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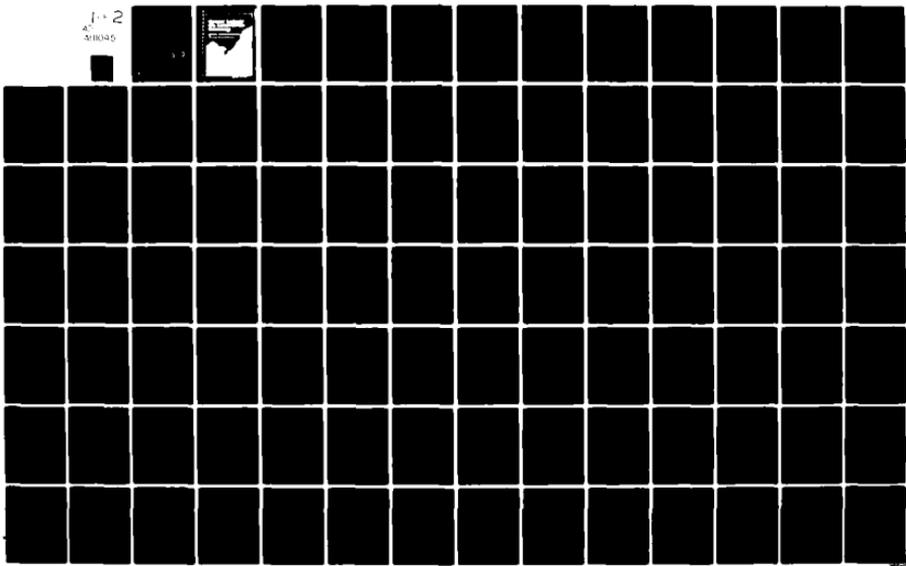
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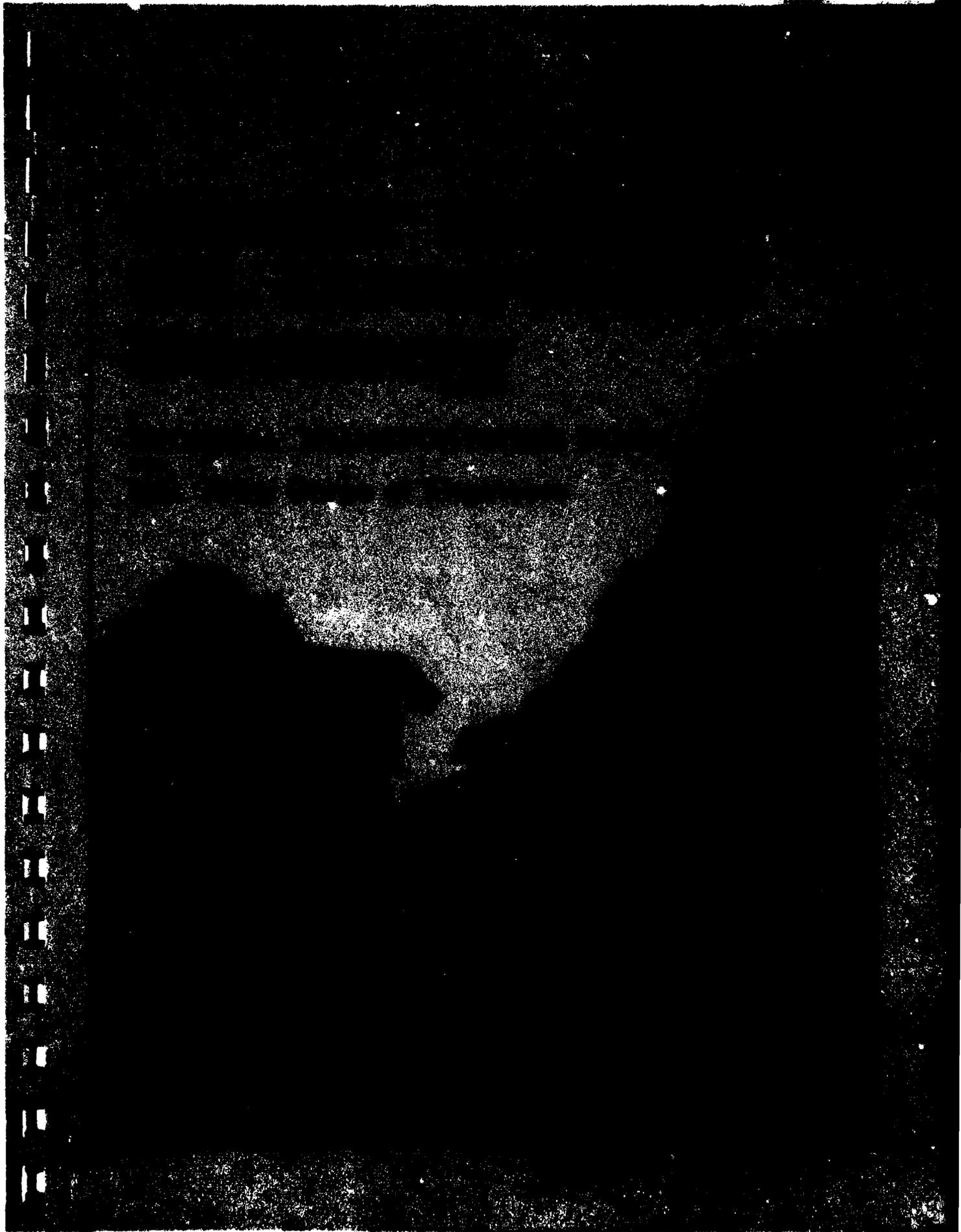
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containerized cargo	shipper preferences									
general cargo	service factors									
Great Lakes liner services	operating costs									
historical freight statistics										
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report analyzes the competitive position of the Great Lakes for containerized cargo. The container market is analyzed from the perspective of shippers and carriers. A pro forma cost analysis for a number of options of accomodating potential general cargo traffic is conducted. Comparative transportation costs per ton are developed for a Great Lakes routing and competing coastal locations.										

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GREAT LAKES/ST. LAWRENCE SEAWAY
REGIONAL TRANSPORTATION STUDY

THE COMPETITIVE POSITION OF
THE GREAT LAKES FOR
CONTAINERIZED CARGO

DECEMBER 1981

for

U.S. Army Corps of Engineers

by

Booz-Allen & Hamilton Inc.
in association with
ARCTEC, Inc.

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I. INTRODUCTION

The U.S. Army Corps of Engineers is responsible for maintaining navigability in U.S. rivers, waterways, and harbors. The Corps currently maintains a navigation system of 25,000 miles of improved channels and 219 locks and dams connecting large regions of the country. Feasibility analysis and planning that precede lock and channel construction and maintenance are integral components of navigation system projects. The Great Lakes/St. Lawrence Seaway Regional Transportation Study is an element of this planning process.

The objective of the GL/SLS Regional Transportation Study is to develop an up-to-date, working analytical tool for economic analysis of GL/SLS transportation system improvements. The near-term uses of study information are feasibility studies of three Great Lakes navigation system improvements. These studies are the following:

- . The St. Lawrence Additional Locks Study, which will determine the adequacy of the existing locks and channels in the U.S. section of the seaway in light of present and future needs.
- . The Great Lakes Connecting Channels and Harbor Study, which will determine the feasibility of providing navigation channel, harbor and lock improvements to permit transit of vessels up to the maximum size permitted by the possible replacement locks at Sault Ste. Marie.
- . The Great Lakes/St. Lawrence Seaway Navigation Season Extension Study, which considers the feasibility of means of extending the navigation season on the entire system.

The Regional Transportation Study is organized in two phases. Phase I has the following elements:

- . Development of cargo flow forecasts for the Great Lakes system
- . Development of data bases required for the evaluation of national economic development (NED) benefits and costs of navigation system improvements

- . Evaluation of lock system performance and ability to process future cargo flows
- . Evaluation of the performance and economic feasibility of improvements to increase the capacity of the system.

Phase II of the study assesses the regional economic, social, intermodal, and energy use impacts of alternative improvements.

This report analyzes the competitive position of the Great Lakes for containerized cargo. This analysis was a major consideration in the development of forecasts of containerized cargo flows for the Great Lakes system, one of the elements of Phase I as identified above.

II. SUMMARY

This report addresses the viability of all-water container service on the Great Lakes. Historical data were analyzed to identify recent trends in U.S. foreign trade of general cargo, and specifically containerized cargo, on the Great Lakes. Then the Great Lakes container market was analyzed from the perspective of shippers and carriers, and the impact of future regulatory developments was investigated. A pro forma cost analysis of operating direct container service and feeder, or relay, container service was performed in order to assess the costs associated with operating container services on the Great Lakes compared to services operated on the Atlantic Coast.

The rest of this report is organized as follows:

- . Chapter III summarizes recent trends in U.S. foreign trade of general cargo and focus on container shipments
- . Chapter IV describes the outlook for direct container services in the Great Lakes
- . Chapter V describes the outlook for container feeder services.

Appendices to the report contain supporting documentation for the exhibits and analyses presented in the report.

III. RECENT TRENDS

This chapter examines historical trends in U.S. foreign trade of general cargo via the Great Lakes system. Table III-1 summarizes historical levels of foreign trade via the Great Lakes. General cargo is divided into liner and non-liner trade. Liner trade is common carrier, regularly scheduled service. Non-liner trade includes irregular or tramp service, proprietary shipments and traffic moving on a contractual basis.

TABLE III-1
U.S. Great Lakes Foreign Trade
(Millions of Short Tons)

<u>Year</u>	<u>General Cargo</u>		<u>Total</u>	<u>Dry Bulk</u>	<u>Total Tonnage</u>
	<u>Liner</u>	<u>Non-Liner</u>			
1979	1.4	6.0 ¹	7.4	60.5 ¹	72.2
1978	1.4	6.0 ¹	5.7	57.2 ¹	68.8
1977	1.4	6.0	7.4	57.3	68.1
1976	1.3	3.2	4.5	56.9	64.8
1975	1.1	2.5	3.6	50.8	56.7
1974	1.0	3.5	4.5	45.2	52.3
1973	2.2	3.6	5.8	54.8	65.1
1972	3.2	4.7	7.9	46.0	58.6
1971	3.6	5.0	8.6	46.0	59.4
1970	3.6	2.9	6.5	49.0	59.7
1969	2.4	4.6	7.0	44.7	55.0
1968	2.8	5.2	8.0	50.9	62.7
1967	4.0	2.0	6.0	46.1	56.6
1966	4.1	1.4	5.5	47.0	58.7

¹ Estimated by Booz, Allen & Hamilton.

² Total tonnage includes tanker.

Source: St. Lawrence Seaway Development Corporation.

Liner activity on the Great Lakes experienced a steady decline from 1966 to 1974. The liner tonnage in 1966 was 4.1 million tons and in 1974 it had dropped to 1.0 million tons. That change represents a 76 percent decline in tonnage over the 9-year period. Liner tonnage has since stabilized at approximately 1.4 million tons per year. This decline in liner activity on the Great Lakes has occurred during a period when total U.S. liner trade has been moderately constant.

Over the last 14 years, non-liner general cargo tonnage and dry bulk tonnage through the lakes have increased. The foreign trade tanker tonnage moving through the lakes has remained relatively constant.

More than half of the general cargo using the Great Lakes has traditionally been imported steel, as shown in Table III-2. In the past 12 years, steel imports have varied between 61 and 76 percent of total general cargo shipments.

TABLE III-2
U.S. Great Lakes General Cargo Trade
(Millions of Short Tons)

<u>Year</u>	<u>Total General Cargo</u>	<u>Steel</u>	<u>Non-Steel</u>	<u>Steel as a Percent of Total</u>
1978	5.7	3.55	2.15	62%
1977	7.4	5.21	2.19	70
1976	4.5	3.00	1.50	67
1975	3.6	2.52	1.08	70
1974	4.5	3.41	1.09	76
1973	5.8	4.42	1.38	76
1972	7.9	5.14	2.76	65
1971	8.6	5.93	2.67	69
1970	6.5	4.92	1.58	76
1969	7.0	4.25	2.75	61
1968	8.0	5.91	2.09	74

The Great Lakes maritime community has promoted general cargo activity in the area. Various local, state and Federal agencies have been dedicated to promoting general cargo and container activity in the Great Lakes. In spite of these efforts, the level of liner carrier services offered in the Great Lakes has dropped considerably. Table III-3 shows the number of liner carriers serving the Great Lakes trades over time. In 1971, 43 liner operators provided service to the lakes from all major foreign trade areas. By 1980, only eight scheduled liner services remained in the lakes.

During the early 1970s, most of the Great Lakes services were breakbulk. As more trade routes were containerized, the number of carriers decreased; for the most part they were not replaced with container services, however. The next chapter will analyze the competitive position of the Great Lakes for direct container services.

TABLE III-3
 Number of Scheduled Liner Carriers Serving the U.S. Great Lakes, 1962-1980

Foreign Area	Year											
	1962	1964	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Europe	20	21	11	8	8	5	6	6	6	5	3	2
Mediterranean	11	2	5	4	2	3	3	3	3	2	2	2
Far East	4	2	7*	4*	1	4	5	3	2	0	0	0
South & Central America	2	4	6	2	2	2	2	2	2	1	1	1
Africa	0	1	6	5	3	2	2	3	3	2	0	1
Middle East & Australia/ New Zealand	6	2	8	4	2	2	2	3	4	2	2	1
Total Number of Liner Carriers	43	32	43	27	18	18	20	21	20	12	9	8

* Three carriers of the Japanese Consortium were counted as one.

Sources: Journal of Commerce and Maritime Administration Office of Trade Studies and Statistics.

IV. THE OUTLOOK FOR DIRECT CONTAINER SERVICES

Container shipments by direct vessel service will probably remain at a low level on the Great Lakes because the lakes are not a viable market for direct container vessel services. Containers currently represent approximately 10 percent of the lakes liner tonnage and the container tonnage will probably remain at this low level.*

The Great Lakes is a viable transportation alternative for selected segments of the liner market. The liner cargo which can be captured by Great Lakes all-water service includes cargo for which containerization does not offer significant advantages, special cargoes such as heavy lifts, and some low-value cargoes requiring inexpensive transportation. These liner cargoes will probably continue to move via the Great Lakes but the overall liner tonnage will probably not experience much growth.

This chapter will discuss the reasons why container movements by direct vessel service will probably remain at a low level. Container cargo activity in the Great Lakes is addressed from the following viewpoints:

- . Shipper perspective
- . Liner carrier perspective
- . Industry and regulatory developments that might impact Great Lakes container activity.

These sections are presented below.

1. GREAT LAKES CONTAINER SHIPPERS DO NOT USE THE ALL-WATER ROUTE BECAUSE IT DOES NOT MEET THEIR SERVICE REQUIREMENTS

Shippers in the Great Lakes hinterland do not move their containers by the all-water route to any significant degree. The Great Lakes all-water route does not provide the level and quality of service required by these

* On all other U.S. coasts, container tonnage represents 55 percent of liner tonnage.

shippers. This section will address the service requirements of general cargo shippers and compare the alternate transportation routes available to Great Lakes shippers.

(1) Quality of Service and Transit Time Are More Important to General Cargo Shippers Than Transportation Costs

Numerous surveys have been conducted to ascertain the relative importance to shippers of one service characteristic or factor over another. The findings of such surveys lend insight into cargo routing criteria and decisions. A review of the service characteristics important to general cargo shippers indicates the competitive position of the Great Lakes.

Shipper surveys indicate that general cargo shippers are most interested in the quality and level of service and transit time. Transportation costs are of secondary importance to these shippers.

Table IV-1 describes the shipper surveys* used in this analysis. The first three surveys were specifically tailored to Great Lakes users and addressed specific Great Lakes issues, for example, seasonality of service. The last two shipper surveys used are recent and identify the criteria generally used in port and route selection.

The findings of the surveys are presented in Table IV-2. The findings show that quality of service and transit time are the most important considerations for a shipper in selecting his cargo routing. Transportation cost is a secondary consideration for general cargo shippers and ranks comparatively with port facilities and cranes. The seasonality of the navigation season is an important

* The Market Strategy Model was developed by the Maritime Administration and considered for use in this analysis. It was not included in the analysis because the model was not readily available for use. (MarAd was in the progress of renegotiating a contract for making the model generally available. Even if the model were available, the data on which the model is based had poor coverage of Great Lakes users and specific Great Lakes issues.

TABLE IV-1
Shipper Port and Service Preference Surveys

Survey	When Conducted	Scope	How Conducted	Number of Respondents	Comments
"Great Lakes Traffic and Competition Study," Simat, Helleisen & Eichner	1978	Great Lakes Shippers	Personal and Telephone Interviews	50	Port Directors Provided Names, Balance Chosen from American Traders Index
"Economic Analysis of the Port of Chicago," Booz-Allen & Hamilton	1976	Exporters and Importers in Illinois, Indiana, Wisconsin and Iowa	Mail Questionnaire	120	Shipper Names Provided by Illinois Department of Business and Economic Development
"Traffic Forecast Study," A.T. Kearney	1975	U.S. and Foreign Shippers, Carriers, Govt. Agencies, Freight Forwarders and Others	Personal and Telephone Interviews	120	Survey Names Compiled by Corps, Kearney, St. Lawrence Seaway Devlp. Corp.
"Massachusetts Port Authority Maritime Strategy Project," Booz-Allen & Hamilton	1980	New England Exporters and Importers	Personal Interviews and Mail Questionnaire	285	Survey Names Compiled from Journal of Commerce, Massport Listings and Mass. Manufacturers Directory
"What's Important in a Port?," Distribution Worldwide Magazine	1979	U.S. Traffic and Distribution Managers	Mail Questionnaire	234	

TABLE IV-2
 Port and Service Preference Factors by Degree of
 Importance to Shippers

	Great Lakes Specific Surveys			General Shipper Surveys	
	Great Lakes Traffic and Competition Study	Port of Chicago Study	A.T. Kearney G.L. Traffic Forecast	Massport Study	Distribution Worldwide
Availability, Frequency and Reliability of Service	V	V	I	V	V
Transit Time	V	V	I	I	NA
Transportation Cost	I	I	I	I	V
Port Facilities/Cranes	I	I	I	NA	V
Carrier Customer Services	L	L	I	L	I
Seasonality of Seaway Year-round Service	I	V	I	NA	NA

V= Very Important
 I= Important
 L= Less Important
 NA = Not Available or Applicable

consideration as well, ranking above transportation cost. The order of importance of the service attributes is as follows:

- . Quality and level of service
- . Transit time
- . Seasonality of service
- . Transportation cost
- . Port facilities/cranes.

A detailed review of the findings of each of the above surveys is presented in Appendix B.

The next section addresses the alternative transportation routes available to the Great Lakes shippers. The shippers' perspective on a limited navigation season is also addressed.

(2) Current Great Lakes All-Water Container Services Are Inferior to Alternate Routes and Until a Parity Service Is Available the Lakes Will Probably Not Be Used More Frequently

Table IV-3 identifies the liner carriers currently offering all-water service to the Great Lakes. Eight carriers advertise regular service and one of these, Manchester Liners, offers a feeder service via Montreal. A container feeder service is the subject of the next chapter of this report. Manchester Liners is addressed here to allow a comparison of the container feeder service with Great Lakes all-water services and other alternate routes.

With the exception of Manchester, the all-water carriers offer approximately one sailing per month out of the Great Lakes. Again, with the exception of Manchester, the all-water services offered are breakbulk with limited container capacity.

These all-water services cannot compete with the alternate services offered via other coasts. This inability to compete is, to a degree, based on the longer navigation distances out of the Great Lakes. Table IV-4 shows selected nautical distances involving the Great Lakes, New York and New Orleans. The longer distances contribute to higher costs, longer transit times and less frequent service.

The major service alternatives available to shippers in the Great Lakes/Europe trade* are

* The Great Lakes/Europe trade is the largest Great Lakes general cargo trade route involving the Great Lakes hinterland.

TABLE IV-3
Liner Carriers Currently Offering Great Lakes
All-Water Service¹

Foreign Area	Type of Service
<u>Europe</u>	
Polish Ocean Manchester Liners	Breakbulk ² Containers via barge feeder to Montreal
<u>Mediterranean</u>	
Lykes Yugoslav	Breakbulk and Containers Breakbulk and Containers
<u>South & Central America</u>	
Great Lakes Transcaribbean	Breakbulk ²
<u>Middle East</u>	
SCI	Breakbulk
<u>Africa</u>	
Safmarine Armada Line	Breakbulk Breakbulk

1 As of October 1980.

2 With limited container capacity.

Source: Journal of Commerce

presented in Table IV-5. The direct and feeder services via the lakes cannot compete on a transit time and service frequency basis. The rail/water services via the U.S. and Canadian coasts are both faster and more frequent.

Table IV-6 shows the alternative services available to shippers in the Great Lakes/Mediterranean trade.* The transit time of the

* The second largest Great Lakes trade.

TABLE IV-4
Selected Nautical Mile Distances
(All-Water Route)

Domestic Port Foreign Port	Duluth	Chicago	Detroit	New York	New Orleans
Hamburg	4770	4677	4044	3674	4536
Rotterdam	4614	4521	3886	3411	4837
Naples	5504	5411	4778	4179	4533
Cape of Good Hope	9478	8385	7752	6801	7294
Singapore ¹	11458	11365	10732	10129	11486
Yokohama ²	12230	12137	11504	9700	9125
Rio de Janeiro	6698	6605	5972	4762	5136

- 1 Suez Transit.
 2 Panama Transit.

TABLE IV-5
Great Lakes/Europe Service Alternatives

Service Options	Carrier offering Services	Average Transit Time	Typical ¹ Rate	Service Frequency
Direct All Water Service	Polish Ocean	24-28 days		Monthly
Barge Feeder via Montreal	Manchester	15-16 days		Weekly
East Coast Rail/Water Service	ACL, Sealand, U.S. Lines ²	9-11 days		Every 1-2 days
Canada-Truck or Rail/Water Service (Thru B of L)	Cast	9-13 days	\$1000-1300/20' (Door to Door)	Every 4-7 days
Canada-Truck or Rail/Water Service	Hapag Dart	13-15 days		2-3 Sailings Per Week

- 1 Based on a Chicago-Rotterdam Movement.
 2 These are not the only carriers serving this market but are the premier carriers. Most N. Atlantic carriers are in this market.

TABLE IV-6
Great Lakes/Mediterranean Service Alternatives

<u>Service Options</u>	<u>Carrier Offering Services</u>	<u>Average Transit Time</u>	<u>Service Frequency</u>
Direct All-Water Service	Yugoslavs Lykes	22-27 days ¹	Every 2 weeks
East Coast Rail/Water Service	Sea-Land ² Zim	16-18 days	Every 1-2 days
Gulf Coast Rail/Water Service	Lykes ² Costa	18-20 days	Every 2-3 days

1 While the ocean transit is fairly fast, these carriers often spend 12-14 days in the Great Lakes.

2 Numerous carriers offer service from the East and Gulf Coasts.

Great Lakes all-water route is inferior to the transit time of alternate routes. The frequency of service out of the lakes to the Mediterranean is not competitive with that offered over other coasts.

In terms of type of ocean service available to the shipper, the U.S. and Canadian East Coasts and the U.S. Gulf Coast again have an advantage over the lakes. As described earlier, the Great Lakes all-water service is predominantly breakbulk with some container capability. All types of cargo handling are available to shippers on the competitive coasts.

A unique service characteristic of the Great Lakes all-water route is the limited navigation season. A 12-month transportation service is very important to container shippers. The lack of a year-round season in the lakes is viewed by shippers as a shortcoming. Shippers who use the lakes route must arrange alternate service for the winter months or accept substitute service from the carriers. Previous Great Lakes studies have found that a navigation season extension would have to be complete, i.e., almost 12 months, to significantly change shippers' views and increase container tonnage through the Great Lakes.

This section has reviewed perceptions and preferences of general cargo shippers regarding transportation services and the Great Lakes all-water route.

2. THERE ARE SIGNIFICANT BARRIERS INHIBITING LINER CARRIERS FROM ESTABLISHING GREAT LAKES ALL-WATER SERVICES

From the perspective of the liner vessel operator, several barriers inhibit serving the Great Lakes market by the all-water route. This section will address the reasons why the all-water route is not attractive to a liner operator.

(1) The Liner Carriers Are Currently Serving This Market by Alternate Routes

Liner carriers operating on competing coasts are presently carrying Great Lakes hinterland cargoes. While some of this cargo does move on the all-water route, the major portion of it moves via other U.S. coasts or Canada. Table IV-7 shows the customs district of export or import of the Great Lakes hinterland general cargo. Eleven percent of the general cargo exports and 27 percent of the imports move through a Great Lakes customs district. The Great Lakes handles even less of the container cargo. Only 4 percent of the export container tonnage and 5 percent of the import container tonnage move through the lakes. The table shows that the major portion of the general cargo moves over the U.S. East Coast.

TABLE IV-7
Area of Exit/Entry of General Cargo Moving To/From Great Lakes Hinterland States,¹ by Percentage of Tonnage, 1976

	Customs District of Exit/Entry								
	New York	Balt-more	Miami	New Orleans	Los Angeles	San Fran	Chicago	Canada	Other
<u>EXPORT</u>									
General Cargo	31%	29%	5%	12%	1%	5%	11%	4%	2%
Container	41%	25%	5%	6%	3%	8%	4%	6%	2%
<u>IMPORT</u>									
General Cargo	25%	21%	1%	11%	3%	7%	27%	2%	2%
Container	40%	19%	3%	4%	6%	17%	5%	4%	2%

1 Great Lakes hinterland states include the 19 states defined as penetration states in the Great Lakes Traffic and Competition Study. The states include Illinois, Indiana, Michigan, Ohio, Wisconsin, Minnesota, Pennsylvania, New York, Colorado, Iowa, Kansas, Kentucky, Missouri, Montana, Nebraska, North Dakota, South Dakota, West Virginia and Wyoming, and are defined as state of acquisition or destination of the cargo.

Source: Bureau of the Census, Domestic and International Transportation of U.S. Foreign Trade: 1976.

Table IV-8 presents a similar analysis for the primary Great Lakes hinterland states.* The all-water route captures a larger share of the general cargo in the primary hinterland but it is still less than half. The all-water route handles 48 percent of the import general cargo. The all-water route share in this case is believed to be heavily weighted by inbound iron and steel which is not truly a liner cargo. The all-water route handles only 22 percent of the export general cargo tonnage. Again, the all-water route's share of the container market is much less. Only 8 percent of the export containers and 10 percent of the import containers move on the Great Lakes all-water route. Liner carriers serving the East, Gulf and West Coasts are carrying most of this general cargo.

Alternate services through Canadian ports are also capturing Great Lakes general cargo. This alternate route has been used increasingly in recent years. The trend in diversion of U.S. general cargo to Canada is shown in Figure IV-1. While the figure identifies total U.S. general cargo diversions, the upward trend is probably equally applicable to Great Lakes cargo due to its proximity to Canada. The Canadian diversions are growing at a faster rate than U.S. liner cargoes.

The primary carrier capturing this U.S. cargo for Canadian diversion is Cast lines. Cast's current expansion program indicates that it expects the Canadian diversion to continue and increase. Cast has announced a \$238 million expansion program designed to double container handling capacity by 1983. Cast has ordered six new vessels with a capacity of 1,450 TEUs each, purchased 4,000 forty-foot containers, acquired two new container cranes for its Montreal terminal, and tripled the size of its current truck fleet. It is estimated that 60 percent of the containers handled by Cast are of U.S. origin or destination.

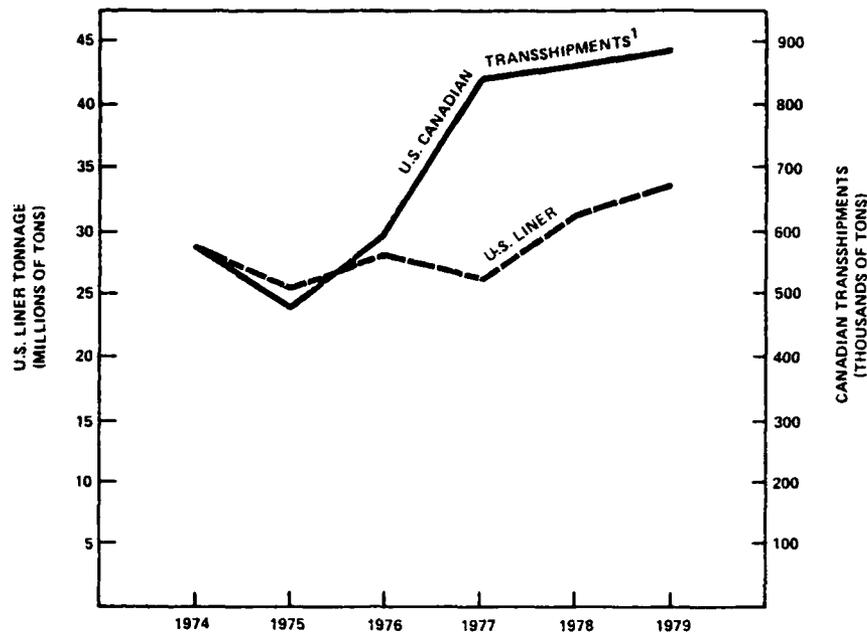
* The primary hinterland states are defined as those fronting the Great Lakes but without major ports on other coasts. The states include Minnesota, Wisconsin, Michigan, Illinois, Indiana and Ohio. New York and Pennsylvania are excluded as they have major ports on the East Coast.

TABLE IV-8
 Point of Exit/Entry of General Cargo Moving To/From
 Primary Great Lakes Hinterland States,¹
 by Percentage of Tonnage, 1976

	Point of Exit/Entry								
	New York	Baltimore	Miami	New Orleans	Los Angeles	San Francisco	Chicago	Canada	Other
<u>Export</u>									
General Cargo	22%	28%	6%	9%	1%	6%	22%	6%	1%
Container	31%	30%	7%	5%	2%	7%	8%	12%	1%
<u>Import</u>									
General Cargo	8%	11%	1%	14%	3%	9%	48%	4%	1%
Container	22%	18%	3%	4%	7%	27%	10%	8%	1%

¹ States include Minnesota, Wisconsin, Michigan, Illinois, Indiana and Ohio and are defined as state of acquisition of the cargo.

Source: Bureau of the Census, Domestic and International Transportation of U.S. Foreign Trade: 1976.



¹ General cargo only.
Source: Maritime Administration

FIGURE IV-1
U.S. Liner Exports and
Canadian Transshipments

This section has identified how the liner industry is currently serving the Great Lakes market. It was shown that the market is served mostly by the overland route. The next section identifies the carrier costs to serve this market.

(2) Based on Current Economic Condition, Liner Carriers Cannot Serve the All-Water Route and Compete on a Cost Basis

A cost analysis was performed to determine the comparative cost per TEU or ton of serving the Great Lakes directly or via the U.S. East Coast. The cost per unit is shown to be 20-25 percent higher on the all-water Great Lakes route. The higher cost to serve the lakes is due to several factors:

- . Longer distances in most cases
- . Increased voyage days due to distance and seaway transit
- . An economy of scale penalty due to operation of smaller vessels and, in many cases, not being able to load full (due to vessel size and depth restrictions in the locks).

- Limited navigation season causing winter vessel lay-up and operational costs, or additional costs to operate on another route in the winter.*

A comparison is made of a carrier's cost of providing service to Europe from the Great Lakes and from the U.S. East Coast. The European trade was chosen for this analysis, as all previous studies of the Great Lakes select Europe as the most feasible general cargo trade route. Table IV-9 shows the foreign trade routes for Great Lakes hinterland container tonnage. Europe represents 66 percent of this market. The East Coast was chosen as the alternate coast as it is the coast over which most of this European trade now moves.

TABLE IV-9
Containerized Tonnage To and From Great Lakes States, by Foreign Area (1976)

Trade Area	Tonnage (000)	% of Tonnage
Asia	252	5%
Europe	3059	66%
Mediterranean	590	13%
Africa	160	3%
Middle East	183	4%
Central & South America	390	8%
Oceania	5	-
TOTAL	4639	100%

NOTE: Great Lakes states included are Illinois, Indiana, Michigan, Minnesota, New York (except southeast portion, Ohio, Pennsylvania (except southeast portion), and Wisconsin.

Source: Bureau of the Census, Domestic and International Transportation of U.S. Foreign Trade: 1976.

The cost analysis is based on the costs of subsidized U.S. flag operation. The vessel operator is assumed to receive both construction and operating differential subsidy. Wages, insurance and some maintenance and repair costs are subsidizable to the

* These problems are considerably lessened in a large carrier organization with multiple trade routes. Even in a large organization, however, there are probably overhead costs to be absorbed due to a partial year service.

extent that these costs are reduced to levels comparable to foreign flag competition on the same trade route. These subsidizable costs represent approximately 80 percent of vessel operating costs. Operating costs after subsidy are approximately equal to foreign flag operating costs.

Subsidy rates vary by trade route. In the Great Lakes trade a subsidy rate of 70 percent was used as indicated by MarAd's Great Lakes Traffic and Competition Study. The subsidy rate for the East Coast trade was assumed to be 30 percent to reflect operating cost levels of the European flag competition.

Vessel capital costs are based on new vessel construction at 1980 prices. In fact, the Great Lakes would probably be served by older vessels which are partially or fully amortized. The cost of an older vessel would be less. Cargo handling costs are based on tariff rates which reflect current liftings, and could probably be negotiated to a lower level if volumes increased. Due to these factors, the costs per TEU or ton developed in the pro formas may be somewhat overstated. It is believed that these costs are representative of current operating cost differentials.

The pro forma comparisons are based on three scenarios:

- . A 660-TEU container vessel in the Great Lakes service and a 660-TEU vessel in an East Coast service with the same utilization.
- . A 660-TEU container vessel in the Great Lakes service at 100 percent utilization and a 1,700-TEU container vessel in an East Coast service with 90 percent utilization.

- . A 796,000 cubic foot capacity combination vessel* in both services at 100 percent utilization.**

All background and support data for the pro formas are included in Appendix C.

Table IV-10 presents the pro forma cost for the 660-TEU vessel serving the Great Lakes and the East Coast. The carrier's cost per TEU in the all-water service is \$1,606. The carrier's cost per TEU in the East Coast service is \$1,313. The cost per TEU is 22 percent higher in the lakes. The cost per TEU to the East Coast does not include inland transportation cost, which is usually for the shipper's account rather than the carrier's account. Most East Coast liner carriers are presently handling the Great Lakes hinterland cargoes without covering the inland transportation cost.

The analysis assumes that the vessel serving the Great Lakes is laid up during the winter. The feasibility of finding alternate winter service for the vessel was not addressed. The cost per TEU from the lakes would decline if winter lay-up costs were not absorbed by the in-season Great Lakes voyages. In Table IV-10, the cost per TEU for the Great Lakes service would decrease to approximately \$1,585 if it were assumed that the ship would be operated elsewhere during the winter and lay-up costs would not be incurred.

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- * The combination vessel is close to the maximum size that will fit into the St. Lawrence Seaway. The vessel deadweight is 14,500 tons which is comparable to the deadweight of the 660-TEU container vessel. The vessel specifications are shown in Appendix C.
 - ** One hundred percent utilization is based on the maximum tonnage allowable to transit the St. Lawrence Seaway. In this case, the 660-TEU vessel is constrained to a capacity of 584 TEUs. In the lakes, 584 TEUs represent 100 percent utilization, whereas on a deep sea voyage 584 TEUs would be 89 percent utilization. The combination vessel is constrained in the Great Lakes to 8,700 tons which is approximately 75 percent of deep sea capacity.

TABLE IV-10
Carrier Costs per Voyage and TEU--
660-TEU Container Vessel Service

Costs	Great Lakes	Fast Coast
	Detroit-Chicago Rott-Hamburg	New York-Baltimore Rott-Hamburg
Vessel Operating Costs	\$ 135,082	\$ 178,226
Voyage Costs		
Fuel	423,794	362,199
Port Charges	24,234	18,493
Cargo Handling	461,952	491,792
Seaway Tolls	14,571	NA
Pilotage	11,796	867
Container Costs	175,230	132,750
Winter Lay-up	184,078	NA
Admin. & Overhead	170,487	139,373
Capital Costs	274,134	209,400
Total Costs per Voyage	\$1,875,358	\$1,533,100
Cost per TEU @ 100% Util. or 1168 TEUs	\$1,606	\$1,313

Note: Support documentation is shown in Appendix C.

Use of the small container vessel on the East Coast does not realistically reflect the type of vessel or service currently offered in the East Coast/European trade. Liner operators in that trade run large, fast vessels and offer a weekly or better frequency. Consequently, a pro forma comparison involving a large container vessel was performed. That pro forma analysis is presented in Table IV-11. A 1,700-TEU container vessel operating at 90 percent

TABLE IV-11
Carrier Cost per Voyage and TEU--
1,700-TEU Container Vessel Service,
U.S. East Coast/Europe

Costs Per Voyage	New York-Baltimore Rotterdam-Hamburg
Vessel Operating Costs	\$ 187,515
Voyage Costs	
Fuel	23,666
Port Charges	450,234
Cargo Handling	1,084,080
Seaway Tolls	NA
Pilotage	1,329
Container Costs	317,609
Winter Lay-up	NA
Admin. & Overhead	234,129
Capital Costs	276,853
Total Costs per Voyage	\$2,575,415
Cost per TEU @ 90% Util. or 3080 TEUs	\$836

Note: Support documentation is shown in Appendix C.

utilization has a cost per TEU of \$836. This cost is half of the Great Lakes cost per TEU of \$1,606. In this situation, the East Coast liner operator could even pay the inland freight cost* and still serve the Great Lakes market at a lower cost.

The comparative cost of liner service was also analyzed for a combination vessel. The vessel was assumed to lift both containers and breakbulk general cargo. The cost per ton for the Great Lakes service is \$117 and the cost per ton for the East Coast service is \$95. Thus, it is 22 percent more costly via the Great Lakes route. This pro forma analysis is shown in Table IV-12.

* The inland transportation cost per container from the Midwest to a North Atlantic coast port is \$500-600.

TABLE IV-12
Carrier Cost per Voyage and Cargo Ton--
Combination Vessel Service

	Great Lakes	East Coast
	Detroit-Chicago Rott-Hamburg	New York-Baltimore Rott-Hamburg
Vessel Operating Costs	\$ 129,746	\$ 169,098
Voyage Costs		
Fuel	405,746	341,285
Port Charges	26,804	24,190
Cargo Handling	568,780	630,420
Seaway Tolls	29,963	NA
Pilotage	15,336	1,037
Container Costs	166,575	125,688
Winter Lay-up	216,019	NA
Admin. & Overhead	184,814	150,991
Capital Costs	289,169	218,190
Total Costs per Voyage	2,032,952	1,660,899
Cost per Tons @ or 17,400 Tons	\$116.84	\$95.45

Note: Support documentation is shown in Appendix C.

This comparison does not consider such cargoes as heavy lift and oversized pieces. These types of cargoes are present in the lakes area and are not conducive to intermodal movement. An all-water service handles these cargoes best. This general cargo does not usually require a liner carrier, however, and can utilize an irregular, tramp-type carrier.

(3) If the Liner Carrier Provides a Door-to-Door Intermodal Service to the Great Lakes Shipper, the All-Water Route May Be a Cost-Effective Alternative for Serving the Container Market

If the ocean carrier provides an intermodal service to the Great Lakes shipper's door, the all-water route becomes more attractive from a cost standpoint. In this case the ocean carrier would pay inland transportation charges and would probably also pay some empty container positioning charges.

The previous analysis was based on unsubsidized U.S. flag operating costs. A comparable analysis was performed for unsubsidized U.S. flag operations. For the 660-TEU container vessel used in the lakes, the unsubsidized U.S. flag cost per TEU is \$1,767. The comparable cost from the East Coast is \$1,366. For the large 1,700-TEU ship operated on the East Coast, the unsubsidized cost is \$857. The cost differential associated with providing service to the lakes is greater for the unsubsidized cases, reflecting the higher net operating costs of unsubsidized operation.

A comparison was made of the carrier's cost to provide a service to the shipper's door by the all-water route and by the East Coast route. This option was analyzed only for the full container service. For this analysis, Peoria, Illinois, was chosen as representative of the shipper location.

The comparative cost per TEU of service to Peoria is shown in Table IV-13. The table shows that with intermodal costs included, the 660-TEU vessel service from the East Coast is more costly than the all-water route. With the 1,700-TEU vessel, however, the East Coast service is still more cost-effective.

The cost per TEU of the lakes service is \$1,806 compared to \$1,611 from the East Coast with a large containership. As mentioned previously, the large vessel is more representative of the actual vessel type used in the East Coast/Europe trade.

TABLE IV-13
Carrier Cost Per Container--Peoria,
Illinois, to Europe

	Great Lakes Cost	East Coast Cost	
		660-TEU Vessel	1,700-TEU Vessel
Ocean Voyage Cost	\$1,606	\$1,313	\$ 836
Rail Cost--Chicago To/From Baltimore	N/A	575	575
Dray Cost--Peoria To/From Chicago	200	200	200
Total Door-to-Door Cost	\$1,806	\$2,088	\$1,611

The cost to serve Peoria directly by rail rather than via Chicago was also evaluated. This route is more costly, however, as it is a joint interline route and does not have volume rates.*

Table IV-13 does not include the container positioning charges which the ocean carrier may have to pay to the railroad to move empty units. The ocean carrier will attempt to balance its rail movements to minimize this charge. Due to this, the per unit charge is difficult to estimate. The empty container charge will increase the East Coast cost more than the Great Lakes cost. The result of this would be that Great Lakes and East Coast costs become nearly equal.

The Great Lakes liner market has been reviewed in terms of the carrier perspective on cargo opportunities and cost to serve the market. The next section will address other factors which influence a water carrier decision to provide service to the Great Lakes.

* The Peoria to Baltimore route is TPW-Logans Point, Indiana-Conrail. The rate is \$779 (excess charge \$2.08) and the local dray to the Peoria railhead is estimated at \$50. Conrail does not cover dray from railhead to pier at Baltimore.

(4) Other Operational Considerations Are a Negative Influence Against a Carrier Establishing a Great Lakes Liner Service

Other operational considerations are a negative influence against the establishment of liner service in the Great Lakes. These operational considerations include the following:

- . Vessel size restrictions limit the vessels that can be used in the lakes.
- . The winter closing presents operational and administrative difficulties.
- . Lack of adequate container port facilities are also a deterrent.

Each of these factors has been well documented in the past and will be addressed only briefly.

The St. Lawrence Seaway and Welland Canal lock systems impose a restriction on the size of vessels that can transit the Great Lakes. The vessel size that can transit is small by today's standards. The trend in the liner industry is toward larger ships. The trend to larger vessels is particularly true for containerships. Only a small percentage of today's container vessels will fit into the lakes. Table IV-14 presents a breakdown of the world container fleet by size of vessel. Assuming that a 600-TEU container vessel is approximately the maximum size that can transit the GL/SLS, only 32 percent of the world fleet is suitable. Of the ships recently built or on order, the percentage is even less.

The trend toward larger vessels and the operational economies realizable from large vessels will make the Great Lakes unattractive for most liner operators. The exception to this might be the combination vessel carrier. While the combination vessel might be able to serve the Great Lakes from a cost standpoint, this vessel type has limited container capacity and is usually inefficient at handling containers.

The winter closing of the Great Lakes presents operational and administrative difficulties for carriers. In the winter season, the carrier must transfer to a new route or lay up for the season. Unless the carrier is large with numerous routes, either choice can be a burden.

TABLE IV-14
World Container Vessel Fleet¹ and New
Buildings by Size of Vessel²

	WORLD FLEET	NEW BUILDINGS
Vessels of 600 TEU ³ Capacity or Less	195	10
Vessels of More Than 600 TEU Capacity	423	75
600 TEU Vessels as a % of Total	32%	12%

- 1 Includes fully cellular container vessels only.
- 2 While vessel size can vary by TEU capacity, it is generally believed that a 600 TEU vessel is approximately the maximum size container vessel that can transit the GL/SLS.
- 3 Does not include small feeder and coastal container vessels.

Source: Containerization International Yearbook, 1980.

The current lack of modern container port facilities in the Great Lakes is a particular disincentive for container operators. Lack of container cranes increases a carrier's cargo handling time and voyage days. Container operators prefer preferential berthing or leased facilities and choice of stevedores. Many carriers on the East Coast have exclusive terminal leases and flexibility in the choice of stevedores. In the Great Lakes, terminals are leased exclusively to stevedores/terminal operators. This could be a problem for container carriers coming into the Great Lakes.

This section has addressed liner and container service in the Great Lakes from the carrier's perspective. Liner operators have few, if any, incentives to serve the lakes by the all-water route. The costs to serve the lakes by all-water is higher and the market can be captured with alternate services by other coasts. Various operational considerations are also a disincentive to serve the lakes.

The next section will address industry trends which could impact the competitive nature of the Great Lakes.

3. INDUSTRY AND REGULATORY TRENDS OR DEVELOPMENTS WILL NOT CHANGE THE COMPETITIVE POSITION OF THE GREAT LAKES

Regulatory and other developments in the maritime industry could have an impact on the competitive position of the Great Lakes. In that most of these developments are promulgated at the national level by government and industry, it is difficult to evaluate the effect on the Great Lakes specifically. However, some initiatives have taken place related to the Great Lakes specifically. Relevant industry developments are presented below.

(1) UNCTAD

UNCTAD is a United Nations code on trade. While the code covers many subjects, one of its provisions is cargo reservation for the national flag fleets of the trading nations. Commonly referred to as 40:40:20, the provision reserves 40 percent of the cargo for the two national flag fleets and 20 percent for third flag fleets. UNCTAD has not yet been adopted by the United States but the trend worldwide is toward its adoption.

The adoption of UNCTAD would not necessarily influence more liner operators to serve the lakes. U.S. carriers would be guaranteed a percentage of the trade and would not be motivated to serve the lakes to capture new cargoes. Lykes is the only U.S. flag liner carrier presently serving the lakes. Lykes' motivation to serve the lakes would be less if a certain share of tonnage were reserved for it on its other routes.

The exact interpretation and administration of UNCTAD is still undecided. That interpretation will determine, to a large degree, its impact on national fleets, coasts and ports.

(2) Rail and Truck Deregulation and Pricing Trends

The result of rail and truck deregulation is still uncertain. The result will probably not benefit the Great Lakes. The truck and rail services will tend to move to high-volume routes where the trade is balanced. Low-volume routes will have less service or pay higher prices.

Many railroads have imposed an empty marine container movement charge of \$200-\$800 per flat car. This action means that shippers have to pay to have empty marine containers positioned back to their facility. This charge should encourage shippers to use Great Lakes ports as the empty positioning charge would be less than from an East Coast port.

(3) Fifty Mile Rule

The "50 mile rule" requires that all containers moving to and from points within 50 miles of a port and containing goods for more than one shipper be stuffed or stripped at the pier by longshore labor. The "50 mile rule" would probably not promote or influence any one U.S. coast over another.

(4) Regulatory Changes To Promote the U.S. Great Lakes

Several measures have been proposed by the Federal Government to promote shipping through the Great Lakes. The measures usually relate to extending the shipping season. As shown previously, a season extension will not increase general cargo traffic through the lakes unless it allows year-round service. With a year-round season, the liner service would have to be comparable to or better than liner services off other coasts.

Another suggested regulatory change is to allow subsidized Great Lakes carriers to offer an alternative winter route without disturbing their subsidy agreements. This would increase liner service in the lakes only if other incentives also existed for coming into the lakes. In other words, such a regulation would not be an incentive for a carrier to serve the lakes. The absence of such a regulation does act as a disincentive, however.

A much discussed regulatory change is the regulation of U.S. foreign trade cargoes moving through Canada. The impact of this would depend on the nature of the regulation, which is still uncertain. If Canadian diversion were stopped or decreased, the liner cargo would still tend to move over alternate coasts.

Another proposed regulatory development is to require a minimum of 10 percent of U.S. Government-impelled cargo to move through each U.S. coast. The Great Lakes currently handles less than 10 percent of this tonnage. Such a regulation would increase tonnage through the lakes and would attract U.S. flag operators into the trade.

This chapter has described the outlook for direct container services in the Great Lakes. The next chapter evaluates the outlook for container feeder services in the Great Lakes.

V. THE OUTLOOK FOR CONTAINER FEEDER SERVICES

The best potential for serving the Great Lakes general cargo market by the all-water route is a container feeder service. A container feeder service has both negative and positive considerations. From the shipper's perspective, a container feeder service is often an inferior service. From the carrier's perspective, a feeder service is a viable alternative. These considerations are presented below.

1. A CONTAINER FEEDER SERVICE CAN COMPETE ON A COST BASIS WITH THE LAND MODES CURRENTLY MOVING THE CARGO

A general cargo feeder service would connect with an oceangoing vessel at a tidewater port. The feeder service would be competing with the alternate land modes for moving cargo to that tidewater port. To compete, the feeder service must have quick turnaround time and must minimize cargo handling costs. For these reasons, the feeder system would handle containers and would not handle non-container general cargo.

In the Great Lakes a container feeder service would compete for cargo moving to the U.S. and Canadian East Coast. Rail service to the East Coast tidewater ports (Montreal, New York, Baltimore) takes two days and costs approximately \$550 per container. A container feeder service to Montreal is the most feasible based on distance.

A pro forma cost analysis of a feeder service connecting the Great Lakes and Montreal was performed. The analysis shows that such a feeder system can be competitive from a cost standpoint.

To be competitive, however, the feeder service must minimize its cost of operation. The analysis was performed on a 168-TEU capacity integrated tug barge (ITB) and a 306-TEU capacity chartered vessel. The capital costs and low capacity of the ITB made that service prohibitive, as the cost per TEU with the ITB was \$746.

The pro forma for a small chartered vessel shows that the feeder service could be competitive on a cost basis. To be cost competitive the vessel must have good

utilization. At 80 percent utilization the cost per TEU is \$523. As the utilization improves, the cost per TEU decreases. Table V-1 presents the pro forma cost analysis on the charter vessel service. The support documentation is provided in Appendix C.

TABLE V-1
Carrier Cost per Voyage and TEU--
Vessel Feeder Service¹

Costs	At 55% Utilization or 337 TEUs	At 80% Utilization or 490 TEUs	At 95% Utilization or 580 TEUs
Vessel Operating Costs ³	\$ 59,785 (2)	\$ 64,460 (2)	\$ 67,210 (2)
Voyage Costs			
Fuel	32,109	32,306	32,615
Port Charges	1,589	2,153	2,768
Cargo Handling	84,388	117,400	140,800
Seaway Tolls	4,514	6,068	6,977
Pilotage	10,500	10,500	10,500
Capital Costs	(2)	(2)	(2)
Admin. & Overhead	19,289	23,288	26,087
Total Costs per Voyage	\$212,174	\$256,175	\$286,957
Cost per TEU	\$631	\$523	\$495

1 Based on 306-TEU vessel. Itinerary is Montreal, Detroit, Chicago.

2 Based on vessel charter costs of \$5,500 per day. This cost covers the vessel operating costs (crew wages, subsistence, stores, M&R, and insurance) and the capital cost of the vessel.

3 Vessel operating costs increase with increase in utilization due to slightly longer voyages.

This analysis shows that a container feeder service can compete for the container market on a cost basis. The shipper's attitude concerning a container feeder service is addressed below.

2. A CONTAINER FEEDER SERVICE DOES NOT OFFER THE LEVEL AND QUALITY OF SERVICE REQUIRED BY THE SHIPPER

When factors other than freight rate are considered, a container feeder service is inferior to alternate service routes from a shipper's perspective. The average transit time for a feeder service is seven days compared to two by rail. The frequency of service is inferior to the rail/water combination service from the East Coast or Canada. From a cost standpoint the service is viable. The service would not meet all shipper requirements but could attract some segments of the container market.

* * * * *

Based on the analysis performed in this chapter, it would appear that a container feeder service via Montreal is a possible alternative for Great Lakes container service. This service would be contingent on low vessel operating costs. With these costs minimized, a feeder service can compete on a cost basis. The acceptability of such a service to shippers, however, is uncertain.

APPENDIX A
GREAT LAKES TRADE STATISTICS

Total Freight Traffic Carried on the Great Lakes

Year	Foreign		Domestic			Total
	Overseas	Canadian	Lakewise	Local	Other	
1978	19,722	50,787	142,666	6,342	1,770	221,375
1977	16,006	53,154	109,080	5,778	1,889	185,906
1976	11,761	53,896	132,113	6,259	1,804	205,833
1975	9,931	46,829	129,360	5,815	1,913	193,848
1974	9,092	42,370	146,068	6,922	2,393	206,845
1973	15,334	51,424	156,622	6,594	1,928	231,902
1972	15,919	44,214	145,013	7,020	1,723	213,975
1971	15,588	43,862	140,955	6,813	1,628	208,846
1970	11,371	50,967	157,059	6,993	1,833	228,222
1969	11,714	45,006	160,846	6,589	1,784	225,938
1968						
1967	10,118	45,116	153,597	6,551	1,821	217,253
1966	10,967	47,491	164,037	7,066	2,116	231,677

Source: Waterborne Commerce Statistics

Great Lakes Foreign Trade
1966-1979
with Service Type

Year	Tonnage (Short Tons)	Percentage by Service Type		
		Liner	Tramp	Tanker
1979	72,249,258	2%	94%	4%
1978	68,761,913	2	94	4
1977	68,126,477	2	95	3
1976	64,618,204	2	95	3
1975	56,655,116	2	96	2
1974	52,337,646	2	95	3
1973	65,154,323	3	93	4
1972	58,556,393	6	92	2
1971	59,388,753	6	92	2
1970	59,715,197	6	93	1
1969	54,994,938	4	94	2
1968	62,670,345	4	94	2
1967	56,603,986	7	92	1
1966	58,417,500	7	91	2

Source: St. Lawrence Seaway Development Corporation

Great Lakes Liner Cargo Liftings

Year	Exports	Imports	Total Tonnage
1979	963,871	481,114	1,444,985
1978	867,178	508,060	1,375,238
1977	722,284	640,246	1,362,530
1976	683,246	609,116	1,292,362
1975	706,241	426,861	1,133,102
1974*	576,559	470,194	1,046,753
1973	1,124,912	1,106,291	2,231,203
1972	1,021,645	2,205,139	3,226,784
1971	1,368,009	2,266,966	3,634,975
1970	1,419,420	2,180,673	3,600,093
1969	1,263,976	1,169,776	2,433,752
1968	1,546,778	1,269,391	2,816,169
1967	2,239,971	1,716,260	3,956,231
1966	1,970,500	2,134,000	4,104,500

* Several strikes in Lakes, collision at Welland Canal. Ocean shipping lost a minimum of 45 days.

Source: U.S. Great Lakes Ports Statistics, St. Lawrence Seaway Development Corporation.

Great Lakes Grain Exports Transshipped
 at Canadian Ports
 (in Thousands of Tons)

Year	Tonnage
1978 ¹	5,750
1977 ¹	4,050
1976 ¹	4,000
1975 ²	3,660
1974 ²	2,700
1973 ²	5,500

1 Source: U.S. Great Lakes Port Statistics.

2 Source: Annual Traffic Report, St. Lawrence Seaway.

Great Lakes Container Movements

Year	No. of Units ¹	Tonnage (000's of LT)
1979	(13,000)	159
1978	(10,000)	140
1977	5,000	79
1976	5,000	86
1975	3,000	46
1974	4,000	59

1 In 1978 and 1979 number of units are expressed in TEUS. In 1974-1977 number of units are defined as number of container moves of any size unit.

Source: MarAd Containerized Cargo Statistics.

Advertised Liner Carriers Serving the Great Lakes
by Foreign Trade Area
Selected Years 1962-1980

	1965	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
12 LUMBER 30	32 LUMBER 31 * ICE CAP	46 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	34 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	18 EUROPE 8	18 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	20 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	21 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	20 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	12 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	9 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	8 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	
11 LUMBER 30	41 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	42 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	43 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	44 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	45 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	46 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	47 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	48 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	49 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	50 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	51 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)	52 EUROPE (10) AFRICA (10) ASIA (10) AMERICA (10) MIDDLE EAST (10) AUSTRALIA (10) POLYNESIA (10) SOUTH PACIFIC (10) ANTARCTIC (10) ARABIAN GULF (10) INDONESIA (10) MALAYSIA (10) PHILIPPINES (10) SINGAPORE (10) THAILAND (10) VIETNAM (10)

Note: For 1962 and 1973, only the number of carriers could be determined. For some years, the estimated number of annual sailings are listed after the carrier name.

Source: Maritime Administration Office of Trade Studies and Statistics, Journal of Commerce and St. Lawrence Development Corporation.

APPENDIX B
ROUTE SELECTION CRITERIA

Criteria for Port Selection

Great Lakes Traffic and Competition Study,
Simar, Helliesen & Eichner

Criteria	Percentage of Respondents ¹	
	Bulk and Crude Cargo	Manuf. Goods and Chemicals
Costs	87%	54%
Transit Time	33%	66%
Port Service	53%	49%
Carrier Service	20%	23%
Service Reliability	40%	37%
Other	7%	11%

Improvements in Great Lakes Service
Which Would Encourage Increased Use
of the Great Lakes

Great Lakes Traffic and Competition Study
Simar, Helleisen & Eichner

Service Factor	Percentage of Respondents ¹	
	Bulk and Crude Cargo	Manuf. Goods and Chemicals
More Frequent Sailings and Better Schedules	18%	31%
Better Transit Time	23%	13%
Lower Costs	14%	17%
Improved General Cargo Service	14%	8%
Year Round Service	5%	13%
Better Service By Selected Ports	14%	15%
Improved Container Service	14%	4%

¹ Survey respondents represent all cargo types. The results were tabulated by commodity group to allow a better representation of container and liner general cargo shippers.

Reasons Why Importers and Exporters
Do Not Use the Port of Chicago

Port of Chicago Survey, Booz, Allen & Hamilton

Reason	Rank of Importance						Total Responses to This Reason
	1	2	3	4	5	6	
Frequency of Service	18	20	13	1	0	1	53
Transit Time in System	24	11	8	7	2	0	52
Seasonality of Seaway System	18	16	10	7	2	0	52
Lack of Specialized Facilities	10	4	5	6	3	1	29
Cost of Transportation	6	6	5	2	1	3	22
Lack of Information	7	0	4	3	0	4	18
Ability to Control	3	2	4	3	3	0	15
Cargo Theft or Damage	2	3	1	2	2	0	10
Rapid Receipt of Docu- mentation	0	1	0	0	2	0	3

Shipper Routing Criteria*

A.T. Kearney Traffic Forecast Study

- . Total transportation cost
- . Service continuity including consideration of year-round service
- . Sailing frequency
- . Total transit time
- . Service reliability
- . Availability of special services
- . Port operation considerations.

* Listing does not denote order of priority.

Port Selection Criteria
Ranking by Percentage of Respondents

Massport Survey, Booz, Allen & Hamilton

FACTORS	VERY IMPORTANT	IMPORTANT	NOT IMPORTANT
Availability and frequency of Ocean Service	73%	26%	1%
Reliability of sailing schedules	66	31	3
Quality and Speed of Inland Transportation	44	39	17
Total Transit Time	55	38	7
Inland Freight Rate	40	43	17
Ocean Freight Rate	59	35	6
Port Related Charges	36	48	16
Cargo Loss/Damage Experience	45	38	18
Sales/Marketing/Customer Service of Ocean Carrier	21	45	33
Sales/Marketing/Customer Service of Port	20	44	36

Port Selection Criteria

Distribution Worldwide Survey, 1979
(In order of importance)

General Considerations	Port Services	Ocean Carrier Services
1. Cost of Transportation and Port Charges	1. Container Cranes	1. Scheduled Conference Liner Service
2. Proximity to Plant	2. Consolidation Services	2. Fully Cellular Container Service
3. Number of sailings	3. Warehousing	3. Scheduled Nonconference Liner Service
4. Equipment & Services	4. Heavy Lift Service	4. Roll-on/Roll-off Service
5. Level of Congestion	5. Export Packing	5. Bulk Carrier Service
6. Quality of Customs Handling	6. Dry Bulk Facilities	6. Feeder Service
7. Amount of Free Time	7. Cold Storage	
8. Last Port of Call	8. Liquid Bulk Facilities	
9. Security		
10. Size & Reputation		

Effect of Navigation Season Extension¹

A.T. Kearney Traffic Forecast Study

Cargo Type	Effect
Ore, Coal, Stone	5% additional tonnage
Grains	12%-15% additional tonnage would be available for G.L. to compete for an on-rate and service basis
Container Cargo	No additional tonnage ²
Other General Cargo	No additional tonnage ²

1. Defined as an 11-month season.
2. Unless a complete season extension.

APPENDIX C

VOYAGE COST CALCULATIONS

This appendix consists of outlines of voyage cost calculations in support of the pro formas presented in the report. The voyage cost calculations are supported by exhibits in the second half of the appendix. These supporting exhibits are noted on the appropriate costs by an exhibit number such as C-1.

5.	<u>Vessel Operating Costs</u>		
	C-18 \$4048 daily for 33.37 days	=	\$135,082
	(Based on MarAd Estimated Vessel Operating Expenses, 1979)		
6.	<u>Fuel Consumption</u>		
	C-5 16.84 Steaming days at \$18,00	=	\$303,120
	8.80 reduced speed days at 12,000	=	105,600
	7.73 port days at \$1,950	=	<u>15,074</u>
			\$423,794
7.	<u>Port Charges</u>		
	C-6 Detroit		
	Dockage	\$1,300	
	Wharfage	\$2,208	
	Chicago		
	Dockage	\$1,190	
	Wharfage	\$4,536	
	Rotterdam and Hamburg estimated at	\$15,000	\$24,234
8.	<u>Pilotage</u>		
	(Provided by G. Scuggin, Great Lakes Pilots Association, a 11-1/2% increase scheduled April, 1981)		\$11,796
9.	<u>Seaway Tolls</u>		\$14,571
	C-7		
10.	<u>Cargo Handling</u>		
	C-8 Stevedoring		
	Detroit	584 TEU x \$72 =	\$42,048
	Chicago	584 TEU x \$120 =	\$70,080

Rotterdam and Hamburg
estimated at \$210,000
(Based on New York and Baltimore)

Terminal Charge

Detroit 584 TEU x \$46 = \$26,864

Chicago 584 TEU x \$65 = \$37,960

Rotterdam and Hamburg
estimated at \$75,000

(Based on New York and Baltimore)

\$461,952

11. Container Costs

C-9 1800 units at \$1.94 per day
for 33 days = \$115,236
600 chassis at \$3.03 per day
for 33 days = 59,994
\$175,230

12. Winter Lay-Up Costs

C-9 Winter lay-up assumed to
be 105 days
1800 crtn. at \$1.94 per day
for 105 days = \$366,660
600 chassis at \$3.03 per day
for 105 days = \$190,890
Capital Cost of \$8,215 per
day for 105 days = \$862,575
Lay-up and maintenance
expense of \$500 per day
for 105 days = 52,500
Total \$1,472,625

Total to be covered equally by

8 yearly voyages

\$184,078

13.	<u>Administrative and Overhead Expenses</u> assumed to be 10% of all voyage costs before admin. and overhead	\$170,487
14.	<u>Capital Costs</u> C-10 \$8,215 per day for 33.37 days	\$274,135

Container Vessel - East Coast/Europe Service
Calculation of Voyage Costs*

1. Vessel 662 TEU Capacity
C-1, C-2 limited by SLS draft
to 584 TEU

2. Itinerary New York, Baltimore,
Rotterdam, Hamburg

<u>Port</u>	<u>IN TEUS</u>	
	<u>Load</u>	<u>Discharge</u>
New York	175	426
Baltimore	409	158
Rotterdam	292	304
Hamburg	292	280

OUTBOUND LEG = 584 TEU = 100% of Constrained Capacity

INBOUND LEG = 584 TEU = 100% of Constrained Capacity

4. Voyage Days
C-3, C-4 Steaming time = 19.47 days
Berthing/deberthing time = 1.33 days
Cargo load/discharge time = 4.69 days
Total Voyage Days = 25.49 days

At 25.49 days per voyage, one vessel can complete 14 voyages per 365 day season.

* Corresponds to Table 12, East Coast Voyage Column

5. Vessel Operating Costs
 C-18 \$6992 daily for 25.49 days = \$178,226
 (Based on MarAd Estimated
 Vessel Operating Expenses, 1979)

6. Fuel Consumption
 C-6 19.47 steaming coal @ \$18,000 = \$350,460
 6.02 port days at \$1950 = 11,739
 \$362,199

7. Port Charges
 C-6 New York
 Dockage \$991
 Wharfage (\$3005)*
 Baltimore
 Dockage \$2502
 Wharfage (\$8732)*
 Rotterdam and Hamburg
 estimated at \$15,000 \$18,493
 (Based on New York and
 Baltimore charges)
 *Included in cargo handling
 charge - used here only to estimate
 Rotterdam, Hamburg charges.

8. Pilotage
 C-11 \$867

9. Seaway Tolls - Not Applicable

10. Cargo Handling
 C-8 Stevedoring
 New York 601 TEU x \$212 = \$127,412
 Baltimore 567 TEU x \$140 = \$ 79,380

Rotterdam and Hamburg
estimated at \$210

Terminal Charges

(New York 601 TEU x \$72.10 = \$43,332)*

(Baltimore 567 TEU x 53.69 = 30,442)*

Rotterdam and Hamburg
estimated at \$75,000

*Included in stevedoring charge, used
here to estimate Rotterdam and
Hamburg charges. Total \$491,792

11. Container Costs

C-9 1800 units at \$1.94 per day
for 25 days = \$87,300
600 chassis at \$3.03 per day
for 25 days = \$45,450

\$132,750

12. Winter Lay-Up Costs - Not Applicable

13. Administrative and Overhead Expenses

Assumed to be 10% of all voyage
Costs before admin. and overhead \$139,373

14. Capital Costs

C-10 \$8215 per day for 25.49 days = \$209,400

Container Vessel - East Coast/Europe Service
Calculation of Voyage Costs*

1. Vessel C-8 Containership
C-1 1712 TEU capacity

2. Itinerary New York, Baltimore,
Rotterdam, Hamburg

<u>Port</u>	<u>IN TEUS</u>	
	<u>Load</u>	<u>Discharge</u>
New York	750	790
Baltimore	790	750
Rotterdam	800	800
Hamburg	740	740

OUTBOUND LEG = 1540 TEU = 90% of Utilization

INBOUND LEG = 1540 TEU = 90% of Utilization

4. Voyage Days
C-12 Steaming time = 14.93 days
Berthing/deberthing time = 1.33 days
Cargo load/discharge time = 6.17 days
Total Voyage Days = 22.43 days

At 22.43 days per voyage one vessel can complete 16 voyages per 365 day year.

* Corresponds to Table 13.

5.	<u>Vessel Operating Costs</u>		
	C-18 \$8360 daily for 22.43 days	=	\$187,515
	(Based on MarAd Estimated Vessel Operating Expenses, 1979)		
6.	<u>Fuel Consumption</u>		
	C-5 14.93 steaming days at \$28,800	=	\$429,984
	7.50 port days at \$2,700	=	<u>20,250</u>
			\$450,234
7.	<u>Port Charges</u>		
	C-6 New York		
	Wharfage		
	Dockage	\$3099	
	Baltimore		
	Wharfage		
	Dockage	\$8567	
	Rotterdam and Hamburg		
	estimated at	\$12,000	\$23,666
	(wharfage included in stevedoring rate)		
8.	<u>Pilotage</u>		
	C-11		\$ 1,817
9.	<u>Seaway Tolls</u> - Not Applicable		
10.	<u>Cargo Handling</u>		
	C-8 Stevedoring		
	New York 1540 TEU x \$212 =	\$326,480	
	Baltimore 1540 TEU x \$140 =	\$215,600	
	Rotterdam and Hamburg estimated		
	at \$542,000 (Based on New York and		
	Baltimore)		\$1,084,080

11. Container Costs

C-9 4800 units at \$1.94 per day

for 22.43 days = \$208,868

1600 chassis at \$3.03 per day

for 22.43 days = \$108,741

\$317,609

12. Winter Lay-up Costs - Not Applicable

13. Administrative and Overhead Expenses

Assumed to be 10% of all voyage
costs before administrative and
overhead

\$234,129

14. Capital Costs

C-10 \$12,343 per day for 22.43 days

\$276,853

Combination Vessel - Great Lakes Europe Service
Calculation of Voyage Costs*

-
1. Vessel Pacer Class
limited by SLS draft
to 8700 long tons
2. Itinerary Detroit, Chicago, Rotterdam,
Hamburg

3. Cargo Liftings

<u>Port</u>	<u>Load</u>	<u>Discharge</u>
Detroit	175 TEU	185 TEU 2500 LT
Chicago	395 TEU 3000 LT	185 TEU 2500 LT
Rotterdam	185 TEU 2500 LT	300 TEU 1500 LT
Hamburg	185 TEU 2500 LT	270 TEU 1500 LT

OUTBOUND LEG = 8700 LT = 100% Utilization

INBOUND LEG = 8700 LT = 100% Utilization

(TEUs estimated at 10 LT)

* Corresponds to Table 14, Great Lakes Voyage Column

4. Voyage Days

C-13, C-14	Steamship time	= 24.94 days
	Berthing/deberthing time	= 1.33 days
	<u>Cargo load/discharge</u>	= <u>5.10 days</u>
	Total voyage days	31.37 days

At 31.37 days per voyage, one vessel can complete 8 voyages per 260 day season.

5. Vessel Operating Costs

C-18	\$4136 daily for 31.37 days	= \$129,746
	(Based on MarAd Estimated Vessel Operating Expenses, 1979)	

6. Fuel Consumption

C-5, C-13		
	16.14 steaming days at \$17,700	= \$285,678
	8.80 reduced speed days at \$12,000	= 105,600
	6.43 port days at \$2,250	= <u>14,468</u>
		\$405,746

7. Port Charges

C-6	Detroit		
	Wharfage	\$2,334	
	Dockage	940	
	Chicago		
	Wharfage	\$9,865	
	Dockage	\$1,665	
	Rotterdam and Hamburg		
	estimated at	\$12,000	\$26,804

8. Pilotage

(Provided by G. Scuggin,
Great Lakes Pilots Association,
a 11-1/2% increase scheduled
April, 1981)

\$15,336

9. Seaway Tolls

C-7

\$30,366

10. Cargo Handling

C-8 Stevedoring

Detroit 360 TEU x \$ 72 = \$25,920

2500 LT x \$ 9 = \$22,500

Chicago 580 TEU x \$120 = \$69,600

5500 LT x \$ 9 = \$49,500

Rotterdam, Hamburg

estimated at \$253,000

Terminal Charge

Detroit 360 TEU x \$ 46 = \$16,560

2500 LT x \$ 4 = \$10,000

Chicago 580 TEU x \$ 65 = \$37,700

5500 LT x \$ 4 = \$22,000

Rotterdam, Hamburg

estimated at \$62,000

TOTAL

\$568,780

11. Container Costs

C-9 1800 units at \$1.94 per day for

31.37 days = \$109,544

600 chassis at \$3.03 per day

for 31.37 days = \$ 57,031

\$166,575

12. Winter Lay-Up Costs

C-9 Winter lay-up assumed to be 115 days 1800 crtn. at \$1.94 per day for 115 days	=	\$401,580	
600 Chassis at \$3.03 per day for 115 days	=	\$209,079	
Capital costs of \$9,218 per day for 115 days	=	\$1,060,000	
Lay-up and maintenance expense of \$500 per day for 115 days	=	<u>\$ 57,500</u>	
Total		\$1,728,150	
Total to be covered equally by 8 yearly voyages			\$216,019

13. Administrative and Overhead Expenses

Assumed to be 10% of all voyage costs before administrative and overhead			\$184,814
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14. Capital Costs

C-10 \$9,218 per day for 31.37 days	=		\$289,169
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Combination Vessel - East Coast/Europe Service
Calculation of Voyage Costs*

-
1. Vessel Pacer Class
C-1, C-2 Limited by SLS draft to
8700 tons
2. Itinerary New York, Baltimore, Rotterdam,
Hamburg

3. Cargo Liftings

Port	Load	Discharge
New York	175 TEU	185 TEU 2500 LT
Baltimore	395 TEU 3000 LT	185 TEU 2500 LT
Rotterdam	185 TEU 2500 LT	300 TEU 1500 LT
Hamburg	185 TEU 2500 LT	270 TEU 1500 LT

OUTBOUND LEG = 8700 LT = 100% Utilization
INBOUND LEG = 8700 LT = 100% Utilization
(TEUs estimated at 10 LT)

4. Voyage Days
C-13, C-14
- | | | |
|----------------------------------|---|------------------|
| Steaming time | = | 18.66 days |
| Berthing/deberthing | = | 1.33 days |
| <u>Cargo load/discharge time</u> | = | <u>3.68 days</u> |
| Total Voyage Days | = | 23.67 days |

At 23.67 days per voyage, one vessel can make 15 voyages per 365 day season.

* Corresponds to Table 14, East Coast Voyage Column.

5. Vessel Operating Costs
 C-18 \$7144 per day for 23.67 days = \$169,098
 (Based on MarAd Estimated
 Vessel Operating Expenses, 1979)
6. Fuel Consumption
 C-5 18.66 steaming days at \$17,700 = \$330,282
 5.01 port days at \$2,250 = 11,273
 \$341,555
7. Port Charges
 C-6 New York
 Wharfage \$ 1,250
 Dockage 595
 Baltimore
 Wharfage \$ 7,700
 Dockage 2,645
 Rotterdam and Hamburg
 estimated at \$12,000 \$ 24,190
8. East Coast Pilotage
 C-11 \$ 1,037
9. Seaway Tolls - Not Applicable
10. Cargo Handling
 C-8 Stevedoring
 New York 360 TEU x \$212 = \$ 76,320
 2500 LT x \$ 12 = \$ 30,000
 Baltimore 580 TEU x \$140 = \$ 81,200
 5500 LT x \$ 12 = \$ 66,000
 Rotterdam and Hamburg
 estimated at \$253,000

Terminal Charges

New York 360 TEU x \$53.69 = (in stevedoring charge)
2500 LT x \$ 6.72 = \$16,800
Baltimore 580 TEU x \$72.10 = (in stevedoring charge)
5500 LT x \$ 8.20 = \$45,100
Rotterdam and Hamburg estimated
at \$62,000

Total

\$630,420

11. Container Costs

C-9 1800 units at \$1.94 per day
for 23.67 days = \$82,656
600 chassis at \$3.03 per day
for 23.67 days = \$43,032

\$125,688

12. Winter Lay-Up Costs

Not Applicable

13. Administrative and Overhead Expenses

Assumed to be 10% of all
voyage costs before administrative
and overhead

\$150,991

14. Capital Costs

C-10 \$9,218 per day for 23.67 days

\$218,190

Vesel Feeder Service via Montreal
Calculation of Voyage Costs at 95 Percent Utilization*

1. Vessel 306 TEU chartered
C-15 vessel

2. Itinerary Milwaukee, Chicago
Montreal

<u>Port</u>	<u>IN TEUS</u>	
	<u>Load</u>	<u>Discharge</u>
Milwaukee	120	120
Chicago	170	170
Montreal	290	290

OUTBOUND LEG = 290 TEU = 95% Utilization

INBOUND LEG = 290 TEU = 95% Utilization

4. Voyage Days
C-16 Steam time = 7.62 days
Berthing/deberthing time = .50 days
Cargo load/discharge time = 3.22 days
Total voyage days = 11.34 days

5. Vessel Operating Expenses and Capital Costs

\$5500 per day for 11.34 days = \$62,370

(Based on vessel charter costs of \$5500 per day. This cost covers the vessel operating costs, i.e., crew wages, subsistence, stores, M&R, and insurance and the capital costs of the vessel).

* Corresponds to Table 17, 95 percent utilization column.

6. Fuel Consumption

C-15 7.62 steaming days at \$3713 = \$28,293
 3.72 port days at \$232 = 863

\$29,156

7. Port Charges

Milwaukee

Dockage = \$46

Wharfage = 240 TEU = 2400 LT = 2880 NT
 x 27.5¢ = \$792

Chicago

Dockage = \$560

Wharfage = 340 TEU = 3400 LT = 4080 NT x 40¢ =
 \$1632

Montreal

Dockage = \$8840

Wharfage = negotiated

\$11,870

8. Pilotage

\$10,500

9. Seaway Tolls

C-17

\$ 6,977

10. Cargo Handling

C-8 Stevedoring

Milwaukee 240 TEU x \$ 50 = \$12,000

Chicago 340 TEU x \$120 = \$40,800

Montreal 580 TEU x \$ 50 = \$29,000

Terminal Charges

Milwaukee 240 TEU = 2400 LT = 2880 NT x \$4.50 =
 \$12,960

Chicago 340 TEU x \$65 = \$22,100

Montreal 580 TEU = 5800 LT = 6969 NT x \$4.50 =
 \$31,320

Total

\$148,180

11. Container Costs

Are assumed to be absorbed by the
line-haul carrier.

12. Winter Lay-Up Costs

With a chartered vessel, there are no winter
lay-up costs.

13. Administrative and Overhead Expenses

Assumed to be 10% of all voyage costs before
administrative and overhead

\$ 26,087

Vessel Feeder Service Via Montreal
Calculation of Voyage Costs at 80 Percent Utilization*

1. Vessel 306 TEU Chartered vessel
C-15

2. Itinerary Milwaukee, Chicago, Montreal

<u>Cargo Liftings</u>	<u>IN TEUS</u>	
<u>Port</u>	<u>Load</u>	<u>Discharge</u>
Milwaukee	110	110
Chicago	135	135
Montreal	245	245

OUTBOUND LEG = 245 TEU = 80% Utilization

INBOUND LEG = 245 TEU = 80% Utilization

4. Voyage Days

C-16	Steaming time	7.62 days
	Berthing/deberthing time	.50 days
	<u>Cargo load/discharge</u>	= <u>2.72</u> days
	Total voyage days	10.84 days

5. Vessel Operating Expenses and Capital Costs

\$5500 per day for 10.84 days = \$59,620

(Based on vessel charter costs of \$5500 per day. This cost covers the vessel operating costs, i.e., crew wages, subsistence, stores M&R, and insurance and the capital cost of the vessel)

6. Fuel Consumption

C-15	7.62 steaming days at \$3713 = \$28,293	
	3.22 port days at \$232 = <u>747</u>	

\$29,040

* Corresponds to Table 17, 80 percent utilization column.
C-21

7. Port Charges

C-6 Milwaukee

Dockage \$46

Wharfage 220 TEU = 2200 LT = 2640 NT x

275¢ = \$726

Chicago

Dockage \$280

Wharfage 270 TEU = 2700 LT = 3240 NT x

40¢ = \$1296

Montreal

Dockage \$8840

Wharfage - negotiated

\$11,188

8. Pilotage

\$10,500

9. Seaway Tolls

C-17

\$ 6,068

10. Cargo Handling

C-8

Stevedoring

Milwaukee 220 TEU x \$ 50 = \$11,000

Chicago 270 TEU x \$120 = \$32,400

Montreal 490 TEU x \$ 50 = \$24,500

Terminal Charges

Milwaukee 220 TEU = 2200 LT = 2640 NT

x \$4.50 = \$11,880

Chicago 270 TEU x \$65 = \$17,550

Montreal 490 TEU = 4900 LT = 5880 NT

x \$4.50 = \$26,460

\$123,790

11. Container Costs

Are assumed to be absorbed by the line-haul carrier.

12. Winter Lay-Up Costs

With a charter vessel, there are no winter lay-up costs.

13. Administrative and Overhead Expenses

Assumed to be 10% of all voyage costs before
administrative and overhead

\$ 24,039

Vessel Feeder Service Via Montreal
Calculation of Voyage Costs at 55 Percent Utilization*

1. Vessel 306 TEU Chartered Vessel
C-15

2. Itinerary Milwaukee, Chicago, Montreal

<u>Port</u>	<u>IN TEUS</u>	
	<u>Load</u>	<u>Discharge</u>
Milwaukee	70	70
Chicago	98	98
Montreal	168	169

OUTBOUND LEG = 337 TEU = 55% Utilization

INBOUND LEG = 337 TEU = 55% Utilization

4. Voyage Days

C-16

Steaming time	= 7.62 days
Berthing/deberthing time	= .50 days
<u>Cargo load/discharge</u>	= <u>1.87 days</u>
Total voyage days	9.99 days

5. Vessel Operating Expenses and Capital Costs

\$5500 per day for 9.99 days = \$ 54,945

(Based on vessel charter costs of \$5500 per day. This cost covers the vessel operating costs, i.e., crew wages, subsistence, stores M&R, and insurance and the capital cost of the vessel)

6. Fuel Consumption

C-15

7.62 steaming days at \$3713	= \$28,293
2.37 port days at \$232	= <u>550</u>

\$ 28,843

*Corresponds to Table 17, 55 percent utilization column.

7. Port Charges

C-6

Milwaukee

Dockage - \$46

Wharfage - 140 TEU = 1400 LT = 1680 NT x 275¢ = \$462

Chicago

Dockage - \$280

Wharfage - 197 TEU = 1970 LT = 2364 NT x 40¢ = \$946

Montreal

Dockage - \$8840

Wharfage - negotiated

\$ 10,574

8. Pilotage

\$ 10,500

9. Seaway Tolls

C-17

\$ 4,514

10. Cargo Handling

C-8

Stevedoring

Milwaukee - 140 TEU x \$ 50 = \$ 7,000

Chicago - 197 TEU x \$120 = \$23,640

Montreal - 337 TEU x \$ 50 = \$16,850

Terminal Charges

Milwaukee - 140 TEU = 1400 LT = 1680 NT x

\$4.50 = \$ 7,560

Chicago - 197 TEU x \$65 = 12,805

Montreal - 337 TEU = 3370 LT = 4044 NT x

\$4.50 = \$18,195

\$85,953

11. Container Costs

Are assumed to be absorbed by the line-haul carrier.

12. Winter Lay-Up Costs

With a charter vessel, there are no winter lay-up costs.

13. Administrative and Overhead Expenses

Assumed to be 10% of all voyage costs before administrative and overhead.

EXHIBIT C-1
Vessel Details

Container Vessel (Sovereign Accord)

LOA = 493.9'
Breadth = 70.8'
Depth = 36.4'
Draft = 27.034'
Speed = 17.25k
GRT = 9913
NRT = 7630
Capacity = 662/20'

Combination Vessel (Marjorie Lykes)

LOA = 592
Breadth = 69
Depth = 41.58
Draft = 32
Speed = 18k
GRT = 11891
NRT = 7780
Capacity = 796,000 cubic feet

Container Vessel (Austral Envoy)

LOA = 812.8'
Breadth = 90.2'
Depth = 53.0'
Draft = 33.1'
Speed = 23K
GRT = 30,990
NRT = 25,196
Capacity = 1,712 TEU

EXHIBIT C-2

Calculations of Constrained Capacity
Due to SLS Vessel Size Limitation

Container Vessel

Vessel capacity = 662 TEU
Tonnage Capacity = 662 TEU at 11 tons per
container = 7282 tons

Each inch of vessel draft removed takes 80 tons of cargo
capacity

Vessel draft = 27'
Seaway draft limitation = 25.5'

Need to remove 18" from vessel draft

Removed capacity = 18" at 80 tons per inch =
1,440 tons

Constrained capacity = 7282 tons - 1440 tons =
6842 10 tons per container
584 TEUS

Combination Vessel

Constrained capacity of 8700 LT provided by Lykes Bros.
Steamship Co., New Orleans.

EXHIBIT C-3

Steaming Time Calculation, 660 TEU Container Vessel

Great Lakes Service

<u>Itinerary</u>	Nautical <u>Miles</u>	<u>Speed</u>	Steaming Time <u>in Hours</u>
Detroit-Chicago	633	12 k ¹	52.75
Chicago-(Quebec)	1225	12 k	102.08
(Quebec)-Rotterdam	3296	17.25 k	191.07
Rotterdam-Hamburg	308	17.25 k	17.86
Hamburg - (Quebec)	3367	17.25 k	195.19
(Quebec)-Detroit	<u>677</u>	2 k	<u>56.42</u>
	9506		615.37 = 25.64 days

East Coast Service

<u>Itinerary</u>	Nautical <u>Miles</u>	<u>Speed</u>	Steaming Time <u>in Hours</u>
New York-Baltimore	410	17.25K	23.77
Baltimore-Rotterdam	3670	"	212.75
Rotterdam-Hamburg	308	"	17.86
Hamburg-New York	<u>3674</u>	"	<u>212.99</u>
	8062		467.37 = 19.47 days

-
- 1 Vessels transit the Great Lakes under reduced speed.
Quebec is approximately where reduced speed begins/ends.

EXHIBIT C-4

Port Time Calculation, 660 TEU Container Vessel
in Hours

Great Lakes Service

Port	Berthing/ Deberthing	Cargo Load/ Discharge
Detroit	8	50.08 ¹
Chicago	8	47.25 ¹
Rotterdam	8	Est. at
Hamburg	8	56.33 ²
	<u>32 hrs. = 1.33 days</u>	<u>153.66 hrs. = 6.40 days</u>

East Coast Service

Port	Berthing/ Deberthing	Cargo Load/ Discharge
New York	8	31.68 ³
Baltimore	8	24.65 ⁴
Rotterdam	8	Est. at
Hamburg	8	56.33 ²
	<u>32 = 1.33 days</u>	<u>112.66 hrs. = 4.69 days</u>

- 1 Based on productivity of 12 units per hour.
- 2 Estimated based on New York and Baltimore inquiries.
- 3 Based on productivity of 19 units per hour.
- 4 Based on productivity of 23 units per hour.

EXHIBIT C-5

Estimated Fuel Consumption Per Day

CONTAINER VESSEL - 660 TEU

SPEED	CONSUMPTION IN BBLs ¹	COST PER BARREL ²	EST. COST PER DAY
17.25K	600	\$30	\$18,000
12 K ³	400	\$30	\$12,000
AT PORT	65	30	1,950

COMBINATION VESSEL

SPEED	CONSUMPTION IN BBLs ¹	COST PER BARREL ²	EST. COST PER DAY
18K	590	30	\$17,700
12K	400	30	12,000
AT PORT	75	30	2,250

CONTAINER VESSEL - 1700 TEU

SPEED	CONSUMPTION IN BBLs ¹	COST PER BARREL ²	EST. COST PER DAY
22.5K	960	\$30	\$28,800
AT PORT	90	30	2,700

- 1 Estimated based on Marad estimated vessel operating expenses, 1979. Used Marad vessel types closest to selected vessels.
- 2 A. Borowski, Marad Office of Ship Operating Costs.
- 3 Maximum speed through GL/SLS lock system.

EXHIBIT C-6

Port Charges

Port	Wharfage	Dockage
Chicago ¹ Iroquois facility	Gen. cargo 95¢/LT Steel prod. 85¢/LT Containers 80¢/LT	7¢/GRT/Day
Lake Calumet facility	All Cargo 40¢/NT	6¢/GRT/Day
Detroit ²	30¢/NRT	\$580/per vessel/ 1st 24 hrs. \$360/ per vessel/each following 12 hrs.
New York ³	50¢/ton for general cargo	5¢/GRT/day
Baltimore ⁴	\$1.40 per cargo ton plus weight of catr. if applicable	17¢/NRT/24 hours
Milwaukee ⁵	27.5¢/net ton	45¢/meter of vessel length per 24 hrs.
Montreal ⁶	Negotiated	\$2.21/GRT of vessel per 24 hrs.

- 1 Ceres, Inc., Iroquois facility.
- 2 Detroit-Wayne County Port Commission.
- 3 The Port Authority of New York and New Jersey.
- 4 Maryland Port Administration.
- 5 Meehan Seaway Service, Ltd.
- 6 Brown and Ryane, Ltd.

EXHIBIT C-7, page 1

Calculation of Seaway Tolls

CONTAINER VESSEL

OUTBOUND

Cargo 584 TEU = 5840 LT = 5957 MT
At 99¢ per MT = \$ 5,897

Vessel 9913 GRT at 14¢ per GRT = \$ 1,388

INBOUND

Same as outbound \$ 7,285
\$14,570

COMBINATION VESSEL

OUTBOUND

Cargo 570 TEU = 5700 LT = 5814 MT
At 99¢ per MT = \$ 5,756

3000 LT = 3060 MT at 2.15 per MT = 6,579

Vessel 11,891 GRT at 14¢ per GRT = \$ 1,665

INBOUND

Cargo 370 TEU = 3700 LT = 3774 MT
At 99¢ per MT = \$ 3,736

5000 LT = 5100 MT at 2.15 per MT = 10,965

Vessel 11,891 GRT at 14¢ per GRT = 1,665
\$30,366

Exhibit C-8

Stevedoring and Terminal Charges

<u>Port</u>	<u>Stevedoring Charge Per Container</u>	<u>Terminal Charge Per Container</u>
New York ¹	\$212	NA
Baltimore ¹	\$140	NA
Chicago ²	\$120	\$65
Detroit ³	20' \$72 40' \$100	20' \$46 40' \$57
Milwaukee ⁴	\$50	\$4.50/net ton
Montreal ⁵	\$50	\$4.50/net ton

- 1 Based on information collected from major North Atlantic container operators. The stevedoring charge includes the terminal charge.
- 2 Ceres, Inc., Iroquois facility.
- 3 Detroit Marine Terminals.
- 4 Meehan Seaway Service, Ltd.
- 5 Brown and Ryane, Ltd.

EXHIBIT C-9

Capital Cost of Containers

FLEET 1800 containers - Assume 3 units per vessel slot
600 chassis - one chassis per slot

COST¹ \$3000 - 20' container
\$4500 - 40' container
\$6000 - chassis 20' or 40'
Container repair allowance - \$150 per year average

FINANCING 14% interest
10 year straight line

DEPRECIATION AND INTEREST EXPENSE
Container - \$1.53 per day
Chassis - \$3.03 per day
Container repair allowance - 41 per day

¹ Source: ITEL Container, Chicago

EXHIBIT C-10

Vessel Capital Costs

Container Vessel - 660 TEU vessel

Cost = \$45 million¹

Assume CDS of 48%¹ which brings cost to \$23,400,000

Assume 25 year life, 12% interest and no residual value

Depreciation and interest

Expense = \$8,215 per day

Container Vessel - 1700 TEU vessel

Cost = \$90 million¹

Assume CDS of 48% which brings cost to \$46,800,000

Assume 25 year life, 12% interest and no residual value

Depreciation and interest

Expense = \$12,343 per day

Combination Vessel

Cost = \$51 million¹

Assume CDS of 48% which brings cost to \$26,520,000

Assume 25 year life, 12% interest and no residual value

Depreciation and interest

Expense = \$9,218 per day

¹ Provided by Maritime Administration, Office of Shipbuilding Costs, Division of Domestic Costs.

EXHIBIT C-11

East Coast Pilotage Charges

Pilotage Rates

New York

Up to 25 pilotage units - \$160
 25/50 pilotage units - \$200
 50/100 pilotage units - \$250
 Over 100 - \$2.50 per pilotage unit - \$1000
 maximum
 Pilotage unit = length of vessel in feet x
 breadth of vessel in feet x depth of vessel
 in feet

Baltimore

0/300 pilotage units - \$0.73 per unit
 300/600 pilotage units - \$0.63 per unit
 Over 600 pilotage units - \$0.49 per unit
 Pilotage unit = length of vessel in feet x
 10,000 breadth of vessel in feet 100

Vessel length 0/600 ft - plus \$12.70 per
 foot of draft
 Length 600/800 - plus \$14.00
 Length over 800 - plus \$15.25

660 TEU Container Vessel

New York 127.28 pilotage units at \$2.50 per unit = \$318
 Baltimore 349.68 units at \$0.63 per unit = \$220
 25.5 feet of draft at \$12.70 per foot = \$329

Total \$867

1712 TEU Container Vessel

New York 388 pilotage units at \$2.50 per unit = \$970
 Baltimore 732 pilotage units at \$0.49 per unit = \$359
 32 feet of draft at \$15.25 per foot = \$488

Total \$1,817

Combination Vessel

New York 170 pilotage units at \$2.50 per unit = \$425
 Baltimore 448 pilotage units at \$0.63 per unit = \$282
 26 feet of draft at \$12.70 per foot = \$330

Total \$1,037

EXHIBIT C-12

Voyage Day Calculation, 1700 TEU Container Vessel

<u>Steaming Time</u>			
Itinerary	Nautical Miles	Speed	Steaming Time in Hours
New York-Baltimore	410	22.5K	18.22
Baltimore-Rotterdam	3670	22.5K	163.11
Rott-Hamburg	308	22.5K	13.69
Hamburg-New York	<u>3674</u>	<u>22.5K</u>	<u>163.29</u>
	8062	22.5K	358.31 = 14.93 days

<u>Port Time</u>		
Port	Berthing/Deberthing	Cargo Load/Discharge
New York	8	40.53 ¹
Baltimore	8	33.48 ²
Rotterdam	8	Est. at
Hamburg ³	8	74.01
	32 = 1.33 days	148.02 = 6.17 days

- 1 Based on productivity of 19 units per hour
 2 Based on productivity of 23 units per hour
 3 Estimated based on New York and Baltimore figures

EXHIBIT C-13

Steaming Time Calculation, Combination Vessel

Great Lakes Service

<u>Itinerary</u>	<u>Nautical Miles</u>	<u>Speed</u>	<u>Steaming Time in Hours</u>
Detroit-Chicago	633	12K ¹	52.75
Chicago-(Quebec)	1225	12K	102.08
(Quebec)-Rotterdam	3296	18K	183.11
Rott-Hamburg	308	18K	17.11
Hamburg-(Quebec)	3367	18K	187.06
(Quebec)-Detroit	677	12K	56.42
	<u>9506</u>		<u>598.53 = 24.94 days</u>

East Coast Service

<u>Itinerary</u>	<u>Nautical Miles</u>	<u>Speed</u>	<u>Steaming Time in Hours</u>
New York-Baltimore	410	18K	
Baltimore-Rott	3670	18K	
Rott-Hamburg	308	18K	
Hamburg New York	3674	18K	
	<u>8062</u>	<u>18K</u>	<u>447.89 = 18.66 days</u>

¹ Vessels transit the Great Lakes under reduced speed. Quebec is approximately where reduced speed begins/ends.

Exhibit C-14
 Port Time Calculation, Combination Vessel
 in Hours

Great Lakes Service

Port	Berth/Deberth	Cargo Load/Discharge
Detroit ¹	8	30.00
Chicago ¹	8	48.33
Rotterdam	8	Est. at
Hamburg ²	8	44.17
32 hrs. = 1.33 days		122.50 hrs. = 5.10 days

East Coast Services

Port	Berth/Deberth	Cargo Load/Discharge
New York	8	18.95
Baltimore	8	25.22
Rotterdam	8	Est. at
Hamburg ²	8	45.17
32 hrs. = 1.33 days		88.34 hrs. = 3.68 days

- 1 Based on productivity of 12 units per 200 LT per hour
- 2 Estimates based on New York and Baltimore figures.
- 3 Based on productivity of 19 units and 300 LT per hour.
- 4 Based on productivity of 23 units and 300 LT per hour.

Exhibit C-15
Chartered Vessel Details

Vessel - Peter Oltmann

LOA = 339'
Breadth = 59'
Depth = 24.5'
Draft = 21.4'
Speed = 16K
GRT = 4,000
NRT = 2,500
Capacity = 306 TEUS
Charter fee = \$5,500 per day

Estimated Fuel Consumption Per Day

Speed	Consumption in Gallons	Cost Per Gallon	Est. Cost Per Day
16 K	4,368	\$0.85	\$3,713
At Port	273	\$0.85	\$ 232

Exhibit C-16
Steaming and Port Time Calculations
Feeder Vessel Service in hours

Itinerary	Nautica Miles	Speed	Steaming Time in hours
Milwaukee	1031	12K	85.92
Chicago	74	12K	6.17
Montreal	1088	12K	90.67
	<u>2193</u>		<u>182.76 Hrs. = 7.62 days</u>

Port	Berth/Deberth
Milwaukee	4
Chicago	4
Montreal	4
	<u>12 hrs. = .5 days</u>

Port	Cargo Load/Discharge		
	at 95% Utilization	at 80% Utilization	at 50% Utilization
Milwaukee	20.00	18.33	11.67
Chicago	28.33	22.50	16.42
Montreal ¹	29.00	24.50	16.85
	<u>77.33 hrs. or 3.22 days</u>	<u>65.33 hrs. or 2.72 days</u>	<u>44.94 hrs. or 1.87 days</u>

¹ Based on productivity of 20 units per hour.

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ARCTEC INC COLUMBIA MD

GREAT LAKES/ST. LAWRENCE SEAWAY REGIONAL TRANSPORTATION STUDY; --ETC(U)

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Exhibit C-17
Calculation of Seaway Tolls for
Feeder Vessel Service

At 95% Utilization

Cargo 580 TEUS = 5800 LT = 5916 MT x \$.99 per MT = \$5857
Vessel 4000 GRT x \$.14 per GRT = \$560 x 2 transits = \$1120
Total \$6977

At 80% Utilization

Cargo 490 TEUS 4900 LT = 4998 MT x \$.99 per MT = \$4,948
Vessel 4000 GRTx\$.14 per GRT = \$560 x 2 transits= \$1,120
Total \$4,514

At 50% Utilization

Cargo 336 TEUS = 3360LT = 3428 MT x \$.99 per MT = \$3394
Vessel 4000 GRTx\$.14 per GRT = \$560 x 2 transits = \$1120
Total \$4514

Note: See Exhibit C - for Seaway Toll rates

EXHIBIT C-18
Calculation of Daily Vessel Operating Cost

The subsidizable items of vessel operating expense are wages and P&I insurance. These items represent approximately 80 percent of the total daily vessel operating costs.¹ For the Great Lakes trade, a subsidy rate of 70 percent was used.² The subsidy rate on the East Coast was assumed to be 30 percent.

660-TEU Vessel

Voyage operating expenses	=	\$9200/day ³	
80% subsidizable	=	\$7360	
Great Lakes subsidy	=	70% of \$7360	= \$5152
VOE = \$9200 - 5152	=	\$4048/day	
East Coast subsidy	=	30% of \$7360	= \$2208
VOE = \$9200 - 2208	=	\$6992/day	

1712-TEU Vessel

Voyage operating expenses	=	\$11,000/day ³	
80% subsidizable	=	\$8800	
East Coast subsidy	=	30% of \$8800	= \$2640
VOE = \$11,000 - \$2640	=	\$8360/day	

Combination Vessel

Voyage operating expenses	=	\$9400/day ³	
80% subsidizable	=	\$7520	
Great Lakes subsidy	=	70% of \$7520	= \$5264
VOE = \$9400 - \$5264	=	\$4136/day	
East Coast subsidy	=	30% of \$7520	= \$2256
VOE = \$9400 - 2256	=	\$7144/day	

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- 1 Maritime Administration, Office of Subsidy Analysis.
 - 2 MarAd Great Lakes Traffic and Competition Study.
 - 3 Maritime Administration, Estimated Vessel Operating Expenses, 1979.

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