a new outlet to the sea, protected for a thousand miles nearer Europe, and because it will make available the managerial ability, the skilled labor, and the existing plants of a large number of shipyards on the Great Lakes.[5]

Consideration of Toll Charges.

The studies of the Survey indicate that there will be considerable traffic through the proposed St. Lawrence Seaway, even under conditions of restricted business activity. With growth in population and in production of both manufactured and agricultural products, it is likely that the full capacity of the St. Lawrence Seaway will come to be utilized. Even under conditions of comparatively low economic activity such as prevailed in the decade of the 'thirties, the savings in transportation costs on St. Lawrence traffic to American shippers would be more than enough to compensate for the annual cost of about $9,500,000. This means that even if tolls were charged to meet all of the annual costs, there would still be a net saving to those utilizing the Seaway.

As a matter of strict economics, transportation services should be self-supporting and self-liquidating. At times this policy is departed from because of other considerations. To encourage establishment of railroads, subsidies were granted to them in their early days of development. National defense considerations require the maintenance of a merchant marine; and a subsidy to ocean transportation in capital costs as well as operating expenses is an established policy. Waterway developments have been free of cost on the general theory that their economic benefits to the Nation exceed the cost to taxpayers.

Whether or not tolls should actually be levied on the St. Lawrence Seaway is a matter of national policy which requires careful study and analysis. The question of charging tolls on waterways has been a highly controversial issue in American history and has become enshrouded in tradition and practice which does not allow a quick and partial solution. With the exception of the Panama Canal, waterways established by the United States have been notably free of tolls. This policy is embedded in the law of the country.

Accepting, however, the general premise that transportation of commodities should bear their fair cost, it is desirable to consider the application of this principle to the St. Lawrence Seaway. It is recommended, therefore, that an investigation should be made of the feasibility of applying tolls on the Great Lakes-St. Lawrence system.

[5] See section 9 below.

This in no way need interfere with the authorization of the construction of the project, since the 4-year construction period will permit ample time to consider thoroughly the problem of tolls from both the national and international viewpoints, and to take any legislative action that may be deemed advisable.

In considering the problem of toll charges on the St. Lawrence, certain difficult problems present themselves. In the first instance, the general policy of charging tolls on waterways must be reexamined before any application in a particular case is undertaken. Since changes in freight rates affect the welfare of established industry and the location of new plants and industry in the future, a reexamination of national policy on tolls requires an extensive analysis of the effect of this change of policy upon American industry, particularly in those areas where waterway transportation is available.

Furthermore, a consideration of tolls in any one case, such as the St. Lawrence Seaway, necessitates an examination of the effect of such tolls upon competitive routes. Tolls cannot be charged on the St. Lawrence without studying the effects of this practice upon the Ohio and the Mississippi River systems and the New York State Barge Canal.

The problem of charging tolls on the St. Lawrence is further complicated by the fact that there already exists an extensive canal system from Lake Superior to the lower St. Lawrence River which is free of tolls. The effect of a new schedule of toll charges upon existing traffic must certainly be studied very carefully, and the possibilities of discriminatory charges in order to preserve the relative position of industries and commerce established on a principle of free water transportation, must be examined. This is particularly important since Canadian national policy in the St. Lawrence watershed, which is the Dominion's economic life line, is based upon the principle of toll-free water transportation.

The peculiar nature of traffic through the St. Lawrence canals at present and through the prospective Seaway also creates some problems that require careful examination. Low-priced, staple agricultural products form a considerable part of this traffic. Hence a flat charge on a tonnage basis, as at Panama Canal, may not be effectively applicable in the case of the St. Lawrence Seaway. It is important, therefore, to study the possibilities of discriminatory rates between classes of products that utilize the Seaway.

The St. Lawrence Seaway is not a continuous canal system. It consists, in fact, of a series of canals separated from each other by lakes, rivers, and channels. There is way-traffic over part of the distance in this extensive Great Lakes-St. Lawrence system, between, for instance, Lake Superior and Lake Michigan, or between Lake Erie and Lake Ontario, or between Lake Ontario and Montreal. Some

traffic utilizes one segment, other traffic uses two links in the waterway system, and there is also through-traffic which utilizes all of the canals in this interconnected system. Hence the establishment of tolls must be studied in the light of this situation, which is immeasurably more complicated than at either the Suez Canal or the Panama Canal.

Finally, the question of tolls on the St. Lawrence Seaway or any part of the Great Lakes-St. Lawrence system must be examined in the light not only of the economic structure of Canada and the Middle West of the United States, but also in the light of the existing legal precedents of each country, and in the light of treaty relations between the two countries.

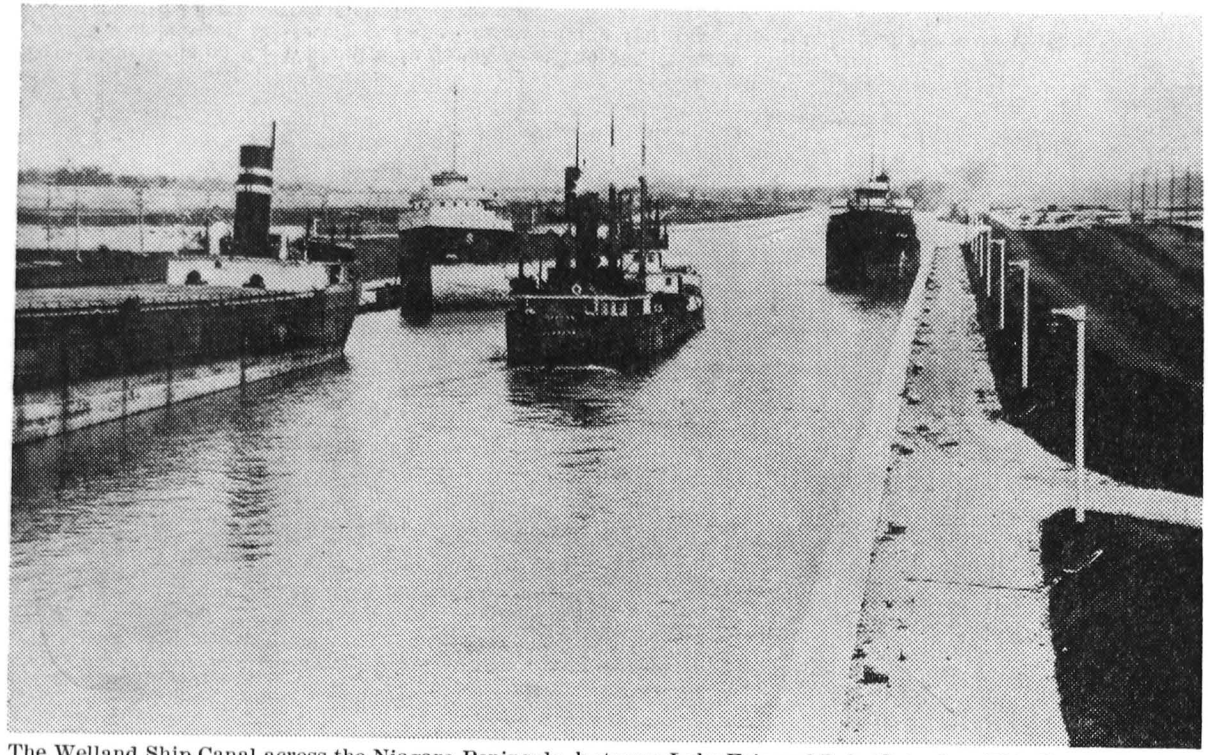
How much of the cost of the Seaway should be considered an incidence upon the commercial users, and how much upon the Federal Treasury, is not easy to determine. There is no question that the Seaway will result in direct savings to the Federal Government in connection with national defense expenditures. The Seaway will make Great Lakes shipyards available for the construction of large naval and merchant ships. It may be said that the Seaway will save the Government the cost of duplicating these facilities at coastal points. To this extent, investment in the Seaway is a substitute, at least in part, for investment in new shipyards needed for the future; it is a desirable substitute since the type of labor, material, and machinery that is required for the Seaway is more easily obtainable than in the construction of fully equipped shipyards.

Again, there will be savings to the Federal Treasury in the capital cost of naval and merchant vessels, at least by 2½ percent, perhaps by as much as 5 percent, of total cost of construction, due to proximity to the source of materials that go into ship construction. There will also be some saving in transportation cost on Government-owned cargo that utilizes the Seaway.

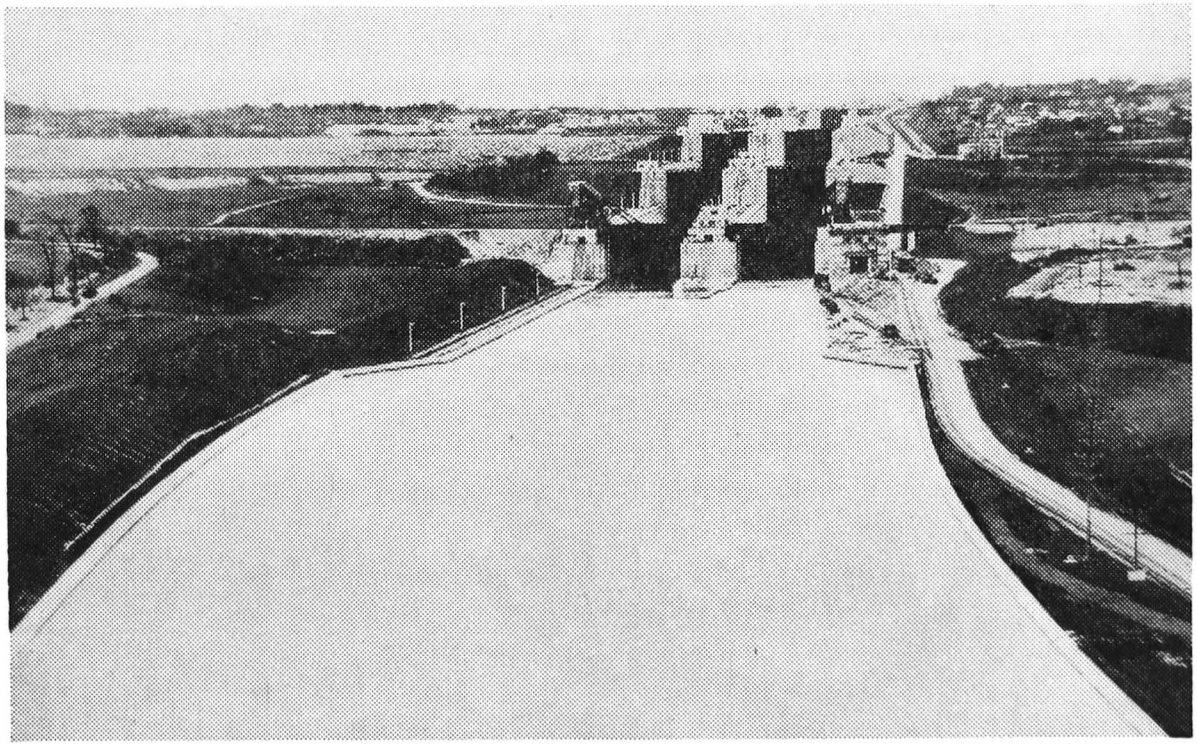
In addition to these direct monetary advantages to the Government there are less tangible strategic factors, such as the greater safety of inland harbors and shipyards, and the protection of the inland waterway through the lower St. Lawrence a thousand miles nearer to Europe than North American ports.

Both the measurable and the unmeasurable advantages of the Seaway to national defense certainly justify the claim that at least a portion of the costs is a legitimate levy against the taxpayers. What proportion should be paid respectively by the commercial users and by the taxpayers requires intensive investigation.

At this point one item of cost may be taken as a legitimate charge against the commercial users from the very beginning of Seaway traffic, namely, operating expenses. Through canal and lockage charges sufficient revenue may be obtained to meet the operating costs. The allocation of the rest of the costs must await a careful evaluation of all the factors herein discussed.



The Welland Ship Canal across the Niagara Peninsula, between Lake Erie and Lake Ontario. This Canal, 28 miles in length, was completed in 1932 by Canada at a cost of $130,000,000. It is part of the Great Lakes-St. Lawrence Seaway system.



Twin flight locks on the Welland Ship Canal, near Thorold, Ontario. Eight such locks scale the difference of 323 feet between the levels of Lake Erie and Lake Ontario. The canals and locks on the St. Lawrence River will have approximately the same dimensions as those on the Welland Ship Canal. There will be only three locks at the International Rapids.

Section 6

The Claimed Disadvantages of the Seaway

On the basis of the studies of the Survey herein summarized, it is clear that the St. Lawrence Seaway is economically justified. There are, however, those who claim that the detrimental effects of the Seaway upon certain existing economic interests would be so great that they would far outweigh any advantages in transportation savings. These disadvantages are claimed to affect mainly four separate spheres of economic activity: The Great Lakes carriers, the coal-mining industry, existing harbors in the Great Lakes and Atlantic and Gulf coasts, and the railroads. In these fields it is claimed that not only the interests of owners and employers would be affected adversely, but also employment and wages of workers would be drastically reduced. If these charges are accurate, there is, of course, ground for hesitancy before undertaking this project. It is necessary, for a thorough evaluation of the St. Lawrence Seaway, to examine the grounds upon which these fears are expressed.

The Interest of Lake Carriers.

Representatives of Great Lakes carriers opposed the St. Lawrence Seaway during the Senate committee hearings of 1932, and continue to oppose it now. They do not recognize the national defense value of opening up the Great Lakes to seagoing vessels, and give preeminent importance to the effect of the Seaway upon the Lake-carrier trade. To indicate the detrimental effects of the Seaway it is claimed that oceangoing ships will not use it, and, therefore, it will be a sheer waste to invest taxpayers' money in a useless undertaking.[1] At the same time the fear is expressed that the Seaway will be used by foreign ships in competition with Lake carriers, and hence diminish the Lake carriers' business,[2] and reduce employment and wages of

[1] Statement of Capt. Richard W. England, Lake Carriers' Association, *Hearings on H. R. 4927*, No. 6, pp. 402–3. The same argument is advanced by witnesses other than those representing the Lake carriers. See Cornelius H. Callaghan, manager, Maritime Association, Port of New York, *ibid.*, No. 14, p. 1340; Henry F. Merrill, president, Port of Portland Authority, No. 17, p. 1661.

[2] Statement of L. C. Sabin, vice president, Lake Carriers' Association, *ibid.*, No. 6, p. 431. See also statements of Chauncey Hamlin, chairman, Niagara Frontier Planning Board, *ibid.*, No. 7, p. 489; Hon. Sam H. Jones, Governor of Louisiana, No. 8, pp. 623–4–5; Frank S. Davis, manager, Maritime Association, Boston Chamber of Commerce, No. 8, p. 648; Francis S. Walker, American Merchant Marine Institute, No. 14, p. 1272; Cornelius H. Callaghan, manager, Maritime Association, Port of New York, No. 14, p. 1336; Hon. Leon C. Phillips, Governor of Oklahoma, No. 15, p. 1360; John L. Lewis, president, United Mine Workers of America, No. 16, p. 1582.

American workers.[3] Some express concern that large amounts of foreign ore will invade the American markets in foreign bottoms, and this ore will undermine both the American ore business and the carrier business on the Great Lakes.[4] Still others claim that grain will be exported directly in foreign bottoms,[5] and that coal will be brought in from England in competition with Lake carriers and American mines.[6]

TABLE 4

Movement of principal commodities on the Great Lakes—1939 (short tons)

Item	Foreign		Domestic [1]	Total
	Imports	Exports		
Ore	80,055	1,222,630	48,811,219	50,113,904
Coal and coke	19,798	8,798,504	35,818,406	44,636,708
Grain	2,626,908	243,942	4,331,634	7,202,484
Sand, gravel, and stone	294,451	334,751	15,888,184	16,517,386
Cement	5		508,336	508,341
Iron and steel	25,818	171,269	2,670,772	2,867,859
Petroleum and products	37,922	578,588	4,968,673	5,585,183
Pulpwood and wood pulp	1,197,000		79,893	1,277,293
Miscellaneous principal commodities	204,274	72,304	1,093,827	1,370,405
Total	4,486,631	11,421,988	114,170,944	130,079,563

[1] One-half of the unadjusted tonnage figure.

Source: Chief of Engineers, U. S. Army, *Annual Report*, 1939.

To analyze these claims it is important to know the nature of Great Lakes traffic and the relationship of lake carriers to the shippers and users of the cargo which they ordinarily carry.

The total commerce of United States ports in the Great Lakes, exclusive of duplications, was 130,079,563 tons in 1939, including import, export, lakewise, and coastwise traffic. Of this, by far the largest portion, 114,170,944 tons, was lakewise or coastwise commerce between American ports on the Lakes. Most of this domestic commerce consisted of commodities which were produced and consumed in the United States. Table 4 shows that ore, quantitatively, constituted by

[3] Statements of Hon. Leon C. Phillips, Governor of Oklahoma, *ibid.*, No. 15, pp. 1359–60; Thomas Kennedy, secretary-treasurer, United Mine Workers of America, No. 15, pp. 1463–76; John D. Battle, executive secretary, National Coal Association, No. 16, p. 1521; John L. Lewis, president, United Mine Workers of America, No. 16, pp. 1574–76–77.

[4] Statements of Capt. Richard W. England, Lake Carriers' Association, *ibid.*, No. 6, pp. 409–17; Capt. Thomas H. Saunders, International Ship Masters' Association, No. 8, pp. 660–63; Andrew H. Brown, transportation commissioner, Cleveland Chamber of Commerce, No. 9, p. 755; S. C. Lush, deputy president, Brotherhood of Railroad Trainmen, No. 17, pp. 1814–24.

[5] Statement of H. L. Bodman, New York Produce Exchange, *ibid.*, No. 13, pp. 1120–21.

[6] Statements of Cornelius H. Callaghan, manager, Maritime Association, Port of New York, *ibid.*, No. 14, p. 1342; Hon. Leon C. Phillips, Governor of Oklahoma, No. 15, pp. 1359–60; Walter Parker, combined interests of the city of New Orleans, No. 15, p. 1395; Thomas Kennedy, secretary-treasurer, United Mine Workers of America, No. 15, pp. 1462, 76–77; John D. Battle, executive secretary, National Coal Association, No. 16, pp. 1520–1–2, 1534; John L. Lewis, president, United Mine Workers of America, No. 16, pp. 1574–76–77, 1580–82–83.

far the most important product, amounting to nearly 49,000,000 tons, closely followed by coal and coke, which account for almost 36,000,000 tons. Sand, gravel and stone, grains, and petroleum products were also substantial items.

In general, according to existing United States statutes, with certain well-defined exceptions, no foreign-flag vessel, nor a foreign-constructed vessel, can engage in coastwise trade between American ports.[7] This in itself would eliminate the danger of competition from foreign vessels in 87.7 percent of the total American traffic on the Great Lakes.

The next question is whether there will be a danger of shifting traffic from coastwise trade in American bottoms to foreign trade in foreign bottoms. The most important single example cited of such a possible shift is in the grain trade. It is claimed that much of the grain trade on the Great Lakes is transshipment trade, mainly via Buffalo, destined to foreign ports. This trade, it is feared, might take to foreign bottoms delivered directly from Great Lakes ports abroad.[8] Such a shift from coastwise trade to direct foreign trade, and from American bottoms to foreign bottoms, cannot affect more than the total American exports of grain via American transshipment points, such as Buffalo and New York. In all likelihood, it will be less than this total for the reason that some of the shipments at the end of the navigation season, by force of climatic conditions, are bound to travel by rail from Buffalo to New York for export during the winter season. Furthermore, a part of the transshipment business is due to extremely favorable ballast rates offered by returning cargo liners from New York. This traffic also would continue in its present channels. However, even assuming that the total of the transshipment business via such a port as Buffalo will go directly to foreign countries in foreign bottoms, the net diversion is still a small part of the total traffic on the Great Lakes. On the basis of studies contained in Parts III and IV of the Survey reports, this transfer of business from American ships to foreign ships may not be more than 1,000,000 tons, and it will probably be much less.

Other major items of traffic on the Great Lakes, such as sand, gravel, stone, and petroleum products, are not divertible because essentially they are domestic products transported on the Great Lakes to domestic destinations for local consumption. The only products over which there has been any controversy are iron ore and coal.

A study of the iron ore business in the Great Lakes indicates that there need be no immediate danger of foreign competition when the

[7] 46 U. S. Code 289 and 46 U. S. Code Supplement 883.

[8] Statement of H. L. Bodman, New York Produce Exchange, *Hearings on H. R. 4927*, No. 13, p. 1120.

Seaway is opened. The iron ore reserves in the Lake Superior region are largely owned or controlled by the steel companies operating in the lower Lake region. The principal owners are the United States Steel Corporation, Bethlehem Steel Corporation, Republic Steel Corporation, Youngstown Sheet & Tube Co., and Cleveland-Cliffs Iron Co. The mines owned by Bethlehem Steel and Youngstown are managed by a partnership called Pickands, Mather & Co., of Cleveland, Ohio.[9] The Temporary National Economic Committee investigation of the steel industry indicated that the captive mines are very profitable to their owners. Sometimes the return on investment amounts to as much as 22 percent,[10] and rarely do they show a deficit. The ore is carried from mine to Lake Superior ports by rail lines owned or controlled by these steel companies, and from Lake Superior to lower Lake ports, it is carried in bulk carriers also owned or controlled by these steel companies. These railroads and Lake carriers are known to be also highly profitable. The price of ore delivered in lower Lake ports is, therefore, a completely controlled price set by the steel companies, this price including the profits that the mining and carrier companies show on their books.

The integrated system of control the steel companies have established over their business from mine to finished products permits them to regulate the importation of ore. A detailed study made by the Survey of the ore business leads to the conclusion that as long as Lake Superior ore lasts, there is no likelihood that the principal steel companies will substitute foreign ores for those owned and controlled by them. The possible influence of potential foreign competition may be a regulator of the self-imposed prices of ore, instead of an actual importation from foreign countries.[11]

In the long run, considering the possibility of exhaustion of Great Lakes ore reserves, it is conceivable that the St. Lawrence Seaway will protect the large capital investments of the steel companies established in the Great Lakes region. At the high rate of consumption of 1937, it is estimated that the known ore reserves of the Lake Superior region would last 20 years. If the national defense emergency should continue a long time, it will become necessary to plan the utilization of Great Lakes ores with a view to preventing their exhaustion by finding alternative sources of ore. Importation of ores from South American countries then would become, instead of a hardship, a necessary step in the self-preservation of the Great Lakes steel industry. When the

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[9] For a description of the interrelationships between Pickands, Mather & Co., Youngstown Sheet & Tube Co., Republic Steel Corporation, Bethlehem Steel Corporation, Cleveland-Cliffs Iron Co., and Interlake Steamship Co. see Hearings on Sen. Res. 266, 75th Cong., 3rd Sess., Part 23, exhibit 4295.

[10] St. Lawrence Survey, Part III, p. 246.

[11] *Ibid.*, pp. 244–48.

ultimate exhaustion of the Lake Superior resources is in sight, the self-protection of the iron and steel industry in the Great Lakes area requires, as an insurance, the availability of a source of ore other than Lake Superior mines. Low-cost water-borne transportation via the Seaway would then become an absolute necessity if the steel industry in the Great Lakes is not to disintegrate and lose to other more favorably located sites on the Atlantic, Gulf, or West coast.

The conclusion is, then, that there is no danger of any considerable foreign imports of ore as long as Lake Superior ore is available; and in case these reserves are exhausted, freer access to foreign sources is an advantage rather than a detriment to the established steel industry in the Great Lakes. The lake carriers, then, owned and operated largely by the steel companies, need not fear immediate adverse effects, except a temporizing influence upon their profits.[12]

The effect of the St. Lawrence Seaway upon the coal trade on the Great Lakes will be discussed more fully in subsequent pages of this section. Suffice it to say here that the danger does not seem great that the Midwestern market will be flooded with foreign coal. Other commodities composing the Great Lakes traffic, as shown in table 4, do not indicate possibilities of diversion from domestic to international trade. Hence grain traffic is practically the only commodity of any magnitude which may be subject to such a diversion.

Even if the total diversion of traffic from American to foreign bottoms in the Great Lakes were twice as much as the diversion of grain traffic, or 2,000,000 tons a year, this would eliminate employment of only 13 ships during the season, with an average carrying capacity of 7,600 tons, making an average of 20 trips a season. Whether this would be a net economic loss to the nation is not easy to determine.

Many of the ships now plying the Great Lakes were built in the first decade of the century, and over the past 40 years the capital investment has already been written off, and a large number of these ships are ready for retirement from active service. It would be unusual if in the course of the next 4 years, while the St. Lawrence Seaway is being constructed, at least 13 of these boats were not retired, if for no other reason than normal depreciation and obsolescence.[13] Hence it cannot be claimed that the diversion from coastwise trade in American bottoms to foreign-flag vessels, even if it should occur, would necessarily cause an economic loss. There would, of course, be a displacement of proprietary interest, as well as some unemployment

[12] In 1937 five steel companies, including U. S. Steel Corporation, Bethlehem Steel Corporation, Cleveland-Cliffs Iron Co., M. A. Hanna Co., and Republic Steel Corporation, owned or controlled 175 out of 390 vessels enrolled in the Great Lakes Carriers Association. Their total tonnage of 1,038,640 composed almost 50 percent of the total tonnage enrolled in the Association. Lake Carriers Association, *List of Members*, 1937, p. 36.

[13] A large proportion of Lake carriers is 30 years old or over. See *infra*, Section 9, table 19.

of American seamen on these 13 vessels which would be eliminated from Great Lakes domestic trade. With an average of 34 to 36 employees per ship,[14] the elimination of 13 ships from the domestic fleet in the Great Lakes would mean the reduction of 442 or 468 workers. The increased activity in the Great Lakes ports for import and export business via the Seaway would certainly be large enough to absorb this amount of labor.

The Market for American Coal.

The Survey has made an extensive study concerning the effect of this project upon the American coal industry. This study considered the effect of the St. Lawrence Seaway upon the domestic market for coal in the United States, and upon the demand for American coal in the Canadian market, and the effect of the hydroelectric project upon the consumption of coal.

Generally, the Survey finds that the domestic market for coal will be unaffected; that the Canadian market will remain unaffected and may even increase; and that the consumption of coal in the generation of electric energy, as well as for industrial uses, may be greatly increased on account of the low-cost hydroelectric energy that the St. Lawrence will make available.

The domestic market.—That the domestic market for coal in the United States will be unaffected by the St. Lawrence Seaway is patent from a comparison of the total imports into the United States with total production. In discussing this matter it must be kept in mind that there is no tariff in this country on imports of coal.

Mr. John L. Lewis emphasized the fact before the Committee on Rivers and Harbors that the Lake States' consumption of American coal is 95,000,000 tons annually. The claim is made that both this and our Canadian markets could be threatened by foreign competition. Mr. Lewis in the course of his testimony stated:

> . . . this area shown on the map there uses 95,000,000 tons of American coal that touches those waters, and that that is a market of tremendous value for any foreign country or countries that want to come into it, that this would make it possible for the entire market to be taken away by the dumping of foreign coal into that market and the displacement of American coal. That is a very substantial percentage of our total American production. It is 20 or 22 percent of the total American production of coal that is unloaded in those waters and I want to safeguard it. Save it for American labor and industry.[15]

[14] Bureau of Marine Inspection and Navigation, United States Department of Commerce.
[15] *Hearings on H. R. 4927*, No. 16, p. 1590.

With regard to the American market of 95,000,000 tons which Mr. Lewis claims will be threatened by the Seaway, the first observation one must make is that the capacity of the Seaway for new traffic will be about 16,000,000 tons a year, divided between the United States and Canada, and between in-bound and out-bound traffic. The claim that the American market of 95,000,000 tons in the Great Lakes area will be threatened by this limited capacity is sheer physical impossibility.

A second observation, equally important, is that our exposed markets on the Atlantic seaboard and in the Gulf have never been threatened by any influx of cheap foreign coal. The principal markets on the Atlantic, Gulf, and Pacific coasts are open to foreign shipping, coming from all the principal coal-producing areas of the world. In spite of this, the total imports of coal into the United States in 1932 were less than 800,000 tons, compared with total domestic production in nearly 360,000,000 tons. In relative terms, the imports in that year were 22/10,000ths of 1 percent of domestic production. In 1939 total imports were slightly over 650,000 tons as compared with domestic production of 445,000,000 tons, or about 14/10,000ths of 1 percent—admittedly an infinitesimal amount. During the 10 years 1929 to 1938 the average imports of anthracite into the United States were 472,000 long tons, as compared with average annual production during that period of 57,000,000 tons. The 1929–38 average bituminous-coal imports were 197,000 tons, of which 174,000 tons came from Canada. The annual average bituminous-coal production during the decade was 356,000,000 long tons. These facts indicate how inconsequential is the threat of foreign importation of coal to our domestic industry, in spite of unhindered foreign shipping available at all the coastal ports.

If the point is made that these figures are not relevant, since the St. Lawrence would be utilized by ships coming back from Europe in ballast, it may be pointed out that the usual balance of cargo between the United States and European ports shows ordinarily an excess of export tonnage over import tonnage. A large amount of empty space on ships coming back from European ports to the United States, therefore, is a normal condition. In 1939 the exports from the North Atlantic district ports to the United Kingdom were 1,470,000 tons and the imports 631,000 tons, indicating the availability of over 800,000 tons of shipping space on the way back from England—space that apparently was not utilized for the transportation of coal to the North Atlantic district. The same relationship exists between all North European ports and North Atlantic ports.

In our coastal region there is a market for coal greater than that in the Middle West. A study of railroad coal freight terminating in

New England, Middle Atlantic States, South Atlantic States, and West South Central States shows that in 1940, the only year for which such statistics are available, railroad coal deliveries in these areas amounted to 143,000,000 short tons, greater than Mr. Lewis' figure of 95,000,000 for the Great Lakes States. Yet no foreign coal was able to undercut this domestic coal market in 1940, or any previous year.

If British coal is unable to compete with American coal in the North Atlantic districts of the United States in spite of the absence of a tariff, in spite of the availablility of unutilized shipping space, by what reasoning can one expect an influx of foreign coal into the Greats Lakes industrial area where the shipping costs from abroad would be greater than to North Atlantic districts, and the costs of hauling American coal from the West Virginia, Ohio, and Illinois mines would be much less than it is to the Northeastern industrial area?

The reason for the inability of foreign countries to meet American coal in our markets, as stated by Mr. Lewis, is that American coal is the cheapest in the world. In spite of this, however, Mr. Lewis claims that our midwestern market would be threatened because totalitarian countries will insist upon underselling us by subventions and subsidies. If foreign countries adopt these policies, they could undersell us more effectively in our eastern markets, for they could bring coal to Boston and New York cheaper than they could take it to Chicago. If this should happen our Government would be faced with the task of protecting the whole of the domestic market against totalitarian raids whether the Seaway is constructed or not.

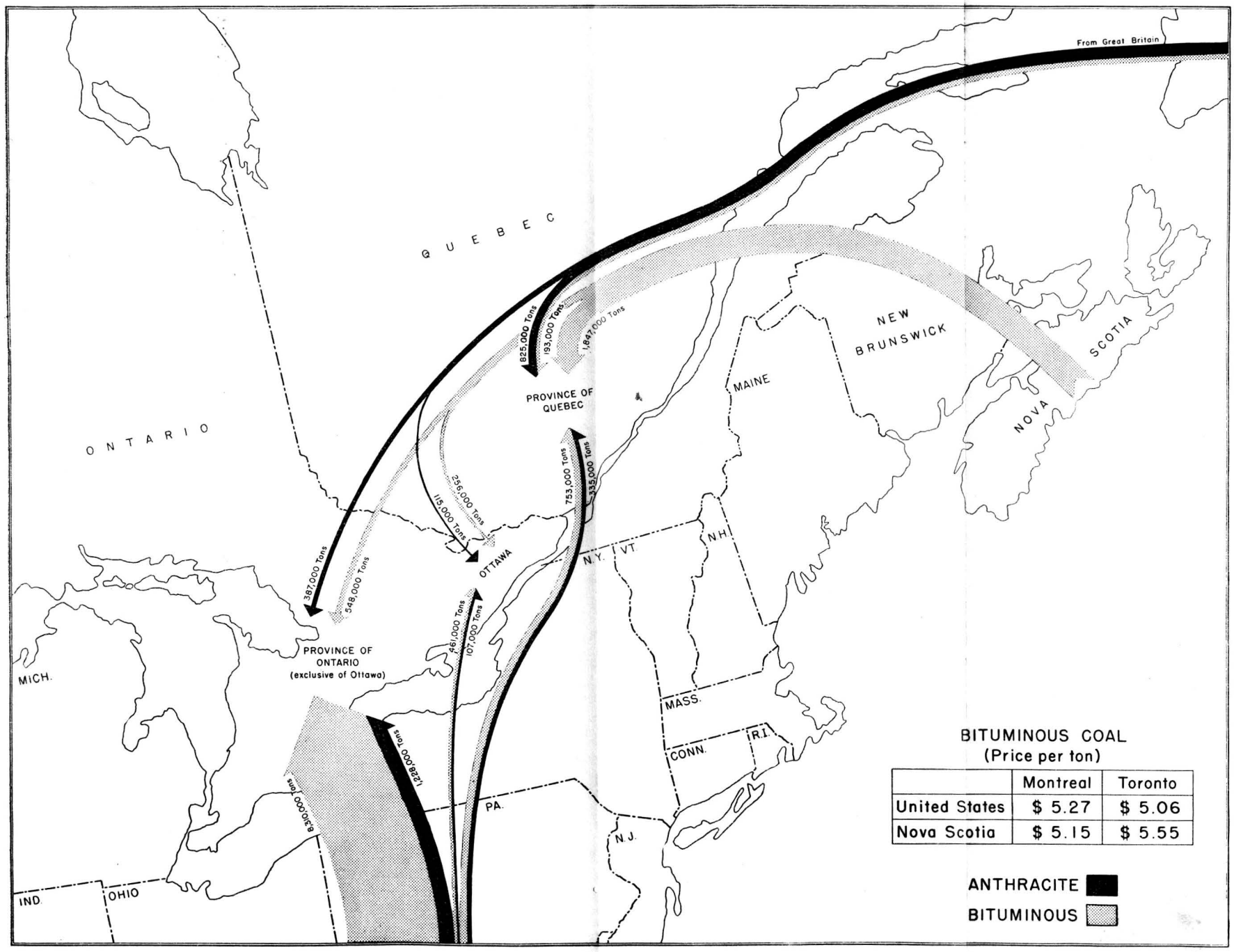
Mr. Lewis has no answer to this except to say that he does not know what the Government would do nor when the Government would become alarmed. Mr. Lewis bases his argument upon the theory that the Government of the United States may become delinquent in its duty to protect American industry against political raids of the sort he envisages. Obviously it is not possible to evaluate a project for the future betterment of the country upon such an assumption.

The Canadian market.—To understand the effect of the St. Lawrence Seaway upon our Canadian market for coal, it is necessary to state certain basic facts. Canada obtains its coal principally from the United States and Nova Scotia. Great Britain supplies but a small portion of the Canadian needs. Table 5 presents the 5-year annual averages, 1932 to 1937, inclusive, of imports to the Province of Ontario and the Province of Quebec from the United States, Nova Scotia, and Great Britain.

CANADIAN IMPORTS OF COAL

FROM THE UNITED STATES AND GREAT BRITAIN AND SHIPMENTS FROM NOVA SCOTIA

ANNUAL AVERAGE 1932-1937



Source: U. S. Department of Commerce, Foreign Commerce and Navigation of the United States.

U. S. Department of Commerce
St. Lawrence Survey
426328—41 (Face p. 42)

This tabulation shows that the total average annual United States export of coal to Canada during 1932 to 1937 was 11,194,062 tons, whereas in the same period Great Britain exported to Canada an annual average of 1,519,757 tons, and Nova Scotia supplied annually on the average 2,650,969 tons.

TABLE 5

Imports of coal into Canada, by source of origin

[Annual average net tons, 1932–37]

Destination	Source		
	United States	Nova Scotia	Great Britain
Anthracite to Ontario	1,334,824		501,877
Bituminous to Ontario	8,771,275	803,949	
Total to Ontario	10,106,099	803,949	501,877
Anthracite to Quebec	334,564		824,936
Bituminous to Quebec	753,399	1,847,020	192,944
Total to Quebec	1,087,963	1,847,020	1,017,880
Grand total	11,194,062	2,650,969	1,519,757

A breakdown of American exports by destination indicates that an average of 1,087,963 tons went to the Province of Quebec in competition with the British anthracite and British and Nova Scotian bituminous, in spite of the fact that the Canadian tariff on imports of coal from the United States is 75 cents per ton, whereas on British coal it is 30 cents per ton. It should be assumed that some of the British coal came as ballast on returning grain carriers, whereas a good portion of American coal sent to Quebec Province is transported by rail, at higher transportation charges.

Since the Province of Quebec is east of the proposed Seaway and already accessible to ocean shipping, the coal market there could not be adversely affected by the Seaway. On the contrary, if the large economical Lake carriers can go from Lake Erie points through to Montreal and Quebec, it is not unlikely that the American market in the Eastern Province of Quebec may expand as a result of the Seaway, barring, of course, any artificial impediments by the Canadian government. The United States already sells almost four times as much bitumiuous coal in the Province of Quebec as does Great Britain, even though British coal has all the advantages in Quebec Province which the opposition to the Seaway anticipate for Ontario. Average annual American exports, from 1932 to 1937 inclusive, to the Province of Quebec amounted to 753,399 tons as against 192,944 of British coal. Thus, British bituminous coal is not able to compete on equal terms with American bituminous in the Province of Quebec. It is unlikely to compete with American coal in the Province of

Ontario west of the Seaway where British coal is more expensive and American coal cheaper.

The argument that ships coming back in ballast from England will bring coal cheaply into the Great Lakes fails completely in view of the fact that there is and always has been available empty shipping space between British ports and eastern Canadian ports. Montreal is the largest grain-exporting center in the world and the balance of cargo for the Port of Montreal and European ports is always in favor of east-bound traffic, which means that there is excess shipping space from European ports to eastern Canada. In spite of this, however, British bituminous is unable to compete with American bituminous on an equal basis in the Province of Quebec. There is no reason to expect that after the Seaway is built empty shipping space from Europe to Great Lakes ports will be any greater or that ballast rates will be any cheaper than from the same European ports to North Atlantic and Eastern Canadian ports. The amount of space required for the eastward-bound grain trade, part of which comes back in ballast, will not be much different when the Seaway is available than without it. The only difference will be that some of these ships will come back into the Great Lakes, whereas now they stop at Montreal or New York.

The conclusion is then that American coal may obtain a further advantage in the eastern Province of Quebec and will be at no greater handicap in the Province of Ontario.

Nova Scotia mines are now operating at capacity of about 8,000,000 tons a year, and it is unlikely that this can be more than doubled within a short space of time under economical conditions of operation. Furthermore, Nova Scotia would have no greater advantages by the Seaway in the movement westward than American producers would have in the movement eastward, for both now use small canal carriers in this trade and both would be able to use larger, more economical bulk carriers in both directions. On the basis of the past trade records and in view of limitations of capacity of Nova Scotia mines, one is justified in concluding that there is no foreseeable danger to the American market of coal in the Province of Ontario.

Displacement of coal by water power.—Technically it is true that a given amount of hydro electricity has an equivalent value in terms of coal. The St. Lawrence project would make available a total of 13,200,000,000 kilowatt-hours of electricity to be divided equally between Canada and the United States. The Canadian half cannot be considered a substitute for coal for the reason that the Province of Ontario would probably develop other water-power sites if the St. Lawrence River is not developed. The American share—6,600,000,000 kilowatt-hours—would be the equivalent, on the conservative

basis of 1 pound of coal per 1 kilowatt-hour, of 3,300,000 tons of coal.

It is erroneous, however, to consider this a loss of an existing market for coal. In the experience of the past 8 years it has been proved that low-cost water power creates its own market for energy which would not exist otherwise. Furthermore, low-cost electricity expands the market for coal because of the response of domestic consumers to low rates, where a 50 percent reduction in rates often causes a 100 percent expansion in consumption of electricity. At the same time low-cost electricity encourages industrial expansion which in turn utilizes more coal. For these reasons, in the Tennessee Valley area in 1934 only 540,000 tons of coal were consumed in the generation of electricity, whereas in 1940 this consumption had increased to 1,891,000 tons—an increase of almost 250 percent, in spite of the fact that during that period the States in this area increased hydroelectric capacity to a very considerable extent. Hence the St. Lawrence hydroelectric project should be looked upon not as displacing coal consumption but as a method of encouraging the utilization of electricity and expansion of industry which will inevitably require the installation of additional steam generating stations in order to meet the expanded demand.

The Effect on Existing Harbors.

Certain port interests have consistently opposed the St. Lawrence Seaway project on the grounds that it will cause great hardship and economic dislocation in their particular cities. Chambers of Commerce and Port Associations of certain principal cities on the Great Lakes, the Atlantic and the Gulf Coasts have registered their opposition to this project. Among the cities from which protests have been heard are the following: Cleveland, Ohio, Buffalo, N. Y., Portland, Maine, Boston, Mass., New York, N. Y., Newark, N. J., Philadelphia, Pa., Baltimore, Md., Hampton Roads, Va., Mobile, Ala., New Orleans, La., Galveston, Tex. Generally, opposition witnesses from these cities discounted the benefits of the Seaway to national defense, and based their stand on the grounds that the project will be harmful to the nation as a whole, and to their ports in particular. Since the arguments with regard to national advantages and disadvantages are considered in other sections of this report, the only phase to be discussed here is the effect of the St. Lawrence Seaway upon the economic life of these particular cities.

The Survey made an extensive study of the effect of the Seaway upon the ports of Buffalo, Boston, and New York. The results of this study are published in Part IV of the Survey reports. There the Survey indicated its general conclusions in the following words:

> The study indicates that New York will lose some foreign traffic and that Buffalo will lose some of its grain transfer business. On the other hand, New York Harbor will ac-

quire new water-borne traffic to and from the Great Lakes area. Similarly, Buffalo also will gain new traffic, both domestic and foreign. In each case, the additional traffic will more than offset the losses. The net gain for Boston will be largest of all.

This conclusion is based upon the premise that the small amount of transshipment business in foreign commerce which these ports would lose would be compensated by the increased coastwise movement of traffic and the growth of the economic activity of the country as a whole.

The intensity of opposition of the port interests above named, particularly those in the Atlantic and Gulf coasts, is not justified by the comparative magnitudes of Seaway traffic and existing activity in our deep water ports. The total new capacity of the proposed Seaway will be 16,000,000 tons, to be divided between Canada and the United States, and between incoming and outgoing traffic. Even if 10,000,000 tons of additional capacity were utilized by American interests this would be only 2.15 percent of the total harbor traffic of the Atlantic and Gulf coast ports in 1937. The annual variations in harbor activity are much greater than the prospective capacity of the Seaway. It is not likely that the Seaway will reach full utilization in less than a decade or two, since it will involve the creation of new services on shore and by water, and reorientation of the established habits of industries and middlemen. It would be a sad commentary upon the country's future economic welfare if the total harbor activity for all our major coastal ports on the Atlantic and the Gulf were not to increase in the next decade or two by 10,000,000 tons, or a little over 2 percent above the 1937 figure.

The fear that St. Lawrence traffic will be a net diversion from existing harbors is based upon the assumption that the American economy will remain static with no prospect of growth or increase of production and consumption as compared with the experience of the past decade. This depression psychology has led many port interests to predicate their position on a desire to keep what they have without attempting to project their own affairs and those of succeeding generations into the changing enviroment and requirements of future decades. The very premise upon which this opposition of port interests is based, namely, a static economy for the future of America, is not acceptable.

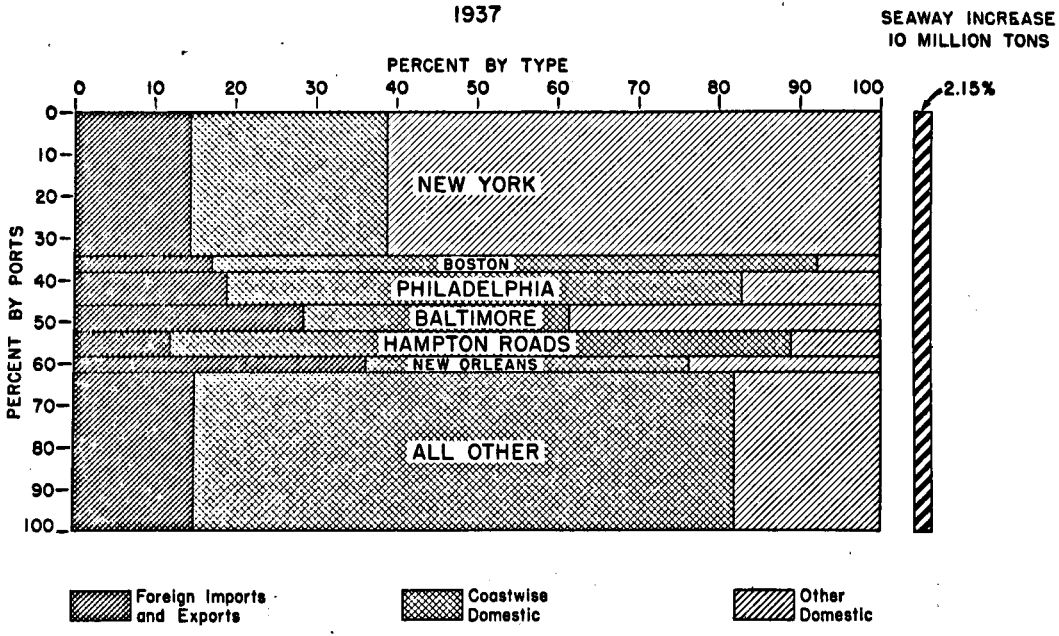
The years 1950 and 1960 will certainly be dissimilar to the years 1932 or 1937. With the fuller employment of resources that the present emergency has forced upon this country, we are now appreciating the broader limits of the productive capacity of the country. This lesson will surely implement our corporate and governmental agencies with the wisdom to utilize the potential resources of this nation to the

TOTAL WATER-BORNE COMMERCE

ALL ATLANTIC AND GULF PORTS

465 MILLION TONS

1937



Source: Chief of Engineers, U S Army

U. S. Department of Commerce
St. Lawrence Survey

fullest for peacetime civilian uses, just as they are now able to do for national defense. In this brighter future, the St. Lawrence Seaway will be but one means of meeting the greatly increased transportation needs of the country.

Aside from the basic limitations of the opposition's premise, there have been exaggerated claims made with regard to specific dislocations. Port interests in Texas, for instance, fear that the St. Lawrence Seaway will diminish traffic in grains. This contention disregards the simple fact that grain traffic through Galveston, for example, is principally in winter wheat produced in Oklahoma and in the Texas Panhandle which is not under any circumstances likely to be diverted to Chicago and the St. Lawrence Seaway. The land distances and the difference in rail transportation costs between point of origin and Texas ports on the one hand, and point of origin and Chicago on the other, are so much to the disadvantage of the latter route, that a saving of, say, 5 to 10 cents per hundredweight via the St. Lawrence Seaway would not change the direction of this grain movement.

Again, port interests in Virginia oppose the St. Lawrence Seaway project for fear that coal traffic through Hampton Roads or Norfolk might be diminished. Yet an examination of source of origin and destination of coal utilizing these Virginia ports will show that their primary markets are in the industrial regions of the Atlantic Coast, and that the St. Lawrence Seaway will not in any way alter the relative advantages of this route.

Mobile, Ala., does not carry any export trade which originates or terminates in the Great Lakes district. There is no conceivable way in which St. Lawrence traffic can affect the port of Mobile, except to increase its coastwise trade, particularly in the products of heavy industries.

New Orleans, La., is the principal transshipment port of the Mississippi and Gulf Coast States. Through traffic to the Chicago area is but a small part of the port's total traffic. This through traffic comes mainly from the Caribbean area, and the shorter sea distance, as well as the availability of cheap river transportation, will probably help it retain its present advantages. Certainly the increasing number of heavy industries being established in the Mississippi Valley as a result of the defense program will create for the future new industrial traffic which does not now exist, far in excess of any influence that the St. Lawrence Seaway may have.

The Survey is forced to the conclusion that the exaggerated fears expressed by many of these port interests are based on the improbable premise that this country's economy will remain static without any prospect of growth and expansion in the future, and upon an inaccurate analysis of the origin and destination of traffic to and from the Middle West.

The Effect on Railroads.

The railroads have been perhaps the most consistent opponents of the St. Lawrence Seaway project. The Association of American Railroads has devoted much time, thought, and money to make a case against the desirability of undertaking the construction of this project. They have used in their opposition all manner of argument—that the Seaway will flood the Midwest with cheap foreign products; that it will hinder the national defense effort by absorbing much needed manpower and materials; that it will be an economic waste and a burden on the taxpayers, since few ocean ships would wend their way into the Great Lakes; that it will undermine the financial structure of the railroads with dire consequences to the holders of railroad securities, including insurance companies; that it will cause untold hardships on railway labor because of diversion of traffic from the rails to the Seaway.

It is intended here merely to give the conclusions of the Survey regarding the effect of the Seaway on the railroad industry. In Part V of the Survey reports, the following questions were considered: (1) Will the St. Lawrence Seaway divert traffic from the railroads? (2) Do the railroads have such excess capacity that a new medium of transportation such as the St. Lawrence Seaway is unnecessary? (3) Is the seasonal movement of traffic such that the St. Lawrence Seaway will actually cause idleness of railway equipment in the season of open navigation?

The Survey's studies show that the St. Lawrence Seaway, besides assisting the railroads in caring for a greatly enhanced traffic, will in fact improve the economical operation of railroads by smoothing out the seasonal variations in rail traffic. Often opponents of the project have reiterated that while they will be burdened with traffic, and hence with the expense of constructing and maintaining facilities to carry cargoes in the 5 months of the winter when the Seaway is closed, "for 7 months of the year these facilities must stand unprofitably idle." This is a plain misstatement of fact. The peak of rail traffic comes in August, September, and particularly October. The facilities constructed to take care of traffic in these peak months *now* stay idle in the winter time. If the St. Lawrence Seaway were operating, the railroads would be freed from constructing and maintaining equipment for these peak summer months, which now stay unprofitably idle on sidings during the winter months. The St. Lawrence Seaway thus will improve the average utilization of cars and locomotives by taking care of a part of the peak load.

In the light of the facts revealed in Part V, the Survey is led to the following conclusions:

1. Under very conservative assumptions of employment conditions, assumptions which are at the lower limit of political tolerance, average

tons of freight originating in the decade of 1950 will probably be between 242,000,000 and 374,000,000 greater than the average of 1930–39. The 10,000,000 tons of additional American traffic which may use the St. Lawrence at maximum utilization would be but a fraction of the expected increase in railroad activity.

2. The railroads of the United States, though much improved in operating efficiency, have reduced space capacity and tractive power to such an extent that, in the net, their carrying capacity is no more than in the decade of 1920–29. This will not be sufficient to meet traffic requirements of the future.

3. The railroads must therefore expand their capacity by purchase of equipment and expenditures on way and structures. The St. Lawrence Seaway will accommodate a small part of the increased demand for transportation. It is an alternative method of meeting a part of our future transportation requirements.

4. The railroads are now burdened with seasonal peak traffic that comes in late summer. The equipment used in carrying this peak traffic stays idle in the wintertime. The St. Lawrence Seaway will help the railroads to improve the average utilization of their equipment by taking a part of the load off the peak. This means that the railroads will not have to buy the equipment to meet the October peak to the extent that the St. Lawrence Seaway will carry some of the peak load. As a result, the St. Lawrence Seaway will improve the average utilization of railroad rolling stock.

These conclusions are the result of an extensive study by the Survey of the economic forces that influence traffic in agricultural, manufactured, and mineral products. Among the factors carefully examined and weighed were population growth and geographical distribution, concentration of agricultural production, trends in consumption of foodstuffs and processed products, and the effect of mechanization of agricultural operations upon traffic. Diversion of traffic from railroads was also considered.

The analysis in Part V reveals that the average tons of freight originated of all kinds, carload and less-than-carload lots, during the decade of 1950 would be, at a very conservative estimate, 1,100,000,000 tons. At this level, tonnage originated would be 28 percent higher that the average of the decade of 1930–39. It is very possible that the average tonnage in the next decade may approximate 1,232,275,000, at which rate it would be 43 percent higher than the preceding decade. The actual tonnage increase over the average of 1930–39 would be in the first case 242,000,000, and in the second case 374,00,000.

In the face of these magnitudes it is plain that the additional American traffic of 10,000,000 tons that may use the St. Lawrence Seaway at its maximum utilization recedes into insignificance. A glance at the

Interstate Commerce Commission statistics will show that the annual fluctuations of traffic on American railroads are many times this amount.

Under these circumstances, the additional traffic that will utilize the St. Lawrence Seaway will be a slight, almost unnoticeable, recession from the large increases in traffic which the railroads can confidently anticipate. In fact, the very estimates which are made in this report for the decade of 1950 will be reached sooner under the impetus of the national defense program. The next question, then, is whether the railroads can meet this growing demand upon their services without expanding their facilities.

Here some explanation is needed about the carrying capacity of railroads in the United States. This is a highly controversial subject. It is here intended merely to recite a few facts which will help answer the question: Will the railroads have to expand to take care of future traffic requirements? The claim of the Association of American Railroads is correct that there have been many operating improvements which have increased carrying capacity in spite of reduction in car capacity and tractive power of locomotives. Average number of freight cars per train has increased from 35.6 in 1920 to 48.5 in 1939, and, as a result, revenue and nonrevenue freight per train has increased from 708 tons in 1920 to 813 tons in 1939. Although there has been much fluctuation in the intervening period, the trend has been definitely upward. Average speeds of freight trains between terminals has increased steadily from 10.3 miles per hour in 1920 to 16.6 miles per hour in 1938, a 60-percent improvement. This rate of speed includes stop-overs at way stations.

As a result of all these changes in operating factors, the carrying capacity of railroads, for a given amount of equipment, has definitely improved. This is shown by the net ton-miles per freight-train-hour, which expresses the results of railroad operating efficiency in loadings per car, number of cars per train and speed of travel. The net ton-miles per train-hour has increased from 7,500 ton-miles per hour in 1921 to 13,500 ton-miles in 1939. This is an 80-percent improvement in 19 years. As compared with 1929, the improvement is 30 percent.

On the other hand, there has been considerable reduction in car capacity and tractive power. The capacity of serviceable cars went down from 99 million tons in 1929 to 74 million tons in 1938, a reduction of over 25 percent. Tractive power of freight locomotives was down by 16 percent in the same interval. Furthermore, the average length of rail haul increased by 10 percent between 1929 and 1939.

In the light of these facts, the best that can be said is that the railroads, at the close of 1938, had a carrying capacity which was probably comparable with late 1920's, although it remains still to be proved

whether the operating efficiency in speed and train loadings can be maintained under the strains of increasing traffic loads.

In spite of these improvements in performance, the railroads of the United States will need much expansion in order to meet the traffic estimates made here under very conservative assumptions. Although the medium estimate of average tons originated for the decade of 1950 is 1,100,000,000 and a possible estimate is 1,232,000,000, the railroads will have to be ready to meet not only these average conditions, but also the cyclical variations. During the decade of 1920–29, the variations were 23 percent below and 10 percent above the average of the decade. During 1930–39 the variations were 25 percent below and 35 percent above the average of the decade.

On a base average of 1,100,000,000 tons, the peak year may require capacity to carry, on the basis of 1920–29 experience, 1,209,000,000 tons, and on the basis of 1930–39 experience, 1,480,000,000 tons. On the base average tonnage originating of 1,232,000,000, the amplitude of cyclical variation will carry the tonnage in peak years to much higher levels.

The railroads as at present organized and operated are not able to meet such increased demands for service in spite of the splendid improvement in operating efficiency. They will have to expand their facilities. They will have to buy much equipment, and according to Interstate Commerce Commission studies, they will have to spend much money on maintenance of way and structures, and additions and betterments. The St. Lawrence Seaway will do no more than assist in carrying a small part of the greatly increased load in the future for which the railroads are not yet equipped.

The national defense program, it is now revealed, imposes the immediate necessity of increasing railway equipment. The Transportation Commission of the Advisory Commission to the Council of National Defense proposed in May 1940 that 270,000 new freight cars should be added to the ownership of the railroads in the course of 2 years, in order to meet the peak requirements of 1943. As the average number of cars retired each year has been approximately 100,000 during the past decade, it would be necessary to construct almost 470,000 freight cars in these 2 years in order to increase car ownership by 270,000.

This program is impossible of achievement in view of the situation existing in the car-manufacturing field. In ordinary times the railway-equipment manufacturers have a total annual capacity of 200,000 freight cars. These manufacturers, however, are also important contributors to the national defense program, particularly in the field of ordnance. A large percentage of their manufacturing capacity is now occupied by orders from the War and Navy Departments. During the first 6 months of 1941 they were able to fabricate only 35,648 cars, or

about 6,000 cars a month. It seems unlikely that the equipment manufacturers can turn out even as many as 100,000 new cars a year. This would be hardly enough to meet the replacement requirements, let alone any new additions to equipment. On August 26, 1941, Mr. Ralph Budd, Transportation Commissioner, stated before the convention of the Association of Railroad and Utilities Commissioners at Minneapolis, Minn.:

> I have already referred to the inability of the railroad-car builders to keep up the car-building program. This program is now being carried on at about one-half the scheduled rate set up to meet the needs of anticipated traffic . . . New locomotives are also badly behind promised delivery dates. Deliveries of maintenance and repair parts, not only for cars but also for locomotives and to a necessary extent for repair to tracks, bridges, and structures, have slowed down and now threaten seriously to impair the operation of the railroads.

It seems highly probable, therefore, that the supply of serviceable freight cars will be smaller by 1945 than it is today. And the same tight situation exists in respect to locomotives, owing to the diversion of locomotive companies to tank and other armament construction.

This condition does not mean that the defense program will be crippled by a shortage of railroad equipment. What will be done is to continue patching up obsolescent rolling stock, loading cars more heavily, diverting less-than-carload lots to trucks, reducing idle car time and increasing operating speeds. Since these measures, some of which are already being exerted, are likely to prove inadequate, some curtailment of nonessential shipments is to be expected in the peak periods of 1942, 1943, and 1944. In any case, it seems certain that the transportation stringency which is already apparent, will become increasingly severe as the defense effort gets into its stride.

It is not likely, therefore, that the acceleration of equipment manufacturing necessitated by the national defense program will build up the railroad carrying capacity to such an extent by 1945 that the Seaway will be an addition merely to an existing excess capacity. On the contrary, all present indications are that if the Seaway is completed by 1945 it will alleviate a condition of congestion that will be experienced during the peak periods in the next few years, until such time as the transportation facilities can be expanded without interference with other defense work undertaken by the equipment manufacturers. The likelihood of stringency in rail transportation is increased, of course, to the extent that railway equipment built in this country must be supplied to friendly powers such as Russia, in order to make the lend-lease program effective.

These facts point to the conclusion that the St. Lawrence Seaway will not cause a net diversion from the railroads, but will take care of increasing need for transportation facilities; hence there is no basis

for the fear that the Seaway will cause idleness of existing railway equipment and employees.

In the light of the fact that the construction of the Seaway will make available a cheaper means of transportation to shippers, and a less expensive extension to the national transportation facilities, it must be considered a desirable method of meeting increased requirements for transportation.

NATIONAL DEFENSE ASPECTS OF THE ST. LAWRENCE PROJECT

Section 7

The Duration of the Emergency

It has been testified by the Assistant Chief of Engineers, United States Army, that St. Lawrence power can be available in 4 years, or by 1945, if construction is approved immediately.

Opposition witnesses have argued that this would be too late to be of any help in the present emergency, either in the supply of power or shipbuilding facilities. They have insisted that the war and the emergency will be over earlier than 1945.

On this question the overwhelming testimony of those responsible for the national defense program of the United States is to the effect that the emergency will be of long duration and plans are being made for the security of the American Continent on this assumption. This point has been clearly made by the President of the United States,[1] the Secretary of War,[2] the Secretary of the Navy,[3] the Secretary of Agriculture,[4] the Secretary of Commerce,[5] the Assistant Secretary of State,[6] and by the Director General of the Office of Production Management.[7]

The President in his message to the Congress, dated June 5, 1941, stated:

> . . . I am advised that we can build the St. Lawrence project in 4 years. Under emergency pressure it may be completed in less time. I should like to agree with the people who say that the country's danger will be over sooner than that. But the course of world events gives no such assurance, and we have no right to take chances with the national safety. . . .[8]

The Secretary of War, Hon. Henry L. Stimson, was questioned by the Chairman of the House Committee on Rivers and Harbors on the duration of defense measures:

> The Chairman. . . . In your opinion, will defense measures be necessary several years from now, say 4 or 5 years in the future?

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[1] President Roosevelt's Message to Congress, June 5, 1941, recommending authorization of construction of the St. Lawrence Seaway and Power Project.
[2] *Hearings on H. R. 4927*, No. 1, pp. 5, 6, 11.
[3] *Ibid.*, No. 2, pp. 95, 98, 101.
[4] *Ibid.*, No. 18, p. 1965.
[5] *Ibid.*, No. 5, p. 284.
[6] *Ibid.*, No. 1, pp. 59, 60, 68, 91.
[7] *Ibid.*, No. 10, p. 812.
[8] *Ibid.*, No. 1, p. 3.

> Mr. STIMSON. . . . I can only say that in my opinion, it is necessary to prepare for a very long emergency. We all hope that it will be briefer, but it is not safe to act on hopes in such a case as confronts us today. . . .[9]

The Secretary of the Navy, Hon. Frank Knox, in speaking of the importance of sea power for the security of this country, stated:

> It is driven home to me with the close application I must give to the subject of sea power, that we are going to live in a disturbed world for a long time, no matter what the outcome of the war may be. . . .[10]

The Secretary of Agriculture, Hon. Claude Wickard, reiterated the same position:

> . . . I do not know, as I said, how long the present war will last in Europe, and I have not any idea when such a thing might recur, but if we do not start now to construct some of these things which are necessary always for the security of our country, we perhaps will not get them. . . .[11]

The Secretary of Commerce, Hon. Jesse Jones, was also questioned by the Chairman of the Committee on the duration of the national emergency. The Secretary stated:

> . . . I can see nothing except a future, in the lifetime of those of us who are now living, and probably more further on, than a war-torn country or at least a country in a world susceptible to war at any time, and there is no time to lose, in my view by not preparing for war conditions and to meet war conditions at any time and doing everything, not just completing this canal, but doing everything else that will make our country impervious to invasion and able to meet any situation that might arise.[12]

The Assistant Secretary of State, Hon. A. A. Berle, Jr., summarized the position of the State Department in the following words:

> . . . The only sane, safe, and prudent course that responsible men would take would be to prepare for a long period of stress. And if a kindly Providence let us off we should be very happy. In that regard I think that the Secretary of War made the only answer that could be made, which is that every dictate of prudence, precaution, and foresight would require preparation for a very long period, which would seem to be indicated by present circumstances.[13]

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[9] *Ibid.*, No. 1, pp. 5, 6.
[10] *Ibid.*, No. 2, p. 95.
[11] *Ibid.*, No. 18, p. 1965.
[12] *Ibid.*, No. 5, p. 282.
[13] *Ibid.*, No. 1, p. 60.

Director General William S. Knudsen, of the Office of Production Management, stated briefly:

> . . . So that when we talk about how long the national defense, how long the emergency will last, we just don't know. It is up to us to do everything we can to get the equipment and the raw materials to fill whatever need we are asked to fill.
>
> When it comes to power, I don't believe we will ever have power enough.[14]

Hon. Herbert H. Lehman, Governor of New York State, was also questioned on the length of the emergency:

> Mr. OSMERS. Do you feel that these facilities, either the Seaway or the power facilities, will be ready sufficiently early to be of any value in this emergency?
>
> Governor LEHMAN. Well, assuming now—that is a question that only an expert may be able to answer, and I am not sure that even he could answer it—assuming that this war lasts, I think that it is tremendously important that we use every possible means that is available to us in our defense. I think you might say, what is the object of building a two-ocean Navy when the Navy will not be ready, these new ships will not be ready until 1946, 1947, or 1948? What is the use of putting in additional locks in the Panama Canal when they will not be completed for a number of years; but it is assuming now that we are going to require a defense in what Secretary Knox described this morning as a very disordered world. I think that this thing is going to be of very great use, and I certainly think that, regardless of opening up that area in the west, the middle west, and the shipyards of the Great Lakes, I believe that the development of additional power for defense industries is of very, very great importance. I think I would be willing to say vital.[15]

Those responsible for the defense program of the country are therefore of the unanimous opinion that the St. Lawrence project is important for national defense and that the present emergency will be of long duration.

In keeping with this expectation, the defense program has been conceived and planned for the long pull. This is certainly true in our plans for the production of airplanes, shipping, and the two-ocean navy.

As the world conflict passed from stage to stage, the magnitude of the defense program and the period of duration has been progressively extended. The expected peak of defense production has moved from 1941 to 1942, and then to 1943, when it is expected that about $3,000,000,000 a month, or $36,000,000,000 a year—one-third of the

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[14] *Ibid.*, No. 10, p. 812.
[15] *Ibid.*, No. 2, pp. 143, 144.

national income—will be devoted to defense expenditures. Whether it will be possible to keep to this schedule of production is still uncertain. In view of shortages developing in many materials, and the consequent curtailment of civilian consumption, at least during the initial stages of the program, there is a possibility that the peak of defense production will be moved further into 1944 and 1945. That the defense effort will continue until then is not seriously doubted. If the present conflict in Europe develops unfavorably for the Allies, it is certain that both in magnitude of the program, and in duration, national defense activities will be extended beyond present limits. From day to day, the production program for ordnance, ships, planes, is being extended and there is no limit yet in sight.

It is not, therefore, safe nor wise to assume that a power project that cannot be brought into use in 1942 or 1943 should not be undertaken. On the contrary, the expected shortages in those areas will be such that even if national defense production should reach the peak in 1943, the retardation of industrial and commercial consumption, and the curtailment in the interim of many civilian uses of power, will have created a backlog of demand for power which can only be satisfied by the continued increase of power facilities after 1943. The only other alternative would be a permanent curtailment of civilian consumption of power.

Section 8

The Need for St. Lawrence Power

Numerous official surveys and many years of consideration have been given to the proposal to harness the International Rapids of the St. Lawrence River. During the past decade the development of this resource by public agencies, instead of private companies, has become the accepted policy of the Governments of New York State and the United States.

Controversy between the private companies and the State of New York with regard to the right to develop the power resources at the International Rapids dates from about 1907. Private companies purchased considerable property adjacent to the International Rapids in the hope of obtaining the right to develop the water power. From time to time they attempted to obtain licenses from New York State for the development of this power as a private undertaking.

In the course of the hearings of the International Joint Commission for the development of the St. Lawrence Seaway in 1920, Hugh L. Cooper & Co., an engineering firm then retained by certain private interests, submitted a brief on behalf of its clients, offering to develop the water power over the whole course of the river from Lake Erie to Montreal, estimated at over 5,000,000 kilowatts, at a cost of $1,300,000,000, including the International Rapids and the purely Canadian sections of the river. This firm offered to make a gift of the joint navigation works to the two Governments in exchange for the power rights.

In 1926 a private corporation applied for a license to the New York State Water Power Commission for the development of the International Rapids Section. In its application it was stated that this power would cost only $98 per installed kilowatt capacity. On September 24, 1926, the Commission decided to issue a license for the development of the International Rapids to this corporation but, according to the New York Power Authority, "a rising wave of public sentiment against the development of this great resource for private profit supported Governor Smith in a sharp battle which ended when the power companies withdrew their applications."[1]

[1] Power Authority of the State of New York, *First Annual Report*, 1932, p. 45.

The economics of St. Lawrence power were not at that time much in dispute. Both private and public agencies recognized the great power potentialities of the International Rapids Section and the principal controversy centered on the issue whether it should be developed under public or private auspices.

Under the leadership of Gov. Alfred E. Smith and, later, Gov. Franklin Delano Roosevelt, New York State policy for public development of the water-power resources of the State, particularly of the St. Lawrence River, became fixed. On March 12, 1929, in a special message to the legislature, Governor Roosevelt recommended the establishment of a State Commission to propose a plan for the development of St. Lawrence River power resources. Governor Roosevelt said in part:

> As the St. Lawrence power resource is the property of the people of the State, we can, I think, all agree to the principle that the actual energy therefrom should be, for all time, under the immediate control of the people of the State and should be transmitted and distributed to the people of the State at the lowest possible cost.
>
> Let me briefly develop these underlying principles. In the matter of the actual development of St. Lawrence power, it is not enough that the ultimate title be vested in the State. I hope there will be no difficulty in securing agreement that not only the title but physical possession of the development should at all times be vested in direct representatives of the people.[2]

Pursuant to these policies, Governor Roosevelt obtained legislation from the New York State legislature establishing the Power Authority of the State of New York.[3] The law directs the Authority, in cooperation with proper Canadian and United States agencies, to proceed with the improvement and development of the International Rapids Section for navigation and power. This public power policy of the State became the policy of the Federal Government upon the accession of President Franklin D. Roosevelt in 1933. Since then the controversy—Private *v.* Public development—has ceased to be an overt issue. On the other hand, whereas there was agreement between private interests and public agencies as to the desirability of developing St. Lawrence power prior to 1928, an increasing flood of criticism by private organizations has been directed against the public development of these power resources. The arguments have ranged all the way from the assertion that there is no market for St. Lawrence power in New York State to the assertion that it cannot be constructed fast enough to be of any benefit in the near future.

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[2] *Ibid.*, pp. 47–8.

[3] Apr. 27, 1931, ch. 772 of the Laws of the State of New York, 154th Sess., Vol. II, p. 1645.

In this section the arguments against the development of the International Rapids Section to obtain hydroelectric power will be analyzed in detail in the light of the facts developed by the St. Lawrence Survey and the House Committee on Rivers and Harbors during the course of the hearings on H. R. 4927. This question will be analyzed under four principal headings: Cost of St. Lawrence power; Normal needs for electric power in New York State in time of peace; The need for power for national defense; Time of development of St. Lawrence power as compared with alternative sources.

Cost of St. Lawrence Power

In 1929 a study was made by Sanderson and Porter, engineering consultants for utility companies, which showed that the power generated in the International Rapids Section could not be sold at prices sufficient to meet the total cost of generation and transmission.[4] The Niagara Frontier Planning Board, on the other hand, conceded that there would be some savings estimated at $3,000,000 per year to the consumers of New York State from the development of St. Lawrence power, although the Board questioned the availability of a market for such a large amount of hydroelectric energy.[5] This contention was repeated by the Chief Engineer of the Niagara Frontier Planning Board before the House Committee on Rivers and Harbors on June 25, 1941.[6]

On the other hand expert testimony on the part of Government witnesses was unanimous to the effect that power from the International Rapids Section would be among the cheapest sources of power in the whole United States.

The average annual production of energy from the American share of the International Rapids development will be about 6,600,000,000 kilowatt-hours. Of this, about 4,000,000,000 will be firm power available 100 percent of the time. On an 80-percent load-factor basis, Brig. Gen. Thomas M. Robins, Assistant Chief of Engineers, estimates that this firm power will cost about 1.7 mills per kilowatt-hour at the bus bar, including all fixed charges at 6½ percent on the $93,375,000 allocated to power.[7]

Dr. James C. Bonbright, Chairman of the Power Authority of the State of New York, testifying before the House Committee on Rivers and Harbors, stated that on a high-load-factor basis the St. Lawrence power could be produced on site for less than 1 mill per kilowatt-hour.[8] This conclusion, valid for the total output of energy,

[4] Moulton et al., *op. cit.*, Appendix K; also ch. 10.
[5] Niagara Frontier Planning Board, *op. cit.*, pp. 119–20.
[6] *Hearings on H. R. 4927*, No. 8, p. 667, statement by Bertram D. Tallamy.
[7] *Ibid.*, No. 12, p. 971.
[8] *Ibid.*, No. 10, pp. 845–46.

is supported by extensive studies of the Power Authority of the State of New York, published by the House Committee on Rivers and Harbors.[9]

Mr. Leland Olds, Chairman of the Federal Power Commission, substantiated these claims before the Committee when he stated:

> This is one of the outstanding power projects of the entire Continent. Probably its only rival is the possibility of additional Niagara development . . . It means approximately 1 mill per kilowatt-hour. . . . That is power so economical that it will be possible to locate industries requiring the cheapest kind of power, not simply at the site, but to disperse them throughout the area within transmission distance.[10]

In comparison, the most economical steam generating station in the same vicinity at Oswego, New York, produces electricity at 4 mills per kilowatt-hour at the station. Transmission costs of St. Lawrence power would, of course, be higher than transmission costs of steam power since the latter can be more conveniently located in relation to the market. Nevertheless, St. Lawrence power would still be considered the cheaper. Brigadier General Robins testified that the transmission of electric power would cost about one-fourth of a mill for 50 miles, one-half of a mill for 100 miles, nine-tenths of a mill for 200 miles, and 1.4 mills for 300 miles.[11] Thus St. Lawrence power can be transmitted over a 300-mile radius for less than 4 mills per kilowatt-hour.

The Power Authority of the State of New York estimated in 1937 that St. Lawrence power could be delivered within a 200-mile radius for 2.55 mills per kilowatt-hour, at which cost it would be 50-percent cheaper than equivalent steam power on an 80-percent load-factor basis.[12]

The St. Lawrence development would provide some 6,600,000,000 kilowatt-hours of electricity to the United States at a lower cost than the most efficient steam station within a radius of 300 miles from Massena, N. Y., which covers almost the whole state of New York, much of New England, and about two-thirds of Pennsylvania.

Market for St. Lawrence Power.

In contrast to the substantial agreement among technicians that St. Lawrence power is highly economical and cheaper than alternative steam power, there has been considerable controversy as to whether

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[9] House Document No. 52, 75th Cong., 2d Sess., *Government Hydro Versus Private Steam Power*, 1937.

[10] *Hearings on H. R. 4927*, No. 5, pp. 333–35.

[11] *Ibid.*, No. 12, p. 973.

[12] *Government Hydro Versus Private Steam Power, op. cit.*, p. 53.

there is a market in New York for the large amount of power that will be generated by this project.

In 1929 Moulton and associates came to the conclusion that since St. Lawrence power could not compete in Metropolitan New York with steam power, its market would be restricted primarily to sales on site which would presuppose the establishment of high-load-factor industries in northern New York. However, they did not question that St. Lawrence power could be exploited and utilized on an economic basis:

> The conclusion indicated by the foregoing analysis is that from the standpoint of neither the United States nor Canada is great haste required in the development of the power resources of the St. Lawrence River. That this power will eventually be exploited and utilized on an economical basis is scarcely to be doubted. Just how rapidly the necessary industrial development along the river will come no one is in a position at the present time to forecast.[13]

The increase in the demand for electricity in New York State from 1927 to 1937 indicates that there was no ground for this circumspect conclusion, since the growth of demand for energy, as well as installed capacity in New York State, between those two dates were greater than would be supplied by the St. Lawrence project. The generating capacity of electric light and power stations in New York State increased from 3,157,615 kilowatts in 1927 to 4,837,375 kilowatts in 1937. The net increase during that interval was, therefore, 1,679,760 kilowatts, or almost twice as much as the American share of the St. Lawrence project. The output in the same interval increased from 9,917,685,550 kilowatt-hours in 1927 to 15,582,897,247 kilowatt hours in 1937. Power generated by central stations, therefore, increased by 5,665,211,697 kilowatt-hours during the 10-year period.[14]

This would seem to indicate that power from the St. Lawrence could have been absorbed without difficulty, in spite of the intervening economic depression. Since St. Lawrence power under public auspices would bring about a reduction in rates, it is undoubtedly true that, in view of the experience of the Tennessee Valley area, all of this power and more could have been utilized. Dr. Moulton's conclusions, based upon the studies of Sanderson and Porter, were, therefore, unduly restrained concerning the desirability of developing St. Lawrence power.

In spite of this experience, there is still a school of thought which insists that there is no demand for the power from such projects as the St. Lawrence. The Niagara Frontier Planning Board claimed in 1940 that there will be no market for St. Lawrence power for a long

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[13] Moulton, *op. cit.*, p. 227.

[14] Census Bureau, *Census of Electric Industries, Central Light and Power Stations*, 1927, table 29, p. 43; *ibid.*, 1937, table 17, p. 28.

time to come, because according to their estimates, demand for electricity will expand only from 13,500,000,000 kilowatt-hours in 1937 to not more than 21,000,000,000 kilowatt-hours in 1950, as contrasted with the estimate of the Power Authority of the State of New York of 26.87 billion kilowatt-hours. How inadequate the Planning Board's estimate is can be observed from the fact that by 1940 New York State generation of electricity had already mounted to nearly 19,000,000,000 kilowatt-hours.[15] With the national defense program superimposed upon normal growth in demand for electricity, the Niagara Frontier Planning Board's statements will probably be surpassed very soon and the Power Authority's estimates may be even too low.

The St. Lawrence Survey has made an independent detailed estimate of demand for electricity in New York State on the basis of peacetime requirements, based on the trends in the different classes of consumption; namely, industrial, commercial, residential, rural, and miscellaneous.[16] This detailed estimate indicates that by 1950 the demand for electricity in the State will be at least 26.6 billion kilowatt-hours, which is large enough to absorb not only the American share of the St. Lawrence development but also the additional power that may be obtained from the redevelopment of the Niagara River.[17]

That there is a market for St. Lawrence power, even under conditions of peacetime developments, is amply proved by past experience. More urgent, indeed, is the need for the St. Lawrence power, as soon as it can be made available, for purpose of national defense industries.

There is already a shortage of electric power in northern and western New York for defense industries, and this shortage is becoming more severe as the defense program develops to its full intensity. Many industries in western New York have been denied additional electric power for defense production.[18]

The shortage in electric power for defense industries in northern New York is very acute and the Office of Production Management has had to resort to temporary arrangements to secure sufficient power for aluminum production. On August 20, 1941, it was announced that the Defense Plant Corporation had made arrangements with the Aluminum Co. of America to construct a new aluminum reduction plant at Massena, New York, with funds advanced by the government. This plant is to produce 150,000,000 pounds of aluminum a year. It will require approximately 180,000 kilowatts of additional capacity. This power is not now available at Massena. It will have to be made available through the temporary utilization of the reserves available in New England, New Jersey, Pennsylvania, and New York, which

[15] Federal Power Commission, *Production of Electric Energy and Capacity of Generating Plants*, 1940, p. 86.
[16] St. Lawrence Survey, Part VI, *The Economic Effects of the St. Lawrence Power Project.*
[17] *Ibid.*, p. 80.
[18] *Hearings on H. R. 4987*, No. 18, pp. 2239–40.

will be transmitted upstate New York by the construction of new transmission facilities. This power, of course, will be expensive for the purpose of aluminum reduction since much of it will be steam power, transmitted at considerable cost over long distances. However, the need is so urgent that this emergency arrangement will be made pending the provision of cheaper hydroelectric power from the St. Lawrence or other available sources.

Hon. William S. Knudsen submitted the following statement to the House Committee on Rivers and Harbors describing the arrangements being made to supply power to this aluminum reduction plant:

> The new aluminum production capacity to be located in upstate New York will require approximately 180,000 kw. of electric power for continuous capacity operation which represents an annual production of at least 150,000,000 [lbs.]
>
> It is contemplated that the permanent source of power for these new aluminum plants will come through the construction of hydroelectric projects on the St. Lawrence or from other hydroelectric developments in New York and Canada. During the interim period between completion of the aluminum plants and the completion of new generating capacity power supply will be made available by pooling power reserves throughout a large portion of New York, eastern Pennsylvania, New Jersey, and New England. This will be accomplished through the construction of additional interconnecting facilities between the private power systems in the area and by strengthening the Peckville-Binghamton, the West Wharton-East Walden and the Hell Gate-Pleasant Valley lines. It is also expected that a small amount of power can be obtained from Canada. While the cost of power during the interim period will be comparatively high, and while the use of generating capacity reserves for this purpose cannot be continued over a long period of time without risking the impairment of service, we believe that this plan provides the only practical arrangement for obtaining power for these plants pending completion of generating facilities which will provide the permanent power supply.

The St. Lawrence power is already much needed in northern New York. The temporary arrangements made for this aluminum plant at Massena cannot be continued since the reserve generating capacity utilized in this case will certainly be needed to take care of local loads. When the St. Lawrence power is available, this aluminum plant will be supplied from that source.

The Defense Power Division of the Federal Power Commission estimates that in the New York State area there will be needed, in addition to already planned extensions to existing facilities between now and 1945, an additional capacity of 1,600,000 kilowatts.[19]

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[19] *Ibid.*, No. 5, p. 336.

Time Factor and Alternative Sources of Power.

Having established that the St. Lawrence power is cheaper than any alternative sources in the northeastern section of the United States, and that the amount of power that would be made available by this project is needed for purposes of national defense, as well as for the normal growth of load during the present decade, the question is then raised whether it can be constructed in time to be of use in the present emergency. To put it differently—this question must be answered: Are there alternative sources of power in the northeastern United States which can be developed more quickly, even if not as economically, than the St. Lawrence project?

Three alternatives have been presented with serious emphasis by opponents of the St. Lawrence project: (*a*) It is asserted power can be obtained much more quickly by the construction of steam generated stations. Steam stations can be constructed, it is claimed, in 18 to 24 months, as compared to 48 months for the St. Lawrence project. (*b*) Additional power is said to be available at Niagara River which can be obtained by just "turning on the spigot." (*c*) Finally, power can be obtained from Canadian sources in a shorter time than from the St. Lawrence project.

Steam power.—There is no doubt that steam generating equipment equivalent to the capacity of the American share of the St. Lawrence project—namely, 820,000 kilowatts—can be made available within 24 months in the New York State area, if priority were given to the power requirements of this section of the country over all other defense requirements. To do this, however, it would mean depriving other sections of the country and other industries of an equivalent amount of power. The total additional capacity needed in the country as a whole is so much larger than the capacity of manufacturers to turn out steam turbines that any given section can obtain steam capacity within the time limits designated by opponents of the St. Lawrence project, only at the expense of other areas.

With a peak defense production at the rate of $3,000,000,000 a month from 1943 to 1945, it is estimated by the Federal Power Commission that a total of 15 to 20 million kilowatts of additional electric generating capacity will be required in all parts of the country. This new capacity must, of course, be manufactured between now and 1945.

In addition to this, manufacturers of turbine and electrical equipment must provide a large part of the requirements of the two-ocean navy and the Maritime Commission's program. These two together require between now and 1945 at least a total of 13,000,000-kilowatt capacity of turbine equipment. It has been estimated that power needs and the requirements of the Navy and the merchant fleet will

necessitate the construction of nearly 29,000,000 kilowatt capacity of turbines in the next 4 years.

The turbine manufacturing capacity of the United States has been estimated by the Federal Power Commission, after field surveys, to be approximately 3,500,000 kilowatts a year, which is divided between hydro-equipment capacity, 1,000,000 kilowatts, and steam-equipment capacity, 2,500,000 kilowatts. This means that with continuous and uninterrupted production the equipment manufacturers should produce, between now and 1945, a total of a little over 14,000,000 kilowatts of turbine capacity, as compared with total national defense requirements of nearly 29,000,000 kilowatts.[20] The figure entitled "Defense Needs and Capacity to Produce Hydro and Steam Turbines" gives a graphic description of the shortage in equipment. It is clear from these facts that no section of the country can be given priority of equipment without depriving some other section in equivalent capacity. It is also clear that the task before the country is not to decide between alternatives of steam and hydro equipment but to utilize all of the manufacturing capacity of electrical equipment, both steam and hydro. It is important to note that to the extent that more of our steam-turbine capacity is devoted to power purposes, to that extent the Navy's program will be handicapped by delayed deliveries of turbines.

The net effect of the argument of those who advocate the establishment of steam stations in preference to hydro stations is that the Navy program would be placed under a handicap, and, secondly, that commercial and industrial consumers will be deprived of power with resultant dislocations in production and employment. Incidentally, such a policy will advance inflationary tendencies by restricting the supply of goods while the money income of the country is increasing.

Niagara power.—Another alternative source of power often mentioned by opponents to the St. Lawrence project is the possibility of obtaining additional power at Niagara Falls. It is claimed that there is unused installed generating capacity in two hydroelectric stations at Niagara Falls—one on the American side in the Adams station, and the other on the Canadian side in the Toronto station. The Adams station is supposed to have 95,000 unused horsepower of capacity which could be utilized immediately by merely "turning on the spigot." The same is claimed for the Canadian station, where it is asserted there is 87,000 unused horsepower capacity.[21]

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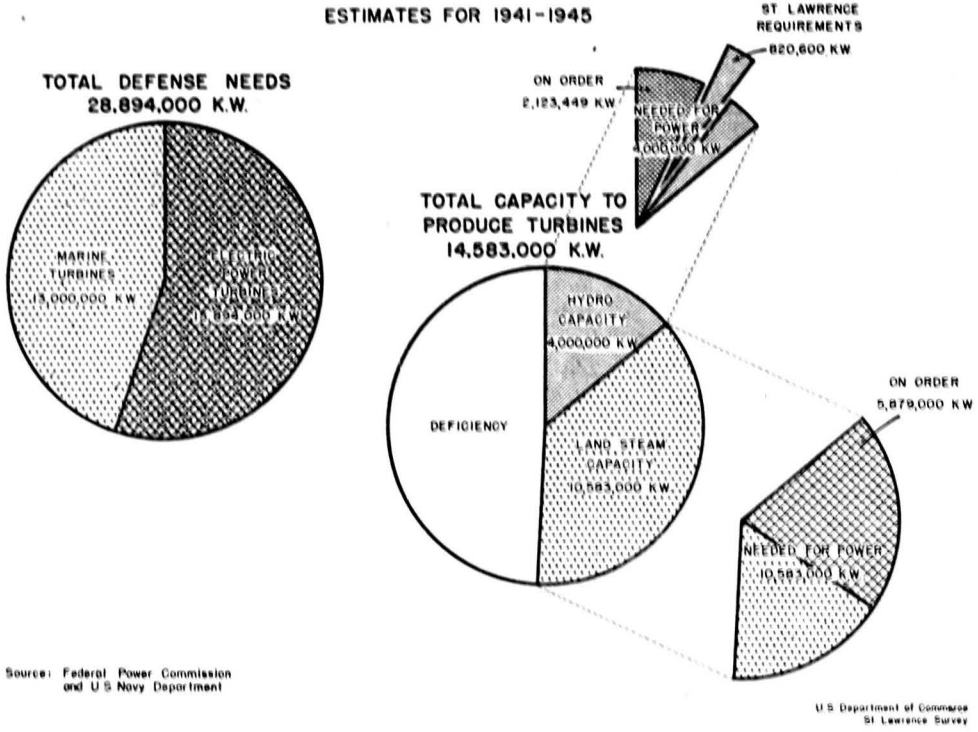
[20] *Ibid.*, No. 18, p. 2062, statement by N. R. Danielian.
[21] *Ibid.*, No. 8, pp. 597–98.

DEFENSE NEEDS AND CAPACITY TO PRODUCE HYDRO AND STEAM TURBINES

ESTIMATES FOR 1941-1945



Source: Federal Power Commission and U.S. Navy Department

U.S. Department of Commerce
St. Lawrence Survey

This point is categorically denied by well-informed officials. Dr. James C. Bonbright, chairman of the Power Authority of the State of New York, testifying before the House Committee on Rivers and Harbors, July 2, 1941, stated:

> The point is made that these sources of power are available merely by turning on the spigot. The truth is, however, that the Adams station is already opening up to full capacity on an emergency basis, despite its admitted gross inefficiency. Whereas, as to the possibilities of increased capacity on the Canadian side, the chief engineer of the Ontario Hydroelectric Power Commission, Mr. Jeffry, told me 3 days ago, when I telephoned him from New York, that both of these plants, the Toronto plant and the Rankine plant, referred to by the Niagara Planning Board, have no available capacity, because they are already being operated to full capacity. Some more energy, as distinct from capacity, can be and will be secured from them, but no more capacity. Hence the 182,000 horsepower of supposed unused capacity on both sides of the Niagara is already a matter of past history. . . .[22]

Canadian sources.—The third alternative source of power generally proposed as a substitute for the development of the St. Lawrence by opponents of this project, is the possibility of developing Canadian hydroelectric resources, particularly extensions to the Beauharnois development in Quebec at the Soulanges section of the St. Lawrence River. It is claimed that Canadian sources could supply additional power, equal to over 4,000,000 horsepower, on the lower St. Lawrence, the Saguenay, St. Maurice, and Ottawa Rivers, and other sites, in much shorter time than the International Rapids Section could be developed.[23]

Principal emphasis is placed upon the possibility of utilizing the flow of the St. Lawrence River at the Soulanges Section in Quebec Province to its full capacity by constructing extensions to the Beauharnois station. This station at the present time has 636,000 horsepower of installed capacity. Two further units now being installed will bring this capacity by next spring to 742,000 horsepower. It is asserted that 750,000 horsepower of additional capacity could be obtained by the extension of this station.[24]

The chief hydroelectric engineer of the Ontario Hydroelectric Commission, Mr. Otto Holden, in a memorandum to the chairman of the Commission, dated July 29, 1941, stated that the full development of the Soulanges Section of the River utilizing all of the water through the Beauharnois station, and thereby eliminating the present partial

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[22] *Ibid.*, No. 10, p. 840. See also testimony of Hon. A. A. Berle, Jr., *ibid.*, No. 1, p. 46, and letter of Hon. Leland Olds to Congressman Alfred F. Beiter, dated November 5, 1941.

[23] Niagara Frontier Planning Board, p. 118; *Hearings on H. R. 4927*, No. 8, p. 600; No. 17, p. 1699.

[24] *Hearings on H. R. 4927*, No. 8, p. 600.

head developments of the river, will supply 531,000 additional continuous horsepower.[25] This must be compared with 1,520,000 additional continuous horsepower in the International Rapids development.

The Beauharnois development could, therefore, supply only one-third of the continuous horsepower capacity of the International Rapids Section. Furthermore, the development of Beauharnois to its full capacity could not be effected in less than 3½ years, even after all of the negotiations and legal arrangements are completed. In this respect the St. Lawrence project is much further advanced in that negotiations and the engineering plans have already been completed. Finally, there is no basis for the expectation that Canada will be able to spare this amount of power for United States use. In fact it is reported that American firms importing power from Canada at Niagara on a temporary basis are now on notice by the Canadian Government of the likelihood of interruption of at least part of the supply because of the increasing Canadian need for power.

The Beauharnois development is not a feasible substitute for the International Rapids development since its available firm power is only one-third the amount of firm power at the International Rapids and it cannot be obtained in any shorter time than from the International Rapids. As indicated, there is no assurance that Canada will be in a position to export to the United States the additional power that might be developed at Beauharnois. On the contrary, it now appears that the Canadian war effort requires full utilization of Canadian power resources.

Conclusion.

The International Rapids on the St. Lawrence River will supply over 13 billion kilowatt-hours of electricity at very low cost—an average of 1 mill per kilowatt-hour for the whole supply, and 1.7 mills for the firm power. This power is needed by both countries, to take care of normal growth in load, and it is needed urgently for the requirements of defense industry. The emergency will be of long duration, and all of the equipment-manufacturing capacity of the country will be taxed to the limit and will still fall short of requirements. There are no alternatives to the St. Lawrence project in the northeast either in Canada or in the United States, since other available sources are also needed for the supply of energy to defense industries.

The President of the United States summarized the situation in the following words:

> Both countries need the power. Both face power shortages which threaten to grow more serious as the demands of the defense program multiply with almost incredible rapidity.

[25] *Ibid.*, No. 18, p. 2073.

Let us remember that it takes tens of thousands of kilowatt-hours of electricity to produce the materials that go into a single airplane. Our present aluminum program alone calls for more than 10,000,000,000 kilowatt-hours a year. It is constantly expanding with the need for more planes to outstrip the aggressors.

Steam-power-plant construction offers no substitute for St. Lawrence power. No steam plants can provide the large blocks of low-cost electric energy required for certain essential defense industries. Furthermore, we are going to need all our capacity to produce steam-power-plant equipment to meet the tremendous demands which are growing in other parts of the country and to build power installations to drive our merchant and naval vessels.[26]

[26] *Ibid.*, No. 1, p. 2.

Shipbuilding on the Great Lakes

The St. Lawrence Seaway will establish a deep-draft channel between the Great Lakes and the Atlantic Ocean. The dimensions of the channels, canals, and locks will be such that all but the largest merchant vessels, and all types of naval craft, with the exception of battleships, aircraft carriers, and battle cruisers, will be able to navigate between the Atlantic and the Great Lakes. This will make it possible to construct seagoing cargo vessels and naval craft up to 10,000-ton cruisers carrying 8-inch guns in Great Lakes shipyards.

It is the purpose of this section to describe the advantages of the Great Lakes in shipbuilding, and the extent to which these inland shipbuilding facilities can aid the national defense program.

Shipbuilding Facilities on the Great Lakes.

In the Great Lakes, on the United States side alone, there are 15 building berths of 500 feet or more in length, and 5 others of about 300 feet in length. It will not be possible here to describe the Canadian facilities because the information is confidential.

From public sources it is possible to obtain the list of the shipyards on the United States side of the Great Lakes. This is given in table 6. The profile map on page 75 shows the location of the principal American shipyards on the Great Lakes. The 15 major berths shown in table 6 can accommodate merchant ships of the Liberty fleet, EC-2 type, as well as the regular C-type ships of the United States Maritime Commission program. They can also construct destroyers. Some of these building berths that are 600 feet or more can build cruisers up to 10,000 tons. To build warships, however, will require some alteration in equipment—dredging of launching slips, strengthening and lifting the height of cranes, and other similar changes which naval builders consider minor in character.

Table 6

Location of large shipyards on the Great Lakes

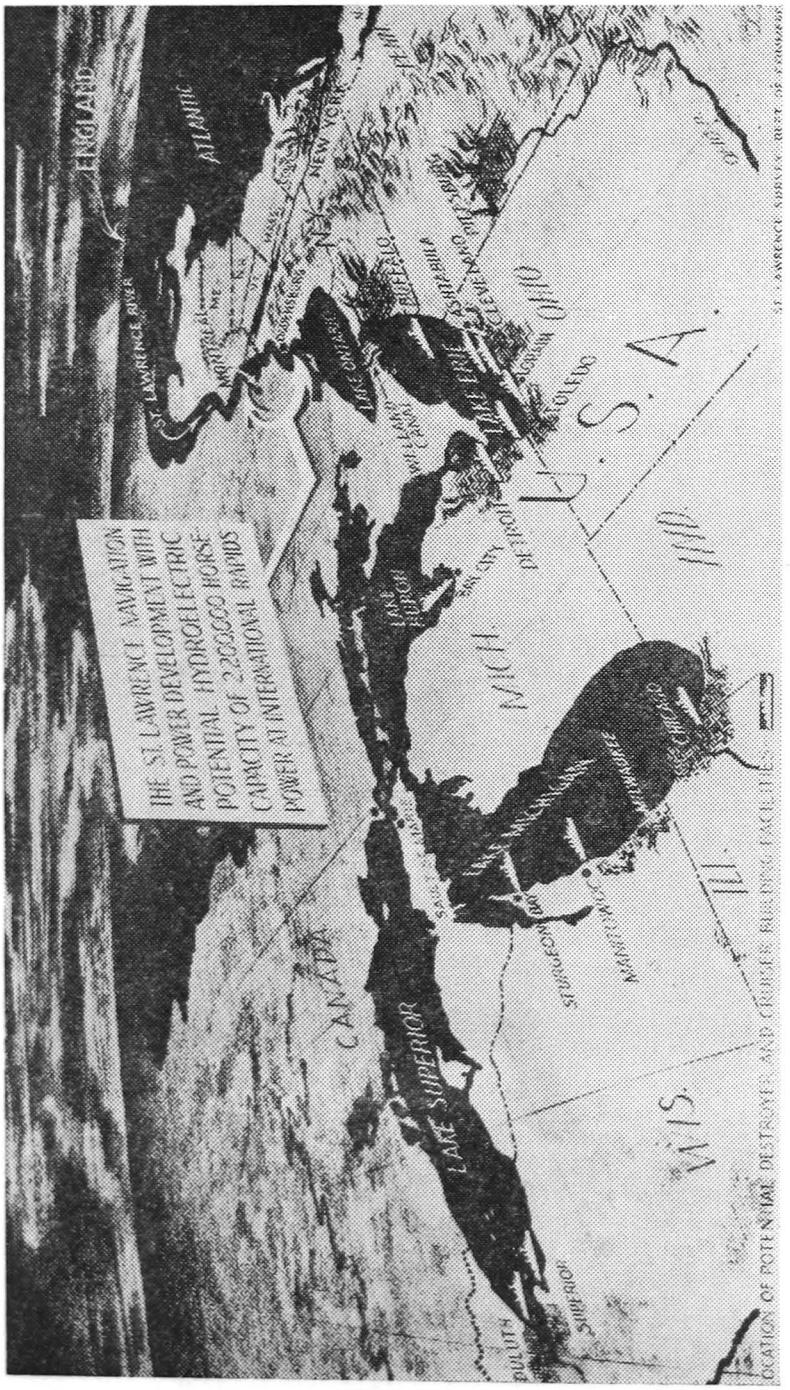
Company and plant	Number of ships which can be berthed		Company and plant	Number of ships which can be berthed	
	500 feet and over	About 300 feet		500 feet and over	About 300 feet
American Shipbuilding Co.:			Marine Iron and Shipbuilding Co., West Duluth, Minn.		2
Cleveland, Ohio	1		Sturgeon Bay Shipbuilding & Dry Dock Co., Sturgeon Bay, Wis.		3
Lorain, Ohio	4		Total	15	5
Great Lakes Engineering Works:					
Ecorse, Mich.	3				
Ashtabula, Ohio	1				
Manitowoc Shipbuilding Co., Manitowoc, Wis.	3				
Toledo Shipbuilding Co., Inc., Toledo, Ohio	3				

Source: *The Great Lakes Red Book*, 1941, The Penton Publishing Co., Cleveland, Ohio.

Rear Admiral George H. Rock (C. C. ret.), former Chief Constructor of the United States Navy, and now Administrator of the Webb Institute of Naval Architecture, inspected the principal shipyards on the Great Lakes on behalf of the Department of Commerce. In a letter to N. R. Danielian, Director of the St. Lawrence Survey, Admiral Rock made the following report on his observations, which gives the most authoritative opinion on the technical ability of Great Lakes shipyards to construct merchant and naval vessels.[1]

> On May 9 to 11 we visited together the American Ship Building Co.'s yards at Cleveland and Lorain, the Great Lakes Engineering Co.'s yard at Detroit, and the Toledo Shipbuilding Co.'s yard at Toledo. Our purpose was to determine whether the Great Lakes Shipyards could build oceangoing ships of the large dimensions that could be taken through the channels contemplated by the St. Lawrence waterways project.
>
> During the last war many of these yards built large numbers of small oceangoing ships, about 260 feet in length, which were sent through the Welland Canal, so it is well known that the yards are experienced at building such cargo ships as well as the lake cargo carriers, and that the yard facilities are sufficient and suitable. It was necessary, therefore, only to determine whether the larger ships of greater beams and depths could be built without plant additions and improvements that might be considered too extensive.
>
> There is no doubt that the shipyards can build the larger ships we have under consideration. The capabilities of the several yards may be listed about as follows:
>
> *Cleveland, Ohio.*—Has one building slip 600 feet which can be extended to about 1,000 feet. Ships can be built of about 70-foot beam and 18-foot draft. Dredging will be necessary if they are over 14-foot light draft; the gantry crane will have to be moved back and raised to span the deeper ship; longer sheet piling at the slip bulkhead and additional supporting piling under the building ways may be required.
>
> *Lorain, Ohio.*—There are two building slips of about 520-foot and two of about 735-foot length. Ships of these lengths with corresponding dimensions of beams and drafts can be built with only moderate improvements for necessary preparations.
>
> *Ecorse plant at Detroit.*—There is one 600-foot and three 800-foot building slips, and the same comments apply as above for Lorain.
>
> *The Toledo Shipbuilding Co., Toledo, Ohio.*—They have one 640-foot slip and two 525-foot slips on which ships of 60- and 62-foot beam, respectively, could be built. There is no special difficulty as to drafts of water. To build larger ships would require extensive changes.
>
> *The Manitowoc Shipbuilding Co., Manitowoc, Wis.*—This company has four slips of 250, 300, 500, and 600 feet, and the conditions there, I am informed, will permit building ships

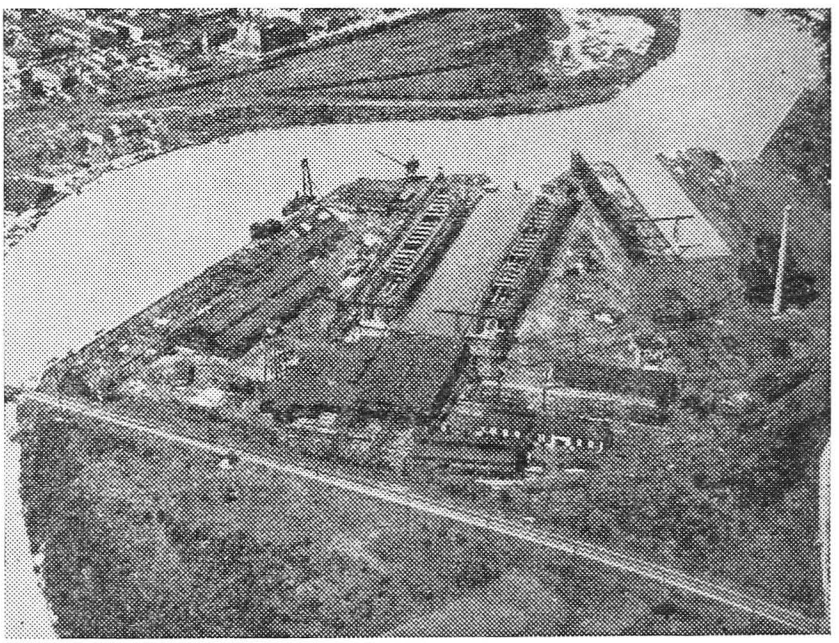
[1] *Hearings on H. R. 4927*, No. 18, pp. 2050–51.


THE ST LAWRENCE NAVIGATION AND POWER DEVELOPMENT WITH POTENTIAL HYDROELECTRIC CAPACITY OF 2,200,000 HORSE POWER AT INTERNATIONAL RAPIDS
ENGLAND
ATLANTIC
ST. LAWRENCE RIVER
NEW YORK
LAKE ONTARIO
BUFFALO
LAKE ERIE
CLEVELAND
TOLEDO
DETROIT
LAKE HURON
LAKE SUPERIOR
CANADA
U.S.A.
MICH.
WIS.
ILL.
DULUTH
SUPERIOR
CHICAGO
LOCATION OF POTENTIAL DEVELOPMENTS AND CITIES HAVING FACILITIES
ST. LAWRENCE SURVEY, U.S. ENGINEER

of corresponding beams and drafts; but this plant, with an order for 10 submarines, will be fully occupied for several years.

These four are the large building yards at present on the Lakes; but some of the smaller existing yards could be put in condition for building smaller numbers of ships, and no doubt new yards would be built when it is settled that oceangoing ships are practicable.

Telephone conversation and later a conference with Ashtabula, Ohio, representatives make it clear that two large ships up to about 700 feet in length and one smaller ship can be built at the same time on their 1,550-foot building slip, these being up to about 64-foot beam and 18-foot light draft. This would mean that there could be at least four large ships under construction at the same time, two on the slips and two fitting



American Shipbuilding Co.'s Shipyard at Lorain, Ohio.

out in the water. Apparently the only work required would be a moderate amount of dredging. A beam greater than 64 feet would entail some additional expenditures, such as widening the keel foundation, building new foundations for the gantry track, shifting railroad tracks, obtaining longer booms for the cranes, etc.—all relatively moderate matters.

We discussed the possibility of building cruisers in the yards on the Lakes, and while I know nothing about any plans of the Navy Department in regard to such assignment, it is practicable to build out 10,000-ton and smaller cruisers at the Detroit and Lorain shipbuilding yards.

Construction of ships on the Lakes would necessarily have to be regulated to suit the closed winter season, but that is a condition which is known and can be met accordingly.

The insurance rates for the trip to salt water are high and for private ships must be met by the builder or the owners. For Government ships, the Government could take the ships over at the building yards.

In his testimony before the House Committee on Rivers and Harbors, Admiral Rock described in greater detail the adaptability of the shipyards he visited to large-ship construction, and the kind of changes that would be necessary to fit them for the present-day naval construction needs of the country.[2]

The shipyards are very well equipped and they are of moderate or medium size; all of them capable of ordinary and continuous expansion. They have in the yards different numbers of building slips. Some like the River Rouge plant in Detroit with four building slips, on which four moderate-in-length or two extreme-length ships could be built at one time, and that would taper down to the Cleveland yard, where they have only one slip, but that is a long one, whether either one long and one short ship could be built, or two moderate-size, like 500-foot lengths.

It might be that for the heavier ships, that would be an ocean-going ship, some very moderate amounts of work would have to be done. Some of the building slips might have to be additionally piled so as to give stronger support for their ways. There might be some changes, too, in the location of the crane tracks for the cranes for handling material in order to move it back and get more space for the building slip, and it might be that the cranes would have to be raised in height in order to reach the material out over the beamier and the deeper ships, but those are moderate and minor items of alterations in the yards.

Also, there probably would be required a moderate amount of dredging, because it seems that in most of the Lake yards the depth of the water in the launching slips is between 14 and 15, and for these deeper, heavier ships it might be necessary to dredge somewhat deeper in the slips and out to the channel which runs alongside, and perhaps dredge also in front of the fitting-out pier. But that is an ordinary matter which is under way all the time anyway, and in dredging moderately deeper in the launching slip or the fitting-out pier, there might be required a longer sheet piling in order to protect the embankment.

It is also a more or less minor question, and in fact in one of the yards that I visited the sheet piling was then in need of renewal, and, of course, driving sheet piling a couple of feet longer would have been of no consequence.

[2] *Ibid.*, No. 2, pp. 148–9.

> Now, so much for the building, except that I was asked to consider whether those yards could build combatant ships. Of course, it would be well known by everybody that they could build destroyers and small craft, but I found that, in my judgment, the two larger yards anyway, at the River Rouge and Lorain plants, could build now the 10,000-ton, 8-inch-gun cruisers, and, of course, the smaller cruisers.
>
> Those in the ordinary terminology are called "large cruisers" because they are 10,000 tons. If we speak of very much heavier cruisers, they are either called "heavy cruisers" or "battle cruisers," but they are out of the picture, because they are so very much larger with much larger dimensions.
>
> There isn't any doubt in my mind also that the other large yards that we saw on the lake could prepare themselves for building these cruisers, because they have the facilities right there, and it would be a matter not of pride but of business to enter into bidding for the building of them.

Admiral Rock characterized the shipyards as "well-equipped, well-organized, and well-staffed." He stated that they are "going concerns" and have been going concerns for 40 years, and "are not problematic in any sense of the word." "They are," he stated, "shipyards where several thousand men have been employed in previous times of stress, and they are located where mechanics exist and where mechanics can be trained."[3]

The ability of Great Lakes shipyards to build the kind of merchant and naval vessels that are greatly needed in the present emergency is established beyond doubt. As a matter of policy, the desirability of utilizing the Great Lakes yards for such construction is accepted.

The Secretary of the Navy, Hon. Frank H. Knox, also stated before the House Committee on Rivers and Harbors that Great Lakes shipyards would aid in the naval construction program if made accessible:

> My recent experience as Secretary of the Navy emphasizes in my mind what a great boon it would have been to national defense now if when this project was first proposed it had been agreed to and put into effect. If that had been done it would not have been only along the 12,000 miles of coast line that we now have scattered our shipyards for building combatant ships, but it would have been along additional thousands of miles of inland waters, completely safe from any dangers from without, where we could be building cruisers, destroyers, submarines right now.
>
> There is an advantage in construction in the interior, not only one of security, one of nearness to raw materials, and in a region where there is an abundance of skilled labor, but it would have been of tremendous advantage to me as the Secretary of the Navy, in letting these contracts for these combatant ships which we are now building in such large numbers, had this resource been available, as it might have been had this project been adopted then.[4]

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[3] *Ibid.*, No. 2, p. 149.
[4] *Ibid.*, No. 2, p. 95.

After detailed study of the St. Lawrence project and Great Lakes shipbuilding facilities, the United States Maritime Commission also has come to the conclusion that the construction of the Seaway would make possible a much greater utilization of those facilities. In transmitting the Commission's favorable report on the St. Lawrence bill, H. R. 4927, Admiral E. S. Land, chairman of the Commission, wrote:

> The Commission is constantly studying how to use to the maximum for defense the shipbuilding resources of the country. There are many shipbuilding sites and prospective supplies of labor in the Great Lakes area not now fully utilized. Temporary expedients are being devised to utilize some ways on the Lakes to build ships to be floated down the Mississippi River. The construction of the St. Lawrence waterway will make possible a much greater use of the Great Lakes yards and will add to our national shipbuilding resources capacity to build large ships now landlocked from the sea. The sooner the St. Lawrence waterway is built, making the lake yards directly accessible to the sea, the more rapidly can the vast fleet of ships disturbed world conditions make necessary be secured.
>
> In the meantime to any extent that the long-range naval-construction program permits the use of the lake shipyards, thus freeing coastal facilities, to that extent cargo-ship construction in coastal yards can be accelerated.[5]

Criticism of the Great Lakes Shipbuilding Facilities.

In spite of this decisive testimony of qualified and responsible officials of the United States Navy Department, and the opinion of the United States Maritime Commission, opponents of the St. Lawrence Seaway have questioned the feasibility or desirability of utilizing Great Lakes shipbuilding facilities. Their objections fall into two groups: One argues that the Great Lakes shipyards are not needed; the other claims that alternative procedures can be invoked to utilize the industry instead of the St. Lawrence Seaway.

In the hearings before the Rivers and Harbors Committee the fact has been repeatedly questioned that all existing large shipways on the ocean coasts are being used. Authoritative witnesses verified in the course of the hearings that all large shipways were being used:

> Admiral ROCK. The yards are very filled up with work orders.
> Mr. CULKIN. All the present yards?
> Admiral ROCK. All of our going yards.
> Mr. CULKIN. And those along the Gulf Coast?
> Admiral ROCK. Even those new yards down at Pascagoula in Mississippi and Tampa, Fla., and the others. They are filled up with orders for a long time ahead.

[5] *Ibid.*, No. 18, p. 2250.

Mr. CULKIN. They are running to capacity and will be for some time?

Admiral ROCK. Yes.[6]

Mr. William Knudsen, Director General of the Office of Production Management, also supported this fact:

Mr. BELL. Mr. Knudsen, the statement has been made here in the hearings from time to time that there are a good many shipyards around the Atlantic and Pacific coasts that are not in use. Are you familiar with the facts on that question?

Mr. KNUDSEN. I am quite sure we have surveyed every way on the coasts.

Mr. BELL. It would be your judgment that they are all in use?

Mr. KNUDSEN. I can give you a statement to that effect, because when I go back to our Shipbuilding Section and our inspection reports I can tell you where every way is, if you would care to have it for the record.[7]

Another point of attack on the shipbuilding advantages of the St. Lawrence is that the Lakes yards could be assigned the task of constructing smaller vessels. It is then assumed that facilities for the construction of large vessels would be released on the ocean coast. The fact is, however, that all the large shipways are at present being used for large ships. There would be no release of capacity because the yards which build the small ships could not handle the big vessels. The small craft could be built in the smaller shipyards in the Great Lakes, and in spite of an extensive small-ship building program there would still be yards that could construct the larger units.

The extent of the facilities which the Great Lakes possess for small ships was emphasized by Admiral Robinson in the hearings on the Navy appropriation bill for 1942:

I told the Senate Naval Affairs Committee that we expected to place the bulk of that work, small craft, on the Great Lakes. That means the area of the Great Lakes, and the area includes rivers like the Mississippi, the Missouri, and Ohio Rivers. That area has more plants all ready and equipped to build small boats than any other area. We have the New England area, the East coast area, the Southeast coast area, the Gulf area, the California area, and the Pacific Northwest area. This is the way we divide the country up. We have 50 percent or twice

[6] *Ibid.*, No. 2, p. 159. See also testimony of Hon. William S. Knudsen, *ibid.*, No. 10, p. 812: "I believe it is a mistake to have an area like the Great Lakes landlocked, limiting the size of ship you can take out. People talk about building ships in two and taking them out. I believe we should have full access to that great area of skill and material."

[7] *Ibid.*, No. 10, p. 818.

as many available shipbuilding yards in that area than in any other I have mentioned.[8]

There are 63 shipyards in the Great Lakes area. Of these only about a half dozen firms are experienced and capable of building large vessels. Thus, the small-ship program can be carried on effectively at the same time that the larger ships are being built. Furthermore, the small-ship construction will be finished in a relatively short time, while the larger ships are scheduled over a much longer period. Some of the intermediate-size yards can build a number of smaller ships and then swing over into the production of larger vessels as soon as the necessary additions to their equipment and facilities have been provided. The small-ship construction meantime will have furnished a training ground for skilled labor.

The entire question of obviating the construction of the St. Lawrence Seaway by building small ships in the Great Lakes was treated in the hearings:

Mr. BEITER: Wouldn't it be feasible to construct all the trawlers and mine sweepers and mine layers in the Great Lakes and make the ports or berths that have facilities along the Atlantic seaway and the Gulf available for the larger draft vessels?

Admiral ROCK: Well, the small craft that you speak of could well be built in many of the Lake yards, but there are also, of course, many other yards on the two coasts that are quite capable of and ready to build them and in the meantime our shipyards that are capable of building large ships are swamped with orders for many years to come.[9]

* * * * *

Mr. BEITER: The point I am trying to make is that the facilities are available there for the construction of these smaller craft and it wouldn't be necessary to construct the Seaway. There are at the present time facilities that are completed and crafts could be built in Great Lakes yards and could sail down either the Illinois River or up through the St. Lawrence without spending several hundred millions of dollars for the improvement of the Seaway. The smaller berths that are available now along the Atlantic coast and Gulf coast could be converted into larger berths for building larger vessels.

Admiral ROCK: Well, that doesn't follow, you know.

Mr. BEITER: Why not?

Admiral ROCK: Oh, no; that doesn't follow at all. A small yard doesn't necessarily—isn't one that necessarily can be transformed into a large shipbuilding yard.[10]

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[8] Navy Department appropriation bill for 1942, p. 729.
[9] *Ibid.*, No. 2, p. 152.
[10] *Ibid.*, No. 2, p. 153.

The Seaway has been opposed as unnecessary for shipbuilding for other reasons. It is pointed out that in the last war, oceangoing ships were built in the Lakes and were taken out to sea through the existing St. Lawrence Canals. These ships were limited to 261 feet 5 inches in length and to a deadweight tonnage of 3,000 or 4,000 tons. Along with wooden and concrete ships, these ships have been ruled out as uneconomical and undesirable in the present emergency.

Failing this alternative another one is proposed. Large ships can be partially built in the Lakes and floated down the Chicago Canal and the Mississippi River for completion. To tow these vessels to the ocean from Lake Erie or Lake Superior over a distance of 1,600 or 1,800 miles will be an expensive and time-consuming effort. Only the hulls can be built in the Great Lakes. The machinery and superstructure must be installed in the lower Mississippi or on the Gulf. It will probably be necessary to construct a large fitting-out yard there, to complete the hulls brought there from the Great Lakes. Constructing a ship in two different places will add to the cost in machinery needed and organization overhead. In addition, hulls will have to be towed on the Lakes to Chicago, through the Illinois Waterway and down the Mississippi River. Although complete details and estimates have not been made, the Maritime Commission estimates that the additional cost per ship may run as high as $200,000 to $300,000. For 40 ships, this increased cost may be in the neighborhood of $10,000,000.

In terms of over-all defense effort, these alternative proposals utilize only part of the resources on the Great Lakes. Workers and machinery will have to be assembled in the South for completion of the ships. Machinery produced in the Middle West will have to be shipped south for the completion, thus adding to transportation demand. In short, as a temporary expedient this plan may be justified; compared to easy egress via the St. Lawrence Seaway there are serious disadvantages. Admiral Rock specifically treated this problem in his appearance before the Rivers and Harbors Committee:

> Mr. BELL: Do you know of any reason why ships of that character (10,000 tons) could not be built on the lower Mississippi?
>
> ADMIRAL ROCK: I don't know enough about the lay-out of that part of the country to give you an answer. I know that there was an investigation under way to see whether certain merchant ships could be built on the Great Lakes under present conditions and it got even down through the drainage canal and down the river.
>
> Mr. BELL: Did you hear the Secretary's testimony that that was now being done, this morning?

Admiral ROCK: That is the part I missed this morning. They have been ordered and those merchant ships will be built there, but of course, it is a rather desperate measure, isn't it, when we have to build ships and take them apart and go to all kinds of time, more money expenditure, to get them where we want them and then finish them in another yard that is wanted for other purposes.

Mr. BELL: The testimony wasn't that they took them apart. He said they built the ships up to a certain point and floated them down and finished them in the other yards.

ADMIRAL ROCK: That is what I meant, putting the upper works on. Of course it would take the time and the labor in another yard to finish them. I say that seems to me like fairly desperate measures. It simply shows the desperate need for ships.

Mr. BELL: You think that there would be considerable delay in partly finishing the vessels and then completing their construction farther down the river?

Admiral ROCK: Well, of course, it's delay, yes; delay in getting the ships down there and then delay in completing them.[11]

Since this testimony was taken, the plan to float large ships down the Mississippi has been abandoned.

In summary, the following objections are raised to the necessity of completing the St. Lawrence Seaway to permit a large shipbuilding program on the Great Lakes:

1. There are extensive facilities for the construction of large oceangoing vessels on the ocean shores which are not now being utilized;[12]

2. There are possibilities for the establishment of new shipyards on the ocean shores which have not been fully exploited;[13]

3. By transferring small ships to the Great Lakes yards, a great number of large ships could be constructed with the facilities thus released on the ocean;[14]

4. The Great Lakes yards will soon be so heavily engaged in constructing smaller vessels that there will not be any capacity left for the construction of the larger vessels;[15]

5. Plans are under way to construct large vessels in the Great Lakes and tow them down the Illinois Canal and the Mississippi River to the Gulf. This makes the construction of the Seaway unnecessary.[16]

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[11] *Ibid.*, No. 2, pp. 155–56.

[12] Statements of Hon. Hugh Peterson, *Ibid.*, No. 2, p. 109; Hon. Alfred F. Beiter, No. 2, pp. 152–53; and Capt. Richard W. England, No. 6, p. 419.

[13] Statements of Hon. Albert E. Carter, *Ibid.*, No. 10, p. 819; Hon. Hugh Peterson, No. 2, pp. 110–11; Capt. Richard W. England, No. 6, p. 419; Hon. Lex Green, No. 12, p. 992.

[14] Statements of Hon. Alfred F. Beiter, *Ibid.*, No. 2, pp. 152–53; Hon. Leonard W. Hall, No. 9, p. 785.

[15] Statement of Hon. C. Jasper Bell, *Ibid.*, No. 2, p. 103.

[16] Statements of Hon. Alfred F. Beiter, *Ibid.*, No. 2, pp. 152–53; Capt. Richard W. England, No. 6, p. 422; Bertram D. Tallamy, No. 7, pp. 590–91.

These points were presented to the United States Navy Department for their critical consideration. In a letter dated July 31, 1941, to N. R. Danielian, Director of the Survey, Secretary Knox clarified the position of the Navy Department:

> In response to your letter of July 16, asking for information on the shipbuilding aspects of the St. Lawrence project, let me first say that I endorse the statements of Rear Admiral George H. Rock. Admiral Rock made a personal tour of inspection of Great Lakes shipyards, and the Bureau of Ships has accepted his conclusions as to the adequacy of the facilities.
>
> Most of the points raised by your letter are already covered in my testimony and in that of Admiral Rock. Since questions have been raised in subsequent hearings, however, I am glad to supplement some of the statements as to which doubts may exist.
>
> 1. There is no foundation in fact for the assertion that there are now shipbuilding facilities located at coastal yards fully equipped to build large vessels which are not now being utilized. All of the existing facilities which can construct large vessels for the Navy and the merchant marine are fully occupied, and on the basis of contracts already awarded, will remain occupied for some time to come.
>
> 2. The question of the possibility of establishing new shipyards at tidewater is generally misunderstood by the layman unfamiliar with the technical problems of ship construction. It is thought by many that any stretch of land on a tidal basin provides a site for a potential shipyard. The problem is much more complicated. A shipyard is not composed merely of building berths and launching ways, but consists of a highly specialized organization of men and machinery which take a long time to create. The location of new shipyards must consider not merely the availability of water-front sites but the experience of management, existence of trained, professional technical, and skilled workers, the existence of a large number of specialized shops equipped with the necessary machine tools. Thus, while shipways can often be added to existing yards in a matter of months, the establishment of new shipyards requires years. Yards for the construction of combatant naval vessels take from 2 to 3 years for completion. These facts explain the statement by Admiral Emory S. Land, Chairman of the Maritime Commission and Coordinator of Shipbuilding in the United States.
>
> "Any further dilution of shipbuilding brains, whether the skilled and unskilled labor in the yards or the managerial and professional talent in the office will . . . not accomplish the ultimate result which we all desire—the delivery of finished ships to make our country strong and to help make Britain and her allies victorious." (Radio address, April 9, 1941.)
>
> 3. It is true that contracts for a number of ships are being placed in the Great Lakes yards. It is not true, however,

that these small ships will prevent the large shipbuilding facilities from constructing large vessels. There are ample facilities throughout the country for the construction of small craft. There is no doubt that if large ships can be taken out of the Great Lakes, there are large shipyards on the Lakes which would build oceangoing vessels. Admiral Rock's testimony covers this explicitly.

4. The Maritime Commission has scheduled, according to its release of July 11, 1941, the construction of 39 C-type vessels in the Great Lakes to reach the ocean via the Mississippi River. According to my understanding, this proposed procedure involves the construction in the Great Lakes of the hull only, which will have to be towed from Lakes Erie, Michigan, and Superior ports down through the Illinois waterway and the Mississippi River to some point on the lower Mississippi or the Gulf where the superstructure and machinery would be installed. This procedure obviously cannot be considered a substitute for a deep-draft channel through the St. Lawrence. It is expensive, cumbersome, and time-consuming and will not utilize to best advantage the shipbuilding skill and the management available in the Great Lakes. It must be regarded merely as a makeshift expedient.

5. When the St. Lawrence Seaway is constructed, it will be possible to utilize the full resources of the Great Lakes in shipbuilding, so that completed ships with cargoes can be taken out to deep water under their own steam.

6. I hope these facts will help to clarify the confusion that has arisen in connection with the Great Lakes shipbuilding program.[17]

Experience of World War I.

The World War experience highlights particularly the important role which the Great Lakes area can play in supplying needed merchant tonnage in an emergency. In discussing the shipbuilding experience of the previous World War, it is important to recall that naval construction at that time was much smaller than at present. About 770,000 tons of displacement were built in 5 years in the earlier period, compared to a present program of over 2,300,000 tons of combatant ships now appropriated for. In the words of Admiral Land:

> Naval building then was infinitesimal compared with that now under contract. . . . If one considers particularly the quality of the vessels, this ship-construction effort is at least 200 percent greater than anything previously attempted.[18]

During the first World War, therefore, a large proportion of the coastal yards were available for merchant ship construction. In

[17] *Ibid.*, No. 18, pp. 2049–50.
[18] Text of radio address, April 9, 1941.

spite of this, the Great Lakes yards were called upon to contribute a substantial tonnage and, still more significant, they were able to build ships in time for the needs of the war during 1917–18, while other yards could not deliver ships until after the war. It must be remembered that the Great Lakes' contribution was made in spite of the obstacle of the shallow St. Lawrence canals. In 1917, the first year of United States participation in the War, when ships were so urgently needed, the Great Lakes district delivered more new cargo ships than the rest of the country combined. Of a total of 50, this district contributed 27. Even on a tonnage basis, the contribution was nearly a third of the Nation's total, and this figure was held down by the limitation on the size of ship which could be taken out to the ocean. In 1918, the last year of the war, the district contributed 18.4 percent of the total deadweight tonnage. Meanwhile, the agency yards like the famous Hog Island, had delivered a total of three ships in 1917 and 1918. This explains in part the opposition of Admiral Land to embarking upon new huge yards of this character. Table 7 compares the output of the Lakes district with that of the country as a whole. The showing is even better if the figures are confined to the more important category of steel ships only.

TABLE 7

Merchant ships delivered, by years, 1917–21

	United States	Great Lakes District	Percent of United States deadweight tonnage
1917	50	27	31.2
1918	533	162	18.4
1919	1,180	220	11.7
1920	473	69	7.1
1921 (to June 30)	52	1	0.8
Total	2,288	479	12.2

SOURCE: United States Shipping Board, *Fifth Annual Report*, 1921, p. 239.

The contribution of the Great Lakes district was not only more prompt, but it was also more economical, thus demonstrating the importance of experience, management, and the advantages of well established going concerns. For example, the Emergency Fleet Corporation expended large amounts of money for the expansion of shipbuilding facilities. Up to October 31, 1918, the commitments for plant and property amounted to $148,495,000.[19] Of this total, $1,569,000 went to the Great Lakes district, only $250,000 of which represented directed investment, the remainder being made up of

[19] United States Shipping Board, *Second Annual Report*, 1918, p. 111.

stipulated additions to contract prices. Henry Penton, a historian of this experience, relates: " . . . except for the one loan referred to, there was not a borrower or a lame duck in the (Great Lakes) District." [20]

The World War records bear out the advantages of the Great Lakes in meeting the housing problem for shipyard workers. Up to August 1, 1919, the Emergeny Fleet Corporation of the United States Shipping Board made commitments of $71,993,231 for housing developments. Of this total only $2,704,046 were used in the Great Lakes district.[21] This represents 3.8 percent of the total expenditures for this purpose. In contrast to this small expenditure in the Great Lakes district is the contribution of the Great Lakes in delivered ship tonnage which amounted to 17.5 percent of deadweight tons delivered by United States yards up to June 30, 1919.

A similarly advantageous comparison exists in the provision of community facilities. The Emergency Fleet Corporation entered into contract for street railway facilities for the transportation of shipyard workers during this same time to the extent of $9,662,865. Only $6,000 was allocated to the Lakes district.[22]

The efficiency and promptness of the performance of Great Lakes yards give evidence of the advantages in management and labor which this area possesses. A brief summary of this evidence is found in the article by Mr. Penton. Up to August 1919 the Great Lakes delivered their contract vessels on an average of 54 days ahead of schedule.[23] The record for average monthly gang rivet drive for the highest yard in any district was set up by a Great Lakes yard; the average for the district as a whole was also highest. The same conclusion is reached when the week is taken as the unit of time rather than the month.[24] The shipyards of the district stood alone in receiving a rating of 100 percent on all four counts of management, finances, workmanship, and labor relations.[25] The good delivery performance was accredited "in large measure to the fact that the lake yards were, in general, old established, highly organized plants, already fully occupied at the inception of the national program, but still more to the caliber of the yard executives." [26]

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[20] Henry Penton, *Notes on Work of Great Lakes Shipyards in the World War*, p. 12. Although $4,550,000 more is shown to have been allocated in the annual reports of the Shipping Board, actually this was more than returned in a voluntary contract adjustment by the American Shipbuilding Co.

[21] United States Shipping Board, *Fourth Annual Report*, 1920, p. 230.

[22] *Ibid.*, table XXV, pp. 237–38.

[23] Penton, *op. cit.*, note 1, p. 6.

[24] *Ibid.*, plate 6.

[25] *Ibid.*, pp. 9–10.

[26] *Ibid.*, p. 8.

Merchant and Naval Shipping Requirements in the Emergency.

The need for merchant and naval ships depends upon a number of basic factors: The course of the present war, the Nation's policy in respect to this war, and finally, the world conditions after the war and the role which this country may assume in the post-war situation. These factors have a bearing not only upon immediate requirements but also on those which may arise over a much longer period of time.

The lend-lease bill has made it clear that this country intends to give full aid to Great Britain, Russia, and China. One of the most dangerous elements in the war situation is the shortage of shipping facilities. The American policy of aiding these countries clearly contemplates supplying whatever shipping deficiencies may arise. Hence, the destruction of Allied shipping has a direct bearing upon the shipbuilding program of the United States and will be considered in relation to it.

Assumptions as to possible courses of the war.—In any study that concerns the present war, it is usual to analyze the problem in relation to possible courses of the war. There are three possibilities: First, a quick British victory, second, a quick German victory, and third, a long drawn-out war of attrition. The first alternative, a quick British victory, cannot be safely used as a basis for national policy. Even in the most optimistic statements the British speak of merely starting their offensive against Germany sometime in 1942 or 1943. In all probability a successful outcome of such an offensive must take several years. Prudence dictates that the second alternative, a quick German victory, should be fully taken into account. Failing this outcome, a long drawn-out conflict is the only remaining alternative. The Hon. Frank Knox, Secretary of the Navy, in testimony before a subcommittee of the House Committee on Appropriations, outlined the viewpoint upon which the Navy Department was laying its plans:

> However, prior to the completion of this program, which provides for a two-ocean navy, we are confronted with two possible situations which may develop: (1) Defeat of Great Britain in the near future, leaving us to face the united strength of the Axis powers. (2) The survival of Great Britain with the commencement of a war of attrition, along with the possibility of Japan becoming an active participant as a belligerent in the Far East on the side of the Axis.[27]

Immediate implications of a quick German victory.—If Great Britain were defeated soon the United States would have to match the naval strength of all the Axis powers, including the naval strength

[27] Hearings on Navy Department Appropriation Bill for 1942, 77th Cong. 1st sess., p. 2.

which may fall into their hands. Whether or not the Axis would engage the United States in naval war shortly after the fall of Britain is not a question which needs to be debated here. It is sufficient to consider the combined strength of possible antagonists, which it is the policy of the United States Navy Department to match.

The tremendous proportions of such a task are evident from a comparison of the relative naval strength of leading powers in the world. On January 1, 1941, the United States had 1,250,000 tons of combatant ships. Germany, Italy, Japan, and France had 2,145,000 tons.[28] The combined tonnage of the four countries enumerated was 75 percent greater than that of the United States. Table 8 compares the naval strength of the United States and the Axis powers. It shows that the relative disadvantage of this country will be considerably worse by January 1, 1943. The conclusion is clear—a British defeat will require necessarily a great increase in the already large naval construction program of the United States.

TABLE 8

Estimated comparative naval strengths of United States and the Axis, by types of vessels (does not include France)

	Jan. 1, 1941		Jan. 1, 1942		Jan. 1, 1943	
	United States	Axis	United States	Axis	United States	Axis
Battleships	15	20	17	22	18	28
Aircraft carriers	6	8	6	8	7	8
Cruisers	37	75	37	81	45	101
Destroyers	159	271	174	292	219	325
Submarines	105	284	108	400	133	500
Total fighting craft	322	658	342	803	422	962

NOTE: France has as immediately effective units: 1 battleship, 1 aircraft carrier, 14 cruisers, 52 destroyers, 60 submarines. It is now reported that no new construction is contemplated.

SOURCE: Navy Department Appropriation bill for 1942, Hearings before a subcommittee of the Committee on Appropriations, House of Representatives, 77th Cong., 1st sess., pp. 2, 3.

Great Britain's immediate needs.—Great Britain's immediate requirements for ships, both naval and merchant, are large. The Axis powers have launched a blockade of England by surface raiders, submarines, and airplanes. The extent of the possible destruction of British shipping can be inferred from the losses which have already been inflicted upon Allied and neutral ships. On March 19, 1941, Lloyd's reported that nearly 5 million tons of British, Allied, and neutral shipping had been sunk in the first 18 months of the war. Subsequently the rate of sinkings was even higher—between 5,000,000 and 6,000,000 tons per year.

[28] *Ibid.*, p. 2.

The German Government has been working upon a mass-production program of submarines, and although the precise number of such craft available is not known, it is estimated to be very large. There are a number of other reasons for fearing that destruction of shipping may be much greater. The Germans now have submarine and seaplane bases from the North Sea down to southern France. This compares with a World War situation in which the German submarines had to operate from the North Sea and had to penetrate the British blockade and mine fields. Even under these limitations, Allied shipping losses in 1917 amounted to 7,500,000 tons. The development of long-range aircraft and their coordination by improved radio apparatus with submarines, creates additional threats to shipping which were not present in the last war. It is not too unlikely, therefore, that the loss of shipping may easily exceed 5,000,000 tons, a rate which has already been reached.

At the same time the efficiency of Britain's shipping resources has been seriously impaired. The convoy system sharply reduces the speed of transportation since the entire convoy must move at the speed of the slowest ship. It has been estimated that the amount of goods which the average vessel can transport in a given time is thus cut in half. This low speed causes a high degree of wear and tear on ships built to operate at higher speeds. This increases the time needed for repairs and shortens the life of the ships, many of which are already very old. Further inefficiency results from the difficulties in loading and unloading ships. British ports have been heavily bombed by the Germans. The east-coast ports of England have in fact been rendered useless because of the German control of the Channel, and all shipments must be made to the five major west-coast ports. Disruption of usual trade routes has increased the length of voyages very greatly. The Mediterranean cannot be used for merchant shipping, and a long detour around Africa must be taken. Such factors combine to diminish the efficiency of British shipping to a point which is probably much less than 50 percent of normal.

Concurrently with these developments the amount of shipping which Great Britain needs has been increased by the war. Food that was imported from Scandinavian countries must now be brought from Canada and the United States. Large amounts of bulky raw materials for war industries, as well as untold quantities of munitions and instruments of war, must be transported across the Atlantic.

The heavy destruction of shipping and the probability that this may increase, the spreading of the war to the Mediterranean, the Japanese threat in the Far East, and the loss of the French fleet,

all combine to tax the resources of the British Navy and its merchant marine. It is clear that Great Britain will need large quantities of both merchant and naval shipping which she herself is unable to supply.

The Naval Program.

One of the most important limiting factors in merchant vessel construction is the huge naval program which in itself demands the creation of tremendous new capacity. It is obvious that naval expansion competes with the merchant ship program for shipways, labor and materials. The limitation of the naval program upon merchant ship production was illustrated by Admiral Samuel M. Robinson, Chief of the Bureau of Ships, United States Navy, in his testimony on the Navy Department Appropriation Bill for 1942:

> To accomplish the sixfold increase in 8 months it was necessary to spread naval construction over a much wider field. On June 1, 1940, there were only 14 shipbuilding plants with Navy orders, and 8 of these were navy yards. Today the number of navy yards is unchanged but there are 14 private plants building combatant ships and 54 additional ones with other types of ships. Thus, there are a total of 76 shipbuilding plants building Navy ships on February 1, 1941. An increase in numbers in 8 months of 443 percent.[29]

In a recent article on the shipbuilding problem, Hanson Baldwin has summarized this factor as follows:

> The problem, therefore, has been one of superimposing a growing, and presently a gigantic, need for merchant ships upon a naval building program unprecedented in world history.[30]

To understand the extent to which the naval program is absorbing shipbuilding facilities, it is necessary to outline the magnitude of the effort, in comparison with the low level of activity after the last war.

Combatant vessels.—By combatant vessels are meant battleships, aircraft carriers, cruisers, destroyers, and submarines. After the World War I and until the emergence of Hitler into power in 1933 only two naval acts were passed. The total cost of construction authorized by this legislation was about $301,000,000. These acts

[29] *Ibid.*, p. 239.
[30] New York Times, March 30, 1941

provided for a total of 1 aircraft carrier, 17 heavy cruisers, and 6 light cruisers. A summary of these facts follows:[31]

Legislative act	Number and type of vessel provided	Total cost
Dec. 18, 1924	8 heavy cruisers	$84, 646, 405
Feb. 13, 1929	1 aircraft carrier, 9 heavy cruisers, 6 light cruisers	216, 643, 002
Total		$301, 289, 407

Since 1933, five naval authorization bills have been passed. The number and types of vessels and the estimated cost for hull and machinery are shown in table 9. The total cost for combatant vessels amounts to almost $6,000,000,000, which is nearly 20 times greater than the sum involved in the authorizing legislation in the years 1924 and 1929.

TABLE 9

Number and estimated cost of combatant vessels authorized since 1933 (hull and machinery only)

Authorizing act	Battleships	Aircraft carriers	Cruisers	Destroyers	Submarines	Estimated cost
N. I. R. A. Executive Order 6174 of June 16, 1933		2	4	20	4	$209, 026, 233
Act of Mar. 27, 1934 (Vinson-Trammel Act)	7	1	8	79	40	1, 228, 367, 956
Act of May 17, 1938 (Naval Expansion Act)	3	2	8	24	10	630, 758, 000
Act of June 14, 1940 (11-percent expansion)		3	5		14	376. 906. 000
Act of July 19, 1940	7	7	33	155	43	3, 290, 680. 000
Total	17	15	58	278	111	5, 735, 738, 189

SOURCE: Hearings on Navy Department Appropriation Bill for 1942, pp. 709–10.

In addition to hull and machinery construction, the present program of naval expansion calls for large sums to be spent by the Bureau of Ordnance for armor, armament, and ammunition for the new construction. For the fiscal year 1939 and subsequent years, the program calls for over $2,000,000,000 to be expended by the Bureau of Ordnance.[32]

The program of combatant vessel construction begun by the N. I. R. A. authorization bill of 1933 is far from complete. As of February 1 of this year, table 10 lists the vessels which were still under contract or on order and their estimated cost. In fact, of the total authorizations since 1933, less than $750,000,000 has been spent, leaving over $5,000,000,000 still to be expended.[33]

[31] Hearings on Navy Department appropriation bill, 1942, p. 708.
[32] *Ibid.*, p. 735.
[33] *Ibid.*, p. 709.

TABLE 10

Number and estimated cost of combatant vessels under contract or order, as of February 1, 1941 (hull and machinery only)

Type	Total cost	Number	Average cost
Battleships	$1,058,478,380	17	$62,263,434
Aircraft carriers	636,353,000	12	53,029,417
Cruisers	1,383,813,444	54	25,626,175
Destroyers	1,578,758,000	205	7,701,258
Submarines	429,918,000	80	5,373,975
Total	5,087,320,824	368	

SOURCE: Hearings on Navy Department Appropriation Bill for 1942, p. 668.

Other naval vessels.—At the same time that legislation was passed for the construction of combatant ships, a large program of auxiliary-ship construction was authorized. Auxiliary ships are classified as fleet auxiliaries, patrol vessels, and district defense vessels. Table 11 shows the status of acquisition or construction as of February 1, 1941, of recently authorized ships of this nature. These include 272 auxiliary and undesignated ships and 375 district defense and patrol vessels, a total of about 650 ships. Table 11 summarizes the status of funds for the construction or acquisition of all these vessels. The total of these funds amounts to over one billion dollars, most of which still remains to be expended since the program has only recently gotten under way.

TABLE 11

Funds authorized for auxiliary and patrol vessels

Type	Construction	Acquisition
Fleet auxiliaries	$601,773,400	$258,564,600
Patrol vessels	149,390,590	8,921,128
District defense vessels	157,639,556	21,319,418
Totals	$908,803,546	$288,805,146
Grand total	$1,197,608,692	

SOURCE: Hearings on Navy Department Appropriation Bill, 1942, pp. 674, 675, 677.

In addition to new construction and acquisition there is to be a great deal of work in recommissioning out-of-date vessels as well as extensive repairs and overhauling. For alterations to naval vessels the expenditures will be over $220,000,000.[84]

The total cost for all types of naval vessel construction, exclusive of armor, armament, and ammunition, authorized since 1934, amounts to little less than $7,000,000,000. Table 12 shows the expenditures

[84] *Ibid.*, p. 655.

of the Bureau of Ships between 1934 and 1940, and the estimated expenditures from 1941 on. As noted previously, estimated expenditures for armor, armament, and ordnance add another $2,000,000,000 to the total. Of the total allotments, more than $4,238,000,000 will be spent subsequent to 1942.

Shipbuilding facilities required.—To carry out this program involves a very large expansion in shipbuilding facilities. Recent authorizations for this purpose amount to $500,000,000, as follows:

Act	*Amount*
January 14, 1940	$35,000,000
July 19, 1940	150,000,000
January 31, 1941	315,000,000

The great rate of increase involved in the naval shipbuilding program and its relation to shipbuilding facilities was brought out by Admiral Robinson:

> As an example of the magnitude of what has been accomplished, there has been an actual expenditure by the Bureau of Ships of about 65 million dollars during December 1940. As recently as 18 months ago, the Bureau's estimators considered that expenditures of 30 million dollars per month would strain the naval shipbuilding and repair facilities of this country. We now expect, that in accomplishing our program, we will more than double our December performance within the next 18 months. . . .
>
> . . . Of course, it is again apparent as it was in 1916 that authorizations and appropriations cannot create a fleet overnight.[35]

The absorption of private facilities for conversion and overhaul of naval vessels was also noted by Admiral Robinson in his testimony:

> As many new units joined the operating forces it became apparent that the Government navy yards could not handle the conversion and overhaul load while contributing their share to new construction. It was, therefore, necessary to bring in several commercial repair yards which previously had not engaged in Navy work.[36]

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[35] *Ibid.*, p. 241.

[36] *Ibid.*, p. 247. The extent to which the naval program will fall upon commercial yards instead of Navy Yards is indicated by the limited plans of the Bureau of Ships, for expansion of shipways in Navy Yards. The Bureau reports that: "There are 19 building ways for combatant vessels at present available in United States navy yards. In addition, it is expected that four (4) more will be completed in 1941 and one (1) in 1942."

TABLE 12

The program of expenditures of the Bureau of Ships, United States Navy
(1934–40 actual; after 1940, estimated)

Fiscal year	Number of vessels	Expended			Estimated expenditures			Total
		Prior to July 1, 1938	Fiscal year 1939	Fiscal year 1940	Fiscal year 1941	Fiscal year 1942	Subsequent to 1942	
Prior to:								
1934	37	$246,665,622	$402,928	$40,310	$51,612			$247,160,472
1934	37	236,440,473	11,588,092	1,886,919	84,974			250,000,458
1935	24	125,500,865	9,603,405	2,550,791	2,702,886			140,357,947
1936	24	99,288,265	35,862,206	14,109,715	11,413,443			160,673,629
1937	20	34,864,592	55,608,114	46,256,473	35,623,802	$6,200,000	$2,098,019	180,651,000
1938	14	4,737,121	29,811,634	36,870,930	14,195,742	5,300,000	715,573	91,631,000
1939	[1] 76		23,892,488	120,368,351	162,439,898	120,640,000	82,398,743	509,739,480
1940	23			29,585,653	86,040,000	69,900,000	75,881,347	261,407,000
1941	[2] 629				304,112,144	932,960,000	4,081,578,256	5,318,650,400
Ship total	[3] 884	747,496,938	166,768,867	251,669,142	616,664,501	1,135,000,000	4,242,671,938	7,160,271,386
Suspense accounts		3,607,913	−61,460	482,984	−135,085		−3,899,352	
Grand total		751,104,851	166,707,407	252,152,126	616,529,416	1,135,000,000	4,238,777,586	7,160,271,386

[1] Includes 39 patrol and district craft.
[2] Includes 231 patrol and district craft.
[3] Includes 270 patrol and district craft.

SOURCE: Hearings before a subcommittee of the House Committee on Appropriations, Navy Department Appropriation Bill for 1942, 77th Cong., 1st sess., p. 733.

Taken together, construction of combatant, auxiliary and patrol vessels, repairs, overhaul, and conversion of naval vessels constitute such a task for the nation's productive capacity, that the present merchant vessel construction program faces great interference. Substantial further increases must reckon seriously with the demands of this naval building schedule.

The merchant shipbuilding program of World War I faced no comparable interference, because the naval program then was very small in comparison with the currently projected effort. In the 5 years 1917 to 1922 about three-fourths of a million tons of standard displacement was built. In the next 5 years the combatant tonnage will be well over 2 million tons. Nor is this comparison fair, inasmuch as technical developments since World War I have made a naval vessel of a given tonnage a far more complex and expensive task than its earlier counterpart.

The vastness of this rate of output can further be emphasized by comparison with the merchant shipbuilding program. The amount of money which is to be expended for merchant ship construction is more than 3 billion dollars. By contrast, the expenditures to be made on naval ships are 7 billion dollars.

Merchant Shipbuilding Program

Until well into 1940 the program for building oceangoing merchant vessels in the United States consisted in the long-term program of the Maritime Commission. The Commission's goal was to construct 50 ships a year. Since the Merchant Marine Act of 1936 and up to October 1, 1940, only 47 vessels of the Maritime Commission were delivered. Construction was gradually to be stepped up to 50 ships a year.

With the deepening of the world crisis, however, the shipbuilding program of the United States was successively expanded. In January 1941 an emergency ship program was inaugurated. These ships designated as the EC–2 type are to be of standardized, simplified design, with a speed of 10 or 11 knots per hour and of 7,500 gross tons capacity. Three months later, in April 1941, the Defense Aid Program was authorized, which called for the construction of 222 more vessels, of which 112 are EC–2's, 72 are tankers, and the rest C-type ships. The most recent and largest addition to the program

in July. Under this legislation, 566 ships are to be built, 418 EC–2's, 123 C-type vessels, and 25 oceangoing tugs. All of these ships are to be completed by the end of 1943. Table 13 presents a summary of the entire shipbuilding program.

TABLE 13

Summary of United States Maritime Commission building program; built, building, or ordered—May 31, 1941

Long-range program	
Passenger	1
C–1 cargo	52
C–2 cargo	82
C–3 cargo	77
C–3 passenger and cargo	18
Cargo ships (special design)	18
Passenger and cargo ships (special design)	6
Tankers	23
Army transports	2
Navy transports	2
Seaplane tender	1
Destroyer tender	1
Total	283
Emergency program of January 1941	
EC–2 cargo	200
Defense-aid program, April 1941	
EC–2 cargo	112
C–1 cargo	10
C–2 cargo	22
C–3 cargo	6
Tankers	72
Total	222
Expansion of July 1941	
EC–2	418
C–3	24
C–2	81
C–1	18
Oceangoing tugs	25
Total	566
Other merchant ship production in the United States	
For the British Government	60
For private account	86
Total merchant vessels built, building, or under contract in the United States	1,417

SOURCE: U. S. Maritime Commission, releases of June 13, 1941, and of July 11, 1941.

The production schedule for the program is estimated by the Maritime Commission as follows: 623,206 deadweight tons in the last half of 1941; 6,642,649 deadweight tons in 1942; 6,552,871 deadweight tons in 1943.[37] Since sinkings of ships in the war are given in gross tonnage, it is necessary to estimate deliveries under the United States shipbuilding program in terms of gross tons. About 1,000,000 gross tons will be delivered by the end of 1941. In the 2 years 1942 and 1943 it is planned to produce about 8,500,000 gross tons; 4,000,000 tons in 1942 and 4,500,000 tons in 1943. The growth of the American shipbuilding effort is dramatically apparent from the following summary of production and future program:

Year	*Gross tons*
1939	200,000
1940	400,000
1941	1,000,000
1942	4,000,000
1943	4,500,000

[37] United States Maritime Commission, release of July 11, 1941.

To the United States program should be added the contribution which the British Empire can make. The production of oceangoing merchant ships of over 2,000 gross tons in the British Empire averaged less than 750,000 tons in the 5-year period, 1935–39.[38] The present production, although extremely difficult to estimate, is believed to be in the neighborhood of 1,000,000 gross tons annually. The probabilities of a substantial increase are negligible; practically all other shipbuilding facilities in the world are owned or dominated by the Axis.

The Great Lakes shipyards, if they had been accessible for the construction of oceangoing vessels, could have increased the 1941 production by 750,000 gross tons, as compared with 1,000,000 gross tons on all three deep sea coast lines. This contribution could have been made without much additional expenditure for facilities.

The record of sinkings by the Germans of British, allied, and neutral shipping indicates that in months prior to the Russian campaign in June the rate approached 500,000 gross tons per month. This is equivalent to 6,000,000 tons per year. With all the strategic advantages possessed by the Germans, it would not be surprising if the rate of sinkings increased rapidly as the Battle of the Atlantic is intensified.

Assuming for the moment that destruction does not exceed this rate, how inadequate is the production which is planned? In 1942 and 1943, the destruction will be met by new deliveries. For the present year, a loss of 5,000,000 gross tons of shipping will exceed new tonnage by 3,000,000 tons. The net deficit in 1940 was over 2,000,000. Thus, while the losses in the next 2 years will be met by the shipyards, accumulated losses amounting to 5,000,000 tons will not be compensated.

Important as it is to make up for past losses, the problem will be intensified if destruction of shipping goes beyond the level of 5,000,000 tons per year in 1942 and succeeding years. An additional incentive for more production lies in the increasing volume of shipments to England which will be forth coming under the lend-lease program.

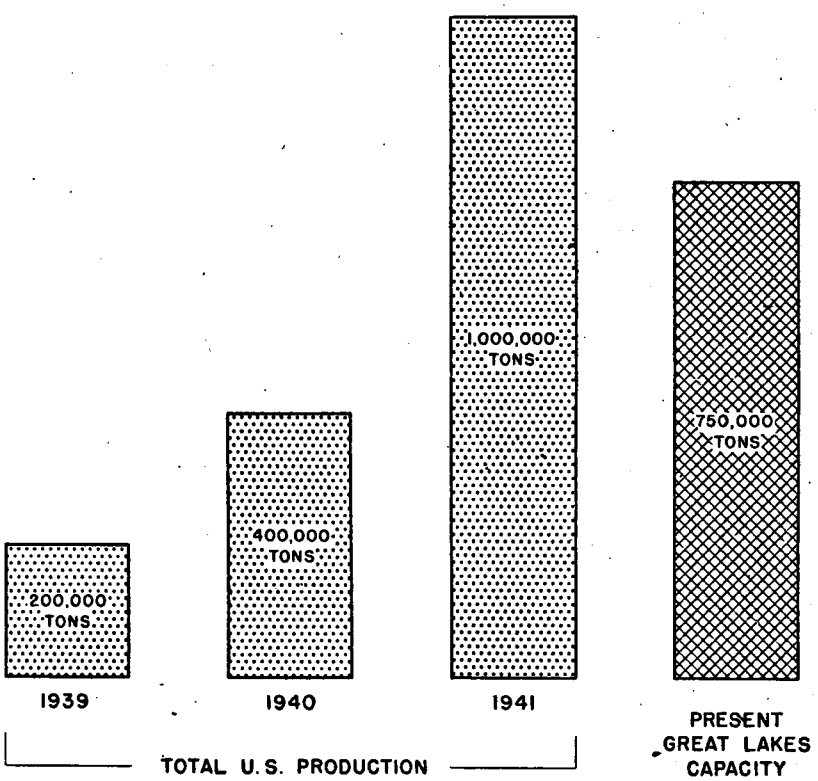
Long-Term Shipping Requirements.

The immediate urgency for more ships has been described. It will be said that if facilities are expanded to the degree necessary to meet the emergency, after this period the country will have burden-

[38] From the United States Maritime Commission.

COMPARISON OF GREAT LAKES SHIPBUILDING CAPACITY WITH TOTAL U.S. PRODUCTION

(IN GROSS TONS)



U. S. Department of Commerce
St. Lawrence Survey

some overcapacity. This indeed was the experience after World War I. There are a number of reasons for believing that changed world conditions as well as a more realistic analysis of future requirements will prove this point of view to be in error. It assumes that we can rely as in the past upon Great Britain, Norway, Japan, Italy, Greece, and other nations for our shipping services. Furthermore, it overlooks the fact that a great deal of replacement is necessary if our merchant marine is to be adequately modernized. In the third place, it does not take into account the extent of the merchant shipping which the two-ocean navy will need as auxiliaries. The deficiency in this respect has already become apparent and a large part of our coastwise and intercoastal services have had to be suspended in order to supply the armed forces with needed shipping.

Historical Background.—To understand how such deficiencies were allowed to develop, a brief review of the history of our merchant marine may be helpful. In the early years of the Nation's existence shipping was an important industry. "In the fiscal year 1826 more than 92.5 percent of the value of our foreign water-borne trade was carried in American ships." [89] Shipping flournished through the clipper era of the 1840's. Shortly thereafter came the beginning of steam navigation. Other countries could build steamships more cheaply and the American industry began to decline. In 1861, at the beginning of the War between the States, American ships carried 66.5 percent of this country's foreign trade. By 1870, due in part to the million tons of American shipping destroyed during the war, only 35.6 percent of the foreign trade was carried by American ships. By 1910 the percentage had fallen to 8.7.

Of course, foreign trade of the United States had grown rapidly during the nineteenth century, so that failure of the merchant marine to keep pace with this growth need not necessarily imply an absolute decrease in shipping space. In this case, however, there was an absolute decline in the tonnage of the United States foreign trade fleet from 2,379,000 tons in 1860 to 783,000 tons in 1910. The foreign trade merchant marine of the United States is shown in table 14.

[89] H. L. Lawrie, *The American Merchant Marine—An Independent Report.* Hearings before the House Committee on the Merchant Marine and Fisheries, 70th Cong., 1st sess., p. 768.

TABLE 14

United States Merchant Marine—1789–1938

Year	Tonnage (thousands of gross tons)	Year	Tonnage (thousands of gross tons)
1789	124	1921	11,077
1800	667	1922	10,720
1810	981	1923	9,069
1820	584	1924	8,794
1830	538	1925	8,151
1840	763	1926	7,719
1850	1,440	1927	7,309
1860	2,379	1928	6,934
1870	1,449	1929	6,906
1880	1,314	1930	6,296
1890	928	1931	5,576
1900	817	1932	5,071
1910	783	1933	4,701
1915	1,863	1934	4,598
1920	9,925	1935	4,560
		1936	4,159
		1937	3,834
		1938	3,551

SOURCE: U. S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States, 1939*, p. 439. Also, U. S. Department of Commerce, Bureau of Marine Inspection and Navigation, *Merchant Marine Statistics*, 1937.

A similar cycle occurred as a result of World War I. From 1917 to 1923 a large program of shipbuilding was undertaken which declined rapidly thereafter. Table 15 shows that 3,602,769 gross tons were built and documented in 1919, but that by 1929 activity had fallen to 37,096 tons.

TABLE 15

Vessels built in the United States and documented, 1915–37 (gross tons)

Year	Tonnage	Year	Tonnage
1915	141,864	1925	100,975
1916	237,836	1926	109,273
1917	461,320	1927	118,656
1918	1,000,318	1928	129,042
1919	3,107,064	1929	37,096
1920	3,602,769	1930	91,929
1921	2,030,420	1931	132,947
1922	567,917	1932	138,712
1923	218,159	1933	155,876
1924	106,608	1934	15,692
		1935	10,598
		1936	41,169
		1937	73,013

SOURCE: U. S. Department of Commerce, Bureau of Marine Inspection and Navigation, *Merchant Marine Statistics*, 1937.

Dependence upon foreign shipping.—Corresponding to this cycle in shipbuilding, tonnage in service of the United States merchant marine rose to a peak just after the war, but receded thereafter year

by year. As shown in table 14, ships registered in foreign trade amounted to over 11,000,000 tons in 1921, and to less than 4,000,000 tons in 1937.

In spite of the fact that foreign trade of the United States had declined sharply in the 1930's, the decline in shipbuilding and the merchant marine increased the dependence upon foreign ships. In 1939, only 22 percent of United States foreign trade utilized American flag ships, whereas in 1921 this percentage was 51 percent (table 16). Simultaneously the British predominance in ocean shipping has grown less marked, so that much of the shipping space used by the United States was supplied by potentially hostile powers. The Maritime Commission states:

> . . . The amount of tonnage under the British flag has been cut in half and the predominant position of Great Britain in the tramp industry has been seriously reduced . . . Second, there occurred a nearly fivefold increase in Japanese tramp tonnage which has raised Japan from fifth to second place among the tramp owning nations. Third, Norway before the war ranked second only to Great Britain as a tramp-owning nation. Since 1914 Norwegian tramp tonnage has declined by 21 percent, whereas all other tonnage under the Norwegian flag has undergone a sixfold increase. Fourth, Greek and Italian tramp tonnage which is largely second-hand tonnage acquired cheaply from Great Britain and Norway has experienced a substantial increase since the war.[40]

TABLE 16

Combined imports and exports of the United States. Tonnages and percentages carried in American and foreign vessels, 1921–39

Year	American ships		Foreign ships		All ships (thousands of tons)
	Thousand long tons	Percentage	Thousand long tons	Percentage	
1921	41,739	51	40,102	49	81,841
1922	44,611	51	42,862	49	87,473
1923	39,152	42	54,067	58	93,219
1924	40,990	44	52,170	56	93,160
1925	37,120	40	55,681	60	92,801
1926	38,227	34	74,599	66	112,826
1927	40,153	41	58,965	59	99,118
1928	43,475	41	62,749	59	106,224
1929	43,153	40	65,307	60	108,460
1930	39,737	41	57,557	59	97,294
1931	28,182	37	47,731	63	75,913
1932	21,471	35	39,084	65	60,555
1933	19,373	33	39,580	67	58,953
1934	22,202	33	45,433	67	67,635
1935	22,865	32	49,247	68	72,112
1936	21,813	28	56,297	72	78,110
1937	24,247	25	72,374	75	96,621
1938	22,436	25	65,994	75	88,430
1939	20,540	22	71,900	78	92,440

SOURCE: U. S. Maritime Commission, Division of Research, Rept. No. 399, annual, p. 1.

[40] United States Maritime Commission, *Economic Survey of the American Merchant Marine*, 1937, p. 17.

Although tramp tonnage has declined in importance relative to liner service, it is still an important factor and indicates the shift from Great Britain to nations potentially inimical to us. That the British Empire and the United States combined have been losing ground relatively to the rest of the maritime nations of the world is shown in table 17. These statistics cover vessels in domestic as well as foreign trade.

TABLE 17

Changes in tonnage of merchant vessels of British Empire, United States, and others, 1926–37

	Gross tons		Decrease	
	1926	1937	Tonnage	Percent
British Empire (excluding Great Lakes)	21,561,178	15,797,181	5,763,997	26.7
United States (excluding Great Lakes)	11,111,232	8,582,492	2,528,740	22.8
Rest of world	26,444,273	24,111,204	2,333,069	8.8

SOURCE: U. S. Department of Commerce, Bureau of Marine Inspection and Navigation, *Merchant Marine Statistics*, 1926 and 1937.

Although all countries have decreased the tonnage of their fleets of iron and steel steamers of 100 gross tons and over from 1926 to 1937, the British Empire and the United States have suffered a much greater percentage reduction than other maritime powers. While the British Empire shows a reduction of 26.7 percent and the United States of 22.8 percent, the fleets of the rest of the world decreased only 8.8 percent.

The foreign-trade fleets of the United States fared even worse than this. The position of the American merchant fleet is described by the Maritime Commission as follows:

> Our weak position among the six principal maritime nations is illustrated in the table below which shows that we rank fourth in tonnage, fifth in ships having speeds of 12 knots and over and sixth in vessels 10 years of age and under. In competitive power, therefore, we stand near the foot of the list.[41]

The replacement problem.—The lackadaisical policy of the United States in regard to the merchant marine has resulted in a mercantile fleet which, as noted previously, is old, obsolete, and in need of extensive replacement. The obsolete condition of the merchant fleet even in 1937 is clear from the fact that 91.8 percent of the total number of vessels and 88 percent of the total tonnage in the seagoing merchant marine would be 20 years old or more by 1942. Table 18

[41] *Ibid.*, pp. 38–9. Table referred to not reproduced.

summarizes the high degree of obsolescence in various types of vessels.[42] This table does not include the ships on the Great Lakes.

TABLE 18

Vessels of United States oceangoing merchant marine in 1937, 20 years or over as of 1942

Fleet	Number of vessels	Gross tons	Percentage of fleet that will become 20 or more years old by 1942	
			Vessels	*Tons*
Domestic trade	479	2,119,000	94.7	92.3
Government-owned, inactive	188	1,130,000	100.0	100.0
Tanker	299	2,060,000	87.2	84.0
Foreign trade:				
Privately owned	302	1,886,000	86.8	81.2
Government-owned	37	207,000	100.0	100.0
Total	1,305	7,402,000	91.8	88.0

SOURCE: U. S. Maritime Commission, *Economic Survey of the American Merchant Marine*, November 10, 1937, p. 37.

TABLE 19

Number and tonnage of bulk freighters constructed for Great Lakes trade, 1902–30

Year[1]	Number constructed	Over-all length in feet			Carrying capacity, long tons		
		Minimum	Maximum	Average	Minimum	Maximum	Average
1902	30	366	440	399	4,800	6,500	5,470
1903	29	374	468	423	4,900	6,900	5,948
1904	7	376	560	463	5,000	10,000	7,128
1905	29	400	569	517	5,000	10,500	8,793
1906	40	400	605	531	6,500	12,000	9,530
1907	40	440	605	517	6,400	12,000	8,937
1908	24	400	569	492	5,500	10,500	8,133
1909	14	374	607	531	5,000	12,000	10,053
1910	20	465	605	538	6,800	12,000	9,570
1911	5	524	617	567	9,000	14,000	11,000
1912	2	524	617	570	9,000	14,000	11,500
1913	5	545	600	581	9,000	12,000	10,900
1914	6	524	625	545	9,000	12,000	9,666
1915	1	----	550	550	----	10,500	10,500
1916	8	472	600	574	7,000	12,000	11,062
1917	13	436	600	567	7,000	12,000	11,076
1920	4	----	600	600	----	13,000	13,000
1922	4	450	617	554	8,000	14,000	11,500
1923	8	350	600	562	5,500	12,000	11,000
1924	5	576	612	600	11,000	13,000	12,500
1925	9	566	618	586	8,500	13,000	11,911
1926	3	600	633	611	12,500	15,000	13,333
1927	9	400	638	588	7,200	14,000	11,983
1929	4	596	605	601	2,700	12,000	10,140
1930	2	604	605	604.5	7,500	12,000	10,500

[1] No vessels constructed in 1918, 1919, 1921, 1928, and 1931 to 1935.

SOURCE: U. S. Army, Corps of Engineers, *Transportation on the Great Lakes*, Transportation Series, No. 1, (revised 1937), p. 43, t. 13.

[42] *Ibid.*, pp. 36, 37.

An equally bad situation exists among the ships on the Great Lakes. Table 19 shows the number of bulk freighters for the Great Lakes trade constructed each year from 1902 to 1930. No ships were built from 1931 to 1935. Since 1935 only six large ships have been built. By contrast with the small amount of construction in recent years, 233 bulk carriers were constructed in the 9 years from 1902 to 1910; in the succeeding 25 years only 88 ships were built.

Merchant Marine Inadequate for National Defense.—It is difficult to estimate the number of merchant vessels which are necessary to complement the Navy. This depends upon the type of action in which the fleet may be engaged as well as the strength of the opposition. According to the Maritime Commission no definite quantitative value may be prescribed for the necessary auxiliary fleet:

> The question of relative importance (of naval and commercial vessels) it might be said is on a par with endeavoring to determine the comparative value of the lungs and the heart to the human being. For the purpose of this study it is only necessary to state that a large volume of merchant tonnage is necessary to the effective functioning of the armed forces of the Nation in time of trouble.[43]

For many years the merchant marine has been totally inadequate for this purpose. About the beginning of this century the country embarked upon expansion of the naval forces. Nevertheless, it continued to neglect the merchant marine. A dramatic illustration of this inconsistent policy is cited by the Maritime Commission:

> The American people were content to build a Navy without auxiliaries. The policy came to a rather ludicrous climax in 1908 when we put the Navy on exhibition by sending it around the world. The gesture lost most of its force unfortunately because of the fact that our mighty battleships had to be serviced by a stream of tenders flying the flags of various foreign nations.[44]

In 1937 the Maritime Commission studied this problem and came to the conclusion that the majority of existing merchant ships were too old and too slow to meet national defense requirements. Many of the ships were too small to meet technical requirements. If these faults were remedied by a program of replacement, the American merchant marine might become adequate for minimum military requirements.

It must be remembered that the survey was made in 1937 when the international situation was far different from the present and when military requirements were far less urgent. It was also made

[43] *Ibid.*, p. 10.
[44] *Ibid.*, p. 53.

before the two-ocean navy was authorized. If the merchant marine was not adequate at that time for a one-ocean navy, one can infer how inadequate it is at the present time.

The following paragraph summarizes the conclusions of the Maritime Commission:

> As will be seen from the foregoing, the American merchant marine in its various categories contains most of the vessels considered by defense agencies as the minimum required for an initial military effort. The value of the vessels is greatly reduced, however, by their advanced degree of obsolescence. We are dangerously deficient in the matter of speed, especially with regard to tankers and a small number of cargo vessels capable of accompanying the fleet. Although it is difficult to cite the exact number of each type of vessel that would be required to meet a given situation, it appears that the defense needs of the United States dictate the replacement of the bulk of the present fleet, and that such replacement should include at least 10 combination passenger and cargo vessels, approximately 20 high-speed tankers, and a small number of fast cargo vesssels.[45]

The conclusions of the Maritime Commission were merely based on *minimum* and *initial* requirements. Although the deficiencies were great at the time of this report, they have been aggravated severely by the expansion of the Navy and multiplied many times over by the tense world situation.

The need for remedying this deficiency.—Although the country has proceeded on its way without serious difficulties in spite of this deficiency, it is no longer safe to continue without remedying the situation. The reasons are clear in the case of auxiliaries and supply vessels for the fleet. The United States may be faced with the combined naval power of the Axis and its subject nations. Not only is a two-ocean navy necessary for this contingency, but it must be well supplied with the necessary complementary commercial vessels.

An adequate merchant fleet is required for other reasons as well. The Maritime Commission states:

> The principal advantage which accrues to our foreign commerce from the possession of a domestic-flag marine is that it provides a measure of insurance against possible interruption of service . . . During the World War the withdrawal of alien vessels resulted in a serious dislocation of our foreign trade at a time when we enjoyed an unprecedented opportunity to expand our business with other nations.[46]

The present situation is probably even more serious in this respect than during World War I inasmuch as the United States is more dependent upon other nations for its shipping facilities.

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[45] *Ibid.*, p. 12.
[46] *Ibid.*, pp. 5–6.

In the quality of service, too, American vessels are preferable:

> The statement is frequently made that American vessels in a trade tend to improve the service available to our exporters and importers. We find this to be a fact. American shippers, in order to compete successfully, require direct, speedy, and reliable service to their markets abroad.[47]

Presently plans are being made for hemispheric defense and economic cooperation against hostile powers. Huge sums are involved in the plans for hemispheric economic collaboration. Unless shipping facilities are available to carry out this program, ships owned by competing nations must be used. In a crisis the necessary shipping facilities might be withdrawn altogether, thus hindering the country's policy of inter-American cooperation. At all events, hostile foreign nations will use their shipping as a weapon against the American program of hemispheric cooperation.

There are a number of other future developments which may add to the demands upon our shipbuilding capacity for a long time to come. South America does not have a shipbuilding industry. Future political developments are likely to require the construction of naval and merchant fleets flying the flags of South American countries. The task of supplying these fleets will undoubtedly fall in large part upon the United States if the disturbed international situation continues.

Whether it is wise to enlarge our shipbuilding capacity is in part dependent upon the capacity of Germany and of the territories which may come under its control. From this point of view, no conceivable program of expansion is sufficient to overcome their superiority for some time to come. Secretary Knox has estimated that the combined capacity of all of Europe for all types of ships, both naval and merchant, is seven times as great as that of the United States. His testimony on the lend-lease bill is as follows:

> Senator NYE. Speaking of shipbuilding capacity, we have laid down a great many new ways in recent years?
>
> Secretary KNOX. In number but not in percentage.
>
> Senator NYE. Do you mean we have not laid down as many as have the European powers?
>
> Secretary KNOX. Not anywhere nearly as many as they already have. I made a calculation sometime ago, and for all types of shipbuilding, both merchant vessels and naval, their shipbuilding capacity if they conquered all of Europe, including Britain, would be seven times ours.[48]

In the construction of merchant vessels, Continental Europe has a marked advantage over the British Empire. In 1939, the latter,

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[47] *Ibid.*, p. 7.

[48] Hearings before the Committee on Foreign Relations, United States Senate, 77th Cong., 1st sess., on S. 275. Part I, p. 228.

including Hong Kong, constructed 769,710 gross tons of ocean going vessels of 2,000 gross tons and over. The rest of Europe produced 1,016,228 tons. The totals for the 5-year period, 1935–39, indicate a similar superiority for Continental Europe over the British Empire. The former produced 4,176,639 tons while the latter accounted for 3,564,924 tons.[49]

It has already been noted that the merchant marine plays an important role in national defense as auxiliaries to the Navy. It was also brought out that at present the merchant marine is inadequate even for our present Navy. With a two-ocean navy, this deficiency becomes even greater. The auxiliary tonnage that would be required for the proper maintenance of the enlarged Navy cannot be estimated accurately. The magnitude of the task can be indicated in small measure by estimating the tonnage which would be required to continue the present ratio between naval and merchant ships when the enlarged Navy is ready.

Legislation has been passed on three successive occasions since 1938 to enlarge our Navy. The net effect of this legislation is to more than double the size of our Navy. Merely to keep pace with this growth in naval power, the merchant marine would have to be doubled. This means that the new tonnage of oceangoing vessels (2,000 gross tons or over) which would be required would amount to 8,000,000 tons. The major units of the two-ocean navy will not be completed until 1946–47. If the merchant-ship expansion is to keep pace with this, the annual construction necessary will amount to about 1½ million tons for this purpose alone.

Another enlightening comparison may be made between trade requirements and shipping capacity. It was seen that American foreign trade has been increasingly dependent upon foreign flag ships. In 1921, about 51 percent was carried by American vessels, while in 1939 this percentage was only 22. To attain the status just after the war would again appear to require a doubling of the merchant marine engaged in foreign trade.[50] At the end of 1937, the foreign dry-cargo fleet of the United States amounted to 2,529,000 tons; the total tanker fleet, both for foreign and domestic trade, amounted to 2,452,000 tons.

The drain upon the shipbuilding capacity through the announced program of repairing British ships cannot be estimated. The need for meeting the increased shipping requirements of Great Britain, for providing the future needs of hemispheric defense, for increasing the ratio of merchant marine tonnage to naval tonnage, indicates

[49] From the U. S. Maritime Commission.

[50] This is not strictly true, because prior to the war our merchant vessels were not used to full capacity.

the proportions of the problem facing the nation. The point is clear that American shipbuilding capacity as of the present is unable to meet all the demands which will be made upon it. In fact, capacity will be strained to meet the requirements of any one particular purpose. To meet them all, it is totally inadequate.

Problems Involved in Meeting Shipping Requirements.

The preceding discussion has attempted to outline shipping requirements and the steps which have been taken to produce enough ships to meet them. This program will not be completed without straining the Nation's resources.

The most obvious indication of strain is the burden laid upon existing shipways and the rapid expansion of shipbuilding facilities. Even in the early part of this year every existing shipway on the ocean coasts was being utilized and faced a long backlog of orders. Thus, on March 31, 1941, there were 972 United States and British vessels, both merchant and naval, under construction or contract. In addition to these vessels, there were 71 vessels under construction or contract for private account.[51] To meet this volume of work only 155 shipways were in existence.

> In some of the private yards the ratio of ships under contract to available shipways is as high as 13 to 1. Some of the private yards do not at the present time possess ways on which to start the construction of Federal and British vessels they have contracted to build.[52]

The necessity for expansion of shipways can be appreciated by the fact that naval vessels may occupy a building berth for as long as 3 years, while C-type vessels are on the ways from 9 months to a year. The expansion planned as early as March 1941 was large. The number of ways to be built was 129, almost as many as the ways in existence. With the expansion of merchant shipbuilding schedules in July of this year by over 500 ships, new facilities in large number will be required. The Maritime Commission has announced that new shipways will be built in existing or reconditioned yards.[53]

Shipways are only one element in constructing ships. Behind them in the shipyards there must be a wide range of shops equipped with numerous and expensive machine tools. Further removed, but equally essential, are adequate facilities for raw materials and fabricating parts for ships. Transportation facilities are necessary to

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[51] U. S. Department of Labor, Bureau of Labor Statistics. *Estimated Labor Requirements for the Shipbuilding Industry Under the National Defense Program*, April 19, 1941, table 3.

[52] *Ibid.*, p. 13.

[53] Release of July 11, 1941.

connect the shipyards with these sources of supply. It is not necessary to call attention to the bottlenecks which exist already in the production of steel and all type of machine tools, propelling machinery, especially turbines, and electrical apparatus. Nor is this the place to describe the heavy burdens which are already resting on the railroads and the even heavier demands to be expected in the near future. It is clear that the utmost skill in planning and executing the shipbuilding effort of this country will be necessary to minimize interference with other defense production in their efforts to obtain materials and transportation service.

More important than materials, machines, and transportation in relation to shipbuilding is the problem of men: Managers, supervisors, skilled laborers of all kinds are needed. A shortage of skilled labor is already making itself felt and by 1942 will become serious. The Bureau of Labor Statistics has estimated the number of workers who will be employed in shipyards in the construction of United States Government vessels.[54] Starting with an actual figure of 114,394 for September 1939, the agency estimates that by the end of 1942 the number of men needed will be 530,800.[55] This does not include the new authorization of July which will increase the rate of shipbuilding activity by 50 percent in 1942 and will continue this rate through 1943. It will not be easy to obtain this skilled labor force. Admiral Land is well aware of the difficulties:

> The shipbuilding industry will be faced with a tremendous problem in obtaining the necessary skilled workers. This need will undoubtedly be met in part by "upgrading" and by adaptation of existing skills. However, the major part of the labor force will have to be recruited from the outside. The shortage of available skilled workers in this industry is such that most of the new workers will require careful selection and extensive training before they can be utilized effectively in the shipbuilding program.[56]

Even more important is the scarcity of managerial experience and supervisory labor. Shipbuilding activity has been so low since the World War that these factors exist only in very limited quantities. The importance of experience has been recognized by those in charge of the shipbuilding program. Admiral Land has stated that expansion of existing companies will be used rather than the creation of new enterprises. The Maritime Commission's award of a con-

[54] Including the programs of the U. S. Navy and the Maritime Commission but not including ships constructed for private and British account.

[55] Bureau of Labor Statistics, *Shipbuilding Industry*, *op. cit.*, p. 21, table 7.

[56] Release of July 11, 1941, p. 3.

tract to the Louisiana Shipyards, Inc., at New Orleans, was made conditional upon the assumption of management by the American Shipbuilding Co., of Cleveland. This firm was made responsible for the fulfillment of the contract through its subsidiary, the Delta Shipbuilding Co. Supervisory labor is one element which can best be trained through actual operations. Classroom conditions cannot serve the same function in the training of skilled artisans.

Other aspects of the national defense program limits the rate of expansion in skilled shipbuilding labor. For example, aircraft production requires the use of certain types of labor which are related to shipbuilding. The expansion of production of ordnance, and the need for more railroad equipment also require draftsmen, designers, loftsmen, welders, and other occupations needed in large quantities in shipbuilding.

Availability of Facilities in the Great Lakes.

The Great Lakes shipbuilding facilities are available for the national defense program and the area has important advantages which will minimize the interference with other defense industries involved in executing the shipbuilding program

In recent years, the chief source of revenue of the shipbuilding companies in the Great Lakes has been in the repair and overhaul of Lake carriers during the winter months. The extent of the unused capacity is clear from the low volume of employment. In 1940 seven of the largest companies employed about 3,000 men. By way of contrast, these same firms employed over 25,000 men during the last war. It is estimated, as shown in table 20, that if they were to operate on three full shifts over 40,000 men would be employed. Thus, 1940 operations were at less than 10 percent of capacity.

The rate of activity in Great Lakes shipyards has been low for many years. Most of the large carriers were built before World War 1, only 48 being built between 1920 and 1930. From 1930 through 1936 no ships were completed. In 1937 and 1938, five vessels of the 600-foot class were constructed and in 1940 a large car ferry was launched at Manitowoc, Wis. This year five ships of 640-foot length and 64-foot beam are scheduled for construction at Lorain, Ohio, and Ecorse, Michigan. The Office of Production Management has recommended the construction of 25 additional bulk carriers, and contracts for 15 of them have already been placed. This program will employ Great Lakes shipbuilding facilities until 1943. The trained personnel of these shipyards will then be available to undertake new work.

TABLE 20

Employment in selected shipyards on the Great Lakes, 1940

Name of shipyard	Number employed		
	1940	During World War I	Total that can be employed in 3 8-hour shifts
Sturgeon Bay Shipbuilding and Drydock, Sturgeon Bay, Wis.	35	300	800
Defoe Boat and Motor Works, Bay City, Mich.	168	550	1,500
Great Lakes Engineering Co., Ashtabula, Ohio	140	2,000	3,000
Great Lakes Engineering Co., River Rouge, Mich.	400	4,000	6,000
Manitowoc Shipbuilding, Manitowoc, Wis.	456	2,200	1,500
American Shipbuilding (Chicago Shipbuilding), South Chicago, Ill.	30	3,000	3,000
Toledo Shipbuilding, Toledo, Ohio	513	3,400	8,000
Calumet Shipyard & Drydock Co., South Chicago, Ill.	110	600	400
American Shipbuilding Co., Cleveland, Ohio	75	2,000	4,000
American Shipbuilding Co., Lorain, Ohio	900	5,000	10,000
American Shipbuilding Co., Superior, Wis.	100	2,500	2,500
Total	2,926	25,550	40,700

SOURCE: U. S. Navy Department, Bureau of Ships.

In addition to having extensive shipbuilding facilities which are only partially utilized, the Great Lakes area has other advantages which are important. One of them is transportation. The raw materials and fabricating parts for ships are heavily concentrated around the Lakes. The basic materials for the construction of hulls are steel plates and shapes. Table 21 shows the geographical distribution of this type of production and indicates that the Great Lakes area is by far the leader in these materials. The capacity for steel ingots in this area is 70.7 percent of the Nation's total, while the Gulf and Pacific coasts together account for 4.2 percent. In structural shapes and plates the Great Lakes area had over 62 percent of total capacity in 1935, while for pipes and tubes its share was nearly 90 percent.

It is clear that the west coast shipyards must transport their iron and steel either overland from the Great Lakes or by water from the Atlantic and Gulf coast mills. The position of Great Lakes shipbuilders in regard to steel is better than even the Atlantic coast yards. Except for the middle Atlantic yards, which can obtain steel from Sparrows Point, Md., or Philadelphia, Pa., a haul from inland points is involved. Many of the shipyards in Maine, Massachusetts, and New York must receive steel parts from inland points. The Lake yards, on the other hand, are located in the center of steel production such as Buffalo, Cleveland, Lorain, and Chicago.

TABLE 21

Production of materials for shipbuilding by regions in percent of United States total, 1935

Area	Steel ingots	Structural shapes	Plates	Pipes and tubes
Great Lakes area	70.7	62.9	62.8	89.1
Atlantic coast	9.4	28.6	32.2	7.9
Gulf coast	3.1	1.5	2.8	
Pacific coast	1.1	2.1	0.2	0.3
All other	15.7	4.9	2.0	2.7
Total United States	100.0	100.0	100.0	100.0

NOTE: The Great Lakes area is taken to include the 6 States west of Pennsylvania bordering on the Lakes, plus the Pittsburgh Industrial Area in Pennsylvania, and the Buffalo Industrial Area in New York. The Atlantic coast area includes all the rest of New York State and Pennsylvania as well as the States bordering on the Ocean.

SOURCE: From U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, *Basic Industrial Markets in the United States, The Iron and Steel Industry*, Market Research Series, No. 142, December 1936, tables 1–4.

Other important materials delivered to shipyards are engines and reduction gears, boilers, generators, switchboards, pumps, and a host of other machinery items. A great portion of this production is concentrated in the Middle Atlantic States, thus giving the Atlantic yards their advantage. Almost as important as the Atlantic seaboard in production of these materials is the Great Lakes area. This statement scarcely needs detailed proof since it is common knowledge that this area is one of the largest machinery-producing centers in the world. This importance is amply borne out by the United States Census of Manufactures, of which a summary tabulation is shown in table 22. For all four industry groups shown in table 22, the eight States bordering the Great Lakes accounted for 65 percent or more of the national total of value added by manufacture.

The Maritime Commission, in making a study of the relative cost of ship construction in various coastal regions, studied the geographic concentration of the production of machinery and equipment for ships. It found that production is concentrated in the Atlantic States and nearby territory, and in the northern part of the Mississippi Valley. It estimated that over 17 percent of the materials which enter into ocean going ships may be purchased in the East and Middle West.

TABLE 22

Value added by manufacture in selected machinery industry groups, percent of total United States, 1937

Area	Electrical machinery, apparatus, and supplies	Engines, turbines, water wheels, and windmills	Machine-shop products	Pumping equipment, pumps, and air compressors
I. Minnesota, Wisconsin, Illinois, Indiana, Michigan, and Ohio	41.0	44.6	40.9	48.0
II. Pennsylvania and New York	25.0	24.6	23.7	17.6
Total	66.0	69.2	64.6	65.6

Source: *U. S. Census of Manufactures*, 1937.

How much of an advantage would the Great Lakes shipyards have from the proximity of sources of supply? The importance of the transportation element in the total cost of shipbuilding has been estimated during Congressional hearings on the merchant marine. To transport all the materials entering into a ship from the base of raw materials through all the stages of production amounts to 10 percent of the total cost of the ship.[57] This estimate is based upon a ship being built in Newport News, Va. Disregarding the transportation between the various mines and factories producing the materials in their earlier stages and concentrating only upon the delivery of the final product to the shipyard, the same authority estimated that this alone accounted for 4.6 percent of the total cost of the ship. The data shown in table 23 on transportation cost to the shipyards of various materials, supplied by the Maritime Commission, indicates that for an Atlantic coast yard transportation amounts to over 3 percent of the total cost of the ship, while the corresponding freight bill for a Pacific coast yard is more than twice as great.

The significance of transportation costs of materials delivered to shipyards can be appreciated by reducing these percentages into dollars. It was estimated that naval ship construction for the two-ocean navy will amount to about 7 billion dollars; at an average cost of 5 percent for transportation, the amount involved will be $350,000,000. For merchant ships, the scheduled expenditures will run in the neighborhood of $2,000,000,000. The transportation element at 5 percent is $100,000,000. A single light cruiser, which costs about $20,000,000 involves transportation costs of about a million dollars.

How much saving is involved in having shipyards which are close to the source of supply? The Maritime Commission, in its report to Congress for 1938, advises that:

[57] Hearings before the House Committee on Merchant Marine and Communications on the Merchant Marine, 70th Cong., 1st sess., February 27–29, and March 1, 1928, pp. 113–15. Testimony of H. G. Smith, vice president of the Bethlehem Shipbuilding Corporation, representing the National Council American Shipbuilders.

> Owing to the resulting freight differential, the delivered price of material is estimated to be 4 percent higher for Pacific coast yards but probably not in excess of 3 percent for yards located on the Gulf compared to Atlantic coast yards.[58]

Since the cost of material delivered to the shipyard constitutes over one-half the total cost of the ship, such freight differences are the equivalent to at least a 2½ percent difference in the total cost.[59] As the Great Lakes shipyards are at least as favorably located in regard to materials as are the Atlantic coast yards, it is conservative to assume that the savings in transportation costs on the Great Lakes would be at least as great as the Atlantic coast compared to the Pacific coast. In specific terms, therefore, a light cruiser which is built on the Great Lakes instead of on the Pacific coast would result in a saving of at least $500,000. A program of 10 cruisers of $20,000,000 each would involve a saving over Pacific coast construction of $5,000,000.

TABLE 23

Costs and freight charges of specific materials for a C–3 type vessel

Materials	Number of units	Atlantic coast shipyard		Gulf coast shipyard		Pacific coast shipyard	
		Transportation charges	Shipyard price	Transportation charges	Shipyard price	Transportation charges	Shipyard price
Main engine and reduction gear (combined)	1	[1] $475.87	$229,664.00	$3,734.13	$203,000.00	$3,374.40	$229,664.00
Main boilers	2	[2] 59.55	58,333.00	3,336.52	63,260.00	4,042.37	66,979.37
Generators	2	(1)	48,880.00	471.17	42,300.00	1,044.00	48,880.20
Main switchboard	1	40.08	8,215.00	274.80	[3] 14,700.00	142.26	8,357.26
Plates and shapes	-------	[4] 34,978.72	[5] 239,625.50	25,503.61	256,137.75	[5] 71,400.45	240,986.46
Totals	-------	35,554.22	584,717.50	33,320.23	578,397.75	80,003.48	594,867.29

[1] Also includes transportation charges on generators, "not including crating, etc., partly rail and partly truck, turbine and gears—P. R. R. 26,498 pounds; turbo generator-truck, 2 lots, 48,150 pounds."
[2] By truck.
[3] This figure includes both main and emergency switchboards.
[4] This figure is obtained by taking one-sixth of the transportation charges of $209,872.35 for steel on 6 vessels.
[5] Estimated—rail and ocean rates.

[58] U. S. Maritime Commission's report to Congress for the period ending October 25, 1938, p. 3.

[59] Calculations based upon the data shown in table 23 bear out this conclusion. The freight charges for specified materials, including shapes and plates, propulsion machinery, and reduction gears, switchboards, and generators, etc., amounted to about $80,000 to the Pacific coast and $35,000 to the Atlantic coast. These materials constitute about one-half of the total material cost. If the freight differential for the rest of the materials were to be similar to those on the specified materials, the total freight bill on the C–3 vessel for the Pacific coast would amount to 7 percent, while the charges on the Atlantic coast for this same vessel would be only 3.2 percent. The difference between the two of about 4 percent in the total cost of materials corresponds with the earlier study of the Maritime Commission, here cited.

Besides the savings in freight bill, there are other economies resulting from the proximity of shipyards and their sources of supply. It is easier to plan and schedule the work. Many delays in the delivery of materials which run up the cost of idle overhead and labor can be avoided. The importance of these factors have been emphasized by the Navy in Congressional hearings. Admiral Robinson presented figures showing that less efficient planning and design (rush work) and delays in receipt of materials, each have accounted for a 2-percent increase in the cost of shipbuilding in the past few years.[60]

Even more important in times of emergency or war or in industrial mobilization, such as now, is the relaxation of congestion and delay in railroad operations. In World War I as everyone knows, this situation was extremely critical. It was intensified greatly by the huge shipyards on the middle Atlantic coast, such as at Hog Island. At times, 40 miles of freight cars were standing on the sidings waiting to be unloaded there. By having the shipyards on the Great Lakes adjoining the steel plants and machinery factories, much of the transportation equipment otherwise needed would be released.

The importance of skilled labor for the shipbuilding industry has previously been indicated. What is the position of the Great Lakes districts in this respect? Ordinarily the answer to this question would be simple, for the great concentrations of skilled workers of all kinds are found here. At present there is an acute shortage of skilled labor which can be used in shipbuilding all over the country. The Social Security Board through its Bureau of Employment Security periodically issues reports upon the availability of labor in defense occupations. As of February 1941, the total number of primary registrations for ship and boat building and boiler making in State employment agencies numbered 6,625 for the entire country.[61] Although the coverage of these figures is by no means complete since registration is on a voluntary basis, they do serve to indicate that in no section of the country is there a surplus of this type of labor.

Besides the number of unemployed workers, the invisible labor supply must be considered in evaluating the position of the Great Lakes districts in regard to labor supply. It is already evident that the future labor requirements of the shipbuilding industry in this country are not going to be met through the simple process of hiring completely experienced but unemployed workers. The problem rather is to be met either by taking workers of comparable and easily transfer-

[60] Navy Department Appropriation Bill for 1942, p. 245.

[61] Social Security Board, Bureau of Employment and Security, Research and Statistics Division, *Labor Supply Available at Public Employment Office in Selected Defense Occupations in February 1941.* National Summary, p. 4.

able skills from other industries,[62] or by an intensive program of training, or a combination of both methods. How does the Great Lakes area fit into this procedure?

In his appearance before the House Rivers and Harbors Committee, Director General William S. Knudsen of the Office of Production Management, repeatedly stressed the advantages of the Great Lakes area in regard to skilled labor:

> Mr. KNUDSEN. We have a very valuable reservoir of mechanical skill and shipbuilding ability in the Great Lakes . . . The skill is there, the steel is there, and the man-power is there. . . . In laying down ways we have to consider first the distance from material sources; and second, the amount of available labor.
>
> Mr. BELL. Is that the only reason why shipways cannot be laid down along the coasts, on account of the availability of labor and material?
>
> Mr. KNUDSEN. You can spread this thing so thin that you cannot get any ships out, but we have put in ways as fast as we thought it was prudent, and with an eye to the production of ships.[63]

The heavy concentration in the Great Lakes area of skills necessary for shipbuilding can be indicated statistically. Table 24 lists the number of persons working at jobs which are closely related to shipbuilding for six Great Lakes States. Although these States accounted for only 22.7 percent of the total United States population in 1930, they had a much greater percentage of these occupations. For example, in the all-important skills of machinists, millwrights, toolmakers, as well as mechanics not otherwise specified, these States had nearly 40 percent of the United States total. In the equally vital occupations of pattern and model makers they had 47 percent, and in the cases of structural iron workers and electricians their ratio was 25 percent. For all the selected occupations shown in the table the figure was 31.2 percent. While these figures are ten years old, they are the latest comprehensive figures available. The general situation indicated by them of a heavy concentration of highly skilled workers of this sort in the Great Lakes area is commonly known to be still valid.

[62] On July 22, 1941, the O. P. M., through Associate Director Sidney Hillman, announced meetings of railroad officials and labor leaders to approve a pair for the cooperative, voluntary transfer of approximately one-fourth of the skilled railway maintenance employees to the shipbuilding and aircraft industries.

[63] *Hearings on H. R. 4927*, No. 10, pp. 811–12, 819.

TABLE 24

Population and number of employees in selected industries in selected States—1930

	Minnesota	Wisconsin	Illinois	Indiana	Michigan	Ohio	Total of selected States	Total United States	Percent of total selected States of total United States
Electricians	4,306	6,230	22,605	7,580	15,938	18,767	75,426	280,317	26.91
Machinists, millwrights, and toolmakers	9,518	26,592	66,026	27,970	90,396	74,450	294,952	761,095	38.75
Mechanics (M. O. S.) [1]	13,332	14,731	46,075	17,544	32,419	38,450	162,551	638,253	39.26
Carpenters	17,657	22,022	59,978	24,355	40,332	51,525	215,869	929,426	23.23
Tinsmiths and coppersmiths	1,743	3,206	7,940	2,626	5,848	7,818	29,181	83,247	35.05
Plumbers and gas and steamfitters	3,372	4,755	16,781	5,915	11,131	13,952	55,906	237,184	23.57
Pattern and model makers	337	1,669	3,040	1,149	3,393	3,781	13,369	28,328	47.19
Structural ironworkers (building)	349	487	2,803	510	1,205	2,151	7,505	28,966	25.92
Apprentices to building and hand trades	504	1,221	3,825	763	1,781	2,251	10,345	40,133	25.78
Iron and steel, machinery, and vehicle industries	7,036	19,468	49,199	28,550	102,795	76,948	283,996	651,398	43.60
Total	58,154	100,381	278,272	116,962	305,238	290,093	1,149,100	3,678,347	31.24

[1] Not otherwise specified.

Source: Fifteenth Census of the United States, 1930—Population Vol. IV: Table 4 for each State—table 13 pp. 25-7 for United States total.

The significance of this situation is apparent. Along the ocean coasts, a great many workers in nonessential industries whose skills are adaptable to shipbuilding have already been attracted by high wages from their usual industries. To some extent skilled workers from the Great Lakes have migrated to the coastal yards.[64] There is still a large number of skilled workers in nondefense industries in the Great Lakes area who could be shifted to shipbuilding. If the local shipyards were to engage in an active program, these workers would be available. They are much less willing to leave their present jobs to take work in distant yards on the ocean coasts. The figures cited serve to indicate the large number of workers in the Great Lakes area whose skills are transferable and from their number a labor force could be recruited for shipbuilding.

Besides the large "invisible" labor supply which would be voluntarily available in the Great Lakes as shipbuilding activities expand,

[64] *Hearings on H. R. 4927*, No. 10, p. 827:

Mr. BELL. Is it not a fact, Mr. Knudsen, that thousands of defense workers have been drawn out of the Middle West to the west coast and other places where airplane factories have been located?

Mr. KNUDSEN. Yes; I am sure some of them have been.

there is the additional manpower which priorities would create. Already certain industries are being limited in order to release labor, materials, and tools to vital defense production. Plans are being studied for further application of priorities, and it is quite probable that labor which can be transferred to shipbuilding may fall under such controls. In that case, the Great Lakes area would furnish the largest reserves of such labor.[65]

In connection with labor supply the construction of small ships which the Navy Department is undertaking in the Great Lakes is of importance. This program will furnish a training ground for labor and will begin the process of upgrading and transferring workers from other industries into shipbuilding. At the same time necessary reconditioning and expansion of facilities for the construction of large lake carriers will be carried on. Thus, the training and assembling of a labor force and the preparation of facilities can be carried on simultaneously.

There is another aspect of the shipbuilding industry which is at present causing concern. This is the matter of providing housing and community facilities for the workers. The Federal Government has already appropriated in the rearmament effort about $650,000,000 for defense housing. At Pascagoula, Miss., alone, $2,450,000 has been allocated for 700 dwelling units for shipyard workers. The United States Navy regards housing as one of its difficult problems. The placing of shipyards in hitherto relatively sparsely settled regions intensifies the problem. The Navy has obligated itself through December 1940, for $40,384,089 for housing at naval ordnance stations only. This does not include housing at navy yards, data for which are not readily available. Not only is this costly but it impedes the progress in assembling the working force.

Community facilities such as schools, local transportation, etc., present a similar problem. A large program of shipbuilding in the Great Lakes district would ease these problems considerably. Instead of workers moving to the ocean coasts where such facilities would have to be provided, they could stay in their existing communities where facilities are already available. Community facilities are in a sense an overhead item. An increase, for example, of 10,000 workers in a community of a million people may require little if

[65] At the present time plans exist to curtail automobile production by 20 percent next year, and the advisability of curtailment by 50 percent with immediate steps to approach this goal is under consideration. Obviously, workers who would be released under such a procedure would be largely concentrated in the Great Lakes States.

any expansion of these facilities. There exists a cushion in the normal vacancy ratio to absorb a sudden increase in the population. This temporary capacity to house more people is augmented by the possibility of "doubling up" and more intensive utilization of existing dwelling units. Consequently, large communities can more easily absorb a given number of new residents than can small communities. A similar increase in a community of 10,000 people doubles the load upon local transportation, sanitation, and education, and necessitates a very large increase in these services.

Migration of workers, besides necessitating the construction of new community facilities, creates the problem of relocation of workers after the peak of the effort has passed. In heavily industrialized and diversified areas like the Great Lakes, this problem is easier to solve. For example, after restrictions on automobile production are lifted, this industry will provide a source of reemployment.

These points were brought out repeatedly in the hearings before the House committee:

> Mr. VOORHIS. Mr. Knudsen, one of the members of the committee asked you a while ago whether it would not be possible to transport labor to places where ships could be built if you do not construct the St. Lawrence Waterway. Does not that involve a tremendous difficulty and future dislocation of labor that would be a very serious problem indeed to cope with and should it not be avoided if it is possible? My question is: Do you not believe it is advisable to avoid it as much as possible?
>
> Mr. KNUDSEN. Oh, absolutely.[66]

And again:

> Mr. BELL. You have to have your shipways, I take it, near your source of supplies?
>
> Mr. KNUDSEN. Near to your material and labor.
>
> Mr. BELL. And Labor?
>
> Mr. KNUDSEN. Yes, sir.
>
> Mr. BELL. You could transfer your labor very easily, however, could you not?
>
> Mr. KNUDSEN. Yes; but it is not very desirable.
>
> Mr. BELL. If you had the materials on the coast you could get the material there and transport your labor?
>
> Mr. KNUDSEN. Yes, sir; but migratory labor is not very desirable; but we have to do it, of course, in certain places.[67]

Conclusions.

The importance of utilizing the resources of the Great Lakes area for the merchant and naval ship-construction program of the United States and its allies is established by the testimony of well-qualified

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[66] *Hearings on H. R. 4927*, No. 10, p. 826.
[67] *Ibid.*, p. 819.

authorities and the officials of the Federal Government charged with the responsibility of carrying out the national defense program.

The Secretary of the Navy, Hon. Frank Knox, Admiral E. S. Land, Chairman, United States Maritime Commission, Mr. William S. Knudsen, Director General of the Office of Production Management, and Rear Admiral George H. Rock, former Chief Constructor of the Navy, whose opinions the Navy Department fully endorses, all have expressed themselves without qualification that it is desirable and important to make the shipbuilding resources of the Great Lakes available for the defense program.

The Great Lakes shipbuilding facilities contributed substantially to the shipbuilding program of the first World War. They can now contribute equally well by assuming the burden of the small-boat program of the United States Navy, and by constructing small cargo vessels for the Maritime Commission. With the limitation of the present channels through the Chicago Drainage Canal and the St. Lawrence River, the utilization of the Great Lakes resources in shipbuilding under present conditions will be partial and expensive. Emergency makeshift arrangements can be made even though more expensive than if a normal outlet for large vessels were available. Such a program will maintain the managements and the labor force occupied and in training. When completion of the St. Lawrence Seaway is within sight, then it will be possible to transfer some of the large naval shipbuilding program to the Great Lakes, thereby freeing coastal yards for immediate utilization. At the same time a large merchant shipbuilding program can be initiated, thereby augmenting the shipbuilding capacity of the country by 750,000 or 1,000,000 gross tons a year.

The contention is no longer justified in the light of developments abroad and the studied opinions of high-ranking officials in the Government that the present emergency will be of short duration, and that it will be over before the completion of the St. Lawrence Seaway. The continuance of the threat to the security of the United States in both the Atlantic and Pacific Oceans, the maintenance of our Navy in a state of mobilization, possible need for enlargement of the Navy, and the provisions of an adequate auxiliary merchant fleet to maintain communication with our distant defense outposts, will necessitate a continuing program of naval ship construction beyond present plans. It will be more economic to secure access to the existing yards and resources in the Great Lakes than to duplicate those facilities elsewhere.

It has become clear that the maintenance of a large merchant fleet is necessary for national defense. In the past this has not always been possible because it has been difficult to sustain an American-

flag merchant fleet on the high seas in competition with foreign ships. Similarly, coastwise and intercoastal trade, which by law is restricted to American-constructed vessels, has also been difficult to carry on economically. It is now realized that a merchant fleet must be maintained as a national defense measure. The Maritime Commission is cognizant of this need and welcomes new opportunities for the utilization of a merchant fleet. In its formal report on H. R. 4927, the Commission stated: ". . . Sound planning for the expansion of our merchant marine must therefore include the further development of water-borne transportation in the coastwise and intercoastal trades." [68] The Commission contends that ". . . any opportunity to provide for the expansion of the use of merchant vessels in normal trades is worthy of serious consideration. . . ." [69] The Commission also agrees that the Seaway ". . . would open to such vessels thousands of miles of additional coast line and would permit them direct access to one of the most highly industrialized and agriculturally prolific regions in the United States." [70]

It is, therefore, clear that the St. Lawrence Seaway would provide greater opportunities for the employment of a merchant fleet in peacetime, so essential to the maintenance of an adequate auxiliary fleet for emergency use.

Even if the present emergency should end in the next few years, the shipbuilding facilities in the Great Lakes would still be needed, for, in addition to the increase in the auxiliary merchant fleet, necessitated by the two-ocean navy, the country would still be faced by the need for replacement of obsolete vessels. Sixty percent of the tonnage of the United States vessels is engaged in the coastwise and intercoastal trade. Virtually all of these vessels, the Maritime Commission reports, are obsolete or approaching obsolescence.[71] These vessels must be replaced as soon as the emergency needs will permit, according to the Maritime Commission; hence it cannot be said that the need for new ships is confined to the present emergency.

Recognizing these facts, the President stated in a message on December 5, 1940:

> . . . Seacoast shipyards are already overtaxed with uncompleted construction. Shipyards on the Great Lakes, with access to the ocean, yet close to the sources of supply of labor, raw and finished materials further removed from possible attack, may be a vital factor in successful defense of this continent. They will help to build the ships which will bring back commerce to the harbors of the Atlantic coast ports.[72]

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[68] *Hearings on H. R. 4927*, No. 18, p. 2249.
[69] *Ibid.*, p. 2250.
[70] *Ibid.*
[71] *Ibid.*, p. 2249.
[72] Message of the President to the Great Lakes-St. Lawrence Seaway Conference at Detroit, Mich., December 5, 1940.

Section 10

Labor and Material Requirements of the St. Lawrence Project

The St. Lawrence project has been attacked as a national defense measure on the ground that it will divert essential labor and materials from other vital defense industries.[1] There can be no question that any project such as this will require men to construct it. The real questions to be considered are two: First, are the services which the St. Lawrence will provide necessary for national defense; and secondly, if this is true, will the St. Lawrence provide these services with more or less labor and materials, particularly skilled labor, and strategic materials, than alternative methods of supplying those same needs.

The hearings before the House Rivers and Harbors Committee have brought out that the power and transportation services and the shipbuilding facilities made available by the St. Lawrence project are very important for national defense. This conclusion was affirmed by the Secretary of War, the Secretary of the Navy, the Secretary of Commerce, the Director General of the Office of Production Management, the Assistant Secretary of State, the Chairman of the Federal Power Commission, and the Chairman of the Power Authority of the State of New York. This indicates that if the St. Lawrence project is not constructed, other means of providing power, transportation, and shipbuilding facilities would be necessary.

If the St. Lawrence project is not constructed it is argued that equivalent steam stations can be built. It was shown previously that this was not a matter of choice and that steam generating equipment could not be obtained in place of the St. Lawrence project without withholding generating capacity from other sections of the country.

However, since the opponents of the project have suggested steam stations as alternative to the St. Lawrence project, the St. Lawrence Survey undertook to measure the labor requirements of the steam stations and the labor requirements of the railroad equipment that

[1] *Hearings on H. R. 4927.* Statements of Mr. Chauncey J. Hamlin, No. 7, pp. 491–92, 519–20, 550; Mr. Bertram D. Tallamy, No. 7, pp. 585–86; Hon. Sam Jones, No. 8, p. 623.

would be needed to carry 10 million tons of traffic during the open season of navigation,[2] and compared them with the labor requirements of the St. Lawrence project. This study was prepared with the cooperation of the United States Army Engineers and the Bureau of Labor Statistics of the Department of Labor.

It must be noted that these estimates of labor requirements of the alternatives to the St. Lawrence do not include the large army of labor that would be required to duplicate anywhere else the numerous shipyards with the shops and machine tools, which this project will make available. Hence the results of the comparison as given in this report are highly conservative and err to the disadvantage of the Seaway.

This study shows that the average annual labor requirement for the St. Lawrence project, on-site and off-site, is less than 20,000 men, of whom 5,893 are skilled, 4,838 are semiskilled, 4,523 are unskilled, and 4,121 are unclassified. The on-site labor will be an average of 10,000 workers.[3]

The peak of the direct labor will not be reached until the third year of construction. In the first year only 7,000 workers will be necessary. This means that the peak of employment on this project will come after the peak of construction of Army camps, airports, defense plants, and of other national defense construction projects.

Comparison with the labor requirements for the steam plants and railroad equipment, which will be necessary if the St. Lawrence project is not built, shows that they would require almost twice as much labor as this project. For the 4-year period a total of 77,501 man-years are required for the St. Lawrence project as against 143,556 man-years for steam stations and railroad equipment. The St. Lawrence project would absorb 23,573 skilled man-years, on-site and off-site, as compared with 44,054 skilled man-years for alternative rail and steam equipment, and 19,354 semiskilled man-years as compared with 54,195 for the alternatives. These figures leave no doubt that, granting the need for power and transportation, the St. Lawrence would require less labor, and therefore would be more economical and desirable in this period of great national defense effort, than alternative services. This preference is emphasized when one considers the shipbuilding facilities that will become available when the project is completed.

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[2] The railroad equipment needed to carry St. Lawrence traffic was estimated on the basis of the requirements to carry the prorated portion during hte peak months. See *St. Lawrence Survey, Part III*, ch. 4.

[3] *Hearings on H. R. 4927*, statements of Hon. Wm. S. Knudsen, No. 10, p. 826, and Brig. Gen. Thomas M. Robins, No. 12, p. 968.

The argument that there is an absolute shortage of labor has been amply refuted. Hon. William S. Knudsen, Mayor Fiorello La-Guardia, and Lt.-Gov. Charles Poletti, of New York, have stated that there is no shortage of labor.[4] Mr. Fred Umhey, a member of the Advisory Council of Unemployment Insurance of the State of New York, has presented statistics to show that there are 400,000 people unemployed in New York State and that the training and skill of many of these unemployed qualify them for this work. With the mounting unemployment forced by priorities, and the completion of many defense construction projects, labor supply will present no difficulties whatsoever.

TABLE 25

Estimate of materials on St. Lawrence project (exclusive of water turbines and generators)

Year of construction	Lumber (M board feet)		Cement (barrels)		Reinforcing steel and rail (tons)		Structural and miscellaneous steel (tons)	
	United States	Canada	United States	Canada	United States	Canada	United States	Canada
First	25,000	4,700	670,000	290,000	14,000	10,000	10,000	3,000
Second	13,000	14,000	1,330,000	380,000	15,000	10,000	14,000	3,000
Third	12,000	2,000	1,270,000	230,000	14,000	15,000	28,000	8,000
Fourth	10,000	3,300	430,000	100,000	7,000	15,000	28,000	6,000
Total	60,000	24,000	3,700,000	1,000,000	50,000	50,000	80,000	20,000
Grand total	84,000		4,700,000		100,000		100,000	

NOTE.—The foregoing is based on the completion of 10 h. e. units during the 4-year program; the remaining 26 to follow in the fifth and sixth years.

SOURCE: United States Army Engineers.

Much is also made of the argument that the St. Lawrence project will absorb materials of which there is a critical shortage.[5] A study of the material requirements of the St. Lawrence indicates that this claim is highly exaggerated. In table 25 the United States Army Engineers have estimated the requirements of lumber, cement, reinforcing steel and rail for each year of the 4 years of construction. It is there seen that the total requirements for both Canada and the United States of lumber will be 84,000 M board feet; cement, 4,700,000 barrels; reinforcing steel and rail, structural and other steel, exclusive of water turbines and generators, 200,000 tons.

[4] *Ibid.*, statements of Lt.-Gov. Charles Poletti, of New York, No. 4, pp. 265–66; Hon. William S. Knudsen, No. 10, p. 826; Hon. Fiorello H. LaGuardia, No. 12, p. 1095.

[5] *Ibid.*, statements of Mr. Chauncey J. Hamlin, No. 7, pp. 520, 550; Hon. Sam Jones, No. 8, p. 623.

The United States' share of these requirements is 60,000 M board feet of lumber, 3,700,000 barrels of cement, and 130,000 tons of reinforcing steel and rail and structural and miscellaneous steel for the 4-year period. These material requirements are but a very small fraction of the total projected output of these products during the next 4 years.

In view of the materials that would be required to construct steam plants, railroad equipment, and shipbuilding facilities of capacity equivalent to that made available by the St. Lawrence project which would be expended if the St. Lawrence is not constructed, this project cannot be said to absorb any considerable amount of materials that would hamper defense effort.

The conclusion is inevitable that the St. Lawrence project would not absorb large amounts of skilled labor and materials in absolute terms, and it will most likely absorb less amounts of labor and materials than would be needed for other facilities in power, transportation, and shipbuilding equivalent to what this project will make available to the national defense effort.

This conclusion is supported by the studies of the St. Lawrence Survey, and is borne out by the opinions of the Assistant Chief of Engineers, United States Army, Brig. Gen. Thomas M. Robins. Han. William S. Knudsen, Director General of the Office of Production Management, testified:

> Mr. VOORHIS. Mr. Knudsen, do you believe that there are materials which would have to be used in this dam and in this work of which we now have a critical shortage, so that we would have a more serious shortage of those materials if we constructed this project?
>
> Mr. KNUDSEN. At the moment I do not see that.
>
> Mr. VOORHIS. And is it not true that the type of labor that would be required for the construction of this project is not the type of labor where we have a critical shortage at the present time?
>
> Mr. KNUDSEN. Correct.[6]

[6] *Ibid.*, No. 10, p. 827.

APPENDICES

Appendix A

EXECUTIVE ORDER

Establishing the St. Lawrence Advisory Committee and Providing for a Preliminary Investigation of International Rapids Section, St. Lawrence River

By virtue of the authority vested in me by the act entitled "An act making appropriations for the Navy Department and the Naval Service for the fiscal year ending June 30, 1941, and for other purposes," approved June 11, 1940 (Public, No. 588, 76th Cong.), and by the Military Appropriation Act, 1941, approved June 13, 1940 (Public, No. 611, 76th Cong.), and as President of the United States, and in order to provide for emergencies affecting the national security and defense, it is hereby ordered as follows:

1. There is hereby established the St. Lawrence Advisory Committee, consisting of Leland Olds, Chairman of the Federal Power Commission, as chairman; A. A. Berle, Assistant Secretary of State; Brig. Gen. Thomas M. Robins, of the Board of Engineers for Rivers and Harbors, Corps of Engineers, United States Army; and Gerald V. Cruise, representative of the Trustees of the Power Authority of the State of New York. It shall be the duty of the Committee to advise the President with respect to the matters hereinafter set forth, and to perform such other functions as the President may determine.

2. The Federal Power Commission and the Corps of Engineers, United States Army, are authorized, empowered, and directed—

(*a*) To make such preliminary investigations as the Advisory Committee may consider appropriate or necessary with respect to development of navigation and hydroelectric power in the International Rapids Section of the St. Lawrence River, including, among other things, (1) preliminary investigations of the potential dam site by means of core borings, test pits, soil analyses, etc., (2) preliminary surveys of the lands necessary for such development, and investigation of the titles to such lands, and (3) preparation of preliminary plans and specifications.

(*b*) To make periodic reports, with recommendations to the President, of the results of the aforesaid investigations.

(*c*) To consult and cooperate with appropriate agencies of the Canadian Government.

3. In the performance of their functions and duties under this order the Federal Power Commission and the Corps of Engineers, United States Army, may avail themselves of the services, records, reports, and information of the Executive departments and other agencies of the Government.

4. The Federal Power Commission and Corps of Engineers, United States Army, shall have authority to appoint, without regard to the civil-service laws, such officers, experts, and employees as they may deem necessary to carry out their functions under this order, and to prescribe their functions, duties, responsibilities and tenure.

FRANKLIN D. ROOSEVELT

THE WHITE HOUSE,
October 16, 1940.

Appendix B

THE PRESIDENT'S MESSAGE TO THE CONGRESS

To the Congress of the United States:

The surveys of the Federal Power Commission and the National Power Policy Committee have convinced me that the development of the International Rapids Section of the St. Lawrence River should be undertaken at the earliest possible date as a part of adequate provision to meet the continuing power requirements of the defense program in certain essential centers of war material production in the northeastern States.

The potential power at this site is best adapted to meet the requirements of expansion in certain essential defense industries, including aluminum, magnesium, ferro-alloys, chemicals, etc. Actually, the Aluminum Co. of America has recently arranged for the import of 30,000 kilowatts of additional power from Canada to meet the pressing requirements of its existing plant located at the very site of the proposed St. Lawrence project and, I am reliably informed, is seeking additional supplies from across the border. Such imported supplies are, in effect, on an annual basis, subject to being withdrawn if required by the Canadian power market.

It is urgent that this project be undertaken at the present time, not only from the point of view of our own defense but also in terms of those of our neighbor, Canada. The Province of Ontario needs to be able to count upon the early availability of this power to meet its growing load. The project may, therefore, be considered as an essential part of the program of continental defense which is being actively worked out by representatives of the two peoples.

I am informed that if the potential power of the International Rapids is to be available to cary the peak load of 1945, preliminary investigations, particularly engineering surveys of the site, including core borings, test pits, soil analyses, etc., must be undertaken immediately. I have, therefore, allocated $1,000,000 of the special defense fund to the Federal Power Commission and Corps of Engineers, United States Army, for this preliminary work and have appointed a committee of four to advise me in planning the work and to cooperate with appropriate agencies of the Canadian Government. The members of this committee are Leland Olds, Chairman of the Federal Power Commission, as chairman; A. A. Berle, Assistant Secretary of State; Brigadier General Thomas M. Robins, of the Board of Engineers for Rivers and Harbors, Corps of Engineers, United States Army; and Gerald V. Cruise, representative of the Trustees of the Power Authority of the State of New York. I have directed the United States Corps of Engineers to begin the necessary investigations immediately.

The preliminary investigations which I have authorized involve no actual construction or commitment to construct. In taking this means of advising Congress of the surveys I am having made, I wish to make it clear that Congress will be kept advised of such further steps as may be necessary.

FRANKLIN D. ROOSEVELT.

THE WHITE HOUSE,
October 17, 1940.

Appendix C

MESSAGE OF THE PRESIDENT TO THE GREAT LAKES-ST. LAWRENCE SEAWAY CONFERENCE AT DETROIT, DECEMBER 5, 1940

To my friends of the Great Lakes Seaway and Power Conference:

As I said in a message to your last conference 4 years ago, this assemblage of leaders from many sections of the country for a most practical purpose is a welcome and significant event.

I said then that "an opportunity is presented to complete a seaway comparable in economic value to the Panama Canal," a seaway to which "the public development of St. Lawrence power is inseparably linked."

It was then an opportunity. It is now a vital necessity.

The United States needs the St. Lawrence Seaway for defense. The United States needs this great landlocked sea as a secure haven in which it will always be able to build ships and more ships in order to protect our trade and our shores.

The United States needs, tremendously needs, the power project which will form a link in the seaway in the International Rapids Section of the St. Lawrence River to produce aluminum and more aluminum for the airplane program which will assure command of the air.

Selfish interests will tell you that I am cloaking this great project in national defense in order to gain an objective which has always been dear to me. But I tell you that it has always been dear to me because I recognized its vital importance to the people in peace and in war.

Let those who oppose the immediate undertaking of this project sit here at the center of the national defense effort in Washington and feel the pressure of the National Defense Commission calling for more and more power for our great aluminum plants and for other munitions industries requiring lots of cheap power. I am sure that they will know that the opposition which defeated the St. Lawrence treaty in 1934 was a mistaken opposition, based on failure to appraise the full needs of their country in the world situation which was even then developing.

What would we not give today, we who are responsible for the country's supreme defense effort, if the great St. Lawrence turbines were already in place, steadily revolving under the drive of St. Lawrence waters now running to waste, producing every hour of the day 1,000,000 horsepower to supply the expansion of our essential defense industries.

Had this project been started in 1934, as we urged, it would now be complete and occupying a place with other great projects, such as the Tennessee Valley in the Southeast, Boulder Dam in the Southwest, and the Columbia River projects in the Northwest, among the great national defense assets of this continent.

No one who has studied our national defense problems and the international situation can possibly fail to see the need for this project in the defense of the

continent. The Congress of the United States, in providing funds for a two-ocean navy on a program covering many years, has properly recognized the essential place of sea power in continental defense. The world's merchant tonnage is diminishing at the rate of tens of thousands of tons a month. The distances which may be effectively covered by bombing planes are rapidly increasing.

Seacoast shipyards are already overtaxed with uncompleted construction. Shipyards on the Great Lakes, with access to the ocean, yet close to the sources of supply of labor, raw and finished materials, further removed from possible attack, may be a vital factor in successful defense of this continent. They will help to build the ships which will bring back commerce to the harbors of the Atlantic coast ports.

Opponents of the project have pointed out that it takes 4 years to build this Seaway. They know, but fail to mention, that it takes at least that long to build a battleship. They also know that this project will cost the United States less than three battleships and that the power project will be entirely self-liquidating.

We hope that the world situation may soon improve. But we are bound to be prepared for a long period of possible danger. Who can say, with assurance, that we shall not need for our defense or peaceful pursuits every possible ship-building resource, particularly those that exist and may be developed in the interior of our country? Only one who can say that we do not need the battleships that we are now building will dare to say that we do not need the essential Great Lakes-St. Lawrence Seaway.

The need for the Seaway is coupled with an increasing demand for the power. Already our defense industries in the Northeast have been required to import huge blocks of electric power from Canada. They are asking greater imports and Canada can agree to supply this power only temporarily. A new source of cheap power for national defense must be developed immediately.

Along with its benefits to national defense, this project will contribute to the peacetime welfare of a multitude of laborers, small-business men, home owners, and farmers. I said in 1936 and I say now, "such a development as we propose to carry out in the Great Lakes-St. Lawrence Basin unquestionably will result in greater activity for all ports and transportation agencies. This has been the history of all new navigation projects and improvements directed to better commercial communication in this country and throughout the world. The fear that the Seaway will result in injury on the lower Mississippi or to our Atlantic ports is groundless."

What this project means to the ordinary man and woman cannot be too highly stressed. It means a more secure nation. It means a continent protected and served by the additional shipping built in inland shipyards. It means more industries, both defense and domestic, thriving on the cheapest power in history. It means more comforts in the homes of many cities and rural areas. It means more work for the ordinary citizen in shipyards, factories, and other transportation services connecting the center of this continent with this great highway to and from our national and international markets.

I am preparing to press for the immediate construction of this project. Because of its vital defense character I have allocated one million dollars of the defense funds made available by the Congress to make the necessary engineering surveys and to prepare the preliminary plans and specifications so that no time may be lost in starting the undertaking.

I am conducting conversations with our neighbor Canada to work out the international aspects of the development of this great common asset. I shall propose to the Congress of the United States, which will assemble in January, that it take the necessary steps toward completion of this St. Lawrence Seaway and Power Project, on which so much of our national safety and welfare depend.

FRANKLIN D. ROOSEVELT.

Appendix D

CANADIAN NOTE TO THE UNITED STATES, MARCH 5, 1941

DEPARTMENT OF EXTERNAL AFFAIRS,
Ottawa, March 5, 1941.

SIR: I have the honor to refer to certain questions which have arisen in the course of the St. Lawrence waterway negotiations, and which we have discussed recently.

2. As you are aware, my colleagues and I have been giving prolonged consideration to the problems presented by the St. Lawrence waterway project. We have noted the progress made in the preparation of the engineering plans for the international section and in the drafting of the general agreement. There is, however, one consideration of a fundamental character to which we desire to call attention.

3. The growing intensity of the war operations and the apprehension that still more serious perils will have to be faced in the very near future, necessitate the most careful examination of any proposed expenditure from the point of view of public need and in the light of war requirements.

4. In existing circumstances, the Canadian Government desires to know whether the Government of the United States is of the opinion, in view of the position in Canada, and, of course, the position in the United States as well, that the project as outlined in the State Department's proposals of 1936 and 1938 and under consideration since that time should now be proceeded with.

5. We have, of course, been fully aware of the desire of the Government of the United States to have a treaty or agreement respecting the St. Lawrence waterway concluded at as early a date as possible, and negotiations which have been carried on more or less continuously for some time past have had in view the desire on our part to arrive, at the earliest possible date, at terms of agreement which would be mutually advantageous. We are also aware of the pronouncements which have been made from time to time by the President, respecting the added emphasis given by the war to the importance alike of power and navigation developments in the Great Lakes-St. Lawrence waterway project. We are also duly appreciative of the agreement recently reached between our respective governments, whereby the Province of Ontario has obtained the right to the immediate use of additional power at Niagara, and the diversion of the waters of the Ogoki and Long Lac Rivers into Lake Superior, in consideration of which, authority was given for the immediate investigation by United States engineers of the project in the international section of the St. Lawrence River in Ontario, in order to enable work of future development to proceed with the least possible delay, once an agreement between the two governments respecting the St. Lawrence development was concluded.

6. We would naturally be prepared to give every consideration to power or navigation developments which the United States may deem necessary to the prosecution of measures calculated to aid Great Britain, Canada, and other

parts of the British Commonwealth of Nations in the present war, or to further the security of the United States itself against possible future events which, at the moment cannot be foreseen, but of which in times like the present full account must be taken. We realize that the Government of the United States will be as solicitous as our own Government to appraise the project at the present time in terms of its contribution to the efforts which are being put forward by our respective countries to preserve and to restore freedom.

It is from this point of view and in this spirit that we would ask that the St. Lawrence project be again reviewed by the Government of the United States before an agreement or treaty be finally entered into.

Accept, sir, the renewed assurances of my highest consideration.

W. L. MACKENZIE KING,
Secretary of State for External Affairs.

UNITED STATES NOTE TO CANADA, MARCH 10, 1941

LEGATION OF THE UNITED STATES OF AMERICA,
Ottawa, March 10, 1941.

SIR: I lost no time in bringing to the attention of my Government your note of March 5 in regard to the St. Lawrence waterway negotiations. In view of the importance of the question you raised, the matter was laid before the President, and I have been instructed, by way of reply, to transmit the following personal message from him to you:

"I have given careful consideration to your recent request that in view of the growing intensity of current war operations and the apprehension over perils which may have to be faced in the near future, the Government of the United States reviews the St. Lawrence project and gives you an indication of its views as to whether, in the existing circumstances, this project as outlined in the State Department's proposals of 1936 and 1938 should now be proceeded with.

"May I say at the outset that I am aware of Canada's increasing war effort and I readily agree that it must have first call upon your country's resources and manpower. I also agree that in view of the existing situation the most careful examination of any proposed expenditure is necessary from the point of view of the public need and in the light of defense requirements.

"With these considerations in mind, the Government of the United States has, as you requested, reviewed the St. Lawrence project. We have welcomed this occasion to review this project because of the fact that our own defense program renders it desirable that all public expenditures in the United States be weighed in the light of considerations similar to those set forth in your communication. The Government of the United States is engaged in a great defense program. It is determined to supply such aid in material to Great Britain, the members of the Commonwealth, and their Allies as may be necessary to enable them to bring the war to a successful termination. Simultaneously, our own defenses are being strengthened to the extent necessary to prevent any foe from menacing the security of this hemisphere. It is indispensable that all public projects contemplated by the Government of the United States be considered from the standpoint of their relationship to these supreme objectives.

"The Government of the United States regards the Great Lakes-St. Lawrence project as directly associated with the accomplishment of the foremost national

objectives of this Government. It believes that the project should be proceeded with and that construction should commence at the earliest possible moment. It regards the construction of this project as a matter of vital necessity.

"You refer to the engineering investigation now being conducted in the international section of the St. Lawrence River. I need hardly say that I directed the release of $1,000,000 from the special defense funds for this purpose only because of my conviction that the completion of this project by 1945 might prove of vital importance to our defense effort. It is gratifying that there has been sufficient progress to make possible the initiation of construction this spring.

"I am sure you will agree with me that, while our countries must put forth the maximum immediate defense effort, we must also prepare for the possibility of a protracted emergency which will call upon the industries on both sides of the border to meet constantly expanding demands. The combination of advantages offered by the St. Lawrence project makes it imperative that we undertake it immediately.

"In terms of the time factor, the St. Lawrence project as a part of our defense program is not exceptional, since we are today appropriating money for construction of vessels of war which will not be ready for service until the completion of the St. Lawrence undertaking.

"I am convinced of the urgent need for the large increment in low-cost electric power which the St. Lawrence project will provide. Already the demand for power is running ahead of expectations. In fact, one of the most serious handicaps to the rapid expansion of airplane production is the difficulty of finding the large supplies of high-load factor power required for aluminum production. We are, of course, expanding our electric facilities for this purpose as fast as practicable, but by the time the St. Lawrence power is available other sources of cheap power will have been largely allocated.

"The St. Lawrence project offers by far the soundest and most economical provision for the power requirements of certain portions of our long-range defense program, more particularly for certain high-load-factor defense industries. Furthermore, the manufacturing facilities and skilled labor available for the construction of steam turbines and electric equipment will be needed to meet the requirements of the vast areas of our continent where water power is not so economically available.

"I am also convinced that the opening of the St. Lawrence deep waterway to afford an outlet for naval and cargo ships constructed in Great Lakes shipyards, far from representing a diversion of funds and resources from the defense effort, would have the opposite effect. Our shipbuilding program, to meet the requirements of defense, will call for a great expansion of shipyards with their associated machine shops and adequate supplies of skilled labor. The extent to which intensified submarine and air attacks on convoys may necessitate an expansion of the program is still unknown. If the war is protracted, however, it seems certain that the number of shipyards required will have to be several times those at present available. In terms of our present industrial arrangements, many of these can be made most readily and economically available in the Great Lakes area.

"If the full burden of our expanding ship construction must fall on seaboard shipyards, the time required to complete the vessels themselves must, in many instances, be increased by the period necessary to construct new shipyards and facilities. With this in mind, it is apparent that the deep

waterway could be completed in time to provide an outlet to the sea for many of the new vessels included in the present program.

"In the light of these facts, it is my belief that the funds and manpower required for the earliest possible completion of the St. Lawrence project could not be better spent for our joint defense effort, including aid to Great Britain. It is my feeling that failure to take advantage of the possibilities of this project would be short-sighted, in no way contributing to an increase in our immediate defense effort, while limiting our defense program in the difficult years which lie ahead."

Accept, sir, the renewed assurances of my highest consideration.

PIERREPONT MOFFAT.

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Appendix E

GREAT LAKES-ST. LAWRENCE AGREEMENT, MARCH 19, 1941

No. 117.

DEPARTMENT OF STATE,
March 19, 1941.

The President of the United States of America and His Majesty the King of Great Britain, Ireland, and the British dominions beyond the Seas, Emperor of India, in respect of Canada, have decided to conclude an Agreement in relation to the utilization of the water in the Great Lakes-St. Lawrence Basin and to that end have named as their respective plenipotentiaries:

The President of the United States of America:

His Majesty the King of Great Britain, Ireland, and the British dominions beyond the Seas, Emperor of India, for Canada:

Who, after having communicated to each other their full powers, found in good and due form, have agreed upon the following Articles:

PRELIMINARY ARTICLE

For the purposes of the present Agreement, unless otherwise expressly provided, the expression—

(a) "Joint Board of Engineers" means the board appointed pursuant to an agreement between the Governments following the recommendation of the International Joint Commission, dated December 19, 1921;

(b) "Great Lakes System" means Lakes Superior, Michigan, Huron (including Georgian Bay), Erie, and Ontario, and the connecting waters, including Lake St. Clair;

(c) "St. Lawrence River" includes the river channels and the lakes forming parts of the river channels from the outlet of Lake Ontario to the sea;

(d) "International Section" means that part of the St. Lawrence River through which the international boundary line runs;

(e) "Canadian Section" means that part of the St. Lawrence River which lies wholly within Canada and which extends from the easterly limit of the International Section to Montreal Harbor;

(f) "International Rapids Section" means that part of the International Section which extends from Chimney Point to the village of St. Regis;

(g) "Governments" means the Government of the United States of America and the Government of Canada;

(h) "countries" mean the United States of America and Canada;

(i) "Special International Niagara Board" means the board appointed by the Governments in 1926 to ascertain and recommend ways and means to preserve the scenic beauty of the Niagara Falls;

(j) "deep waterway" means adequate provision for navigation requiring a controlling channel depth of 27 feet with a depth of 30 feet over lock sills, from the head of the Great Lakes to Montreal Harbor via the Great Lakes System and St. Lawrence River, in general accordance with the specifications set forth in the Report of the Joint Board of Engineers, dated November 16, 1926.

ARTICLE I

1. The Governments agree to establish and maintain a Great Lakes-St. Lawrence Basin Commission, hereinafter referred to as the Commission, consisting of not more than ten members of whom an equal number shall be appointed by each Government. The duties of the Commission shall be—

(a) to prepare and to recommend plans and specifications for the construction of works in the International Rapids Section in accordance with and containing the features described in the Annex attached to and made part of this Agreement, with such modifications as may be agreed upon by the Governments;

(b) upon approval of the plans and specifications by the Governments, to prepare a schedule allocating the construction of the works in the International Rapids Section on such a basis that each Government shall construct the works within its own territory or an equivalent proportion of the works so approved;

(c) to approve all contracts entered into on behalf of either Government for the works in the International Rapids Section;

(d) to supervise the construction of the works and to submit reports to the Governments from time to time, and at least once each calendar year, on the progress of the works;

(e) upon satisfactory completion of the works, to certify to the Governments that they meet the plans and specifications drawn up by the Commission and approved by the Governments;

(f) to perform the other duties assigned to it in this Agreement.

2. The Commission shall have the authority to employ such persons and to make such expenditures as may be necessary to carry out the duties set forth in this Agreement. It shall have the authority to avail itself of the services of such governmental agencies, officers and employees of either country as may be made available. The remuneration, general expenses, and all other expenses of its members shall be regulated and paid by their respective Governments; and the other expenses of the Commission, except as provided for under Article III, paragraph (b) of this Agreement, shall be borne by the Governments in equal moieties.

3. The Governments agree to permit the entry into their respective countries, within areas immediately adjacent to the Niagara River and the International Section to be delimited by exchange of notes, of personnel employed by the Commission or employed in the construction of the works, and to exempt such personnel from the operation of their immigration laws and regulations within the areas so delimited. In the event that the Commission, pursuant to the provisions of paragraph 1 (b) of this Article, allocates to either of the Governments the construction of works, any part of which is within the territory of the other Government, the latter Government shall make provision for the according, within the area in which such a part is situated, of such exemption from customs, excise, and other imposts, federal, state, and provincial, as may be reasonably practicable for the effective and economical prosecution of the work. Regulations providing for such exemptions may be settled by the Governments by exchange of notes.

4. The Governments shall, by exchange of notes, prescribe rules and regulations for the conduct of the Commission. They may by the same means extend or abridge its powers and duties; and reduce or after reduction increase the number of members (provided that there must always be an equal number appointed by each Government and that the total number of members shall at no time exceed 10); and upon completion of its duties, the Governments may terminate its existence.

ARTICLE II

The Government of Canada agrees:

(a) in accordance with the plans and specifications prepared by the Commission and approved by the Governments, to construct the works in the International Rapids section allocated to Canada by the Commission; and to operate and maintain or arrange for the operation and maintenance of the works situated in the territory of Canada;

(b) to complete, not later than December 31, 1948, the essential Canadian links in the deep waterway, including the necessary deepening of the new Welland Ship Canal and the construction of canals and other works to provide the necessary depth in the Canadian section of the St. Lawrence River; provided that, if the continuance of war conditions or the requirements of defense justify a modification of the period within which such works shall be completed, the Governments may, by exchange of notes, arrange to defer or expedite their completion as circumstances may require.

ARTICLE III

The Government of the United States of America agrees:

(a) in accordance with the plans and specifications prepared by the Commission and approved by the Governments, to construct the works in the International Rapids section allocated to the United States of America by the Commission; and to operate and maintain or arrange for the operation and maintenance of the works situated in the territory of the United States of America;

(b) to provide, as required by the progress of the works, funds for the construction, including design and supervision, of all works in the International Rapids section except (1) machinery and equipment for the development of power, and (2) works required for rehabilitation on the Canadian side of the international boundary;

(c) not later than the date of completion of the essential Canadian links in the deep waterway, to complete the works allocated to it in the International Rapids section and the works in the Great Lakes System above Lake Erie required to create essential links in the deep waterway.

ARTICLE IV

The Governments agree that:

(a) they may, in their respective territories, in conformity with the general plans for the project in the International Rapids Section, install or arrange for the installation of such machinery and equipment as may be desired for the development of power and at such time or times as may be most suitable in terms of their respective power requirements;

(b) in view of the need for coordination of the plans and specifications prepared by the Commission for general works in the International Rapids Section with plans for the development of power in the respective countries, the Commission may arrange for engineering services with any agency in either country, which may be authorized to develop power in the International Rapids Section;

(c) except as modified by the provisions of Article VIII, paragraph (b) of this Agreement, each country shall be entitled to utilize one-half of the water available for power purposes in the International Rapids Section;

(d) during the construction and upon the completion of the works provided for in the International Rapids section, the flow of water out of Lake Ontario into the St. Lawrence River shall be controlled and the flow of water through

the International section shall be regulated so that the navigable depths of water for shipping in the Harbor of Montreal and throughout the navigable channel of the St. Lawrence River below Montreal, as such depths now exist or may hereafter be increased by dredging or other harbor or channel improvements, shall not be injuriously affected by the construction or operation of such works, and the power developments in the Canadian section of the St. Lawrence River shall not be adversely affected;

(e) upon the completion of the works provided for in the International Rapids section, the power works shall be operated, initially, with the water level at the powerhouses held at a maximum elevation 238.0, sea level datum as defined in the Report of the Joint Board of Engineers, for a test period of 10 years or such shorter period as may be approved by any board or authority designated or established under the provisions of paragraph (f) of this article; and, in the event that such board or authority considers that operation with the water level at the powerhouses held to a maximum elevation exceeding 238.0 would be practicable and could be made effective within the limitations prescribed by paragraphs (c) and (d) of this article, the Governments may, by exchange of notes, authorize operation, subject to the provisions of this article, and for such times and subject to such terms as may be prescribed in the notes, at a maximum elevation exceeding 238.0.

(f) the Governments may, by exchange of notes, make provision for giving effect to paragraphs (c), (d), and (e) of this article;

(g) during the construction of the works provided for in the International Rapids section, facilities for 14 foot navigation in that section shall be maintained.

ARTICLE V

The Governments agree that nothing done under the authority of this agreement shall confer upon either of them proprietary rights, or legislative, administrative, or other jurisdiction in the territory of the other, and that the works constructed under the provisions of this agreement shall constitute a part of the territory of the country in which they are situated.

ARTICLE VI

The Governments agree that either of them may proceed at any time to construct, within its own territory and at its own cost, alternative canal and channel facilities for navigation in the International section or in waters connecting the Great Lakes, and to utilize the water necessary for the operation of such facilities.

ARTICLE VII

The High Contracting Parties agree that the rights of navigation accorded under the provisions of existing treaties between the United States of America and His Majesty shall be maintained notwithstanding the provisions for termination contained in any of such treaties, and declare that these treaties confer upon the citizens or subjects and upon the ships, vessels, and boats of each High Contracting Party, rights of navigation in the St. Lawrence River, and the Great Lake System, including the canals now existing or which may hereafter be constructed.

ARTICLE VIII

The Governments, recognizing their common interest in the preservation of the levels of the Great Lakes System, agree that:

(a) each Government in its own territory shall measure the quantities of water which at any point are diverted from or added to the Great Lake System, and

shall place such measurements on record with the other Government semi-annually;

(b) in the event of diversions being made into the Great Lakes System from other watersheds lying wholly within the borders of either country, the exclusive rights to the use of waters which are determined by the Governments to be equivalent in quantity to any waters so diverted shall, notwithstanding the provisions of Article IV paragraph (c) of this Agreement, be vested in the country diverting such waters, and the quantity of water so diverted shall be at all times available to that country for use for power below the point of entry, so long as it constitutes a part of boundary waters;

(c) if any diversion of water from the Great Lakes System or the International Section, other or greater in amount than diversions permitted in either of the countries on January 1, 1940, is authorized, the Government of such country agrees to give immediate consideration to any representations respecting the matter which the other Government may make; if it is impossible otherwise to reach a satisfactory settlement, the Government of the country in which the diversion of water has been authorized agrees, on the request of the other Government, to submit the matter to an arbitral tribunal which shall be empowered to direct such compensatory or remedial measures as it may deem just and equitable; the arbitral tribunal shall consist of three members, one to be appointed by each of the Governments, and the third, who will be the chairman, to be selected by the Governments;

(d) the Commission shall report upon the desirability of works for compensation and regulation in the Great Lakes System, and, upon the approval by the Governments of any such works, shall prepare plans and specifications for their construction and recommend to the Governments an equitable allocation of their cost; the Governments shall make arrangements by exchange of notes for the construction of such works as they may agree upon.

ARTICLE IX

The Governments, recognizing their primary obligation to preserve and enhance the scenic beauty of the Niagara Falls and River, and consistent with that obligation, their common interest in providing for the most beneficial use of the waters of that River, as envisaged in the Final Report of the Special International Niagara Board, agree that:

(a) the Commission shall prepare and submit to the Governments plans and specifications for works in the Niagara River designed to distribute and control the waters thereof, to prevent erosion, and to ensure at all seasons unbroken crest lines on both the American Falls and the Canadian Falls, and to preserve and enhance their scenic beauty, taking into account the recommendations of the Special International Niagara Board; the Governments may make arrangements by exchange of notes for the construction of such works in the Niagara River as they may agree upon, including provision for temporary diversions of the waters of the Niagara River for the purpose of facilitating construction of the works; the cost of such works in the Niagara River shall be borne by the Governments in equal moieties;

(b) upon the completion of the works authorized in this Article, diversions of the waters of the Niagara River above the Falls from the natural course and stream thereof additional to the amounts specified in Article 5 of the Boundary Waters Treaty of 1909 may be authorized and permitted by the Governments to the extent and in the manner hereinafter provided:

(1) the United States may authorize and permit additional diversion within the State of New York of the waters of the River above the Falls for power

purposes, in excess of the amount specified in Article 5 of the Boundary Waters Treaty of 1909, not to exceed in the aggregate a daily diversion at the rate of five thousand cubic feet of water per second;

(2) Canada may authorize and permit additional diversion within the Province of Ontario, of the Waters of the River above the Falls for power purposes, in excess of the amount specified in Article 5 of the Boundary Waters Treaty of 1909, not to exceed in the aggregate a daily diversion at the rate of five thousand cubic feet of water per second;

(c) upon completion of the works authorized in this Article, the Commission shall proceed immediately to test such works under a wide range of conditions, and to report and certify to the Governments the effect of such works, and to make recommendations respecting diversions of water from Lake Erie and the Niagara River, with particular reference to (1) the perpetual preservation of the scenic beauty of the Falls and Rapids, (2) the requirements of navigation in the Great Lakes System, and (3) the efficient utilization of equitable apportionment of such waters as may be available for power purposes; on the basis of the Commission's reports and recommendations, the Governments may by exchange of notes and concurrent legislation determine the methods by which these purposes may be attained.

ARTICLE X

The Governments agree that:

(a) each Government undertakes to make provision for the disposition of claims and for the satisfaction of any valid claims arising out of damage or injury to persons or property occurring in the territory of the other in the course of and in connection with construction by such Government of any of the works authorized or provided for by this Agreement:

(b) each Government is hereby released from responsibility for any damage or injury to persons or property in the territory of the other, which may be caused by any action authorized or provided for by this Agreement, other than damage or injury covered by the provisions of paragraph (a) of this Article;

(c) each Government will assume the responsibility for and the expense involved in the acquisition of any lands or interests in land in its own territory which may be necessary to give effect to the provisions of this Agreement.

ARTICLE XI

This Agreement shall be subject to approval by the Congress of the United States of America and the Parliament of Canada. Following such approval it shall be proclaimed by the President of the United States of America and ratified by His Majesty the King of Great Britain, Ireland and the British dominions beyond the Seas, Emperor of India, in respect of Canada. It shall enter into force on the day of the exchange of the instrument of ratification and a copy of the proclamation which shall take place at Washington.

In witness whereof the respective plenipotentiaries have signed this Agreement in duplicate and have hereunto affixed their seals.

Done at Ottawa, the ____ day of March in the year of our Lord one thousand nine hundred and forty-one.

[SEAL]

Appendix F

GREAT LAKES-ST. LAWRENCE BASIN BILL[1]

[H. R. 4927, 77th Cong., 1st sess.]

A BILL To provide for the improvement of the Great Lakes-Saint Lawrence Basin in the interest of national defense, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of promoting interstate and foreign commerce and the national defense, and providing an improved waterway through the Great Lakes, the Saint Lawrence River, and connecting waters reaching to the Atlantic Ocean, and for the generating of electric energy as a means of financing, aiding, and assisting such undertaking, the agreement made by and between the Governments of the United States and Canada, published in House Document Numbered 153, Seventy-seventh Congress, first session, providing for the construction of dams and power works in the International Rapids section of the Saint Lawrence River, and the completion of the Saint Lawrence Deep Waterway, is hereby approved; and the President is authorized and empowered to fulfill the undertakings made in said agreement on behalf of the United States, and to delegate any of the powers and duties vested in him by this Act to such officers, departments, agents, or agencies of the United States as he may designate or appoint. The works allocated for construction by the United States under said agreement shall be undertaken immediately under the direction of the Secretary of War and the supervision of the Chief of Engineers in accordance with the laws, regulations, and procedures applicable to rivers and harbors projects, subject, however, to the terms and conditions of said agreement; and shall be diligently prosecuted with a view to making essential facilities of said project available for national defense uses at the earliest possible moment.

SEC. 2. The President is hereby authorized and directed to negotiate an arrangement with the Power Authority of the State of New York for the transfer to said Power Authority of the power facilities constructed pursuant to this authorization and the right to use the United States' share of the waters at the project for hydroelectric power purposes upon such terms and conditions as may be agreed upon, including provision for payment of $93,375,000, which represents the revised estimate of cost allocated to power in accordance with the method of allocation included in the joint recommendation of the Corps of Engineers, United States Army, and the Power Authority of the State of New York dated February 7, 1933, such payment to be made by the Power Authority over a period of fifty years with interest at the rate of 3 per centum compounded annually. In addition, the arrangement shall include provisions protecting the interests of the United States and assuring a widespread equitable disposition of the power to domestic and rural consumers within economic transmission distances, and provisions for the prior use of such water for the purposes of

[1] The provisions of this Bill were incorporated by the House Committee on Rivers and Harbors as section 2 (a), (b), and (c) of the Rivers and Harbors Bill, H. R. 5993.

navigation and the delivery, without charge to the War Department, of so much power as said Department shall need for the operation of navigation facilities. The arrangement negotiated pursuant to this section shall be reported to Congress upon the convening of its next session, and shall become effective when ratified by Congress and the State of New York.

SEC. 3. When the Secretary of War deems it necessary for the purpose of expediting the construction of this project he may enter into contracts without advertising or competitive bidding: *Provided*, That the cost-plus-a-percentage-of-cost system of contracting shall not be used; but this proviso shall not be construed to prohibit the use of the cost-plus-a-fixed-fee form of contract when such use is deemed necessary by the Secretary of War, and this authority to contract may be exercised through such officer or officers as the Secretary of War may designate. The prior use of all waters of the Saint Lawrence River within the boundaries of the United States and all lands, dam sites, and easements required for the purposes of this Act are hereby declared to be necessary for the regulation of interstate and foreign commerce.

Appendix G

PRESIDENT'S MESSAGE TO THE CONGRESS, JUNE 5, 1941

[H. Rept. Doc. No. 245, 77th Cong., 1st sess.]

To the Congress of the United States:

I recommend authorization of construction of the St. Lawrence seaway and power project, pursuant to the agreement of March 19, 1941, with Canada, as an integral part of the joint defense of the North American continent.

Production and more production is the keynote of our all-out race for national defense. Electric power and transportation are limiting factors in the production of planes, guns, tanks, and ships.

The enemies of democracy are developing every hydroelectric resource and every waterway from Norway to the Dardanelles. Are we to allow this continent to be outmatched because short-sighted interests oppose the development of one of our greatest resources?

Your action on this project will either make available or withhold 2,200,000 horsepower of low-cost electric power for the joint defense of North America.

Your action on this project will either open or keep bottled up one of the greatest transportation resources ever offered a people.

Both countries need the power. Both face power shortages which threaten to grow more serious as the demands of the defense program multiply with almost incredible rapidity.

Let us remember that it takes tens of thousands of kilowatt-hours of electricity to produce the materials that go into a single airplane. Our present aluminum program alone calls for more than 10,000,000,000 kilowatt-hours a year. It is constantly expanding with the need for more planes to outstrip the aggressors.

Steam-power-plant construction offers no substitute for St. Lawrence power. No steam plants can provide the large blocks of low-cost electric energy required for certain essential defense industries. Furthermore, we are going to need all our capacity to produce steam-power-plant equipment to meet the tremendous demands which are growing in other parts of the country and to build power installations to drive our merchant and naval vessels.

Our defense production is a gigantic assembly line. Transportation is its conveyor belt. If raw materials cannot flow freely to our great industrial plants, and the products cannot move continuously to the front, defense breaks down. Bottlenecks in transportation are as serious as shortages of power.

Expanding production is going to burden the railroads to the limit. We are expanding their rolling stock as fast as we can, but even the present orders for new cars and locomotives are competing for manufacturing capacity which could otherwise produce tanks and other items of heavy armament.

The seaway will help prevent transportation bottlenecks. It will provide a great highway to and from important defense-production areas. It will cut by more than a thousand miles the stretch of dangerous open water which must be traveled by supplies to Great Britain and strategic North Atlantic bases. It will increase our capacity to build ships.

The Great Lakes today hold many shipways and drydocks, as well as resources of men and materials for shipbuilding. They are bottled up because we have delayed completing the seaway. If we start the seaway now, scores of additional merchant ships may be built in coastal yards freed by transferring a portion of the longer-term naval program to the Great Lakes.

The St. Lawrence project must be expedited. No comparable power, shipbuilding, and transportation facilities can be made available in the time required to construct this project.

In dealing with the present emergency, too many people have underestimated the degree to which our resources will be taxed. We cannot afford to make any more mistakes of that kind.

I am advised that we can build the St. Lawrence project in 4 years. Under emergency pressure it may be completed in less time. I should like to agree with the people who say that the country's danger will be over sooner than that. But the course of world events gives no such assurance, and we have no right to take chances with the national safety.

I know of no single project of this nature more important to this country's future in peace or war. Its authorization will demonstrate to the enemies of democracy that, however long the effort, we intend to outstrip them in the race of production. In the modern world that race determines the rise and fall of nations.

I hope that authorization will not be delayed.

FRANKLIN D. ROOSEVELT.

THE WHITE HOUSE,
June 5, 1941.

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