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16. Abstract

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MEGAPORTS AND LOAD CENTERS OF THE FUTURE WITH THE PORT OF HOUSTON AS THE BASELINE PORT

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ABSTRACT

Improvements in containership technology will require modern port terminal facilities. The number of ships calling on U.S. ports is likely to decrease, but larger and more automated containerships will increase the amount of cargo handled per ship. The result will be greater cargo tonnages handled by seaports and the need for faster turnaround. High capacity, expensive cargo handling equipment will be increasingly used and port terminal operations will become even more automated, particularly in container handling, where robotics equipment may well be introduced within the next decade. Present shipping trends seem to indicate that a small number of east, west, and gulf coast seaports will dominate the U.S. container business, those ports gaining "megaport" status. The remaining U.S. ports, in order to remain viable, will turn toward serving more specific market niches. These niches include handling the present containership fleet, feeding to and from the megaports, and non-traditional development activities such as bulk and breakbulk services. This study delineates and describes the external environment, facilities, and operational characteristics of a "megaport/load center port" capable of meeting market requirements by the year 2010. The Port of Houston is evaluated within this research as an example of a prototypical, next generation seaport.

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EXECUTIVE SUMMARY

Containerization has revolutionized the way we view freight transportation. This change of view has simultaneously transformed both the land and ocean sides of cargo movements. Worldwide interregional movements of loaded containers are forecast to rise at a compound annual growth rate of 8% through the year 2000, and to level off to 7.2% by the year 2010. The highest annual growth rates forecast for particular U.S. regions are 13.1% for ports of the Gulf of Mexico (inland ports and those along the Texas-Mexico border) and 7.6% for ports of the southeast Atlantic, driven primarily by changing trade patterns between the U.S. and its neighbors along the Atlantic-coast of South America and Mexico.

Overall U.S. container trade, as opposed to the worldwide interregional trade forecast of 8%, is forecasted at 6-6.5%. Annual container trade between the U.S. and the countries above has recently surged, and a few southeastern U.S. ports such as Miami and Jacksonville have benefited from the increase. Gulf coast ports are also expected to benefit, and these benefits are projected to continue well into the next century.

The major stakeholders involved in container trade include cargo owners and consignees; shipowners; ports and terminals; domestic trucking, rail, and intermodal carriers; and government transportation, trade regulators, and agencies. The growth in containerization has caused these stakeholders to change their thinking and manner of operation in a number of important ways, and is continuing to do so. The physical and operational characteristics of ships change as their capacities increase, a fact that places increasing demands on navigation channels, port infrastructure, and landside transportation linkages.

The economic realities associated with modern container carriage are requiring shipowners to order larger and larger vessels. While much of the current fleet of containerships consists of "Panamax" and smaller vessels, most recent containership orders have been for vessels in the "beyond-post-Panamax," or "megaship" class—vessels with capacities of over 6000 twenty-foot equivalent units (TEUs). Futurists predict that vessel sizes will continue to increase well into the 21st century, until megaships in the 8000-TEU class become commonplace in the market.

As long as these megaships can operate at their capacities, increasing vessel size while maintaining or increasing vessel speed can reduce cargo-carrying costs per TEU. The recent growth in containerized trade and the projections for continued growth in world trade brought on by lower tariffs and emerging trade agreements indicate that the ocean freight carriers are merely responding to world economic conditions by ordering these larger containerships. The same kind of thinking has caused many carriers to enter into alliances and other cooperative arrangements with each other and with related stakeholders. Alliances and vessel-sharing arrangements will continue to occur, and these will help shipowners maximize the efficient use of these megaships. Another benefit will be the increase in the carriers' returns on their investments. The size and speed of ships calling on U.S. ports are major determinants of how well the freight transportation infrastructure will be able to respond to the increasingly complex demands of shippers.

Not all ports need the capability to handle these new megaships. The economics of these new ships will mean fewer port calls, and in some cases will mean the elimination of certain port calls altogether. This occurrence means that the U.S. port infrastructure will evolve into a kind of "hub-and-spoke" system similar to our current airport system, with a few large ports serving megacontainerships while other ports operate as "feeder" ports moving cargoes to and from these larger “load center” ports. This change will require a number of physical infrastructural changes at the ports.

The major impediment for most U.S. ports that will accommodate megaships involves channel and berth water depths. Only a very few U.S. ports can accommodate the drafts of these larger vessels, and none of these ports are gulf coast ports. Further, the volume of cargo carried by the megaships will require larger berths, more efficient terminals, larger cranes, and greater storage area.

Landside access bottlenecks are also either currently a problem or will potentially be one at most U.S. ports. Whether such bottlenecks occur because of inefficient cranes; poor terminal operations; or problems at gates, bridges, tunnels, or the landside carrier’s entry, they must be addressed in order to maintain efficient operations and to continue to attract shippers and carriers to the port. Such conditions will force ports that expect to handle megaships to make capital improvements that include not only deeper and wider channels, larger terminals, bigger and faster cranes, and more acres of container storage, but also improved access to inland markets through dockside rail sidings, as well as streamlined rail and highway corridors.

Further, more efficient means of communication among the various carriers in an intermodal cargo movement and between these carriers and the port, U.S. Customs, and others involved in the movement of cargo through the transportation chain will be necessary. Improvements in communication efficiency, such as electronic data transfer that eliminates much of the paperwork now involved in freight carriage, are quickly approaching the importance of the actual physical carriage of the cargo itself as a means of reducing bottlenecks and expediting freight movements.

Along the U.S. and Mexican gulf coasts, there are currently no ports capable of accommodating megaships of the size and draft projected for the near future. While gulf ports face a variety of impediments to the calling of such vessels, the one most common to all the ports is channel and berth water depth. Very few ports on the gulf maintain channels that are even close to the depth required to handle these future vessels. Only the Port of Houston has current plans to increase its channel depth and width to accommodate such ships. Landside access is also a problem at most ports, as are acreage for storage and the availability of sufficient cranes and other cargo-moving equipment.

Currently the Port of Houston has the most modern terminal facility among all gulf ports, and has a new, more efficient facility already in the planning stages to be constructed beginning in the next few years. It is this port that this study projects to be the leading candidate to operate as the "load center" port for the Gulf of Mexico, handling the majority of containerized cargo in the new evolving hub-and-spoke system.

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CHAPTER ONE: INTRODUCTION

Containerization has revolutionized the way we view freight transportation. The old system of independent incremental movements of breakbulk cargoes has been replaced with today's view—a globally streamlined transportation system that moves unitized cargo or containers on single integrated or "seamless" contracts from door-to-door. This change of view has simultaneously transformed both the land and ocean sides of the exchange. Early in this technological transformation, innovations such as cellularized containerships, unit and, later, "stack" trains appeared. Domestic third parties called intermodal marketing companies (IMCs), like their counterparts at sea, the nonvessel operating common carriers (NVOCCs), expedited this transformation. The increase in containerization had its initial impetus from the discovery that reducing the number of times that cargo had to be handled in its movement from origin to destination results in safety and security improvements, as well as efficiencies in expedited transportation. Later, additional growth in containerization innovations came as a result of increased trade and decreased international barriers.

In any country where containerized freight moves, the overall infrastructure feeding containers to and receiving containers from ocean carriers includes:

- ports and terminals;
- domestic trucking, rail, and intermodal movements; and
- governmental regulations.

Shipping consultant M. John Vickerman predicts that at least a few ships in the 7000- to 8000-TEU range are likely to be plying international waters within five years. The main concern is whether any port will be able to handle them. There are currently no ports that have the proper combination of long-reach and heavy-lift cranes, big marine terminals, deep-water channels, and berths necessary for accommodating such megaships. Moreover, designers have yet to solve the problem of how to retool the inland infrastructure to handle the surge of new containers and unit trains that loading and unloading a megaship would entail.[1]

This report examines the trends, external environment, port, and other stakeholder responses to the dynamic changes occurring in the world of containerization.

Chapter Two provides an overview of the trends relating to container trade, containerships, and the infrastructure that supports container shipping. Chapters Three and Four examine the stakeholder responses to the trends presented in Chapter Two. Chapter Five provides an in-depth assessment of the above on gulf coast ports. Chapter Six describes a model of the load center port for the gulf coast. Chapter Seven contains conclusions and recommendations.

In general, this report is about changes occurring in modern container shipping and the significance of those changes to gulf coast ports—particularly the Port of Houston. The main concern is <u>which port</u> will handle these changes.

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[1] Vickerman, Background Paper 2, 7.

CHAPTER TWO: TRENDS IN CONTAINERIZATION

The container transportation industry exists in a dynamic, global trading environment. This chapter provides an overview of four trends relating to container trade increases, containership fleet increases, the development of the infrastructure which supports container shipping, and ship capacity increases.

- Container trade increases — Container trade world wide has grown 9.5% per year this decade and will continue to do so at an 8% growth rate. U.S. container trade is projected to grow at a rate of 6% per year versus the 6.5% rate it has grown each year this decade.
- Containership fleet increases — Fleet capacity is increasing at a rate of 9.9% per year and the largest percent of increase is in the largest containerships.
- Infrastructure development — Ships' economies of scale leads to lower cost and fewer numbers of larger vessels. Port mechanization leads to efficient handling of larger numbers of containers faster.
- Ship capacity increases — Container ship capacity is projected by the year 2000 to be 33.7% higher than the 1996 ship capacity. Between 1980-1995, the world fleet grew at an average of 9.9% per year while traffic in containers grew at 9.5%.

The authors of this study have drawn much of the data used in this chapter and those that follow from several prominent sources (books, briefings, reports). The sources most often cited include *Containerisation International Yearbook* (1995-1997); *Lloyd's Nautical Year Book 1997; The Containership Register 1997; Impacts of Changes in Ship Design on Transportation Infrastructure and Operations*; *A Report to Congress on the Status of the Public Ports of the*

United States 1994-1995, a Maritime Administration Office of Ports and Domestic Shipping report; and various DRI/McGraw Hill publications and data bases.

2.1 Container Trade

The rate and origin/destination of container traffic volumes are two of the most important factors influencing the container market. Analysts suggest that maritime containerized trade will grow at a rate of about 6.5% per annum between the years 1995 and 2000.[2] Between 1991 and 1995, world container trade grew by about 9.5% per year (a straight year-to-year increase of 5.2% from 1994), reaching a volume of more than 134 million twenty-foot equivalent units (TEUs) in 1995. Growth in the U.S. trades has been somewhat slower, at only about 6% per year, reaching a volume of more than 21 million TEUs in 1995. According to the Port Import/Export Reporting Service (PIERS) of *The Journal of Commerce*, U.S. total box traffic (in TEUs) increased 8% between February 1996 and February 1997.[3] Table 2.1 lists selected U.S. ports and shows their container traffic in February 1996 and February 1997.[4] Figure 2.1 depicts the increase in the Compound Annual Growth Rate (CAGR) in Container Port Traffic (TEUs) in both the United States and the world from 1991 to 1995.

[2] Boyes, *v.*
[3] Data from manifests and bills of lading were compiled by PIERS. Cargo carried for most shippers is excluded.
[4] The data in this table are somewhat misleading because they cover only a two-month period in 1996 and 1997. At this writing, new mid-year data have just been reported. They show that Houston leads the gulf ports in total TEUs and the total is 10% higher in 1997 than after the first half of 1996. Similarly, New Orleans TEUs have grown by 17%, Gulfport by 12%, Freeport, TX by 1%, Lake Charles, LA by 22%, and Galveston, TX by 14%. Gulf ports reporting decreases in TEUs over the period were Mobile, AL (-29%), Tampa, FL (-53%), and Pascagoula, MS (-15%). Overall, container traffic has grown by about 10% since June 1996. Brennan, 15A.

Table 2.1

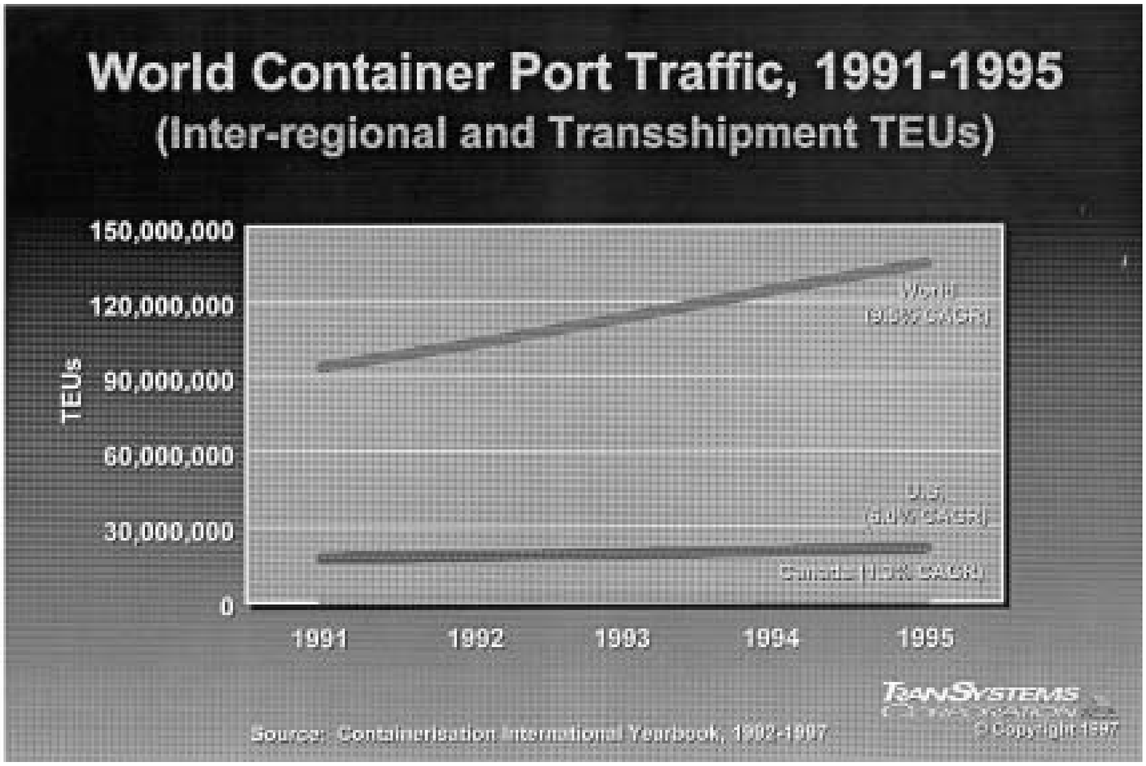
U.S. Total Box Traffic

February 1997 vs. February 1996

Port	Feb. 1997 TEUs Totals	Feb. 1996 TEUs Totals	% Change	1997 Total TEUs	1996 Total TEUs	%Change
Long Beach	**204,266**	178,696	14%	**395,705**	358,513	10%
Los Angeles	**160,326**	132,342	21%	**326,991**	282,628	16%
New York	**122,246**	117,517	4%	**246,069**	232,535	6%
Seattle	**76,507**	72,307	6%	**155,118**	144,451	7%
Charleston, S.C.	**72,811**	62,102	17%	**140,702**	120,902	16%
Hampton Roads	**60,154**	57,443	5%	**117,096**	109,732	7%
Oakland, Calif.	**58,243**	65,762	-11%	**118,599**	133,908	-11%
Miami	**47,169**	40,139	18%	**90,258**	77,545	16%
Tacoma, Wash.	**45,685**	41,671	10%	**82,841**	82,194	1%
Houston	**42,829**	46,458	-8%	**84,451**	91,212	-7%
Savannah, Ga.	**40,054**	34,958	15%	**79,112**	71,571	11%
Port Everglades, Fla.	**37,456**	33,021	13%	**71,312**	63,656	12%
Baltimore	**21,409**	24,807	-14%	**44,306**	44,745	-1%
New Orleans	**17,967**	14,869	21%	**36,076**	30,343	19%
Portland, Ore.	**16,550**	9,250	79%	**35,785**	27,138	32%
Jacksonville, Fla.	**13,908**	13,782	1%	**27,971**	27,431	2%
San Juan	**10,646**	11,909	-11%	**20,334**	22,697	-10%
Philadelphia	**9,871**	9,385	5%	**20,543**	19,345	6%
Gulfport, Miss.	**9,485**	8,572	11%	**18,887**	18,413	3%
West Palm Beach, Fla.	**8,417**	8,143	3%	**16,512**	14,966	10%
Wilmington, Del.	**7,314**	8,574	-15%	**15,134**	16,912	-11%
Wilmington, N.C.	**7,028**	6,194	13%	**13,903**	11,963	16%
Honolulu	**3,393**	2,402	41%	**5,955**	4,093	45%
Boston	**2,912**	3,612	-19%	**6,183**	6,268	-1%
Richmond, Va.	**2,793**	3,871	-28%	**5,381**	6,737	-5%
Ponce, Puerto Rico	**2,159**	4,232	-49%	**5,237**	7,953	-34%
Freeport, Texas	**2,054**	1,791	15%	**4,661**	3,640	28%
Dutch Harbor, Alaska	**1,757**	1,231	43%	**1,960**	1,330	47%
San Francisco	**1,159**	0	na	**2,179**	195	1019%
Lake Charles, La.	**1,090**	1,277	-15%	**3,078**	2,793	10%
Mayaguez, Puerto Rico	**965**	510	89%	**1,637**	1,100	49%
Mobile, Ala.	**903**	1,272	-29%	**1,873**	2,624	-29%
Femandina Beach, Fla.	**724**	1,788	-60%	**1,743**	4,039	-57%
Galveston, Texas	**684**	522	31%	**1,186**	1,035	15%
Manatee, Fla.	**487**	762	-36%	**1,115**	1,468	-24%
Total	**1,112,578**	1,022,481	**9%**	**2,204,235**	2,049,607	**8%**

Source: Data from the Port Import/Export Reporting Service of the Journal of Commerce, April 30, 1997. Cargo carried for most military shippers is excluded from the tabulation as required by law. Empty containers are also excluded. Percentages of change are calculated before rounding. Hampton Roads includes the ports of Norfolk, Portsmouth, and Newport News, Va. Philadelphia includes the ports of Chester, Pa., Pennsauken, Glouchester, Salem, and Camden, N.J. Total volume accounts for ports not included. International containerized cargo only--breakbulk and bulk not included.

Figure 2.1



From 1991-1995, world traffic was 9.5% CAGR, U.S. traffic was 6.0% CAGR, and Canadian traffic was 1.3% CAGR.

A recent article in *The Journal of Commerce* stated that U.S. container volume grew a scant 1% in 1996. On the other hand, the article cited Michael Scalar, senior consultant at DRI/McGraw Hill, who believes that by the end of 1997 container volume growth will probably be in the 5% to 7% range that U.S. ports have traditionally experienced.[5]

Perhaps more significant is the world containerization of the general cargo trades, whose volume has nearly doubled over the last 10 years. Over 60% of all general cargo is shipped in containers, compared with only 23% in 1980. Figure 2.2 depicts the increase in the volume of containers relative to general cargo since 1980.

[5]Mongelluzzo, 2D.

Figure 2.2

Growth figures vary from coast to coast and within port ranges. Eight of the United States' top ten containerports—Long Beach, Los Angeles, New York/New Jersey, Seattle, Oakland, Charleston, Tacoma, and Savannah—generate most of their cargo from the east-west trade lanes. Only two of the top ten, Miami and Houston, depend heavily on the north-south trades. Table 2.2 shows the top ten containerports in the U.S. in 1996, whose ranking is based on the total number of TEUs.

Table 2.2

Top Ten North American Container Ports 1996

Ranking by TEUs

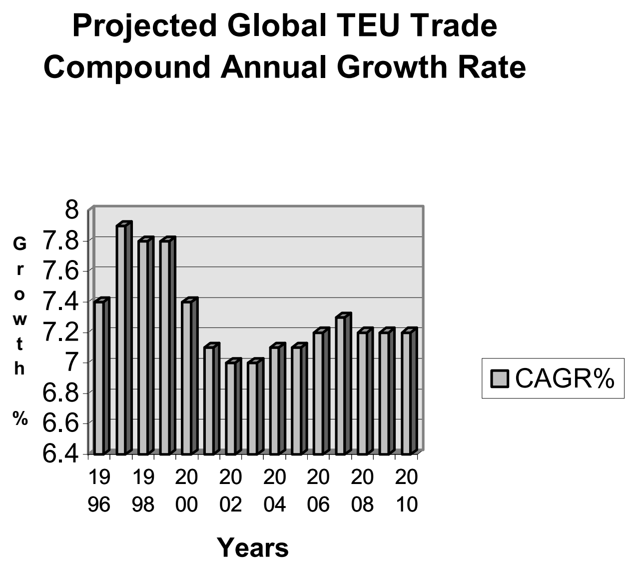
Rank	Port	TEUs
1	Long Beach	3,067,334
2	Los Angeles	2,682,802
3	New York/New Jersey	2,269,500
4	Oakland	1,498,202
5	Seattle	1,473,561
6	Hampton Roads	1,141,357
7	Charleston	1,078,590
8	Houston	794,481
9	Port Everglades	701,281
10	Miami	656,798

Source: *AAPA*

Worldwide interregional movements of loaded containers (excluding empties and transshipment moves) are forecast to rise at a compound annual growth rate (CAGR) of 8% through the year 2000. This growth is expected to level off to 7.2% by the year 2010.[6] Figure 2.3 depicts the projected TEU trade, with its associated growth rate (CAGR) through the year 2010.

[6] Vickerman, Background Paper 1, 1.

Figure 2.3



Source: DRI/McGraw Hill

Different regions of the U.S. will, of course, grow at different rates. The highest growth is forecast for the gulf ports from Miami to El Paso (13.1% CAGR) and the southeast ports (7.6%). Northwest ports (Oregon to Alaska) are forecast at a CAGR of 7.2%, while southwest ports (Oakland to San Diego) are forecast at a CAGR of 6.3% (Figure 2.4).[7]

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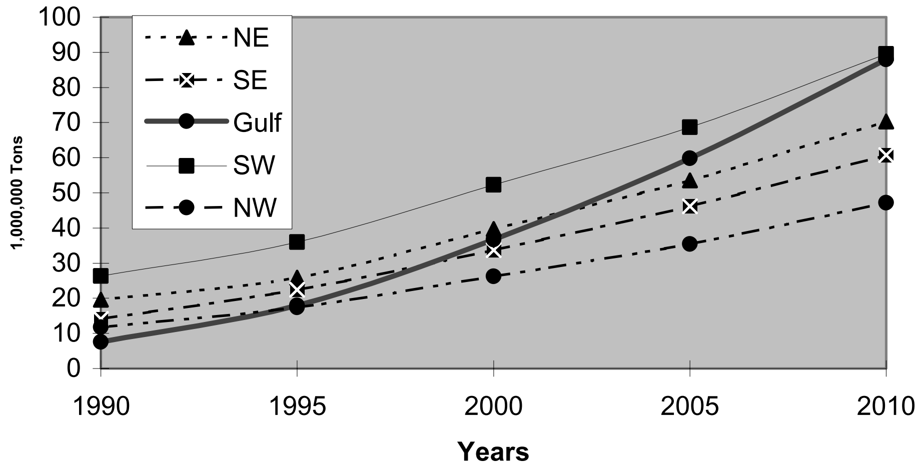
[7] Vickerman, Background Paper 1, 2.

Figure 2.4

U.S. Containerized Tonnage Forecast



NE: Maine to Virginia SW: San Diego to Oakland Gulf: Mobile to El Paso
SE: NC to Tampa NW: Oregon to Alaska

Source: DRI/McGraw Hill

Although U.S. trade with Latin America is growing rapidly, the annual container volume regarding trade with South America—particularly Brazil—has recently surged. Trade volume with South America's east coast grew close to 20 percent in 1994; however, according to PIERS data, major ports in the U.S. saw a 143 percent increase in containerized exports to Brazil. Ports such as Miami and Jacksonville, Florida, have seen some of the largest increases. In contrast to other trades, where capacity increases have far surpassed the growth in demand, the Latin American trades enjoy the unique distinction of quantity demanded exceeding quantity supplied.[8] Table 2.3 depicts gulf coast containerport growth from 1985 to 1996.

[8]Hall, "Florida ports expanding: Intermodal will be imperative for trade with Latin America," 20C.

Table 2.3

Gulf Coast Container Port Growth, 1985-1996			
	1996 TEUs	1985 TEUs	CAGR
1. Houston	794481	362728	7.40%
2. Veracruz	265171	-	-
3. New Orleans	261007	380397	-
4. Gulfport	153470	56000 est.	9.60%
5. Freeport	48158	33670	3.30%
6. Other	89932	89130	-
TOTAL	1612219	921925	5.20%

Source: AAPA/TranSystems Corporation/*Containerisation International Yearbook 1988*

2.2 Containership Fleet

On January 1, 1997, the world containership fleet consisted of 2094 vessels with a capacity of 3,211,017 TEUs.[9] The fleet consists of the following sectors:

- **Feeder—**under 1000-TEU capacity;
- **Panamax** and **Sub-Panamax—**between 1000 and 4000-TEU capacity, capable of transiting the Panama Canal;
- **Post-Panamax—**4000-TEU+ capacity, which exceeds Panama Canal dimensions.

The physical and operational characteristics of ships change as their capacities increase, placing increasing demands on navigation channels, port infrastructure, and landside access capabilities. "Panamax" vessels (the largest that can transit the Panama Canal) average 896 feet in length and not more than 106 feet across the beam, with a draft just over 39 feet. The typical

[9] Clarkson Research Studies, *vi-vii*.

"post-Panamax" ship in today's fleet averages around 925 feet in length and 125 feet across the beam, with a draft of over 43 feet.[10]

The three newest megaships—the *Regina Maersk, Hanjin London,* and *Hyundai Independence*—have length and beam sizes roughly 13 percent greater than the typical Panamax vessel and the required maximum draft of 46 feet.

The average size, dimensions, and the average speed of each containership class are listed in Table 2.4.

Table 2.4

Classifications of World Containerships

WORLD CONTAINERSHIP FLEET IN PROFILE

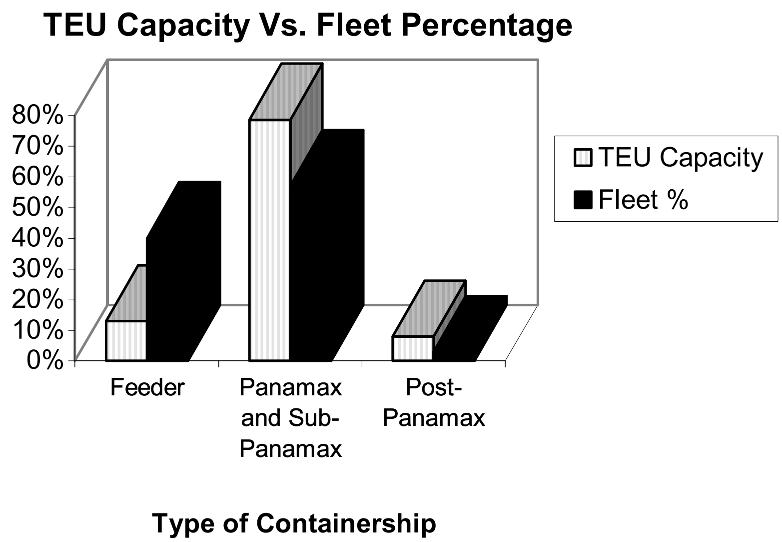
Average Size/Dimensions/Speed							
Class	TEU Range	Length (Feet)	Beam (Feet)	Draft (Feet)	Speed (Knots)	In Fleet (%)	TEU (%)
Feeder	100-999	354.3 -488.9	56.8-73.8	20.7-27.9	13.9-16.5	40	13
Sub-Panamax, Panamax	1000-3999	610.3-895.7	89.9-105.0	33.1-39.4	18.5-22.3	57	78.6
Post-Panamax	4000 +	928.5 +	124.7 +	43.3 +	24.1 +	< 3	8
As of January 1, 1997							

Source: *AAPA Advisory*, April 22, 1997

The feeder sector accounts for 40% of the fleet in number and 13% in TEU capacity. Panamax and sub-Panamax ships account for 57% of the fleet and 78.6% of the TEU capacity. Post-Panamax vessels account for less than 3% of the fleet but handle over 8% of the TEUs (Figure 2.5).

[10] Vickerman, Background Paper 1, 2.

Figure 2.5



Source: *The Containership Register 1997*

During the period 1980-1995, the containership fleet grew an average of 9.9%. During the 1990-1994 period, the fastest growing sector measured by TEU capacity was the post-Panamax sector, which grew 41%. Ships capable of handling over 1000 TEUs and capable of transiting the Panama Canal accounted for the second largest growth—slightly less than 35%.[11]

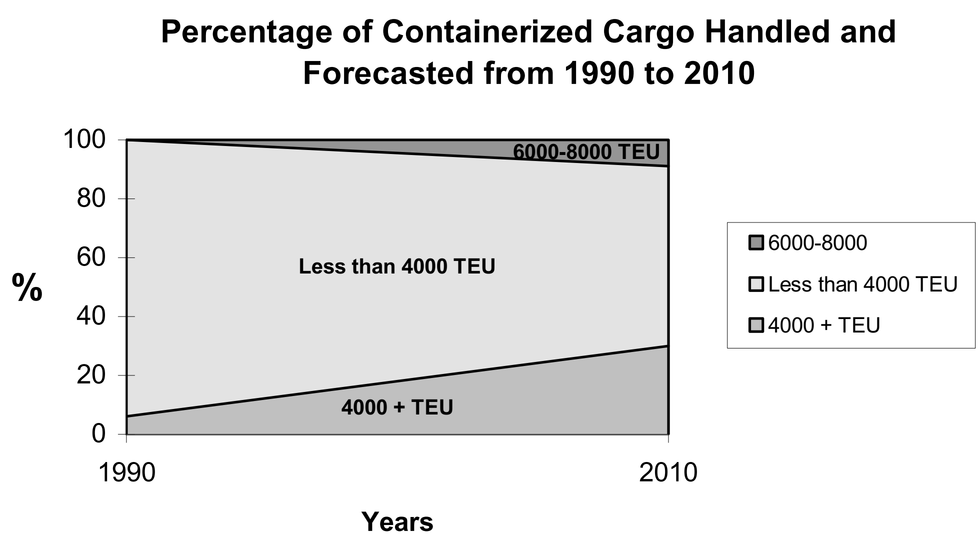
The first of the megaships[12] over 6000 TEUs, *Regina Maersk*, was delivered in January 1996. Recent and planned deployments through 1997 include six ships by COSCO, five by Hanjin, and five by Hyundai, all in excess of 5000 TEUs. In addition to the planned 1997 deployments, P&O Nedlloyd ordered six containerships with capacities of 6674 TEUs—the largest in the world. These new vessels will serve high volume, long distance trades—primarily from the Far East to the U.S. pacific coast and from the Far East to Europe.

[11] Clarkson Research Studies, *vi-vii*.

[12] The definition of megaship varies. Some suggest that any ship with a capacity over 4500 TEUs is a megaship. For this study, only ships with TEU capacity greater than 6000 TEUs will be considered megaships. In subsequent chapters, this definition does not apply. Vickerman's definition of a megaship (4000 TEUs or greater) is then used.

In 1990, less than 6% of U.S. containerized cargo was handled on ships of 4000 TEUs or more. By the year 2010 almost 30% will be handled on ships in the 4000+ TEU class, with more than 9% on ships in the 6000- to 8000-TEU class.[13] Figure 2.6 illustrates the decreasing trend in the less than 4000-TEU class containerships.

Figure 2.6



Source: U.S. Department of Transportation, Maritime Administration

[13] Vickerman, Background Paper 1, 2.

Table 2.5 presents a profile of the world containership fleet by vessel class and ship characteristics.

Table 2.5

World Container Ship Fleet in Profile

Vessel Class	Size (TEUs)	Length (Ft.)	Beam (Ft.)	Draft (Ft.)	Speed (Knots)
100 - 499 TEUs	305	354.3	56.8	20.7	13.9
500 - 999 TEUs	738	488.9	73.8	27.9	16.5
1,000 - 1,999 TEUs	1,403	610.3	89.9	33.1	18.5
2,000 - 2,999 TEUs	2,499	774.3	104.7	38.4	20.8
3,000& Over TEUs	3,656	895.7	105.0	39.4	22.3
4,000 & over TEUs	4,559	928.5	124.7	43.3	24.1
Total Average	**1,582**	**587.3**	**83.7**	**31.2**	**18.2**

Source: Clarkson Research Studies, *The Containership Register 1996*

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2.3 Infrastructure

Provided that these megaships can be filled with revenue cargo, increasing vessel size while maintaining or increasing speed can reduce the cost per TEU. The major hurdle for some ports, with regard to accommodating the megaships, will be dredging. Currently, only half of the top ten U.S. containerports, which together handle nearly 80% of the container traffic, have existing channel depths that can accommodate these vessels. Table 2.6 gives the minimum and maximum depths at berths at the top ten North American ports (based on TEUs). Also included in the table is the number of container berths at these ports.

Table 2.6
Channel Depth/Container Berths
Top Ten North American Container Ports
(including minimum and maximum depths at berth)

Rank	Port	Min. Depth	Max. Depth	# of Container Berths
1	Long Beach	32	52	56
2	Los Angeles	33	52	13
3	New York/New Jersey	35	40	30
4	Oakland	35	42	16
5	Seattle	50	70	15
6	Hampton Roads	32	45	13
7	Charleston	27	40	21
8	Houston	27	40	21
9	Port Everglades	31	44	16
10	Miami	25	42	4

Sources: *Seaports of the Americas: 1997 AAPA Directory;*
Containerisation International Yearbook 1997

Not all ports need the capability to handle these vessels. The economics of these new ships will mean fewer port calls, and in some cases the elimination of some particular port calls altogether.

The volume of cargo carried by the megaships will require larger berths, more efficient terminals, large cranes, and storage yards. Table 2.7 shows current cranage available at the top ten North American ports. Figure 2.7 describes crane evolution from the 1960s to the late 1980s. Futhermore, landside access will have to be improved to handle the higher peak volume of rail and truck traffic.

Table 2.7

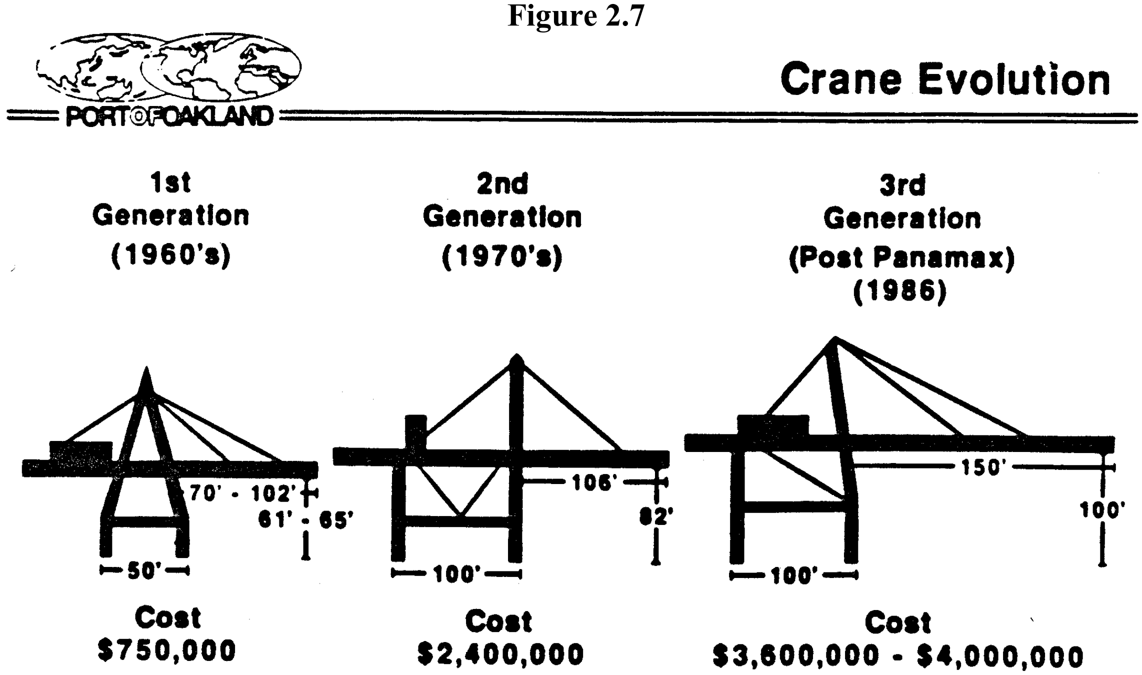
Top Ten North American Container Ports Cranage*

Rank	Port	14.5 ton	23 ton	30 ton	35 ton	40 ton	50 ton	80 ton	Gantry	Capacity	Ottawa 30	Ottawa 50
1	Long Beach			9		25	4					
2	Los Angeles				1	24						
3	New York/New Jersey			4	6	22	2					
4	Oakland			2	1	8						
5	Seattle					14	3					
6	Hampton Roads			1	1	16						
7	Charleston								4			
8	Houston	1		8		6	2	1		10	10	7
9	Port Everglades		2		2		2					6
10	Miami					3	7		10			

* The numbers in the table represent the number of cranes in each category

Sources: *Seaports of the Americas: The 1997 AAPA Directory; Containerisation International Yearbook 1997*

Figure 2.7



Sources: Port of Oakland/U.S. Department of Transportation, Maritime Administration

Landside access to and from the major U.S. containerports has been one of the bottlenecks in the international system of container movements. Whether this bottleneck occurs due to inefficient cranes; poor terminal operations; problems at gates, bridges, tunnels, or at the carrier's entry, it must be addressed in order to keep the trade and economic development flowing. Figure 2.8 lists several causes of the problem of landside access, and shows the percentage of twenty-five containerports in the U.S. that experience each of these problems, at least to some degree. Notice that the problem occurring at the largest number of ports is competition among uses for available land. Second in frequency is congestion along truck routes, and the third most common impediment to landside access involves truck and rail due to at-grade crossings.

Figure 2.8

Overview of the Committee on

Landside Access to U.S. Ports

Transportation Research Board National Research Council

Landside Access Impediments

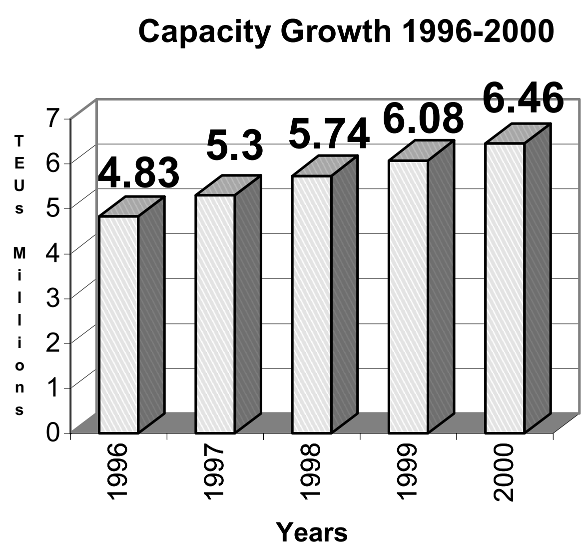
Impediment		Percent of Container Ports (25 Ports)
Congested Truck Routes		64
At-Grade Rail-Highway Crossings		56
Inadequate Double Stack Rail Clearances		36
Competition for Available Land		84
Restricted Access Improve. Due to Lack of Land		44
Regulations Restrict Truck/Rail Operations		16
Wetland Regulations	Usually	24
	Sometimes	32
DOT Coordination with Port	Usually	40
	Sometimes	36
	Rarely	24

Source: 1997 AAPA Survey of Ports

2.4 Capacity Concerns

Rate wars have been underway for a number of years as ship capacity has increased well above the growth in trade. This is expected to continue into the foreseeable future with ship capacity projected to be about 33.7% higher in the year 2000 than in 1996. *Containerisation International Yearbook 1997* estimates fleet capacity as of November 1996 to be 4.83 million TEUs. Drewry Shipping Consultants forecast that the capacity will grow to 5.3 million TEUs in 1997, 5.74 million in 1998, 6.08 million in 1999, and 6.46 million in the year 2000 (Figure 2.9).[14]

Figure 2.9



Source: *The Journal of Commerce*

Drewry's figures show 303 new vessels totaling 582,983 TEUs of capacity due in 1997; 209 ships with 484,580 TEUs of capacity due in 1998; and another 18 ships with 31,146 TEUs of

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[14]Knee, 13C.

capacity in 1999. That totals 530 vessels with aggregate capacity of just under 1.1 million TEUs[15] (Table 2.8).

Table 2.8

Number of Ships/TEU Capacity in Use and Projected for 1997-1999

	# of ships	TEUs
1997	303	582,983
1998	209	484,580
1999	18	31,146
TOTAL	530	1.1 million

Source: Drewry Shipping Consultants/ *The Journal of Commerce*

How the new tonnage will be distributed among the world's shipping lanes is not clear. Presumably, carriers will deploy them according to projected growth in trade. The ocean carriers' response to the trends in containerization is the subject of the next chapter.

[15] Hall, "Florida ports expanding: Intermodal will be imperative for trade with Latin America," 20C.

CHAPTER THREE: OCEAN CARRIER RESPONSES TO CONTAINERIZATION

3.1 Participants in Increasing Trade

The stakeholders (participants) in the increasing world trade in containers are:

- shipowners;
- ports;
- domestic intermodal operators; and
- government.

These stakeholders comprise much of the infrastructure that carry this trade. They respond to increases by reflecting, stimulating, and helping to create growth. This chapter will deal with the ocean carriers.

Ocean container carriers are helping to promote increased international trade as well as having to respond within themselves to the context, issues, and trends of increased container usage by what is referred to as rationalizing their operations. This chapter deals with this response. Specifically this means they are doing the following:

- restructuring and reducing costs while growing in scope, size, and capitalization;
- improving asset utilization; and
- creating global capacity through partnerships with other lines and enhancing levels of service.

Those ocean carriers most involved in the container business are the principal players shown in Tables 3.1 to 3.4. They have the largest container fleets and extensive land and sea operations worldwide. Many of them are involved as part of larger organizations, such as Maersk (which owns various European businesses, including oil exploration). Sea-Land is part of the CSX Rail Corporation. Evergreen Marine is part of numerous related businesses based in Taiwan. Some are private while others are state enterprises, but all are seeking economies of scale and most are moving into megaships and into alliances regarding the deployment of such vessels. Table 3.1 shows the twenty largest ocean carriers involved in intermodal container transportation, as of January 1996.

Table 3.1

The Key Players: Fleet Details of Top Twenty Carriers by Slots Deployed as of January 1, 1996 (includes vessels over 1000-TEUs only)

Company	Country	Total nominal capacity of vessels in operation (TEU)
MAERSK	Denmark	173,928
SEA-LAND	USA	173,748
EVERGREEN	Taiwan	145,418
COSCO	China	140,552
NEDLLOYD	Netherlands	111,458
NYK LINE	Japan	108,330
P&O CONTAINERS	UK	99,000
MITSUI OSK LINES	Japan	96,881
HANJIN	S. Korea	96,723
APL	USA	84,107
DSR -SENATOR	Germany	70,513
YANGMING	Taiwan	69,405
OOCL	China	67,572
MSC	Switzerland	66,908
HAPAG-LLOYD	Germany	65,355
ZIM	Israel	64,488
"K" LINE	Japan	63,084
NEPTUNE ORIENT LINE	Singapore	60,984
HYUNDAI MERCHANT MARINE	S. Korea	58,322
Cie. MARITIME D'AFFRETEMENT (CMA)	France	43,262
TOTAL FLEET		2,608,778

Source: *Containerisation International Yearbook 1997*

Table 3.2 summarizes the data given in Table 3.1 to show the concentration of containership fleet capacity among the largest players. Notice that because the twenty largest carriers hold 71.3% of the total containership capacity all the remaining carriers are holding only 28.7%, very close to the capacity of the top five ocean container carriers alone.

Table 3.2

Percentage of Container Capacity Held by Largest Ocean Carriers

Companies	TEUs	Percent of Total Container Fleet
TOP 5	745,485	(28.6%)
TOP 10	1,230,526	(47.2%)
TOP 15	1,570,279	(60.2%)
TOP 20	1,860,419	(71.3%)

Source: *Containerisation International Yearbook 1997*

Table 3.3 shows total world containership fleet, by numbers of vessels in service at the various size classes, and the total vessels currently on order for each size class. Implicit in the data is the relationship between current fleet capacity and the amount of new capacity on order. The total capacity of the newly ordered vessels is about 22 percent of the current containership capacity. The editors of *Containerisation International Yearbook 1997* question the wisdom of such a large orderbook given the persistent worries about overcapacity that have characterized the industry in recent years.[16]

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[16]Lambert, 8.

Table 3.3

World Containership Fleet as of November 1, 1996

VESSEL SIZES	**VESSEL NUMBERS**	
TEU SIZE CLASS	IN SERVICE	ON ORDER
4500+	36	45
3000-4500	242	73
2000-2900	347	91
1000-1999	942	167
Under 1000	4624	177
TOTAL	6191	563

Source: *Containerisation International Yearbook 1997*

As the economies of scale increase and the alliances grow in size and scope, so too does the concentration of firms in the industry as seen in the following figure (Figure 3.1).

Figure 3.1

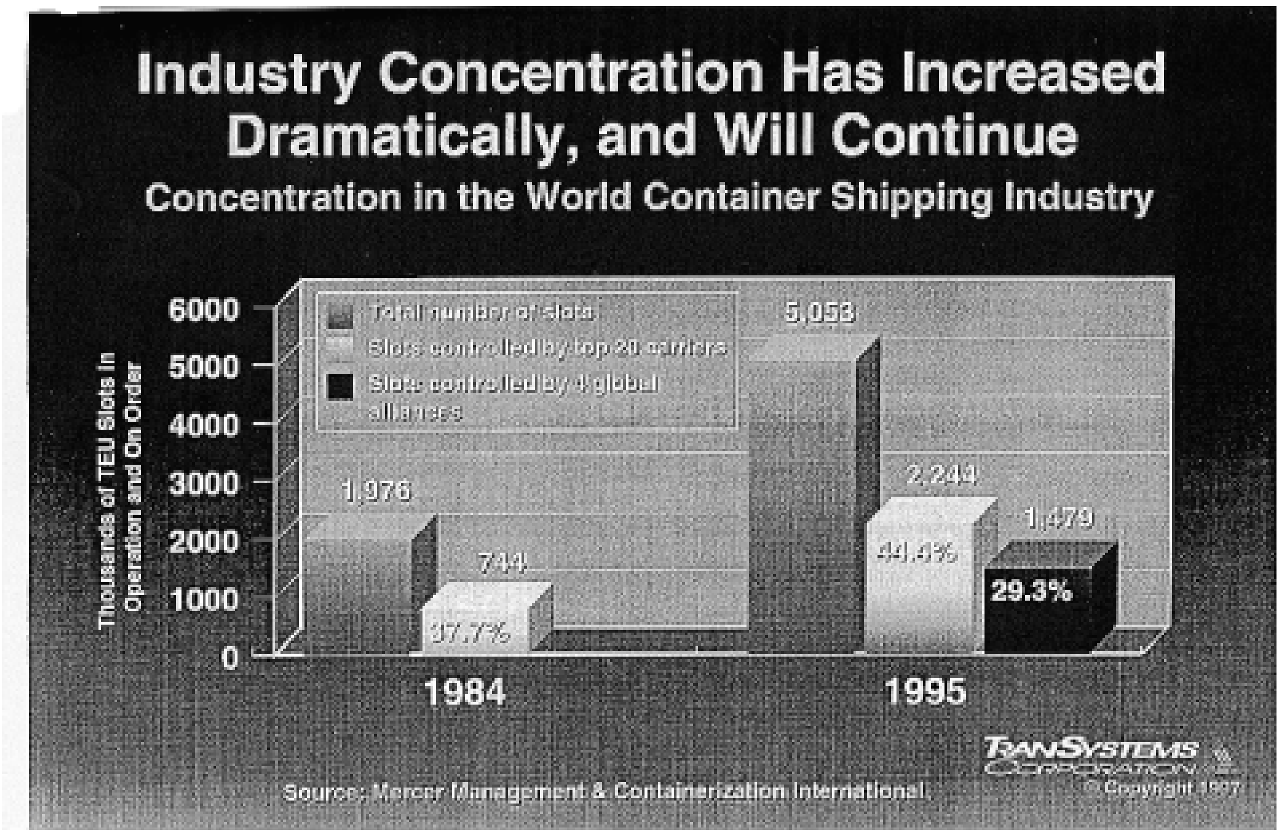

Table 3.4 shows megaship deployments that have occurred since November 1995 including those expected to be put in service within the next few months.

Table 3.4

Recent/Upcoming Mega-Ship Deployments Since November 1, 1995

Carrier	Size (TEU)	Number	Notes
APL	4,800	3	
Cosco	5,200	6	in service 1997
Evergreen	5,364	6	in service 1996
Hanjin	5,302	5	in service 1996
Hyundai	5,551	5	in service 1996
	5,551	2	
Maersk	6,000	5	in service 1996/97
	6,000	10	on order
Mitsui	4,700	1	
OOCL	4,950	3	
P & O/Nedlloyd	6,674	4	

Source: Containerization International Yearbook, 1996, the Journal of Commerce and American Shipper.

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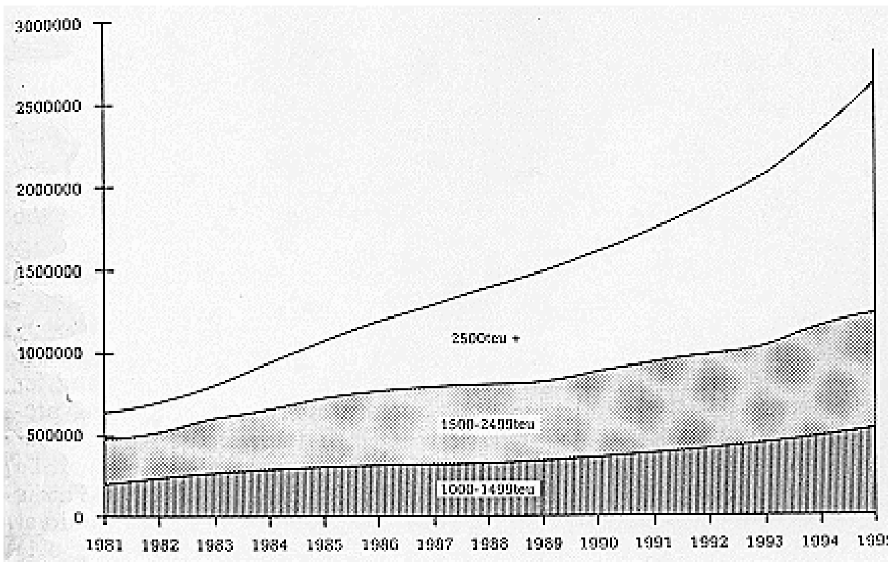
Figure 3.2 illustrates the background of this fleet and its capacity from 1981 to 1995.

Figure 3.2

Containerization fleet capacity (TEU) 1981-1995 (year-end totals)



NOTE: Data only includes fully-cellular vessels over 1,000 teu, and other vessels of a similar capacity permanently employed on fully-containerised operations.

Source: Lloyd's Shipping Economist Containership Database

Table 3.5 demonstrates the future growth of several key carriers.

Table 3.5

Containerships on Order* 3000-TEUs or Above as of January 1, 1997

Company	Number of Vessels	TEUs
EVERGREEN	20	95,510
DSR SENATOR	15	68,175
MAERSK**	11	60,900
COSCO	13	55,300
P&O	6	40,044
HANJIN	9	38,572
UASC	10	38,000
NEPTUNE ORIENT	8	34,372
SEA-LAND	8	32,496
NYK	5	28,660
HAPAG-LLOYD	7	26,466
ZIM	5	17,000

TEU = 20-foot equivalent unit

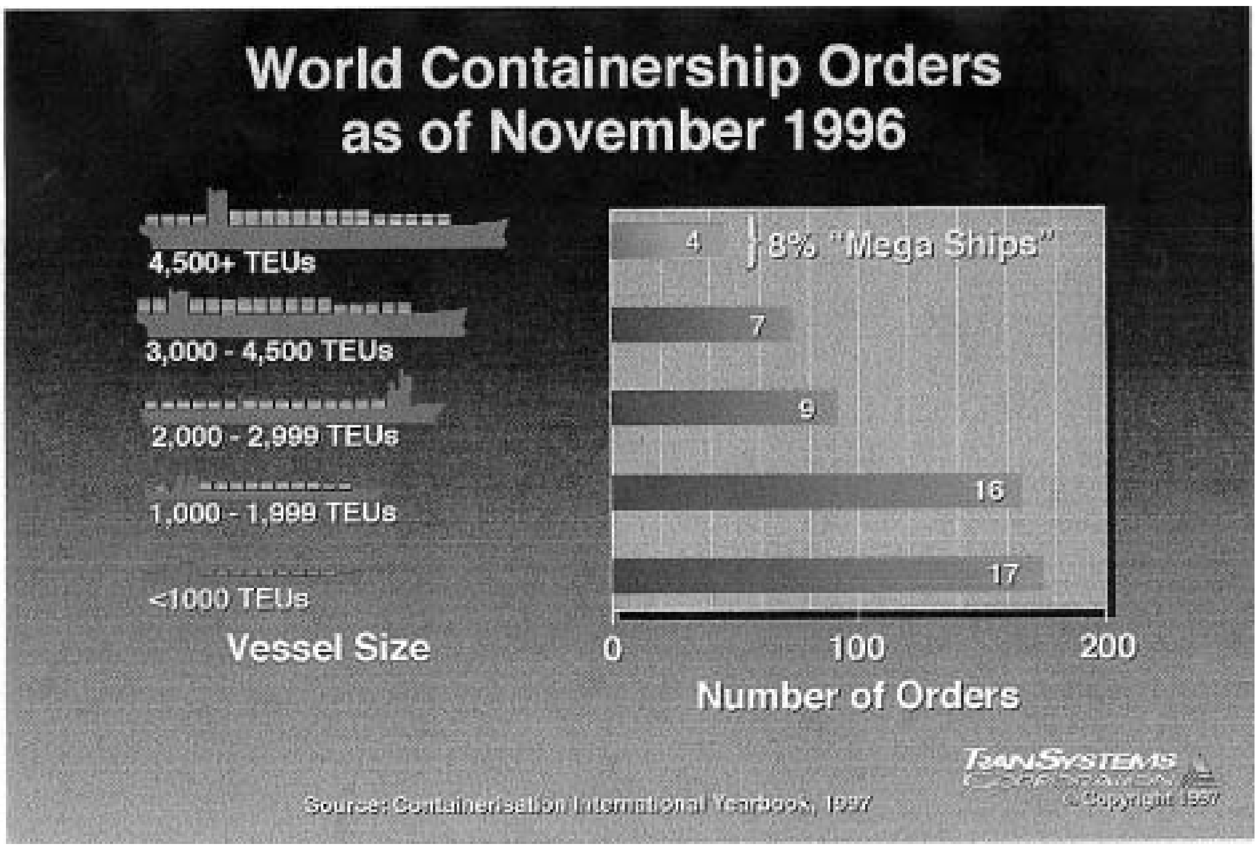
* Does not include carriers ordering four of fewer vessels.

** Does not count three 6000-TEU capacity vessels ordered January 1997

Source: *Fairplay Magazine, The Journal of Commerce*, February 12, 1997

Another view of the magnitude of this trend to economies of scale as illustrated by the ever increasing sizes of containerships is reflected in the current orders for large ships, as depicted in the Figure 3.3.

Figure 3.3



The German Federal Ministry of Education, Science, Research, and Technology sponsored a research project to be published by year end 1997. They forecast that several 8000-TEU capacity containerships will be operating in the Europe/Asia trades by the end of 1997.[17] A study by the German ship classification society Germanischer Lloyd has estimated that operating

[17]Porter, "Study sees even larger ships ahead," 13A

costs per TEU on such a ship would be 10 percent less than for a 4000-TEU ship. The acquisition cost of one of these larger vessels (8000-TEU capacity) is expected to be around U.S. $120 million, compared to the approximate U.S. $100-million cost of each of P&O's recently acquired 6700-TEU capacity ships. The research team that conducted the study of relative vessel costs includes the German shipbuilder Howaldtswerke-Deutsche Werftst, the Institute of Shipping Economics and Logistics, the Hamburg Ship Model Basin, the Eurokai container terminal operator in Hamburg, and Germanischer Lloyd. The study's objective was to examine the effect of these larger ships on costs in the container transportation system as a whole, and not to merely concentrate on cost differentials due to a single, isolated ship.[18]

Analysts are concerned that worldwide container shipping capacity is increasing at a rate unsupported by projections of demand for containerized carriage of freight. Capacity grew between 12% and 13% during 1995, with the addition of almost 300,000 TEUs. However, new records in the level of containerized trade look inevitable.[19] The increasing size of containerships has, to this point, been the most important response by container carriers to increasing world trade.

3.2 Restructuring and Reducing Costs While Growing

In addition to increasing vessel size, ocean container carriers are also seeing advantages both in growth of the size of the firm and in the restructuring of operations away from those of separate companies into shipping alliances. This has led to a market structure where two or more

[18]Porter, "Study sees even larger ships ahead," 13A.
[19]Gardiner, 122-123.

companies typically share the same increasingly larger ships in order to gain from economies of scale, of integration, and of scope. Alliance members might share each others' vessels in the same trade, and often are in the relevant conferences together, while still maintaining separate commercial identities. Because they can pool their resources to operate larger ships, these companies can take advantage of lower average costs per TEU carried than those faced by their smaller competitors. This cooperation gives the alliance members a cost advantage over smaller existing competitors and creates barriers preventing potential new entrants into the industry. Because of the lower costs, alliance members may either be able to earn greater returns on their investment or offer cheaper freight rates to their customers, or both. These lower freight rates result not only from purchasing more cheaply (which is what occurs per slot on the larger ships), but also from operating more efficiently (which is what occurs when vessel load factors are highest). A fully loaded 6000-TEU capacity ship costs about 21% less to operate per TEU than does a 4000-TEU capacity ship.[20] These increasingly larger ships have various sizes as seen in the following two figures (3.4 and 3.5). They show the forecast of ships trading to and from the U.S. but not necessarily ships of U.S. Flag Registry. The term "Panamax" used in Figure 3.4 and elsewhere refers to the maximum-sized vessel that can transit the Panama Canal. Post-Panamax vessels are those beyond the canal's limits.

[20]Porter, "Ocean carriers told to buy big or lose money," 4C.

Figure 3.4

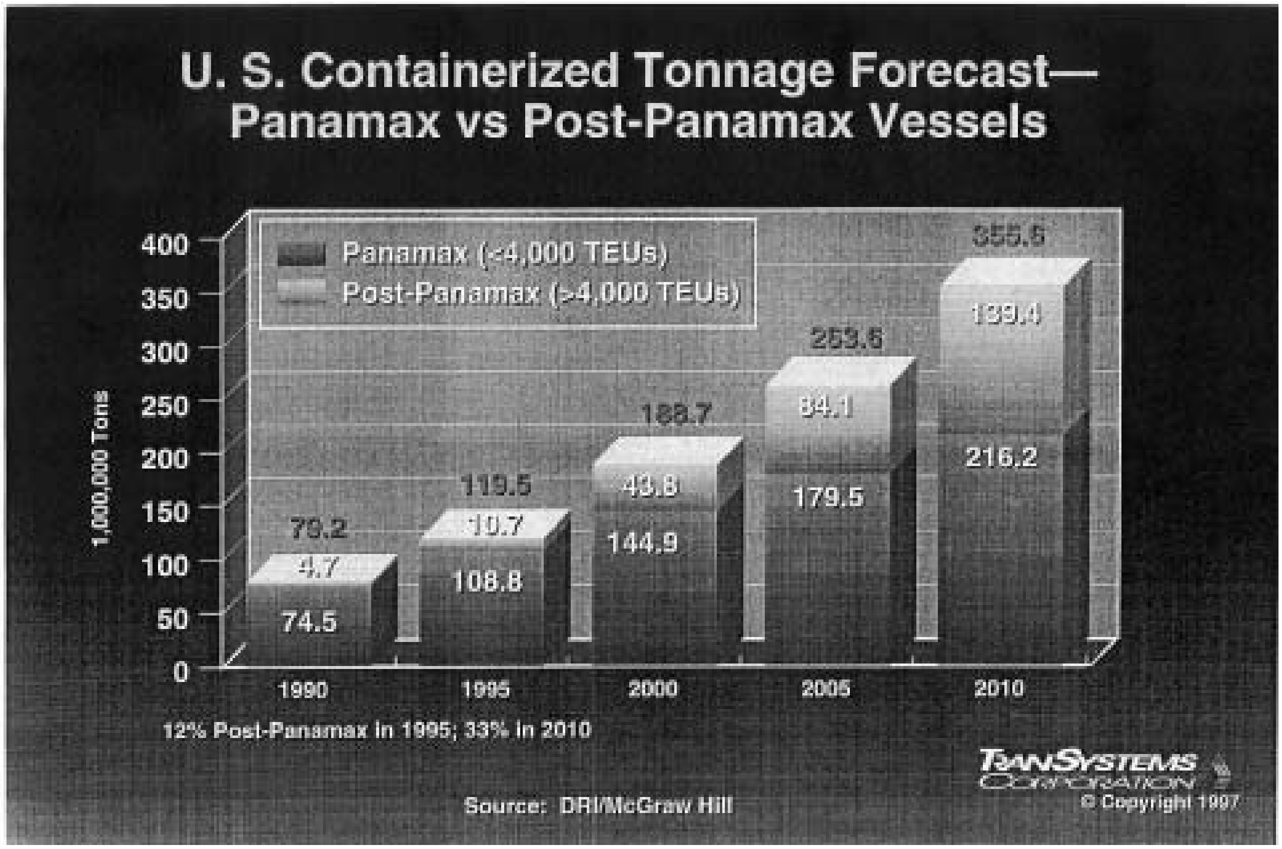

U. S. Containerized Tonnage Forecast—
Panamax vs Post-Panamax Vessels
Panamax (<4,000 TEUs)
Post-Panamax (>4,000 TEUs)
1,000,000 Tons
400
350
300
250
200
150
100
50
0
79.2
4.7
74.5
119.5
10.7
108.8
188.7
43.8
144.9
263.6
84.1
179.5
355.6
139.4
216.2
1990
1995
2000
2005
2010
12% Post-Panamax in 1995; 33% in 2010
Source: DRI/McGraw Hill
TranSystems Corporation
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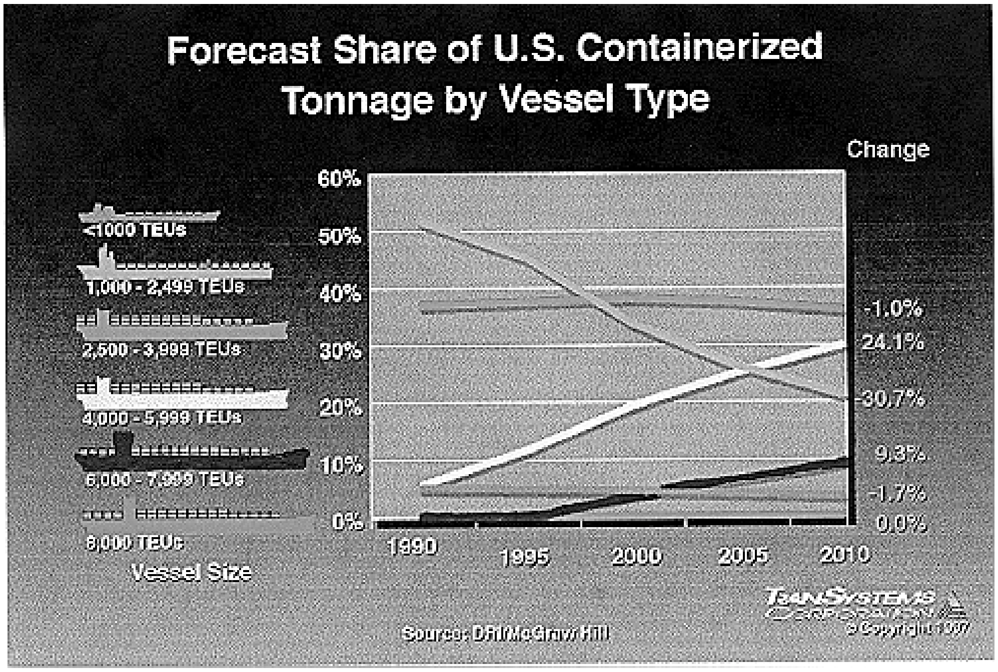
Figure 3.5



So, while all the gains from port-to-port vessel cooperation are not yet clear because such behavior is in its initial stages, firms operating as alliances anticipate that they will gain additional advantages from:

- joint vessel and equipment purchase and finance;
- joint operation of ocean terminals and inland depots;
- sharing of inland transportation arrangements;
- jointly negotiated labor contracts; and
- integration of administrative and information systems.

These alliances are distinct from single-trade slot chartering arrangements in that they are not just space-sharing leases, but are global in nature and increasing in their exploration of the potential benefits of deepening integration between the partners. Even so, companies who merely slot charter with one another in single trades are responding to the same trends and following patterns of cooperation similar to the behavior of the global alliance members, though in more limited and more tentative approaches. They often have a less-than-global scope and may piece together slot charter arrangements with differing competitors to form their own webs.[21]

Alliances have taken various forms, including equity, integration, and cooperation. Equity mergers are taking place between P&O and Nedlloyd, between Hanjin and DSR, and between APL and NOL. Integration of operations is occurring between Sea-Land and Maersk. Cooperation through ship sharing is taking place among some members of the Grand Alliance (P&O, Nedlloyd, Hapag Lloyd, NYK, and OOCL) and those of the Global Alliance (APL, Mitsui OSK Lines, and Hyundai Merchant Marine).[22] There is also talk of a slot chartering agreement between the two main alliances. Other agreements exist in more abbreviated forms, including single trade lanes.

Conferences are the traditional form of carrier cooperation, a kind of "software" cooperation. Since the U.S. Shipping Act of 1916, and reaffirmed in the Shipping Act of 1984, ocean common carriers have been allowed to discuss, fix, and regulate ocean freight transportation rates as well as freight through rates within their agreements, which have included the formation of conferences, consortia, and now alliances. On the other hand, "hardware" cooperation—a major result of the alliances—is so new and involves so few specific partners that the individual carriers who are alliance members are also maintaining their previous relationships

[21]Damas, "Alliances & webs, special report," 37.
[22]Damas, "Alliances & webs, special report," 40.

with relevant conferences. Conferences are trying to rationalize service more broadly by attempting to make the quantity of shipping capacity they supply coincide more closely with their customers' demands for that capacity. They are trying to maintain their members' profitability by balancing considerations of changes in rates with those of improving the quality and scope of conference services in order to find common ground among their members. The conference for a particular trade lane attempts to get its members to sell off or scrap older vessels, and to deploy any others in different trades when the lane in question experiences excess capacity. In theory, such behavior by shipowners will decrease the supply of shipping tonnage, which angers cargo interests because it keeps rates high. In practice, however, restraining the capacity of individual conference members has been problematic, especially when the same economic pressures cause nonmembers (independent competitors) to shift some of their capacity into the trades that seem to be expanding or the most profitable. This behavior of outsiders beyond the conferences' control keeps constant and increasing pressure on conferences to react in weakness, having failed to maintain rates, much less to increase them.

3.3 Improving Asset Usage

While the market has been growing in size and scope, it has not experienced commensurate growth in freight rates. The benefit objectives of alliances (of whatever type) have been to cut costs and increase revenues through increasing size, density, and scope of operations. The direct benefits of such consolidation include:

- more cost effective vessel deployment (i.e., improved capacity rationalization);

- improved flexibility in responding to ongoing changes in world-wide cargo flows;
- improved ability to collectively provide high-grade services;
- increased number of direct port calls with fewer transfer points;
- reduced reliance on feeder vessels due to that increase in ports called;
- increased number of fixed-day sailings;
- reduced transit times;
- increased ability to maintain integrity (punctuality) of each service string or loop;
- increased risk sharing; and
- improved coordination in new building programs.

Indirect benefits include:

- reduced potential competition by the creation of barriers to entry and mobility, given the higher level of assets and infrastructure now required to enter the industry or enter a specific trade lane without a partner; and
- reduced current competition among alliance members because of the high degree of cooperation and coordination necessary, and the tendency of alliance partners to generally protect cost savings gained in vessel operations by avoiding rate erosion.[23]

When the benefits of consolidation mentioned above are taken in combination, they create an environment that enhances rate and service stability, which is an important advantage to carriers. In addition, the cooperation and reduced competition among the large players on the carriers' side of the market means that there is a greater possibility of future rate improvement in areas where rates are currently low, such as depressed major trade lanes.[24]

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[23]FMC Bureau of Economics & Agreement Analysis, 8.
[24]FMC Bureau of Economics & Agreement Analysis, 8.

But these benefits do not come without costs. Some of the costs of consolidation include:

- loss (either real or perceived) of individual carrier identity;
- decrease in an individual carrier's control of his own vessels;
- need for higher levels of continued cooperation among carriers who have been, by nature, competitive with each other; and
- increases in the amount of resources required to solve the initial and ongoing day-to-day problems that inevitably occur in vessel operations.[25]

Further, a reliance on larger and larger ship size to achieve these production economies means that shipowners are now held hostage to load factor requirements. That is, they must have cargoes sufficient to keep their new 6000-TEU vessels full and in continuous operation. This will require greater flexibility among carriers in their pursuit of cargo. Such flexibility means that carriers will likely have to:

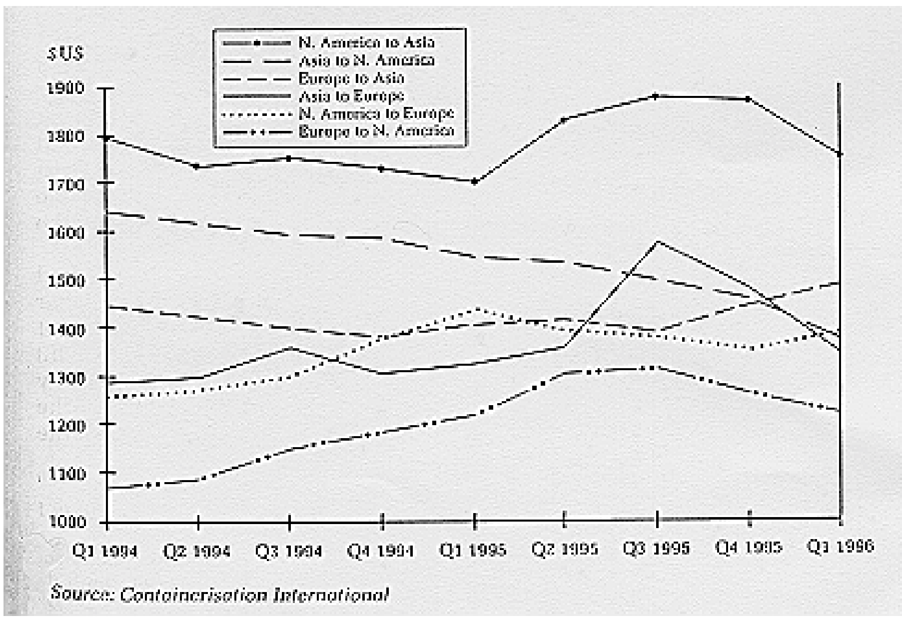
- convert different types of goods from breakbulk to container transport;
- increase specialized liftings, such as in the reefer trades;
- improve feeder service, especially north-south linkages to the backbone east-west routes;
- control costs;
- expand globally on land and sea; and
- extend the process of integration into terminal, depot, equipment sharing, and eventually information systems and other, more difficult areas of administration.[26]

[25]FMC Bureau of Economics & Agreement Analysis, 8.
[26] Damas, "Alliances and Webs, Special Report," 40.

Pricing trends seem to contradict the impetus to grow and expand. Figure 3.6 illustrates this paradox in the setting of freight rates.

Figure 3.6

Freight Rate Indicators for Principal East -West Trade Routes (All-in rates, Average Revenue in $U.S.)



Source: *Lloyd's Nautical Year Book 1997/Containerisation International*

Traditional pricing of ocean transportation for containerized general cargoes is designed to provide a utility or value to the cargo owner based on the increased worth of his cargo in its new place. Usually freight carriage pricing is directly correlated with the value of the goods themselves. Cargo volume, of course, also enters into the pricing equation because higher volumes help defray the cost of an expensive voyage by maximizing the ship's utilization level—

its load factor. So, freight rates have traditionally been set using a combination of determining factors—cargo value, cargo volume, specific route and distance, and difficulty of carriage. Over the years, these highly complex tariffs have been slowly but surely simplified into broader categories. Worse, from the operator's point of view, has been the pressure from many container shippers for a single uniform "freight all kinds" (FAK) rate, no matter what cargoes the container might hold.[27]

Economies of scale spur the building of megaships. Marginal contributions of one more unit or container above the carrier's current level of variable transportation costs (of loading, unloading, fuel, etc.) help him recover the enormous fixed costs of asset acquisition, and so become a driving force in shipping. Therefore, high-volume shippers are preeminent in the industry—they are the shippers whose business the carriers are most anxious to attract. Once rates are established for the specific cargoes of these highly sought after cargo owners on particular trade lanes, smaller-volume shippers of those same cargoes will be charged slightly higher and higher rates over the same trade lanes until the highest rates are charged for occasional shippers of that commodity. This has been the rationale for rate setting in the U.S. during the regulated era of common carriers in ocean-liner service.

Just as reduction of freight rates to promote high cargo volumes may increase vessel load factors, so does the formation of alliances of several firms that may then share the same set of resources. Sharing of vessels also means more turnarounds and faster transits by limiting port pairs, further improving asset utilization.

[27] Gardiner, 118.

Historically, many countries have reserved their domestic commercial transportation for the sole employment of domestic carriers. Laws enacted to express this purpose are known as cabotage laws. In the United States, the Jones Act restricts intra-U.S. shipping to U.S. domestic carriers, as distinct from U.S. international carriers. Therefore, international carriers must earn their revenues from any U.S.-related cargo by carrying it over some ocean to or from some port in the United States. They cannot legally conduct any trade strictly between one U.S. port and another. Ships that can reduce the number of U.S. port calls not only decrease port costs and vessel downtimes, but also increase the time that they are operating at a profit because the vessels can make more trips per year. Firms that consolidate their ships into an alliance are able to limit the number of port pairs, or limit the string per vessel by having other ships cover other port pairs. Such efficiency in vessel usage reduces the total number of vessel movements between U.S. ports and thereby increases the profitability of an alliance ship.

The alliances use both around-the-world and pendulum services to cover the major east-west trades of containerized general cargoes. The north-south trades, while not as large, are providing key niches for smaller regional carriers, who are increasingly forming partnerships with the global conglomerates. These carriers are becoming <u>feeders</u> of the larger carriers, taking containers to and from the east-west ships. Concomitant increases in the level of efficiency of these smaller, feeder carriers helps to provide a critical balance in the overall shipping market, as the market becomes more concerned with its operation as a unified system of freight transportation. Cargo-owner expectations of a reliable and seamless interfacing of ocean transportation services are growing as globe circling grids form where the larger carriers control the dominant east-west routes, fed by the smaller carriers from the north and south.

3.4 Achieving Global Capacity

Carriers and alliances of all sorts are being more creative, sharing assets, and sharing already existing capacities. P&O and Nedlloyd, for example, have already merged, forming the world's largest container carrier, an alliance of English and Dutch shipping firms that were already large individually. They currently operate four vessels, each of about 6674-TEU capacity, in the Europe to Far East trade, with an option for two more to be deployed.

Sea-Land and Maersk have recently integrated operations, short of an actual equity merger. Each company expanded its menu of value-added services by aligning with businesses that have capabilities that complement its own, so that now the two companies are able to offer expanded services both to each other and to their customers. This integration has resulted in more efficient investment for both firms, a fact that has reduced operating costs on several fronts, including vessels, equipment, terminal operations, personnel, fuel, and financial capital. These efficiencies also improve the possibilities of cost-effective entry into new markets. They enhance the firms' competitive advantages by allowing either company to offer more frequent sailings, fixed-day-of-the-week departures, and better access to certain terminals. Thus, quite a few direct operating advantages can come through the right alliances. Others of these advantages include expanded global coverage; rationalization of capacity by entering a partnership to improve service while, at the same time, taking vessels out of one trade and redeploying them elsewhere; raising the utilization levels of vessels and equipment; and increasing market share by offering better service in key customer segments of the market. The Maersk alliance with Sea-Land in the Pacific increased the weekly number of sailings of each company to five while reducing some excess capacity and allowing a reduction in intra-Asian feeder services from nine to eight.

Currently, Sea-Land/Maersk operates 105 containerships, including four 4000-TEU vessels in the U.S.-Europe trade and four 6000-TEU vessels in the Asia and European trade, with six more vessels on order.

Other firms taking advantage of the efficiencies afforded by megaships are Hyundai Heavy Industries, which has an unspecified number of megaships on order; Hyundai Merchant Marine, whose orderbook shows seven 5551-TEU capacity ships; and COSCO, which has recently deployed six 5250-TEU capacity ships in the Asia to North America trade, calling at the ports of Los Angeles and Seattle.

At the same time that these carriers are cooperating to promote efficiency in the supply of container carriage, the needs of shippers are growing in both size and complexity. Carriers must also be more flexible, not only in the kinds of services they offer, but also in how they offer these services. This situation is forcing continuing consideration by carriers of new ways to create alliances, not only with other carriers, but also with intermediaries and customers. Cargo owners' needs include lower transportation costs (not necessarily lower freight rates, although these are key components of carriage costs); consistent and reliable service, including information on the status of their shipments; and any other value-added elements that permit the cargo suppliers to provide better service to their own customers. Cargo suppliers are also attempting to increase their efficiency by reducing the number of carriers with whom they do business. In many instances, these cargo owners are going as far as forming global, multi-trade partnerships with carriers or third parties, such as forwarders.

3.5 Conclusion

The past increases in container volumes, when coupled with the expanding world trade brought on by lower national tariff and non-tariff barriers, indicate that ocean freight carriers are correct in placing large orders for new ships. The efficiencies of larger scale vessels in the face of tremendous competitive pressures make the ordering of megaships unavoidable. Alliances will continue to strengthen and deepen in order to maximize the utilization of these megaships and the return on the carriers' investments in these ships. Their size and the speed with which they call on U.S. ports are, for now and into the foreseeable future, major determinants of how well the freight transportation infrastructure will be able to respond to the increasingly complex demands of shippers.

CHAPTER FOUR: INFRASTRUCTURE RESPONSES TO INCREASED CONTAINERIZATION

4.1 Port Responses

Ports are responding to the increase in containerization by handling containers more efficiently, making major capital improvements, reorganizing, reducing costs, and enhancing levels of service. These improvements will be discussed more fully later in this chapter.

Among all of the roles that ports play in the transportation system, first and foremost, ports develop and manage real estate to act as land-based platforms in the transfer of goods to and from ships. For many years, ports have acted merely as the landlords of this real estate. But now, with the new demands of a large number of stakeholders in the global transportation system, port operators are required more than ever to do an efficient job of managing their facilities. It has often been said that the three key ingredients of the port as a real-estate landlord are "location, location, and location." A port is, for better or worse, intimately linked to its hinterland while, in a similar fashion, the parties using its connection are linked to ships and to the global market.

Ship owners, on the other hand, do not need to feel any particular loyalty to a given loading or discharge port except where cargo circumstances warrant such loyalty. Given the available alternatives from which shippers may choose to have their cargo delivered, carriers may be able to deliver their cargo within some fairly broad geographic limits. They might, for example, deliver cargo to a neighboring port or to a more distant port, from which the cargo can be delivered to its destination via rail landbridge or truck. So, because carriers basically hold the trump cards in this game, they are simply building bigger ships and using them to leverage ports and inland distribution networks to achieve greater returns. This development increases competition among fewer large liner companies calling at fewer ports. With that increasing concentration at sea comes the expectation of similar concentration of cargo carrying capacity on land.

A. Capital Improvements of Ports

As vessel size increases, hub ports that allow the transfer of cargo to and from containerships for inland and coastal markets by use of feeder and barge services are becoming increasingly fewer, more sophisticated, and more important to the overall transportation system. The ports that handle the megaships have required capital improvements that include larger terminals, bigger and faster cranes, more acres of container storage, improved access to inland markets through dockside rail sidings, streamlined rail and highway corridors, and deeper channels and berths that afford safe passage in and out for these larger ships. These capital improvements are necessary for a port to remain competitive in attracting and retaining the megaships, the railroads, and the cargo shippers and consignees. According to U.S. Department of Transportation (USDOT) statistics, U.S. ports invested more than $12.5 billion between 1946 and 1992, and expect to add another $5.5 billion by the end of 1997, for port and related shoreside transportation infrastructure.[28]

Competition, however, is the hallmark of our age, and ports compete just as fiercely with one another for the new giant containerships as any manufacturer would for the supply lines in its industry. The increase in efficiency resulting from this competition is the promise of market economies in the United States and elsewhere around the world. Members of global trade and transportation supply chains are increasingly competing with their peers in alternative supply lines. These same players are also cooperating with one another to facilitate the myriad of transactions that are handled through their interconnected web of relationships. The quest to achieve newly discovered and ever-increasing economies of scale further intensifies this competition and stimulates the formation of alliances. Increased investments to achieve economies of scale require sound explanations to taxpayers/investors to assure them that they will receive a reasonable rate of return on this additional investment. The magnitude of today's investments in megaships, ports, and infrastructure can no longer be based on a speculative "build it and they will come" attitude. Rather, these investments require support from a number of stakeholders throughout the transportation chain if a port is to be successful in the long run. Achieving this stability is all the more difficult, given the uncertainties of these increasingly competitive times. Today's competition and the accompanying uncertainties it generates are often a curse for those trying to plan strategies for investment.[29]

[28]Helberg, 25.
[29] Borrone, April 1996.

1. Terminals

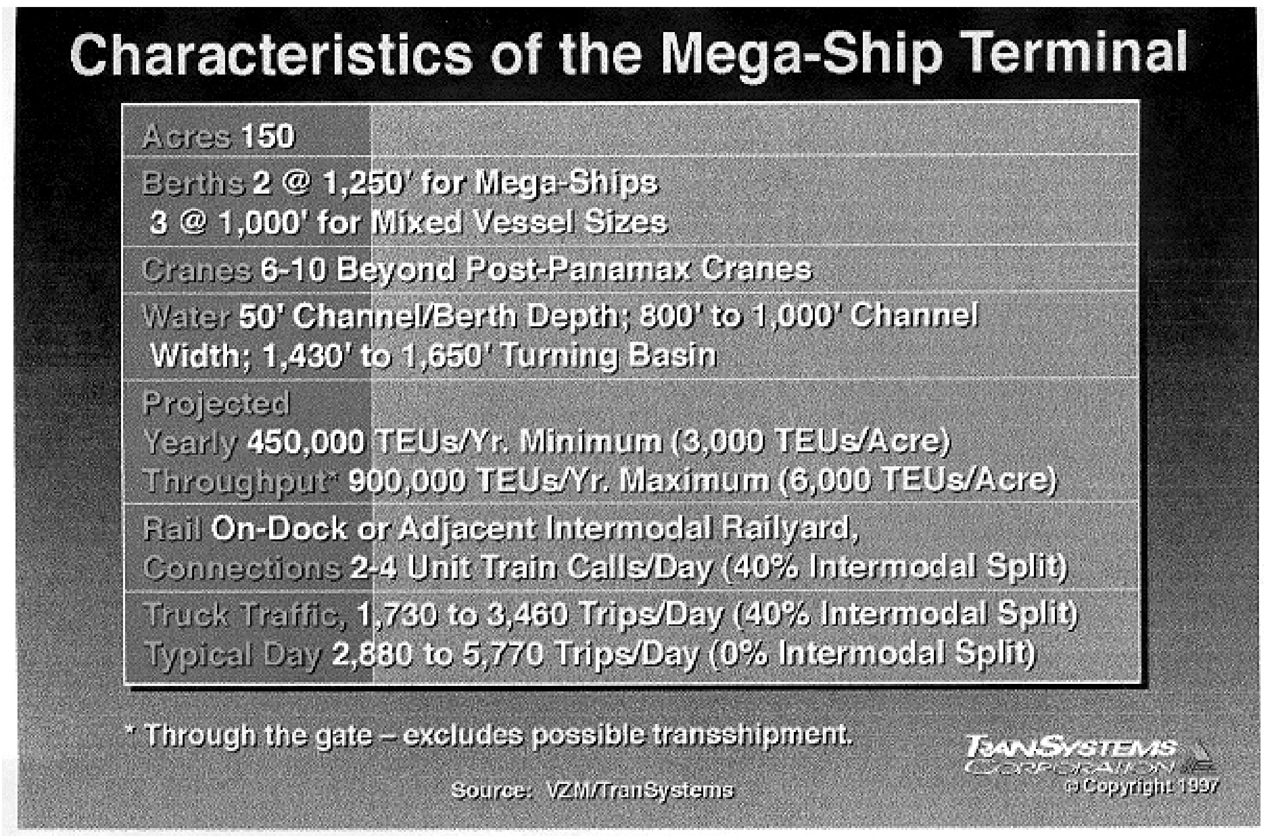
The increased carriage of cargo in containers on megaships puts greater pressure on the port terminal to process the containers off the ship, through their yard, and on their way to a further destination with dramatically increased efficiency. But a port, like a pipeline, is only as efficient as its smallest bottleneck or, like a supply chain, is only as strong as its weakest link. The port's interstate highway connection or railhead connection is often the point where the port's container flow is choked off.[30] According to M. John Vickerman, the average time a container rests at a U.S. marine terminal—its dwell time—is 6 to 8 days. Compare this statistic to that of U.S. intermodal rail terminals, where the average container dwell time is 1.5 to 2 days. Ceros president Christos N. Kritikos has suggested that marine terminal dwell time could be reduced by changing the traditional berth structure at ports by creating slips for these ships so that they could be worked simultaneously from both sides. This dwell time throughout the transportation portion of the supply chain can be reduced as shippers and carriers are able to better establish performance standards on which others can rely. Shippers can then avoid getting containers to port quite as far in advance to make ship cutoffs for export. Other improvements are noted in the subsequent discussions of technology to be found later in this chapter. Some of the characteristics of megaship terminals are enumerated in Figure 4.1.

Port responses often include operation of their water side operations independently from their land side receiving and loading of trucks and trains. This provides another area of tremendous potential improvement in efficiency as integrating and coordinating these two sides

[30] Helberg, 23.

occurs. The supply chain can be shortened in time if only the same percentage of containers is able to move directly through the port without having to be stacked and rehandled. The port of Rotterdam has cut not only much of their cost by so doing, but that of their customers as well.

Figure 4.1



2. Cranes

Bigger and faster cranes are needed to handle these bigger and faster ships. The largest containerships in 1995, Panamax vessels, had capacities of just over 4000 TEUs, whereas the current megaship *Regina Maersk* is capable of loading 6000 TEUs. Panamax ships are stopping at two to four ports before sailing foreign, while the new megaships are reducing that number of ports to the fewest possible. Carriers would prefer stopping at only one or two ports per coast and transshipping containers to and from those ports via feeder vessels or some other transportation mode. Therefore, the ports at which these carriers choose to call will be those that are willing to invest in infrastructure improvements necessary to attract and keep these vessels.

For example, on the U.S. West Coast, the port of Long Beach (in its efforts to attract ever larger containerships) has acquired 20 post-Panamax cranes capable of working vessels up to 16 containers wide. The port has, at a cost of between $1 and $2 million apiece, also recently modified three more cranes located at the California United Terminals Facility to increase their horizontal reach to 141 feet so that these cranes can now handle Hyundai's 4400-TEU capacity ships that call at the terminal. More recently, the port remodified these cranes to raise them by 29 feet to a total height of 105 feet so that they can handle Hyundai's 5551-TEU capacity ships. Cranes of similar capacity, if purchased new, would cost about $7 million each. Hanjin's new Long Beach terminal, opened in mid-1997, has six cranes that can reach 151 feet horizontally, over 18 rows of containers. COSCO is soon expected to order several cranes that have a horizontal reach of 180 feet, able to work vessels loaded 20 containers across so that they can handle 6,000-TEU capacity vessels (see Figure 2.7 for crane evolution. Figure 4.2 shows the world crane population that exists and that which is on order. Figure 4.3 describes port container crane productivity in the world as of November 1995.). COSCO's terminal is scheduled to open in mid-1998.[31]

[31]Mongelluzzo, "With cranes, size is everything," 1B.

Figure 4.2

World Crane Population— Existing and On Order

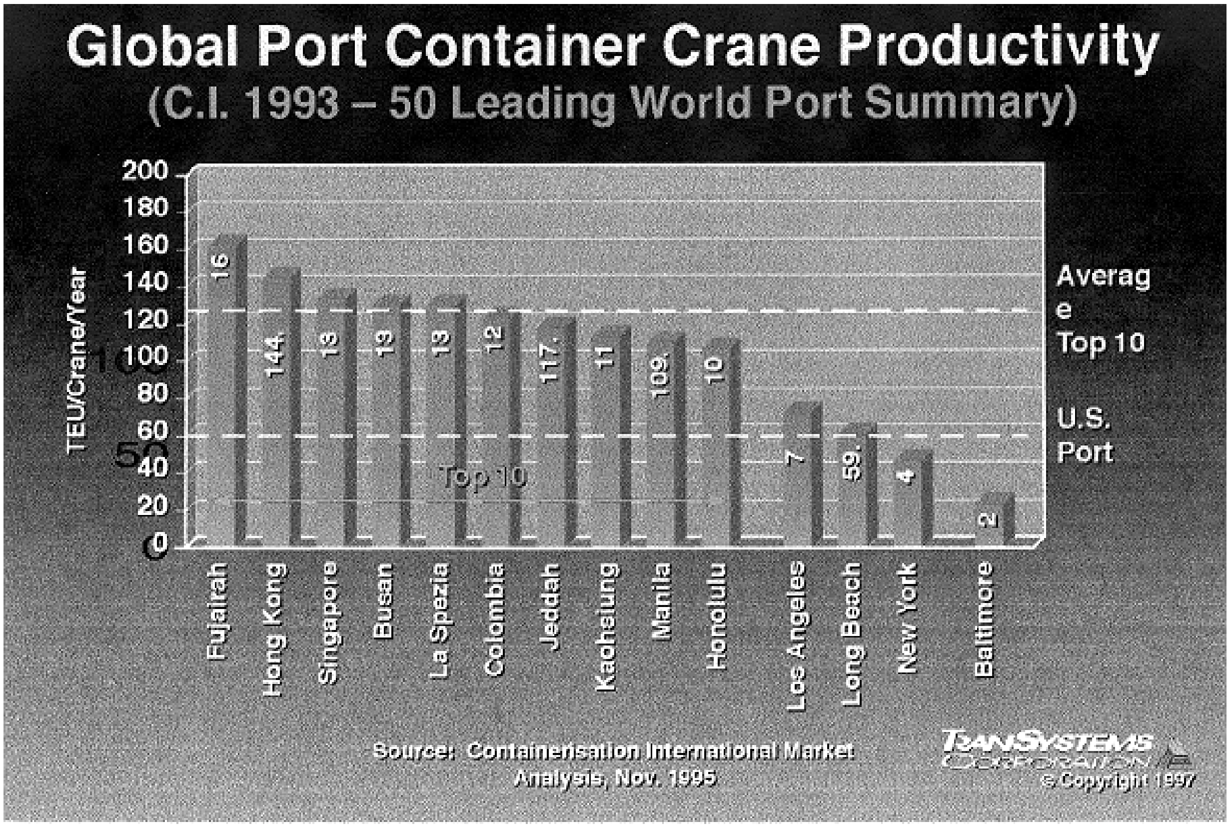
Size	Ship Handling	Operating in 1995	1996 - 1998 Deliveries*	U.S. /Canadian Orders 1996 - 1998
Panamax (<144' outreach)	13 wide 32.2m beam <4000 TEU	77%	30%	7
Post Panamax (144' - 158' outreach)	16 wide 40.0m beam 4000-6000 TEUS	19%	23%	4
Beyond-Post Panamax (>158' outreach)	17 wide + 42.5m + beam 6000 TEU +	3%	44%	55

* A total investment of $1.2 billion dollars.

Source: Containerisation International, AAPA and P&O Containers

TranSystems Corporation

Figure 4.3



Vickerman estimates that the time needed in one port to work a 5000-TEU vessel carrying 85 percent capacity, a task that encompasses the handling a total number of 8500 TEUs on and off, would be 189 crane hours. That means the ship would spend a minimum of 47 hours in port with four cranes operating. The ship would spend 38 hours in port with five such cranes working, and 32 hours in port with six comparable cranes. This is considerably longer than the current time spent by a containership at a single port call, though it is comparable for a current vessel calling at two ports.

Presently, Panamax ships are calling at approximately three U.S. ports, with an average use of two to three cranes in each; thus, the total time spent in each port is 24 to 30 hours with all aspects of the infrastructure working according to schedule. This means that these ships are having to spend about three days in port before sailing foreign. Additional time must be added to their schedules for the "unproductive" interim transit of a couple of days between these three U.S. ports.

When transshipments are added into the picture of TEUs handled on a megaship, they increase the time, pressure, and number of lifts required to load or unload a ship. As the number of ports called by a vessel decreases, the number of transshipments increases, as does the liftings per crane. There are at least four handlings for a transshipped container, as opposed to only two for a container going straight through the port. Many of these can be handled the second time from the inbound discharge directly onto a chassis or train without having to be handled into and out of a stack.

Normally containers must be discharged from the ship onto a chassis, then placed either in a stack or on wheels by a second type of crane, while those to be loaded are removed from one of these areas and placed by crane onto the ship. Then, when the inbound truck or train arrives, the containers headed inland are moved from the stack onto truck or train. Those on wheels are hooked to a tractor and pulled out. Those being transshipped are moved shipside and reloaded outbound. Improved efficiency of container handling and, therefore, lower dwell time results if the containers move directly from a ship onto the awaiting truck, train, or feeder vessel rather than going into "storage" in the port's container yard.

3. Acreage

Land needed for major transportation in older congested urban areas competes with residential values, with environmental quality, and with other modes for traffic flows. Competition for land use forces up land values and makes needed port expansion more difficult and more expensive. One way around this problem used by a number of ports is the reclamation of land from the sea. The Port of Rotterdam, for example, is filling in 5000 acres of ocean to create more space.[32]

Ports have dual operating styles for storage of containers, and each style uses land in a different manner. Keeping containers on chassis for expedited movement obviously requires far greater land to marshal operations than does stacking them. This expedited movement is one reason why U.S. container handling productivity, when measured as throughput per port acre, is low compared to many other countries' ports. The United States has traditionally had more land than most Asian and many European ports, so there is typically greater acreage available for storage in the U.S. than in other countries. This fact has kept most U.S. ports from embracing the more acreage-saving storage technologies used by other countries. Vickerman states that 50 acres per berth is average in the U.S., and that megaships may require 50 percent more land unless major changes occur in how U.S. ports handle throughput.

4. Dockside Rail

Dockside tracks are being installed in terminals such as the new American President Lines (APL) facility in Los Angeles. APL's new Los Angeles terminal has the capability of

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[32]Wastler, "European giant adds more muscle," 1C.

handling 64 double-stack railcars, or the equivalent of three full trains, at the same time. APL expects to shift 200,000 to 250,000 moves from truck to rail in the terminal's first full year of operation. Sean Kelley, Vice-President of APL's terminal operations, says that this terminal will begin operation with ten inbound and ten outbound trains per week and will grow to accommodate four inbound and outbound trains per day.[33]

The location of dockside tracks varies among ports from tracks located immediately alongside ship to distances of more than 2000 feet away. Even if the track is not very close to the vessel, having the dockside rail in the container yard is far preferable from a throughput standpoint to having to rehandle and dray containers across town to a train. The solution to the problem of how to decrease dwell time lies in how the carriers and the port's administrators preplan and communicate efficiently to and from the rails in order for the containers to pass along the entire chain more quickly. Proper planning of rail facilities will allow trains to run in a more timely fashion and also allow the docks to be cleared of cargo and trains more quickly after each cargo move.

5. Corridors

Concentrations of inventoried stock in fewer locations and the need for fewer distribution centers result from shortening logistics chains. These large concentrations of cargo in one place lead to corridors that open through main hub ports. It is along these routes, both domestic and international, that the concentrations of stocks in containers and trailers are being distributed.

[33]Mongelluzzo, "APL opens mammoth box terminal at Los Angeles," 1B.

What arrives in concentrated unitized form is then redistributed by "second-line" hubs which, in turn, ship goods back along the same routes.

Access to these corridors from dockside is a critically weak link, or bottleneck.[34] The Transportation Research Board of the National Research Council found in 1993 that two-thirds of the U.S. containerports face growing traffic congestion on the major truck routes leading to the ports. Half of the ports have numerous at-grade crossings on rails serving them. One third of the ports do not have adequate bridge and tunnel clearances for efficient double-stack container trains.[35]

Twenty-five percent of all trade entering the United States by sea passes through the ports of Los Angeles and Long Beach.[36] The $1.8-billion Alameda Corridor is a rail and truck corridor that will link the Los Angeles-Long Beach port complex with intermodal railyards 20 miles from the docks. It consolidates 90 miles of rail lines owned by three railroads into one route for 29 train trips per day from the port to intermodal facilities. It also eliminates dozens of grade crossings. Construction on the corridor began in April 1997. By the year 2001, the completed corridor is expected to considerably alleviate the southern California ports' congestion problems and should also improve general vehicular mobility in the region.

Houston, spurred by the recent merger of Union Pacific and Southern Pacific rail companies, is doubling the trackage to improve rail access to its Barbours Cut container facility and is, at the same time, improving loading facilities using funds raised through a $13-million

[34] Transportation Research Board, 4.
[35] Transportation Research Board, 4.
[36] Trunick, 23.

bond sale and a $13-million grant through ISTEA. These improvements will open up competing rail services and eliminate the day-long delays that occur all too often under current rail conditions at the facility.

On the other end of the infrastructure improvement spectrum, voters in the state of Washington recently rejected legislative proposals to raise state gasoline taxes $565 million for the construction of 28 freight mobility improvement projects.

6. Dredging

Each year in the United States, in order to maintain ship channels and make ports more accessible, about 400 million cubic yards of sediment must be dredged. Of this total, about 5% to 7% is from seriously polluted soils. Regular maintenance of this type is necessary at more than 90% of the major U.S. ports.[37] The factors affecting the need for dredging include:

- accessibility: ability to approach and depart safely;
- commodity flows: level, intensity, and value;
- vessels: characteristics, sailings/design draft; and
- market forces: volume, vessel size, and dynamics.[38]

Current water depths at several U.S. ports that might potentially be concerned with the 46-foot minimum draft of megaships can be seen in the following table (Table 4.1).

[37] Helberg, 24.
[38] Scalar, April 1996.

Table 4.1

Channel Depths of Selected North American Containerports (Feet)

	Pacific	Atlantic	Gulf
50+ feet	Seattle (175)	Halifax (60)	
	Long Beach (76)	Baltimore (50)	
	Vancouver BC (50)	Hampton Roads (50)	
	Tacoma (40-50)		
46-49 feet	Los Angeles (45)	Everglades (47)	
	Honolulu (45)	Freeport (47)	
40-45 feet	Oakland (42)	Miami (42)	New Orleans (45)
	Portland (40)	Savannah (42)	Tampa (43)
		Charleston (40)	Houston (40)
		NY/NJ (40-45)	
<40 feet		Jacksonville (38)	Gulfport (36)

Note: Berths may not be dredged to these depths.

Source: Seaports of the Americas, 1996

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In its annual report to the Congress, the U.S. Army Corps of Engineers projected that by the end of 1997 the Harbor Maintenance Trust Fund should reach a level of about $1.1 billion. In a case tried before the United States Court of Federal Appeals, the court found that applying the harbor tax to exports is unconstitutional and ordered revenues collected from exports via this tax to be refunded. This leaves in question how future dredging will be funded.

B. Restructuring and Reducing Costs to Increase Efficiency

From the point of view of port administrators, measurement of the productivity of ports entails counting the number of TEUs handled per acre, per hour, or per crane. The shipowner, however, is more concerned with how quickly his vessel can get in and out of the United States while achieving the highest load factors and calling at the fewest ports. Port investors are concerned with maximizing the port's throughput per dollar invested. Domestic carriers are interested in minimizing the unprofitable time that their equipment sits idle at a port while waiting to be loaded and unloaded. Cargo owners are concerned with transportation service quality, reliability, and with meeting anticipated delivery schedules. Irrespective of the manner by which one measures port productivity, however, it is nonetheless true that ports are restructuring themselves by forming port alliances and by finding new inroads to cooperation with labor and government.

1. Alliances With and Among Ports

In a manner similar to the behavior of carriers, there are a number of ports forming alliances of varying degrees. Cooperation between the ports of New York (NY) and Port Elizabeth (NJ), as well as between those of Philadelphia (PA) and Camden (NJ) (also known as The Delaware River Port Authority), has provided increased benefits to the individual ports. The ports of Long Beach and Los Angeles have cooperated in planning both landside and ocean approach developments. The ports of Seattle and Tacoma, although once fierce competitors, recently joined forces to encourage the passage of corridor improvement legislation (though their efforts were unsuccessful, as mentioned earlier).

The necessity of "getting close to the customer" is such a well established marketing principle that it has almost become cliché. Even so, in the real world, a closeness in logistics often actually leads to some form of integration. The reliance on "just-in-time" deliveries, for example, clearly means that freight transportation schedules must be in lock step with production methods and schedules. This means that ports must try to integrate their own operations as well as to integrate their operations with those of carriers and with shippers. So, when a containership arrives at berth it must be handled immediately—regardless of the hour.

Every effort is made by ports to add value to shippers' products and services. When shippers need marshaling or terminal space, it is allocated to them if at all possible. Special handling arrangements are becoming increasingly difficult around mechanized container yards. But these are exactly what is required when carriers attempt to convert breakbulk and bulk commodities into containerized cargoes. Ports, therefore, attempt to find space off dock, away from the container yard operations at the pier, in order to accommodate the customer. Sometimes this process involves finding third parties or private investments to develop specialized services or facilities in which the port can act as catalyst for specialized operations.

2. Needed Labor and Government Cooperation with Industry

Extensions of labor hours may be required beyond the current hours of operation practiced at most U.S. ports. Many Asian ports currently operate 24 hours per day. A 24-hour port operation schedule has been too costly a strategy for most U.S. ports to seriously consider, although many ports do work extended hours (and all of them work around-the-clock when a containership is at berth).[39] The labor/management relations at the Delaware Valley Ports is an example of such progressive reorganizing. Labor wanted jobs, security, and jurisdictional authority. Management wanted a labor contract that allowed the port to remain competitive. Their recent contract allows for anywhere between 14 and 19 starting times per day, inclement-weather work, and many other work-rule modifications. These concessions were all accomplished at lower costs for port users, so all sides won.[40]

The voters and regulators in many political jurisdictions must reach a consensus regarding the costs and benefits of projects and programs before improvements in the publicly funded portions of the transportation infrastructure can be put into place. The process of educating voters about the long-term benefits of an efficient transportation infrastructure is essential if gridlock is to be avoided and development is to occur, especially in this period where voters are typically in favor of downsizing the government. Because foreign trade—when measured as the total of exports and imports—now accounts for over 20 percent of the value of U.S. Gross Domestic Product (GDP) and is continuing to grow, it is a catalyst of economic growth. Foreign trade's emergence, the role of the transportation infrastructure in moving these goods, and the relative productivity of the U.S. transportation system compared to transportation systems of other countries are all factors that must be considered in the financing debate among the voters and transportation system stakeholders.

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[39] Vickerman, Background Paper 3, 4.
[40] Baldwin, 15A.

C. Enhancing Levels of Service

A comparison of the most efficient U.S. ports with some others worldwide shows that the best Asian ports achieve throughputs that are considerably higher than those experienced by U.S. ports. Several factors influence these differences in throughput. The major reasons for the statistical superiority of the best Asian ports are:

- higher rates of transshipment;
- more widespread use of more technologically advanced terminal equipment;
- more intensive cargo storage and berth usage; and
- around-the-clock operations.[41]

Several of these factors, such as the longer hours of operation, keep the throughput statistics less than perfectly comparable with U.S. port productivity numbers. However, despite the differences in what are considered conventional operating methods between the U.S. and other countries, the question remains as to how ports in the United States, in order to compete with the world's most efficient ports, can raise their level of performance to meet or exceed this standard.[42] Vickerman suggests an answer to the question, contending that some of the deficiencies in U.S.-port throughput can be alleviated through:

- increased use of intermodal rail, which can potentially cut dwell time down from 1 to 4 weeks to about 2 days;
- more intensive container stacking; and

[41]Vickerman, Background Paper 3, 3.
[42]Vickerman, Background Paper 3, 3.

- use of more advanced information technologies and terminal equipment, such as the "elephant train" technology used in Rotterdam.[43]

1. Invisible Port Tied to Intelligent Transportation (IT) Systems

The "invisible port" is a mechanism through which the various links of the logistical chain connect in the "behind-the-scenes" networks of people, of organizations, and of computers. The whole system is connected, through what seems like an infinite number of invisible threads of information and instructions, to the more familiar "visible" port activities that we see and hear.[44] The invisible port acts as a central nervous system through which all of the activities of the visible port are linked and given the information needed to guide operations. The number and complexity of data flows are growing by the day. The invisible port directs the visible port. So, just as the body cannot function when its nervous system fails, the visible port cannot function if the invisible port's system of information transfer is inadequate. Given the modern shipper's demand for just-in-time service and carriers' desire to reduce equipment idle time, today's port and land-based transportation network must be connected to each other by an electronic information network. The commonly used term for such a state-of-the-art electronic information transfer system is "information technology and telecommunications" (IT) system.[45]

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[43]Vickerman, Background Paper 3, 3.
[44]Scholten and Walters, 4.
[45] Scholten and Walters, i.

Perhaps the best example of the implementation of an IT system can be found at the Port of Rotterdam, in the Netherlands. At Mainport Rotterdam, the Rotterdam Municipal Port Management and the Rotterdam Port Industries' Association have joined together to set up an information technology and telecommunications (IT&T) committee designed to coordinate their electronic infrastructure and to solicit the cooperation of the port's various stakeholders in making the port's operation more efficient. The committee is made up of experts from container and general cargo companies that operate at the port, as well as agents, truckers, customs officials, IT companies, and nearby educational institutions. In addition to the local input, the committee also consults with other ports, other transport regions, and other related industries. The IT&T Committee is the driving force behind Mainport Rotterdam's recent and continuing improvements in technological and telecommunications efficiency.

The various components of the information transfer process—input, storage, management, processing, and distribution of data—must all be handled in an efficient manner if the "invisible engine" is to run smoothly. An IT engine that runs smoothly creates an energy that drives the whole port system, so it must be shared by everyone concerned to be effective. For this reason, IT projects do not benefit just one stakeholder and are therefore not effective if they are merely useful to that stakeholder. Instead, development of IT projects always requires the cooperation of a least two, and usually more, of the stakeholders.[46] This kind of cooperation has been a standard operating procedure at Mainport Rotterdam, which is one of the reasons why it is one of the world's leading ports. In 1995, the port had twenty-two IT-related "invisible construction" projects under development! Some of these projects include:

[46] Scholten and Walters, 5.

- installation of a network of fiber optic cable throughout the 26-mile-long port to make communications tie-ins easier for the various stakeholders;

- use of bar codes on containers, combined with electronic data interchange (EDI), to better link the administrative and physical cargo-handling processes; this project also included a pilot study to determine the feasibility of creating a new, more sophisticated standard for a grouped-container bar code system, called the Serial Shipping Container Code (SSCC), and integrating it into the port's operations;

- use of "Smart Cards" (or "Cargo Cards")—an electronic identification and paperwork replacement system used by truckers at the gate to inform the cargo handlers that they have arrived and are ready to receive cargo; the system has reduced bottlenecks created by paperwork and has consequently lowered waiting time through better information sharing;

- use of MISTER, a system whose name comes from a Dutch acronym meaning "small and medium-sized businesses in the Port of Rotterdam: stronger through the use of information technology;" this is an IT technology that attempts to attract smaller businesses to the port by providing them information transfer technologies customized for each business to make its specific connections to the port more efficient; and

- use of the Substance Information, Ship Transport, and Emergency Response (SISTER) database; this system provides information on hazardous cargo, allowing the port to control the quality of such cargoes that enter the port in order to both prevent disasters and to respond better to those that occur.[47]

2. Adapting Current Technologies

Getting more out of current resources before investing in future assets is a priority to ports because the magnitude and costs of these new investments are so great. Thus, it stands to reason that technologies that complement the current stock of resources to improve the efficiency of their use will generally be the first to be implemented. Some of these innovations include pin handling systems, yard inventory software, automated guided vehicles, in-ground conduits, and state-of-the-art storm-drain systems to respond to environmental mandates.[48]

In 1994, Sea-Land Service, Inc., opened the world's first automated container terminal at the Deltaport facility of the Port of Rotterdam. This terminal handles containers by using automated machinery, and so uses only about one-third of the number of workers that are required by a regular terminal moving the same cargoes. Built to move 500,000 containers (in TEUs) per year between truck and ship, last year it handled over 560,000, and is expected to handle more than 600,000 TEUs in 1997. The terminal has improved efficiency by concentrating on container flow rather than size and storage capacity. Seventy percent of the cargo moved through the terminal is handled on trucks, which are usually loaded or unloaded and out of the terminal within a half hour of arrival while using only four gates. This rapid turnaround time has

[47] Scholten and Walters, 5.
[48] Vandeveer, 89.

virtually eliminated at Deltaport the problems of traffic congestion, long truck lines, and idle equipment that are commonplace at most ports.[49]

> It works like this. A trucker carrying an export container comes into the Deltaport gate and submits the paperwork and identity via electronic scanning, intercom, and pneumatic tube.
>
> The trucker then gets a card key and travels about a quarter of a mile to the next set of gates. During that time, the Delta computer is double-checking the information and figuring out where the container needs to be to meet the right ship at the right time in the right order with all the other containers that need to be stacked on that ship.
>
> At the second set of gates, the trucker is told to take the container to one of four staging areas.
>
> Once the truck is parked at the staging area, a straddle carrier, one of the few pieces of equipment with a human operator, plucks the container off the truck trailer and takes it to the appropriate lane. These 16 lanes are long alleyways stretching between the truck staging area and the wharf side. Containers are stacked 2 high and rest in lava rock to keep them stable. The straddle carrier goes on to pluck another container for the trucker to take out of the terminal.
>
> Meanwhile, large robotic spiders move over long container lines, shuffling the nested containers like a mother hen rearranging eggs.
>
> The shuffling, all computer driven, has an important purpose—getting export containers toward the wharf and import containers toward the trucks. Ideally, when the ship pulls in, all the containers it will take with it will be waiting in the front of the lines, ready to be loaded in an order that will make unloading the ship somewhere else as easy as possible.
>
> . . . Except for a few lashers and the crane operator, the process is automatic.[50]

The Sea-Land operation at Deltaport Rotterdam provides an outstanding example of the synergistic relationship between the "invisible" and "visible" aspects of an efficient cargo-handling system.

[49] Wastler, "Caution clouds Delta's dawn," 4B.
[50] Wastler, "Caution clouds Delta's dawn," 4B.

At the Port of Virginia, another equipment handling and storage innovation involves chassis stacking racks. The port is establishing a neutral 100-acre chassis pool in order to cut its ocean carriers' costs as well as its own. Lowering the number of available chassis required by 30 to 40 percent of the usual 18,000 units in storage is estimated to save carriers $14 million per year based on an average $5 per unit per day storage tariff. The container pool is expected to provide additional saving by decreasing container maintenance and repair costs.[51]

Ocean carriers are calling at fewer ports, so the port system is evolving into a hub-and-spoke system similar to that seen in our air transportation system. The ports of call for the megaships will all be hub ports, and will tend to develop into megaports in order to handle the expected increases in cargo. This evolution is requiring larger commitments of both public and private investment. Improving efficiency through eliminating bottlenecks, both physical and informational, is also a basic requirement.

Productivity of U.S. ports cannot be directly compared to that of many foreign ports, especially those of Asia. The most efficient foreign ports tend to be more privatized and often operate 24 hours a day, in a different labor climate, on little land, and by using intensive stacking methods rather than "on wheel" operations. So, foreign customs and conventions and those ports' operating objectives must be weighed in assessing their productivity before comparing them to the best ports in the United States. Further, because the use of feeders is much more prevalent in Asia than in the U.S., the extra handlings necessary in this process means that the number of ocean container moves in Asia will be overstated relative to those of the U.S. for the

[51]Sansbury, 1B.

same basic service. As the hub-and-spoke system develops in the United States and containerports separate into two basic classes (megaport and feeder port), increases in the number of container handlings by both types of ports should soon make the relative advantages of a national commitment to such a system evident to both taxpayers and private firms and investors. The establishment and maintenance of a consensus among all the stakeholders—public and private—in the freight transportation system as to the benefits of developing this hub-and-spoke or megaport/feeder port system has become increasingly important.

4.2 Intermodal Responses to Increased Containerization

A. Background and Growth

Containers and trailers both move intermodally. Containers move through incremental contracts with a carrier in each mode and through joint-mode contracts between ship and truck, ship and rail, truck and rail and, sometimes, ship-truck-rail. Complete data are not readily available to show container movements interfaced between strictly ship and truck, even though such movements make up a significant share of the U.S. international container trade. However, we do know most of these moves are between locations within 700 miles of the port, a range within which the speed and flexibility of trucks enable them to dominate rail and other ground transportation services for container moves. Trucked containers in longer-haul intermodal moves also often have two truck moves associated to and from a rail move. So trucking is much more important to the international container traffic system than is rail, for which data are much more readily available.

Over the past decade, U.S. intermodal rail traffic (containers and trailers) has doubled. It has only been since the early 1990s, however, that shippers, consignees, and motor carriers have come to realize both the cost effectiveness and the reliability of combined trucking and rail operations. Some of the reasons that shippers and carriers have cited for switching from strictly truck to intermodal rail service include higher frequency of on-time delivery, lower claims, and improved billing accuracy.[52]

In the United States, as late as 1984, only one dedicated double-stack intermodal train per week ran from the U.S. west coast to the inland United States. By 1994, however, more than 200 trains of this type were traveling such routes on a weekly basis, and now most major U.S. railroad companies are finding that intermodal traffic is their fastest growing cargo segment.[53] The following two Figures (4.4 and 4.5) illustrate this trend.

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[52]Fossey, 13.
[53] Vandeveer, 88.

Figure 4.4

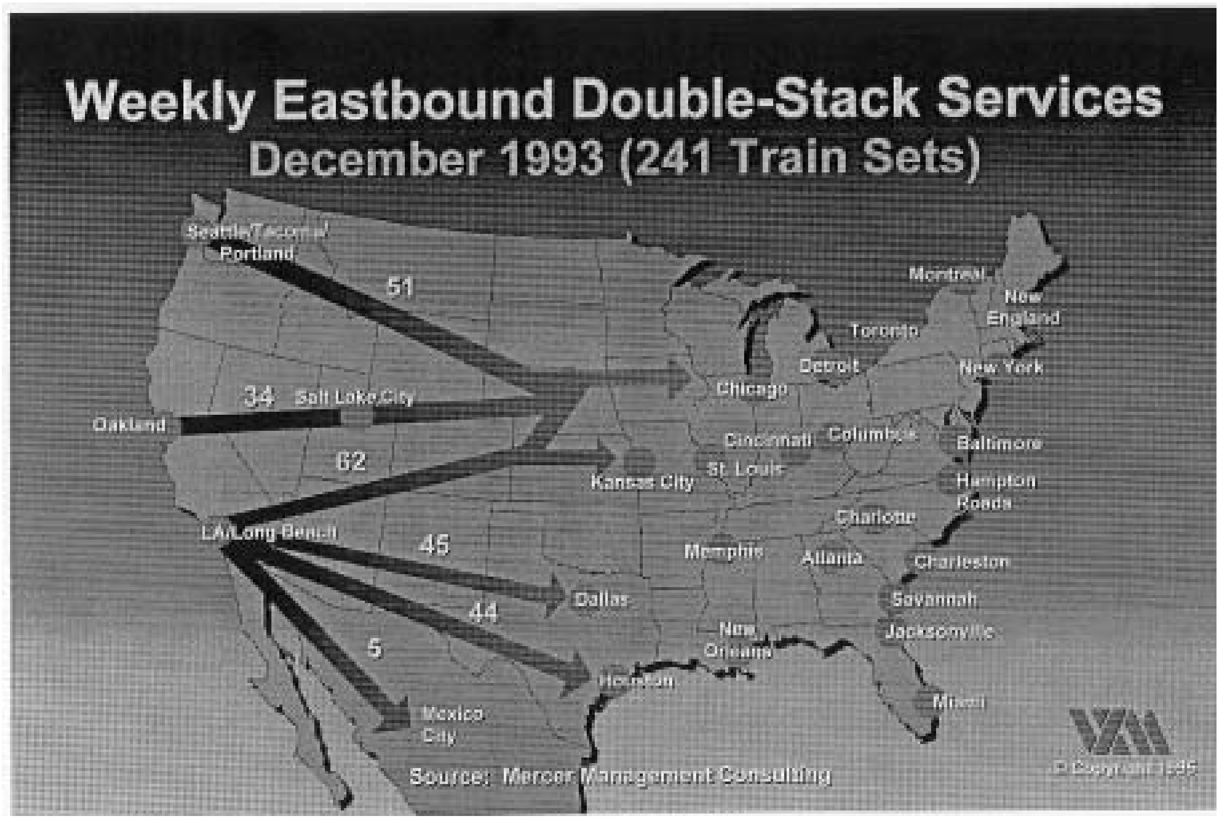
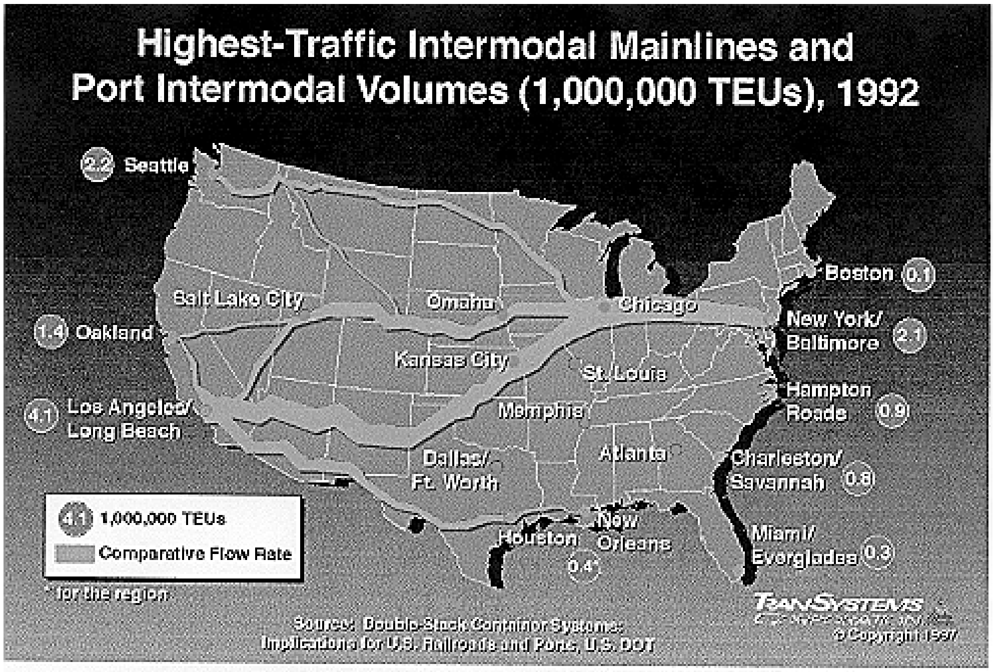

Weekly Eastbound Double-Stack Services
December 1993 (241 Train Sets)
Seattle/Tacoma/
Portland
51
Oakland
34
Salt Lake City
62
LA/Long Beach
45
44
5
Mexico
City
Chicago
Kansas City
Dallas
Houston
Montreal
New
England
Toronto
Detroit
New York
Cincinnati
Columbus
Baltimore
St. Louis
Hampton
Roads
Charlotte
Memphis
Atlanta
Charleston
Savannah
Jacksonville
New
Orleans
Miami
Source: Mercer Management Consulting

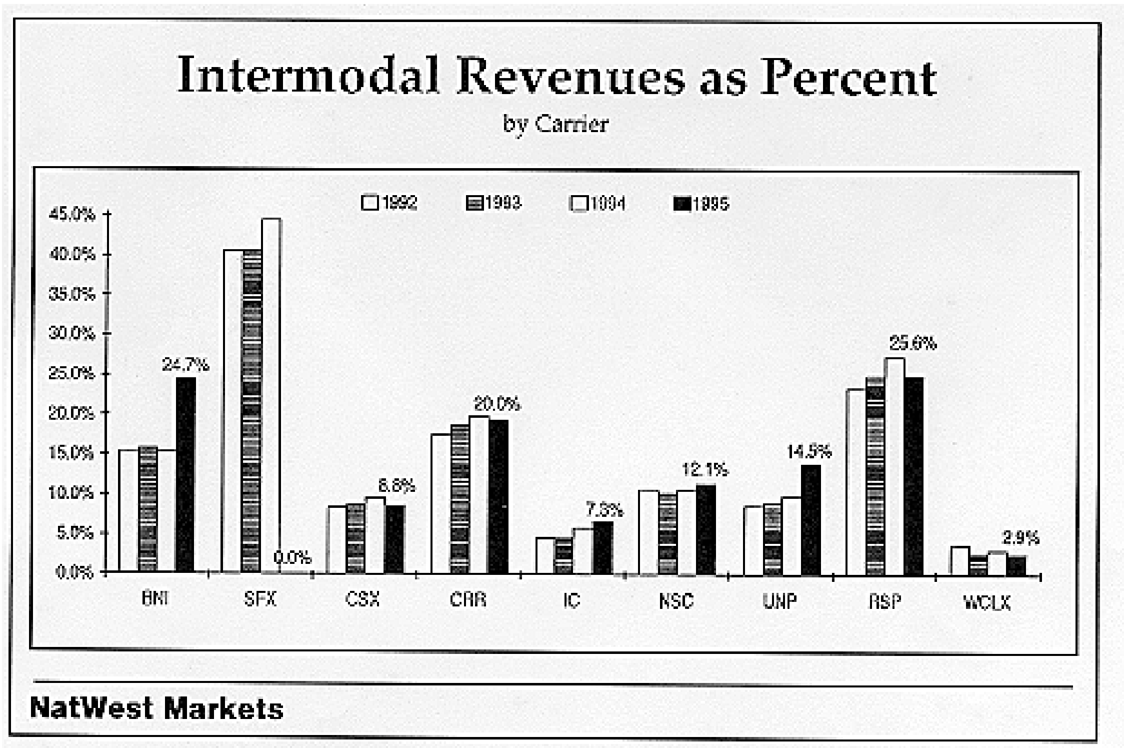
Figure 4.5



Highest-Traffic Intermodal Mainlines and
Port Intermodal Volumes (1,000,000 TEUs), 1992
2.2 Seattle
Salt Lake City
Omaha
Chicago
Boston 0.1
1.4 Oakland
New York/
Baltimore 2.1
Kansas City
St. Louis
Hampton
Roads 0.9
4.1 Los Angeles/
Long Beach
Memphis
Dallas/
Ft. Worth
Atlanta
Charleston/
Savannah 0.8
4.1 1,000,000 TEUs
Comparative Flow Rate
* for the region
Houston
New
Orleans
0.4*
Miami/
Everglades 0.3
TranSystems
Source: Double-Stack Container Systems:
Implications for U.S. Railroads and Ports, U.S. DOT
© Copyright 1997

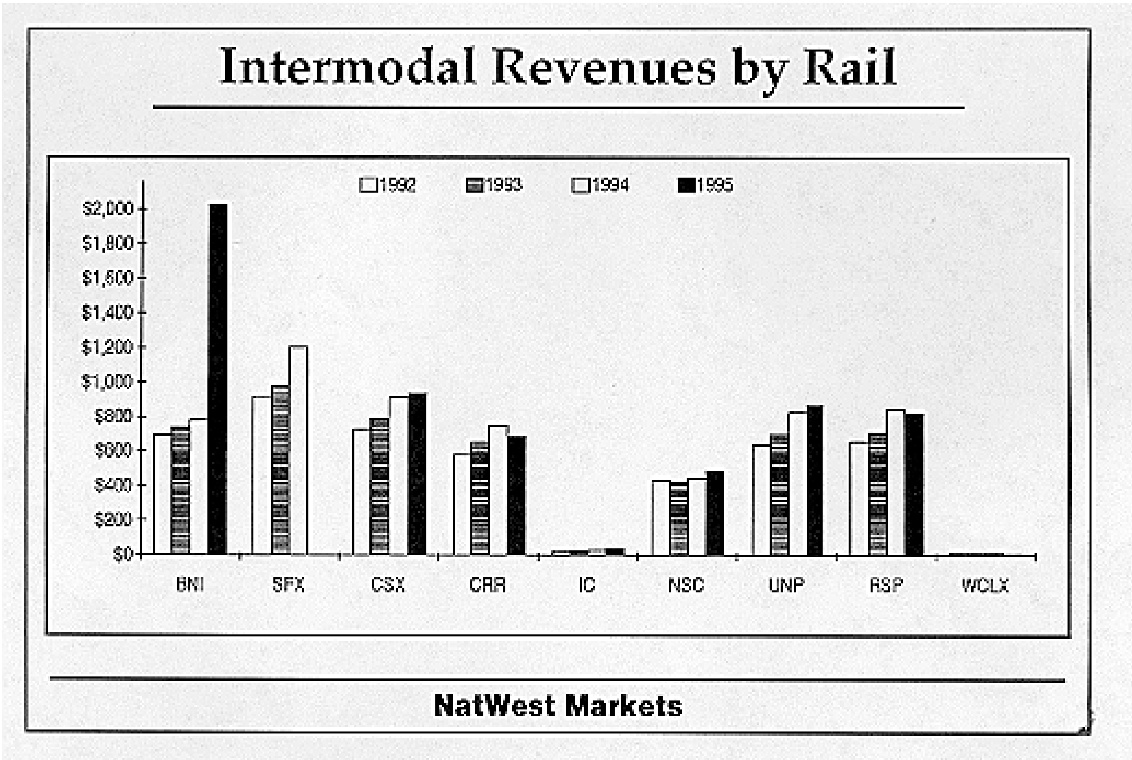
Figures 4.6 and 4.7 illustrate the increasing significance of overall intermodal activity on the rails.

Figure 4.6



Source: DRI/McGraw Hill, *Intermodal Insights* 1996

Figure 4.7



Source: DRI/McGraw Hill, *Intermodal Insights* 1996

Intermodal movements account for 1.4% of the total U.S. freight tonnage and 1.9% of revenue from all freight movements in the United States. U.S. intermodal rail moves are approximately 20% of U.S. rail traffic. Annual intermodal movements in the United States have grown from about 2.4 million loads in 1972 to over 8.1 million in 1995. Between 1996 and 2004, U.S. rail intermodal traffic is forecast to grow about 5% per year in volume and 4.3% per year in revenue. Overall, growth in intermodal revenues is expected to be about 53% between 1994 and 2004. This revenue growth is second only to the 92.1% increase projected for air carriers, and is well above the 23.8% growth projected for freight revenues in all modes combined. Fifty percent of this intermodal growth is expected to occur because of increases in international intermodal traffic. Less-than-truck-load (LTL) intermodal traffic is forecast to increase by about 9.8% per year, while truck-load (TL) intermodal growth is expected to be about 4% per year over this same period.[54]

The container's share of intermodal rail moves is now over half. This percentage should continue to grow as international trade expands. Tables 4.2 and 4.3 show actual and projected growth rates of volume and revenues for the various U.S. domestic transportation modes, including intermodal transport.

Table 4.2

Table 4

Domestic Transportation Growth—Volume[1]
1994-2004

	Million Tons			Modal Share			CAGR[2]		Cum.[3]
	1994	1999	2004	1994	1999	2004	94-99	94-04	94-04
Truck	5,456	5,987	6,499	54.9%	55.4%	55.9%	1.9%	1.8%	19.1%
Rail	1,614	1,825	1,982	16.2%	16.9%	17.1%	2.5%	2.1%	22.8%
Intermodal	128	160	208	1.3%	1.5%	1.8%	4.7%	5.0%	62.5%
Air	7	10	13	0.1%	0.1%	0.1%	8.8%	6.7%	92.0%
Water	1,058	1,091	1,151	10.6%	10.1%	9.9%	0.6%	0.8%	8.8%
Pipeline	1,676	1,726	1,769	16.9%	16.0%	15.2%	0.6%	0.6%	5.6%
Total	9,938	10,799	11,622	100.0%	100.0%	100.0%	1.7%	1.6%	16.9%

[1] Primary shipments only
[2] Compound Annual Growth Rate
[3] Cumulative change, 1994-2004

Source: *U.S. Freight Transportation Forecast…to 2004*

[54] DRI/ McGraw-Hill, 9.

Table 4.3

Table 5

Domestic Transportation Growth—Revenue 1994-2004

	Billion $ 1994	1999	2004	Modal Share [1] 1994	1999	2004	CAGR [2] 94-99	94-04	Cum.[3] 94-04
Truck	$362.2	$394.9	$436.9	78.2%	76.7%	76.2%	1.7%	1.9%	20.6%
Rail	$33.9	$38.3	$41.9	7.3%	7.4%	7.3%	2.5%	2.2%	23.8%
Intermodal	$8.5	$10.3	$12.9	1.8%	2.0%	2.3%	4.0%	4.3%	52.6%
Air	$20.3	$31.1	$39.1	4.4%	6.0%	6.8%	8.8%	6.7%	92.1%
Water	$7.8	$8.1	$8.5	1.7%	1.6%	1.5%	0.7%	0.8%	8.5%
Pipeline	$30.4	$32.4	$34.2	6.6%	6.3%	6.0%	1.2%	1.2%	12.4%
Total	$463.1	$515.1	$573.5	100.0%	100.0%	100.0%	2.1%	2.2%	23.8%

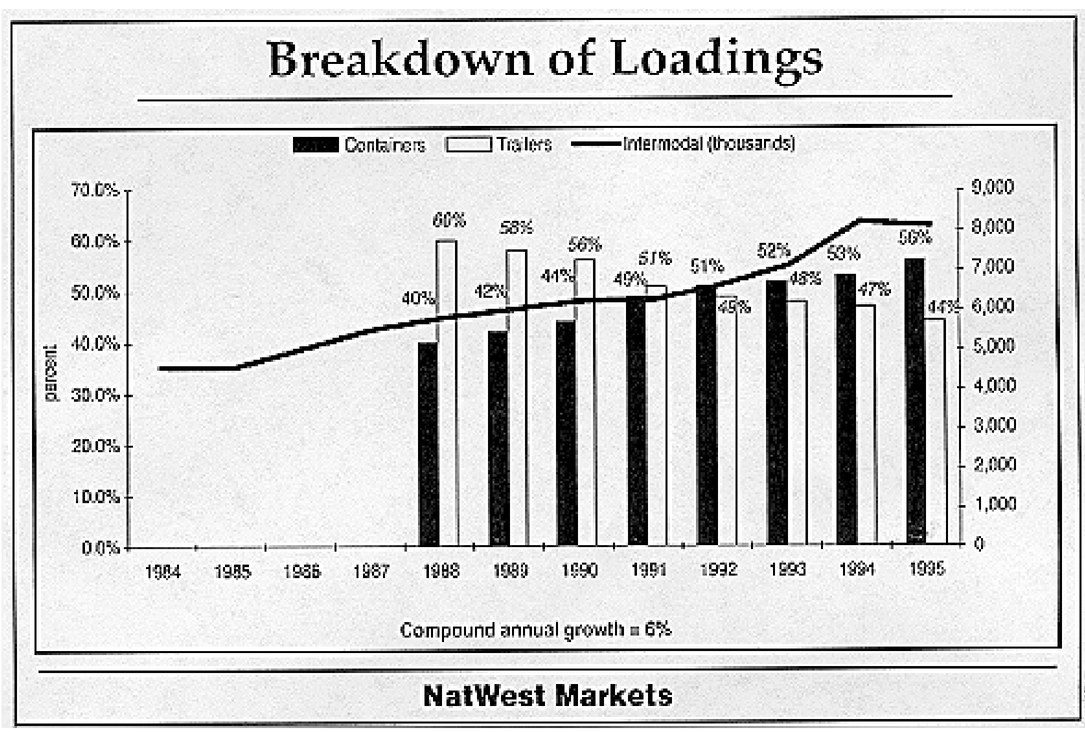
[1] May not equal 100 percent due to rounding [3] Cumulative change, 1994-2004
[2] Compound Annual Growth Rate

Source: *U.S. Freight Transportation Forecast…to 2004*

Ocean carrier restructuring began with the integration of intermodal operations and information transfer methods. This transformation allowed ocean carriers to rationalize their systems and procedures, giving them greater ability to take the lead in forming partnerships with other modes to seamlessly interface equipment moving door-to-door on single factor contracts. It became more commonplace for information to be on-line and available simultaneously to the numerous locations and departments within an ocean carrier's organization. This improvement provided a new sense of confidence in the dependability of transportation operations that enabled shippers and receivers to rely on the operations' efficiency to help them in their planning, which allowed them to reduce their inventories and, consequently, lower their costs. This tying together of information and operations led to increases in the speed of container throughput. This process, as we have already seen, is increasingly being viewed by all the freight transportation system stakeholders as a unified, integrated system rather than as merely a collection of elements.

Figure 4.8 shows the total U.S. rail loadings of containers, trailers, and the total of rail intermodal moves for the period 1988 through 1995. One noticeable change has been in the percentage of total container and trailer moves that involve containers, and the direct relationship of that growth to the growth in intermodal movements. Between 1988 and 1995, containerized moves grew from about 40% of total container/trailer loadings to about 56% by the end of the period. Over that same period, intermodal loadings grew at about 6% per year, reflecting the complementary nature of containers and the intermodal transportation process.

Figure 4.8



Source: DRI/McGraw Hill, *Intermodal Insights* 1996

At APL Stacktrain Services, carriers and equipment providers have learned from the growth in containerization that:

- customers want increasingly more varied types and mixes of equipment, and they want all of these to be more readily available;
- better planning and marketing are necessary in order to improve both the positioning and use of containers and trailers;
- conventional rail yards, often located in congested and acreage-constrained urban areas, need relocating or reconfiguring for efficient stacking, tracking, pickup, and clearing of cargoes and equipment; and
- at the same time that cargo owners were looking for a seamless, low cost, long-haul transportation service that could provide them with all the benefits of intermodal efficiency, the rail and trucking sectors were, unfortunately, splitting into groups of regional carriers each having limited control over the overall routes and/or equipment fleets.[55]

One result expected as a benefit of mergers and acquisitions in the rail industry is the establishment of an integrated network that is characterized by balanced routes, that affords the carriers greater equipment positioning capabilities, and that provides terminals offering customized products and services at competitive rates. With the rail industry's deregulation, rail firms have found that their ability to reposition themselves among the players in the freight market

[55]Courtney, *Mergers, Consolidations, Industry Stability and the Customer: A Transportation Assessment,* 1.

has been enhanced by the relaxation of constraints on their consolidation of networks and services.[56]

One potential problem limiting the growth of containerized freight is a shortage in the number of containers available for use, and especially the total number of containers needed for specialized cargoes. Reefers, tank containers, flat racks, and open top containers are currently the most common types of “nonstandard” specialty containers. While there are shortages of some container types, the total number of containers in service grew by about six percent during 1996. Of containers in use, about half are leased, and most of the other half are owned by steamship companies. Twenty percent of the leased units are of the nonstandard, specialized types, including high cubes—the type of container which is experiencing the fastest growth in demand by cargo owners. Specialized equipment is an increasing percentage of the total leased fleet.[57]

B. Rail Mergers

U.S. railway companies had their origins as regional carriers and partners of their regional mining, agricultural, and timber customers. The rail companies have struggled to change their status from regional to national in response to the U.S. economy’s movement towards globalization. Those that have been successful in this endeavor have done so through interchanges, switching arrangements and, more recently, mergers, especially those of the end-to-end type. These changes have not yet let the rail firms overcome the imbalances and incomplete

[56] Courtney, *Mergers, Consolidations, Industry Stability and the Customer: A Transportation Assessment,* 1.
[57] Tirschwell, “Is bigger better? For some, yes,” 16A.

rail route coverages left after the industry's deregulation (enacted by the passage of the Railroad Revitalization and Regulatory Reform (4R) Act of 1976 and the Staggers Rail Act of 1980). Rail cargo movements of less than about 500 to 700 miles are still too slow and cumbersome, especially for time-sensitive cargoes, so most moves of this distance are handled by trucks.

Figure 4.9

Railroad Network

Source: Association of American Railroads.

Transparency 28 (Fig. 6.1)

Merger activity among rail firms has been similar to that in the trucking industry, except that it is generally more important to rail companies because there are greater benefits to be had through economies of scale. The rationale for most mergers among rail companies is primarily one of increasing efficiency as the firms eliminate deficiencies in tracking and extend their routes through the addition of the newly absorbed lines.

Recent rail mergers all share similar goals. Mergers should:

- simplify routes and interchanges;
- reduce transit times and increase the frequency of on-time service;
- manage equipment more efficiently;
- recognize differences in the time-sensitivity of traffic along various routes and take action to correct related inefficiencies;
- continue expansion via long-term capital improvements; and
- enhance competition by offering new, more customer-responsive products and services.[58]

Since deregulation, mergers in the railroad industry have reduced the number of Class I (large) railroad firms from 31 in 1984 to 14 in 1990 to 5 in 1997. As a direct response to mergers and consolidations, the number of inland terminals has also fallen. Figure 4.10 illustrates this consolidation.

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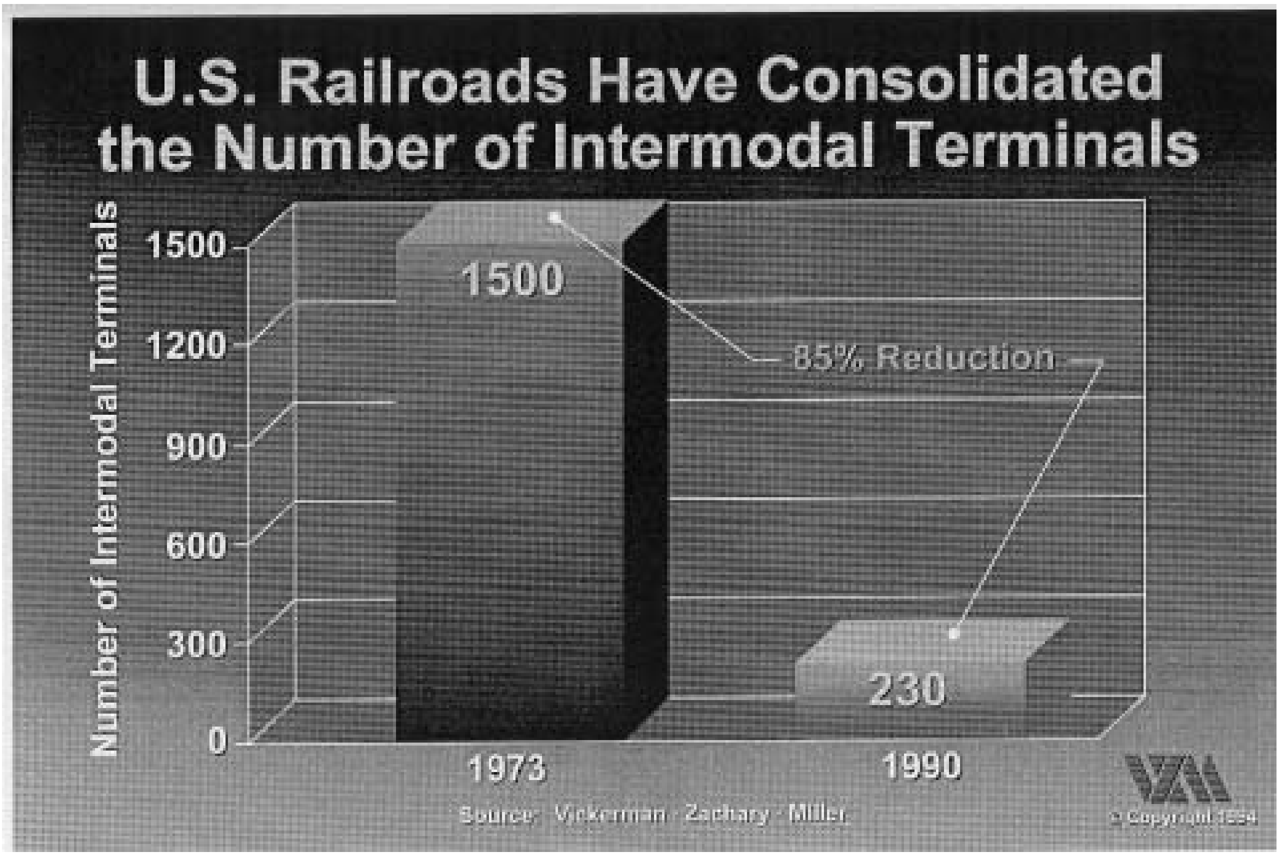
[58] Courtney, *Mergers, Consolidations, Industry Stability and the Customer: A Transportation Assessment,* 1.

Figure 4.10



There is general agreement among transportation experts that deregulation and the resulting consolidation of railroad activity have had a positive impact on the industry. Rail labor productivity has increased by a larger percentage over the last twenty or so years than has productivity in any other transportation mode. Improvements in capital equipment have increased overall rail industry productivity as well. These productivity gains have helped to improve the profit margins in the industry, which have been extremely low over the last half of this century, and have also led to reduced freight rates. However, many cargo owners are still not satisfied with the rate reductions that have resulted from these increases in efficiency.

For example, in a case recently reviewed by the Surface Transportation Board (STB), a few utility companies in the eastern United States complained that rail companies serving them in the delivery of coal to their power plants had a virtual monopoly in that carriage and were overcharging them for this service. The utilities claimed that the rail companies were creating a bottleneck in the delivery of these fuels and asked for more competition among the rails in the region so that lower freight rates would result. This kind of reduced competition, the utilities claimed, has been one of the negative results of rail mergers. However, the STB ruled in favor of the railroads, saying that there was not enough evidence to prove that the rail companies were acting in an anti-competitive manner. The STB's ruling did grant a few exceptions and also stated that this particular ruling was not intended to set a precedent allowing bottlenecks and anti-competitive behavior to exist in the industry. [59]

One of the most evident failures of rail companies in the era of deregulation has occurred with rail terminal switching and interconnections between rail firms in the eastern United States, where the "big three" rail companies (CSX, Norfolk Southern, and Conrail) carry virtually all of the rail-based freight. These firms have lagged behind other modes and other rail firms in their response to the growth of intermodalism, a fact that has led some experts to believe that the takeover and division of Conrail by CSX and Norfolk Southern will not hasten a movement toward intermodalism in the eastern United States. However, the possibility of CSX and Norfolk Southern's sharing terminals acquired in the Conrail acquisition may provide them the opportunity to make significant improvements in intermodal operations by using neutral operators.

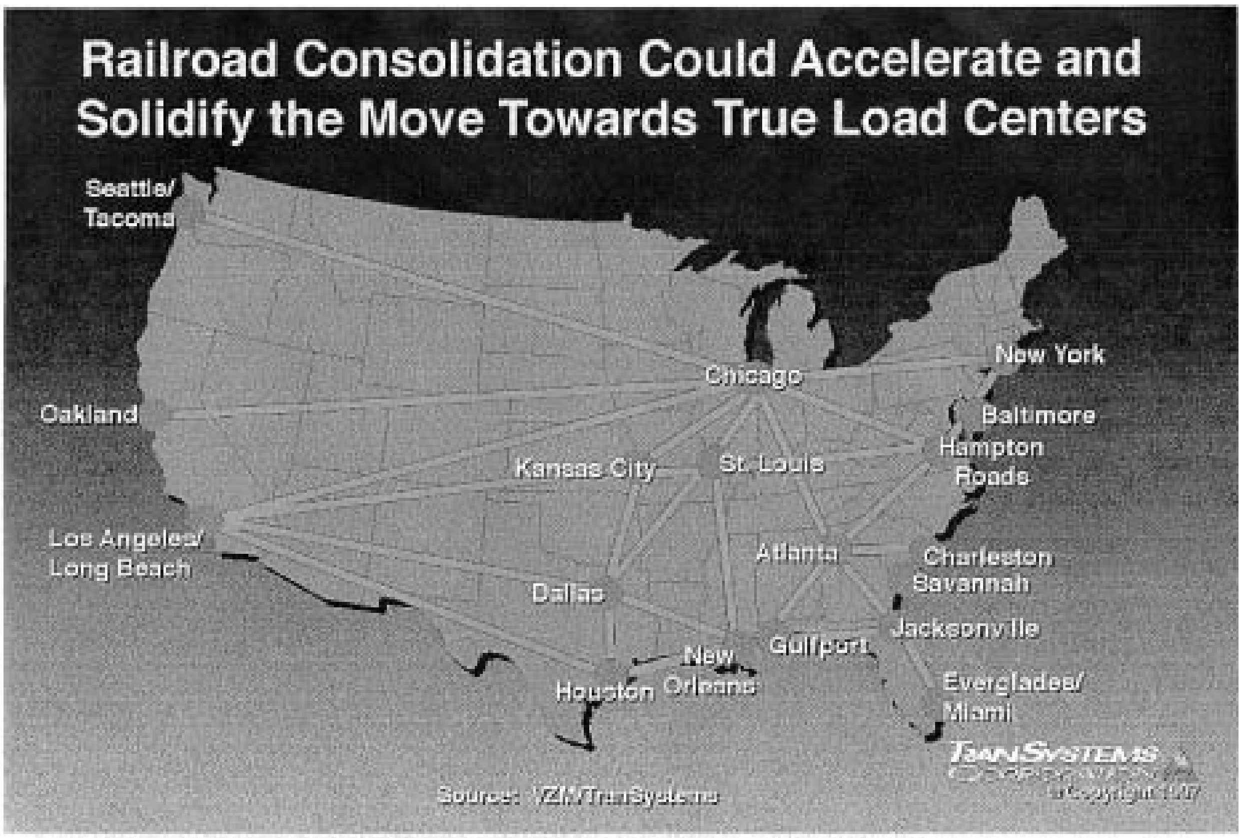
[59]Watson, "Railroads win one over shippers," 2B.

Even among firms where intermodalism has been more fully embraced, there are still gains to be made by reducing container dwell time (although dwell time is typically lower at rail terminals than at marine terminals). The major issues involved in shortening container dwell time at rail terminals include:

- adding dockside rail at any potential megaport;
- reducing bottlenecks by using paperless information processing for trucks;
- extending labor hours; and
- using advanced technologies such as radio-signal-based container and equipment identification tags and applying global positioning system (GPS) technologies to containers for pinpointing their location.

Figure 4.11 depicts the trend toward railroad consolidation and its impact on the creation of true load centers.

Figure 4.11



C. Road-based Responses

Responses to the increase in container traffic by the stakeholders in road-based freight transportation have taken various forms. The National Highway System legislation, enacted in November 1995, called for the Secretary of Transportation to submit to Congress for funding approval a list of projects connecting major transportation facilities to the nation's highways.

The Intermodal Association of North America has led a freight connectors' coalition in developing this list, and is now monitoring the list of connections as they are being implemented by the U.S. Department of Transportation.[60]

The trucking industry can be divided into two basic kinds of operations. The first, truckload (TL) carriage, usually involves a cargo pickup at a single origin, where a full trailer or container is loaded and carried to its destination or to a transshipment point in an intermodal operation. TL operations require only limited terminal operations because there is little or no consolidating or separating of cargo necessary. The second kind of operations, less-than-truckload (LTL) carriage, may involve several pickup points where parcels of cargo are loaded into a trailer or container and may require delivery to several different destinations. This means that the carrier must first deliver these cargoes to consolidation or break-bulk terminals, where the cargoes can be sorted and reloaded to continue to their ultimate destination.

These two segments of the industry are very distinct with regard to the existence of economies of scale. Because the TL segment of the industry does not require the level of terminal use that the LTL segment's operations demand, TL trucking faces a cost structure characterized by a much higher proportion of variable costs to fixed costs than does the LTL segment. This means that, in the long run, TL truckers do not experience the degree of economies of scale that are experienced by LTL truckers. What this means for the trucking market is that there are a far greater number of small truckers competing against each other in the TL market segment than there are LTL firms in the other segment. LTL firms are generally

[60] Courtney, *Intermodal Information Technology: A Transportation Assessment*, 12

fewer and larger relative to their counterparts in the TL market, where we see a much greater number of small owner/operators competing favorably and profitably against bigger firms in some given small niche of the market.

Only a portion of this highly fragmented trucking industry is involved with containers. Many rail companies also have trucking operations that handle both containers and trailers. Trucking firms that are trying to achieve the somewhat elusive economies of scale in this industry generally do so through mergers and spin-offs. These firms (even the small ones) may also benefit from production economies by use of vehicles with greater carrying capacities and by hauling multiple trailer units behind a single tractor. Double and triple trailers are being used on a state-by-state basis (they are illegal in some states and on certain highways). A national committee formed to determine legal sizes and weights for rail and truck has not yet reached a consensus regarding any national standards for maximum truck size and weight.

Since the Motor Carrier Act of 1980 initiated the process of trucking industry deregulation, the industry has witnessed numerous mergers and spin-offs, especially in the LTL segment. Trucking firms have entered into these consolidations and divestitures for three basic reasons:

- to develop a national network that connects regional TL and LTL operations in order to improve labor productivity and increase efficiencies in the utilization of terminals, vehicles, and other equipment;
- to expand services and increase market size without raising costs; and

- to shed their less-profitable long-haul operations, a service that can be performed more efficiently through intermodal carriage and, instead, concentrate on regional TL, LTL, and long-haul premium express services.[61]

The relatively low (compared to air- and waterborne carriage) cost of entry into the trucking industry has led to a flood of owner/operators entering the industry since the beginnings of deregulation in 1980. The additional competition has greatly reduced profit margins, especially in the LTL segment where these owner/operators are more prevalent. In the face of low profits, many owner/operators are joining groups or are entering into contractual arrangements with larger, more established firms in order to reap some of the benefits from any economies of scale that might exist in the segment. Owner/operators have also been a major force pushing for increases in vehicle size and weight, since they can gain from these kinds of economies even if they have only a single rig if that rig can carry more cargo. Some national standards for size and capacity limits for trucks may finally emerge as part of the NEXTEA legislation (to be discussed more fully later) that is being considered to replace the current surface transportation legislation that expired in September 1997.

D. Intermodal Activities in Europe, Latin America, and the U.S.

Depending on the specific infrastructural problems that countries face, certain trends are developing in the response of government and industry in those countries reflecting their

[61] Courtney, *Mergers, Consolidations, Industry Stability and the Customer: A Transportation Assessment,* 2.

recognition of the growing importance of intermodal freight transport. A few examples show both similarities and differences in the countries' responses. Not all responses have been the same because the countries have not operated from the same starting point. However, it is the similarities that can be seen that are striking when we look at three different geographic areas—Europe, Latin America, and the United States.

In Europe, a group of twenty-five firms and agencies including shippers, freight forwarders, and state and privately owned rail companies plans to develop a route from England to Hungary, and plans to later extend the route to Ireland and to the Ukraine. Another such route is being considered to move cargo between Stockholm, Sweden, and Lisbon, Portugal. These rail "freeways" would greatly increase rail competitiveness by reducing the amount of driver and locomotive switching as the trains pass between countries. Trains would be allowed to use their own personnel and equipment and pay a toll to the country through which they were passing. These routes are being planned in spite of the fact that rail's share of overall freight carriage in Europe has dropped from 32% in 1970 to less than 15% in 1996.[62]

Europe is also suffering, especially during rush hours, from severe road congestion. Therefore, several European countries, including Germany, Austria, Italy, and the Netherlands, are attempting to optimize other modes of transportation, particularly freight rail service. According to a European Commission White Paper on rail freeways, selected priority high-volume rail transport corridors need to be established to expedite transit to cross intra-EC borders. Three north-south routes will be the first to be developed. These will be along the

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[62]Barnard, "Europe freight plan derailed," 1B.

corridors between northern German port cities and eastern Italy, between Rotterdam and western Italy (Gioia Tauro), and between Rotterdam and Vienna.[63]

Three major groups of rail users have backed the EC policy proposal: 1) the European Shippers' Council; 2) CLECAT, the European liaison committee of freight forwarders; and 3) the European Community Shipowners' Associations (ECSA). Two major railroad associations also welcomed the rail freeways proposal: 1) the Community of European Railways (CER), and 2) UIRR, the International Union of Road-Rail Transport Companies.

Advantages of a rail freeway include:

- easier access for new operators;
- the higher priority given to freight in the allocation of "train paths" (timetable slots along a particular route);
- simplified administration and pricing by the rail infrastructure companies; and
- smoother international rail freight service.[64]

An assessment of freeways conducted by CER and completed in April of this year concluded that, by optimizing operations on the Netherlands/Italy corridor, transport times could be cut by about 80 percent and commercial speed could rise nearly 20 percent (to 31 miles per

[63]Damas, "Europe prepares for rail 'freeways'," 65.
[64]Damas, "Europe prepares for rail 'freeways'," 65.

hour). Currently, the average speed of freight trains in European Union countries is around 10 miles per hour.[65]

In 1996, despite increased competition from new operators and work stoppages caused by strikes, Intercontainer, the pan-European container consortium of 28 rail firms, carried a record number of containers. Although Intercontainer handles only cross-border traffic, the consortium saw its 1996 container traffic grow 2.3%, to 1.35 million TEUs, and its revenue increase about 4.4%, to U.S. $551 million. The year 1997 has seen intermodal traffic increase by 4% over the first five months. However, modal performance varied greatly last year, with maritime traffic dropping from 700,000 TEUs the year before to 684,000 TEUs last year (a 2.3% decrease), while inland traffic surged by 7.6%, from 619,000 TEUs to 665,000 TEUs.

Intercontainer is also facing a major challenge in the Netherlands, where it has lost business to a rail shuttle operated by two shipping lines, P&O/Nedlloyd and Sea-Land Service, that moves cargo between Rotterdam and Germany, France, and Italy. At the same time, two of Intercontainer's shareholders, Deutsche Bahn of Germany and NS Cargo of the Netherlands, have together entered into a joint venture with CSX. The resulting firm, called NDX Intermodal, is competing with Intercontainer by running shuttles between Rotterdam and Antwerp, Belgium, and Rotterdam and Munich, Germany. So far, this new venture has not had much impact on Intercontainer's traffic, and the Rotterdam to Munich service has been particularly unprofitable for NDX.[66]

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[65]Damas, "Europe prepares for rail 'freeways'," 65.
[66]Barnard, "Intercontainer haul record number of boxes," 5B.

In Europe, integrated intermodal systems are considered to be essential to saving on transloading, warehousing, inventory, and other associated customer costs.[67] In a recent article in *American Shipper*, Philip Damas cited twelve guidelines for European intermodal development. These are:

- finding the right mixture of markets and businesses from which to build a balanced intermodal system;
- developing routing alternatives for efficiency and flexibility;
- expanding the proportion of variable to fixed costs by operating with smaller numbers of dedicated assets;
- expanding service options through creation of alliances;
- recognizing that deregulation stimulates innovation;
- allowing customers, rather than operators, to drive changes in the industry;
- aggressively pushing for better service;
- developing special-purpose terminals with dockside rail links and pushing for greater standardization of equipment;
- resisting the temptation to take on new technologies too quickly;
- providing blanket customs clearance for inland rail shipments; and

[67]Damas, "Rhein: Europe should learn from U.S.," 7.

- letting trains run through.[68]

Trucks currently handle between seventy and eighty percent of Europe's freight movements. Eighty-five percent of road transport moves are for distances of less than 150 kilometers (100 miles), and the ratio of truck to rail moves is forty-to-one. Governmental authorities in several countries are attempting to create tax incentives and other measures intended to alter the existing balance in the usage of the various transportation modes. Some of these measures include road taxes; fuel excises; tolls for the use of particular tunnels, bridges, or highway segments; value-added taxes; special levies on newly purchased vehicles; and registration fees. European truckers complain that they are penalized monetarily to achieve political goals, and that these payments are being used to subsidize featherbedding in state-owned and operated rails.

In South America, the Mercosur nations (Argentina, Brazil, Paraguay, and Uruguay; plus Chile *ex officio*) have also been discussing improved highways and increased cooperation among rail companies. Recent privatization efforts by the governments of several South American countries (particularly Argentina, Brazil, Chile, and Uruguay), along with increased private and public investments in infrastructure, have resulted in significant improvements in the roadway, railway, and port systems of those countries.

Two-thirds of all cargo transported in South America travels by truck, and the World Bank estimates that 45 percent of South America's roads were not designed for the weight and

[68] Damas, "Rhein: Europe should learn from U.S.," 7.

volume of traffic they are now receiving.[69] Argentina is currently attempting to privatize approximately one-third of its urban highway system and make needed improvements to it, so that by year's end only about 10 percent of Argentina's highways are expected to be in poor condition. The Interamerican Development Bank (IDB) is also funding numerous infrastructure projects in Latin America. A significant component of many of these projects is the inclusion of provisions calling for the restructuring of administration and improving highway safety.[70]

Inefficiencies are common among the Mercosur countries' rail services. For example, rail carriers in the five countries must deal with four different gauges of track. And customs service at borders tends to be inefficient, even in the best of instances.[71] However, these countries are trying to reduce inefficiencies such as these by moving toward privatization, greater cooperation, and increased investment in their transportation infrastructure. Uruguay's railway, for example, recently reformed its operations by reducing staff, selling extraneous assets, and eliminating passenger service to concentrate on long-distance, large-scale freight shipments.[72]

Ports are improving as well in the Mercosur nations. Librepart, one of three terminals at Santos, Brazil, has been privatized, and is now swamped with business. The Port of Buenos Aires, Argentina, was privatized about five years ago and is now seeing greater efficiencies in its operation. Similar developments are occurring in other South American countries and in Mexico as well.

[69]Slee, 68.
[70]Slee, 68.
[71]Slee, 69.
[72]Slee, 69.

In the United States, sister companies of some of the major Pacific ocean carriers have set up intermodal units to provide unit train and double-stack rail service. Table 4.4 shows these domestic intermodal companies and the ocean-carrying affiliates.

Table 4.4

Domestic Intermodal Operations of Ocean Carriers

INTERMODAL DOMESTIC AFFILIATE	**OCEAN CARRIER**
ESI	OOCL
RAILBRIDGE	K-LINE
APL LAND TRANSPORT SERVICES	APL
CSX	SEA-LAND
MOL	MITSUI

We have already discussed many other infrastructural and market changes that have occurred recently in the United States as a response to containerization and the movement toward intermodalization of freight cargo. Deregulation of several transportation modes (especially trucking and rail), rail mergers, privatization of Conrail, a number of changes in the administrative framework (such as the elimination of the Interstate Commerce Commission), highway improvements, and various other changes over the last twenty or so years reflect the same kind of trend that is evident in both Europe and Latin America. All of these countries recognize that freight transportation services can be provided more efficiently through the use of intermodal technologies. So, both public and private incentives are pushing the transportation systems in these countries in that general direction.

E. Technology Enhancements

Many people and companies in Latin America are experiencing "electronic shock" over the rapid introduction of communications innovations and improvements. This past January, Brazil installed an import- and export-tracking system called Siscomex, similar to the Automated Management System and Automated Export System used in the United States. Argentina has used a similar import-tracking system, known as MARIA, since 1991.[73]

Transportation carriers, government agencies, and shippers and receivers of cargo are all responding to the increases in containerization by resorting to more intensive use of technology to process logistics information. Estimates among industry experts suggest that if transportation firms will take full advantage of improvements in information technology, they may be able to cut their cycle time—the time from the beginning of an operation to its end—by as much as 40%, may reduce errors by 30%, and may save as much as $5 per document that they generate.[74] Table 4.5 shows some of the ways that carriers and shippers are embracing electronic information processing to improve efficiency in their operations.

Table 4.5

Current Uses of Electronically Processed Transportation Information

Carriers rely on information systems to:	**Shippers rely on carrier, third-party, or internal information systems to:**
1. receive freight bookings	1. process orders
2. construct rate quotes	2. tender freight
3. issue bills of lading	3. shop for rate and schedule information
4. track and manage equipment	4. generate, transmit, and file shipping documents
5. plan routings	5. manage inventory multi-point distribution
6. determine load sequencing	6. trace shipments
7. manage documentation	7. measure carrier performance
8. trace shipments in transit	8. identify supply-chain weaknesses
9. monitor equipment utilization	9. process and pay freight bills
10. respond quickly to failure situations	10. budget and manage costs
11. coordinate consolidated loads and multiple-point distribution	
12. confirm pickup and delivery	
13. generate performance, accounting, and other reporting summaries	
14. issue freight bills	

[73] Slee, 70.
[74] Courtney, *Intermodal Information Technology: A Transportation Assessment,* 1.

Managing information is just as important to the overall efficiency of the containerized freight transportation system as is managing the actual physical transportation of the containers themselves. Therefore, information management adds a great deal of value to the physical transaction. Better, more timely information is the result of new developments in the software used for carrying out the activities listed in Table 4.5, above. As software and associated hardware improve, we can expect even greater gains in productivity and value added from better inventory management and reduced delivery times, and these improvements will inevitably lead to lower costs to the carrier and perhaps lower rates to the shipper as better information leads to smarter processes throughout the freight transportation system.[75] The gains in technology for processing information can be found in new developments in software, in electronic data interchange (EDI), and in programs designed for the Internet.

1. Software Developments

New developments in software have caused major changes in the way information is processed in all areas of the economy, and these kinds of changes are no less important for the transportation industry than in other areas. Whether used in diagnostic equipment, simulation programs, automatic equipment identification, weighing-in-motion devices, improved data management, or communications systems, new more sophisticated software has been an indispensable tool for increasing efficiency in the industry and will continue be as more firms embrace the technology and as standards for the technology are set in the industry.

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[75]Courtney, *Intermodal Information Technology: A Transportation Assessment,* 4.

Diagnostic monitoring equipment is now being built into all modes of transport to automatically monitor mechanical functions and improve the efficiency of engines and machinery. The newly constructed megaships have many of those types of controls, which afford the vessels improved safety and maintenance and provide the carriers with long-run cost savings. The software that evaluates information from this equipment is critical for diagnosing a problem when it occurs and identifying potential problems before they occur.

Simulation programs are being developed for such activities as overall operations planning, inload sequencing of containers onto trains and ships, navigation, and routing trucks and ships around weather patterns and traffic.

Automatic equipment identification involves the use of electronic identification tags on containers, vehicles, and other movable equipment as it passes into ports or across borders. Both mobile and stationary monitors that can read plaques on containers as they enter terminals or cross the borders between the United States, Mexico, and Canada are now in use at several check points along these borders. Intelligent transportation devices such as these, when incorporated into an overall information system, can greatly improve data interchange by efficiently tracking containers and other equipment at the check points where these devices are located.

Weighing-in-motion devices can actually weigh equipment while it is in motion. Weighing a container as it enters and leaves a terminal means fewer moves onto and off of scales, which saves time, provides a greater degree of safety on land, and provides those loading a ship with information that can be used to improve the ship's stability at sea.

Both document image scanning and improved communication terminals are quickly entering mainstream use by transportation firms. One problem that transportation stakeholders hope these technologies will help solve is that of repositioning empty containers and equipment. There are billions of dollars being spent each year repositioning empty equipment. Some ports report that as much as seventy percent of container movements through their facility are empties. Clearly, if carriers and other container owners can find some way to interchange equipment globally, they will be able to save both time and transport costs.[76] One method used to remedy the equipment positioning problem is the "neutral equipment pool," or "gray box." Neutral equipment pools manage the available equipment through expanded interchanges among equipment owners. Participants in the pool may either supply their own empty equipment or lease containers to fulfill their obligations to the pool and can acquire containers when they need them, either from other participants or from a leasing company. When they return them, they do so at predesignated prices at or near their expected destinations. This saves carriers both the expense of positioning the container at a point of origin and that of repositioning the empty at its destination. Transamerica Leasing, which manages one such equipment pool, provides a computerized bulletin board and back-up accounting system so that participants can instantly pull up information as to the availability of equipment at various locations and keep track of their own equipment being used by other participants in the pool. Transamerica serves 125 lessees on a limited basis by identifying and interchanging containers for them. Andersen Consulting has published an exhaustive directory of logistical software jointly with the Council of Logistics Management.

[76]Tirschwell, "Carriers still struggle to reposition containers," 9C.

2. Electronic Data Interchange (EDI)

EDI is another basis of many current programs. Some of these include ISA, The High Tech Forwarder Network, Track Net, and Encompass.

ISA is an information systems agreement entered into by twelve ocean carrier companies. These firms have agreed to use a set of standardized information conventions in order to improve communications at ports and terminals by electronically transmitting gate activities, stowage plans, empty equipment releases, cargo manifests, and import-cargo releases. It is also used in concert with shippers to arrange container bookings, to provide shipping instructions, to send bills of lading and invoices, to provide container status checks and vessel schedules, and to send out arrival notices.

Other examples of EDI technologies include the High Tech Forwarder Network and Encompass. In the former, one hundred freight forwarders, together with General Electric Information Services, have created a shipment-tracking and purchase-order-managing program called Track Net. Encompass is the name of a supply-chain management, shipment-tracking, and vendor-measuring program established by AMR and CSX.[77] Numerous customized programs of shippers and receivers use this technology. The cooperation among firms through alliances in intermodal operations has necessitated their cooperation in developing information transfer systems that are compatible for their joint use. Therefore, it stands to reason that, as firms in all modes continue to merge and form other kinds of alliances in an attempt to cut costs and achieve

[77] Courtney, *Intermodal Information Technology: A Transportation Assessment,* 12.

economies of scale, the development of joint EDI for rail, truck, and intermodal operations will provide a promising opportunity for cooperation.[78]

3. The Internet as a Basis for Information Processing Programs

The enormous popularity of the World Wide Web has prompted a number of commercial enterprises to develop websites related to information transfer in the transportation industry. We mention only a few examples here, though the numbers of such sites are growing by the day. At this writing, an inquiry into ocean shipping showed some 460,000 related sites!

Mariner Systems, Inc., provides an Internet site available by subscription that is designed to provide the user with shipping schedules and ocean freight rates based on integrated information from the carrier's own IT system. Several independent service providers, such as Sealink Information Technology and Ocean Wide have established themselves as information clearinghouses for use by small carriers and other transportation service firms. Such clearinghouse operations are still in their infancy. Nevertheless, it is already evident that these kinds of services will soon evolve into a simple and effective means of providing information on comparative rates and schedules, as well as recent and currently contracted freight bookings to brokers, cargo owners, and carriers.[79]

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[78] Damas, "Alliances & webs, special report," 44.
[79] Damas, "Alliances & webs, special report," 44.

F. Summary of Intermodal Responses

Because intermodal cargo movements are growing, so has the necessity for growth in the industry's related infrastructure. Trucking is still the most widely used participant in intermodal transportation, since it is almost impossible to carry any type of goods without at some point using a truck. Other modes are embracing the intermodal mind set, and are beginning to see the need for increased integration in both information and operations systems. Such cooperative effort by all of the stakeholders in the container transportation chain will be necessary to build the efficiency and reliability required to take full advantage of intermodal possibilities.

4.3 Governmental Responses to Increased Containerization

Government is attempting to deregulate and privatize the freight transportation system and to become a catalyst in promoting trade and development, at both the domestic and international levels. In the United States, some of the more important recent or pending legislation and other government actions affecting containers include:

- legislation expected to pass in the next session of Congress, preliminarily called the Shipping Act of that year, that will likely disband the Federal Maritime Commisssion (FMC);
- the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA);
- the National Crossroads Transportation Efficiency Act (NEXTEA), to replace ISTEA;
- the Intermodal Safe Container Act of 1997;

- the North American Free Trade Agreement (NAFTA); and
- the processing of rail mergers by the Surface Transportation Board (STB) and other federal agencies.

In addition to these events of domestic origin, international developments have occurred that have begun to alter the roles of free enterprise and government regulation in trade among a number of countries. From the U.S. perspective, the most significant of these international developments have been those brought about by agreements reached in the latest round of General Agreement on Tariffs and Trade negotiations, and through the signing of the North American Free Trade Agreement.

A. Deregulation of Transportation Modes in the United States

The term *devolution* has been coined to describe the rolling back of the regulations that have been imposed on the various modes of the U.S. transportation industry and which have accumulated over the last century. Beginning in the mid-1970s, the federal government began a process of deregulating several transportation modes, starting with railroads and passenger airlines. Further deregulation followed, so that by the mid-1980s, trucking was undergoing devolution and there were further rollbacks of regulations in the rail industry. Ocean shipping also saw some minor regulatory changes at about that time, although coastal and inland shipping is still subject to fairly severe restrictions through the Jones Act.

Because containerization and intermodalism are relatively new concepts, little has been done formally to either regulate or deregulate these areas of transportation as a separate mode, since the individual modes involved in the intermodal carriage of containers have already been subject to their own individual regulatory framework. In the context of container transportation deregulation, devolution has most closely followed a trend towards privatization or "self regulation" by the markets themselves, though there have been some recent developments that have addressed containers directly. Some changes in container regulation are expected to occur if the Federal Maritime Commission (FMC) is eliminated, as expected later this year, and merged with the currently existing Surface Transportation Board.

1. Expected Elimination of the FMC and Creation of the Intermodal Transportation Board (ITB): The Shipping Act of 1997

Under proposed shipping act reform, the Federal Maritime Commission will merge with the Surface Transportation Board (STB) (which, itself, replaced the Interstate Commerce Commission 1996) to form a new federal agency called the Intermodal Transportation Board (ITB). The merger is scheduled to occur on January 1, 1999, while most other changes proposed by the Shipping Act legislation are scheduled to take place on March 1, 1998.

Another significant change created by this act involves strengthening the regulation of "controlled" or foreign carriers. To many trade and transportation industry experts, this particular aspect of the act appears to be an attempt to penalize Japanese carriers for discriminatory port practices in Japan. The legislation allows for service contracts to be opened to one or more shippers. Also, it should make independent action on the part of ocean carriers easier by shortening from ten to five days the notice period required before implementation and by allowing that prerogative to extend into conference service contracts.

Confidential contracting with individual ocean carriers is the heart of the new legislation. This confidentiality enables individual liner companies to enter into private contracts with shippers and receivers of cargo without publishing these individually negotiated rate schedules for view by the general public or by other customers. Instead, the liner company would merely be required to file the contracted rates with the ITB, though it might also have to make the rates available upon request to a liner conference which also happened to be negotiating with the same customer. Individual carrier tariffs would still need to be published through an automated tariff system in a format reasonably accessible to the public, though the schedule would not have to be filed with the government. The legislation would require that only the essential terms of conference contracts be published. A proposed amendment to the legislation would, if passed, allow carriers to submerge these individual contract terms among aggregate data, so that no specific terms could be easily discerned. All anti-discriminatory pricing privileges would be eliminated, and initiating or increasing tariff rates could take effect in 21 days instead of the current 30. A collective bargaining provision has also been added. The bill's sponsors hope that its passage will create greater competition among ocean carriers in liner service by reducing filing costs, weakening conferences, increasing uncertainty, and creating greater flexibility in pricing.

2. Changes at the State Government Level

Since the passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), many state highway departments are now calling themselves state "Departments of Transportation," and have broadened their scope of activities commensurate with their name change. Such changes at the state level foreshadow a movement, required by ISTEA, toward more local involvement in the overall transportation planning process, and more diversified planning at the state and local levels.

Devolution has meant that privatization of trade development is increasingly being viewed as a more appropriate means of encouraging trade than are the government-led incentives that have been the standard course of action in trade development over most of this century. Some recent, privately induced inventions and innovations have taken place in the field of electronic computerized networks as related to international and domestic trade, as well as in other aspects of international business. This expanded role of business in the trade development process has created a new catalyst to the encouragement of trade which is seen as less political and more easily supportive of a broad constituency of stakeholders just entering international markets than would be the case if it were initiated by, for example, the U.S. federal government.

3. Automation of Customs

The major responsibilities of the U.S. Customs Service are to facilitate trade, protect the national revenue, and enforce trade laws. Customs is responsible for assessing and collecting all duties, taxes, and fees on imported merchandise; enforcing customs laws; administering certain goods that must be marked with the country of origin or that require special marking or labeling; checking a shipment to determine if it contains prohibited articles; checking to see that goods are correctly invoiced; and checking to see if goods are in excess of the invoice quantities or if a shortage exists. Customs inspectors must examine different types of goods to determine whether the goods meet special legal requirements. Customs officers also must ascertain the quantity of goods imported, making allowances for shortages and revising duties for overages. Some goods are weighed, gauged, or measured to make sure that they meet certain standards. So, it is evident that there is a great potential for bottlenecks to occur that create idle times for vessels and personnel when customs inspections are slowed.

In September 1996, Congress passed the Illegal Immigration Reform and Immigration Responsibility Act. Among other provisions, the Act requires the Department of Justice to develop a plan that makes the transition from the former standard, highly paper-intensive practices to a relatively paper-free automated data collection system at U.S. ports-of-entry. Customs has responded to this mandate and to increased pressure to expedite the movement of both containers and vessels (of all modes) through automation. The majority of filings by carriers, shippers, and receivers is now paperless. This movement away from paper documentation is already providing a greater efficiency to carriers and shippers by reducing container dwell times as well as the idle times of truckers and other carriers, and by enabling the overall functioning of the Customs Service itself to improve its operating efficiency.

Other technologies are also being implemented. Free particle detectors are portable, hand-held devices that allow the detection of traces of illegal narcotics and explosive particles. EDI is allowing shipping transactions to be conducted at computer terminals linked to a large data network that includes information for freight bookings, the tracking of shipments, customer billings, and clearing of customs. Satellite tracking is potentially one of the most important innovations for improving efficiencies in containerized transportation. Employing two recent technologies—Low Earth Orbit (LEO) data communications and the Global Positioning System (GPS)—satellite tracking involves the installation of a communicator inside a container and a small antenna on the container's exterior. Then a satellite transmitter, a GPS receiver, and a power supply are placed in a small, watertight "black box" affixed to the container. Data such as container location and cargo status can be constantly monitored from the time of loading all the way to the container's destination. Once this kind of security system comes into widespread use, its benefits in the areas of container security, cargo inspection, and overall speed of transit should be great.

4. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA)

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) authorized $155 billion for surface transportation systems. In spite of its name, the act has been primarily a local roadway and mass transit reauthorization statute, and a means of placing more of the overall transportation system planning into more localized hands through funding requests by Metropolitan Planning Organizations (MPOs). According to the U.S. General Accounting

Office, through the first four years of ISTEA's implementation only 1% of its funds, or $104 million, was apportioned for highway and other non-transit projects.[80] Railroad involvement was limited to passenger service, and aviation was excluded from the act entirely. So, despite policy statements and planning provisions resulting from the Act, no significant funding for freight projects came forth.[81] Some efforts have been made, however, to make highway grade crossings safer, and highway deaths have dropped 31% during ISTEA's existence.

Still, a number of transportation experts see a lack of understanding of freight transportation issues in ISTEA's passage and implementation. Problems involving freight transportation were not adequately addressed by the act, and these shortcomings have impeded progress towards a more efficient freight transportation system.[82] One of ISTEA's major objectives was to give more emphasis to transportation projects at the local level to satisfy more localized concerns. However, the Freight Stakeholders' National Network has recently shown that about 90% of even the largest MPOs had insufficient data with which to conduct adequate freight planning.[83] Further, the U.S. Department of Transportation has no database of information on public and private investment in intermodal transportation, nor has it tracked how states have attempted to use ISTEA funds for such projects.[84]

NEXTEA, the National Economic Crossroads Transportation Efficiency Act, is scheduled to take effect in October of 1997, and should remedy some of the shortcomings of the act that it will replace if it passes. It has $3.2 billion allotted for promotion of infrastructure and improved

[80]Trunick, 23.
[81] Helberg, 23.
[82]Trunick, 23.
[83]Trunick, 23.
[84]Trunick, 23.

safety. It also includes provisions for more planning for intermodal container freight development, as well as the funding to implement better access to intermodal terminals, improved corridors, and information technology and telecommunications (IT) systems. The act also includes $100 million annually to leverage non-federal public resources for projects of national significance, such as interstate trade corridors that would cut congestion and bottlenecks at borders.

One continuing problem in the debate over passage of NEXTEA that tends to plague passage of any transportation-related act at the federal level is the issue of "donor vs. donee" states. States whose taxpayers typically pay out more to the federal government in fuel taxes and other levies than they receive back in highway construction and other infrastructure improvements generally oppose acts that increase the federal role in the transportation system. Texas and Florida, for example, usually find themselves among donor states, and argue that their tax dollars could be spent better by passing more of their contributions back to the state governments for allocation to state transportation needs. New York, on the other hand, generally receives more federal funds for infrastructure improvements than it donates through tax dollars, so that state favors continuation of most programs that redistribute other states' tax dollars its way. By the same token, ports are often left out of comprehensive transportation planning because inland states may not always recognize benefits they receive from an efficient port system and may feel that they are donors to coastal and river states in the support of ports. Until some compromise is reached on the donor-donee issue, the establishment of a comprehensive national transportation policy involving all modes of transportation will be difficult to accomplish.

5. Capital Improvements and the Highway Trust Funds

The National Highway System legislation of November 1995 called for the Secretary of Transportation to submit to Congress for funding approval a list of projects connecting major transportation facilities to the nation's highways. This list was developed through the Intermodal Association of North America and is being implemented by the Department of Transportation.

6. Rail Mergers

The Surface Transportation Board's criterion for approval of rail mergers has been to narrowly view competitive remedies wherever competition is reduced, saying it is sufficient to provide substitute service or trackage rights to a rival carrier. In the cases reviewed so far, the STB's view has been that a merger of two railroad companies does not have to create new carrier competition if such competition did not exist before the merger.[85] The board members agreed that the number of rail carriers in a specific location is relatively unimportant because the real competition along its lines is from trucks.[86]

The General Accounting Office, in its recommendations for integrated intermodal infrastructure improvements for Chicago, said that the short-term solution to the problem is better highway connections. The longer-term solution, however, would require a multi-user intermodal terminal for rail-to-rail connections.

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[85]Watson, "Board to tackle rail merger," 21C.
[86]Watson, "Board to tackle rail merger," 22C.

In the case involving the CSX and Norfolk Southern's takeover of Conrail and dividing it into two parts, the STB agreed with the two suitors that Conrail's privatization and separation would improve efficiency and reduce or eliminate delays from transfers that currently plague the line.

If rail companies are to seriously improve intermodal service, they will need to delineate services as the air and trucking industries have done. They must provide, in addition to any "regular" service, a time-definite operation that operates on a priority basis or one based on a seven-days-per-week operation. Making such changes will require rail companies to establish a dedicated rail feeder, and possibly dedicated tracks, in order to fulfill the demands of their customers for an agile, flexible, intermodal system.[87]

7. The Intermodal Safe Container Transportation Act

The Intermodal Safe Container Transportation Act of 1997 went into effect in April of this year. The 1997 act amends a similarly named container act passed in 1992. The basic purpose of both of these acts is to make sure that before a trucker moves an intermodal container he is given accurate information about the container's weight and cargo content. While this new act does not constitute a major departure from standards and practices already in place in the container industry, it requires some changes in container documentation from the time the container is loaded and placed in the hands of its first carrier for intermodal transport.

[87] Trunick, 25.

The act restricts a container's gross cargo weight to 29,000 pounds. The shipping documents or a weight certificate must now conspicuously show the actual gross cargo weight, a reasonable description of the cargo, the identity of the certifying party, the container or trailer number, and the date of certification.

This requirement means that a carrier can presume the gross weight of the container or trailer is less than 29,000 pounds if no certificate is tendered, and will have a lien against the cargo for any fines or penalties incurred as a result of this reliance. This presumption is not valid, however, if the carrier has reason to know that the cargo exceeds the 29,000 pound limit. Cargo interests have the right to place a lien against the carrier or any other member of the transportation chain to recover all legal costs incurred if it turns out that someone failed to pass along required information or did so inaccurately.

The law does not apply to perishable goods, nor to private motor carriers that consolidate and transport their own cargoes, nor does it apply if one of these private carriers later transfers the loaded container or trailer to a second motor carrier (unless this happens to be the first tender). A forwarder, a customs house broker, or a NVOCC (nonvessel operating common carrier) is not considered to be a tendering party unless it is legally responsible for loading the container. All parties are responsible for passing along any certifications they receive.

B. International Trends

The Asia-Pacific Economic Cooperation Forum (APEC) formed in 1989, agreed in 1994 to open trade and investment among developed nations who are group members by the year 2004, and to expand trade into developing nations by 2020. APEC has set specific targets for trade development over the next few years. These targets include trade liberalization and deregulation and increased investment in infrastructure. Hitting these targets should achieve the broader objectives of macroeconomic stability, investor protection, and economic incentives that will encourage private firms to begin transactions in Asian areas that have up to now been restricted to public-sector activities. APEC recognizes that, in spite of worldwide movements toward lessening protectionism, there is still a great deal of both overt and covert protectionism in several Asian countries. This means that these economies are still effectively closed.[88] Until this situation changes, gains from trade will be less than optimal for those countries.

Conferences are a kind of international regulating body and, as such, are in the process of reform, as are many other regulatory bodies. One conference's (OOCL's) chairman has called for reform of the overall conference system, including creation of a new pricing system made up of base rates and value-added supplements. The goals of the reform are to make conferences 1) more transparent in operation; 2) more approachable and user friendly; and 3) more closely cooperative with governments in making laws more uniform.[89]

1. General Agreement on Tariffs and Trade (GATT)

The Uruguay Round of the General Agreement on Tariffs and Trade was completed in December of 1993. The agreement reached and finally signed in mid-1995 by more than 117 major trading nations resulted from the eighth round in a series of trade negotiations that began with the formation of GATT shortly after World War II. The purpose of the Uruguay Round was

[88]Dibenedetto, 5A.
[89]Damas, "OOCL's Poon urges reform of conferences," 6.

to establish rules for stopping a trend towards more protectionism that had appeared in recent years among GATT's members, and to begin reversing that trend. The Uruguay Round addressed new areas of trade that had been left out of previous negotiations—areas such as agriculture, foreign investments, and services. The major provisions resulting from the agreement are as follows:

- Tariffs are to be reduced, and the percentage of goods subject to no tariff should effectively double (from about 22 percent to about 45 percent); tariffs were eliminated on some specific categories of goods.

- Quotas on agricultural imports and textiles should be replaced with less restrictive tariffs over a ten-year period; existing tariffs on these products are to be reduced by 24 to 36%.

- New mechanisms for resolving disputes involving "dumping" are to be installed.

- Subsidies granted to producers of agricultural exports are to be reduced by 21%; industrial research subsidies are limited to 50% of cost.

- Tariffs and other restrictions imposed to protect a domestic industry from a temporary import surge are allowed, but health and safety standards that restrict imports may only be imposed if scientific evidence shows these safeguards are really needed.

- Patent, trademark, and copyright protection will be recognized among the countries.

- Further talks were scheduled between the United States, Europe, and Japan regarding reduction or elimination of government subsidies to makers of aircraft, steel, and computer chips in the countries where those subsidies exist.

- Requirements that foreign investors buy raw and intermediate materials locally are being phased out.

- The GATT secretariat is being replaced, with that authority given to the World Trade Organization. Trade disputes will be settled by two-thirds majority vote rather than the unanimous consent required under GATT.[90]

Although not all of the Uruguay Round's aims were met, the concessions that have resulted from these negotiations are expected to increase trade among the member nations by about $275 billion per year and to raise standards of living among the members and their other trading partners.

2. North American Free Trade Agreement (NAFTA)

In 1994, the U.S. Congress, in a joint letter, urged President Clinton to take steps to guarantee that all trucks entering the United States meet U.S. safety standards and have adequate oversight by competent inspectors. Further, the letter requested that, for trucks entering from Mexico, the Mexican government should furnish, in a timely manner, the safety and compliance

[90]Salvatore, 280-286.

histories of carriers and drivers. The Mexican government's response was that trucks of 68.2 feet are the maximum lengths safely allowed into Mexico. This restriction means that almost all 53-foot trailers, with their tractors, exceed Mexican size limits. Trucks of this size are typical of the larger, more efficient single-trailer units used by U.S. trucking firms. Many trucks traveling U.S. highways are much larger.

Mexico and the United States generally agree that vehicle safety is an important issue that must be assessed, and a forum for addressing technical issues is provided through the trinational Land Border Standards Subcommittee. Some progress has been made by this committee in reaching mutual agreement among the three NAFTA countries on safety-related issues such as carrier oversight, record keeping, electronic data interchange, and inspection procedures. Listed below are several specific issues where agreements have been reached.

- Mexico has agreed to accelerate the training of law enforcement personnel to perform vehicle inspections and bring them to the level of commercial Vehicle Safety Alliance standards.

- A comparison of traffic control devices and country-specific traffic information has been completed for each of NAFTA's three countries. Canada released its findings earlier this year, the U.S. is scheduled to release its findings before the end of 1997, and Mexico's report is due in the first quarter of 1998.

- The NAFTA members have agreed to exchange vehicle accident data to determine whether such data might be suitable for studying causal relationships between accidents and misunderstanding of traffic control devices by drivers.

- Canada has agreed to offer a tanker-truck inspection course in Mexico.

- The NAFTA members have agreed to set the legal age for operating a vehicle in international commerce among the three countries at 21 years of age.

- The three countries have agreed that a common format is necessary to record hours of service and other entries into trucking log books, and have further agreed to develop such a standard format.[91]

3. Intermodal Regulation

In both Europe and the United States, laws governing the regulation of the domestic operations and pricing practices of conferences often differ from those governing the same activities of alliances. The United States, for example, permits joint-venture single operations, but not jointly negotiated common pricing. So, conferences can establish such arrangements but alliances can not. Conferences are also required to be open about such practices so individual lines can establish separate domestic operating companies.

[91]Hall, "Nafta trucking dispute lingers," 16A.

The European Commission currently exempts applications to their competition laws for joint intermodal pilot projects. These are being studied for their improved efficiencies; otherwise, common negotiating of such joint intermodal operations is illegal.[92] Members of the Trans-Atlantic Conference Agreement hope that, by improving road, rail, and barge services for their (container) customers, they will eventually persuade the European Commission to drop charges against the cartel for inland price fixing.[93]

4. International Regulatory Changes

The most recent trend has been to focus more on market controls and less on governmental controls, with a movement towards privatization occurring at ports and among national carriers of all sorts. The half-century employment guarantees for European dockers have ended. Large parts of the ocean cargo reservation laws of Latin America are no longer applicable. Indonesia has dropped its operating license requirements. China has eased its central control and allowed the China Ocean Shipping Company to better follow trade patterns in its operations. Similarly, Sri Lanka has ended its Central Freight Bureau system of cargo allocation, while India has relaxed coastal shipping laws and has paved the way for companies to operate under foreign flags.[94] The United States is expected to relax some international shipping regulations soon.

[92]Damas, "Special Report," 48.
[93]Porter, "Trans-Atlantic lines seek EU settlement," 1.
[94]Magnier, 1B.

The Trans-Atlantic Conference Agreement (TACA), a group of 17 members, was formed in 1992, after the European Commission declared the Trans-Atlantic Agreement (TAA) to be an illegal cartel, a decision that is still being contested. The commission allows TACA to set ocean freight rates only collectively. Any other rate-setting scheme is in violation of European competition rules. Dispensations are granted to allow door-to-door quotes to conferences that improve the efficiency of their road, rail, and barge services to the benefit of shippers. It is for this reason that TACA is experimenting with the establishment of three new inland hubs located at Munich, Frankfort, and Lyons. These inland ports have the same status as an ocean port as far as customers are concerned. Shippers who choose to pick up and return containers to one of these ports can save the cost of one leg of a round trip between these points and the ocean port.[95]

A Hapag Lloyd spokesman believes that the future of conferences does not lie in their ability to set freight rates. Instead, the viability of conferences depends on their ability to serve as forums where carriers can discuss matters of common interest, such as the tariff structure, shipping capacity, port coverage, and trade barriers.[96]

The ports on the U.S. West Coast are competing to become megacontainerports. They are competing with each other for:

- investment in capital improvements, including cranes;
- support from domestic and international carriers; and

[95]Porter, "TACA lines try out new rating plan," 1B.
[96]Porter, "TACA lines try out new rating plan," 1B.

- freedom from government regulation and assistance from government in streamlining and integrating their facilities, transfer function, and the interconnections to both land and sea.

The recent trend toward "downsizing" and "reinventing" government has been about promoting economic development through the expansion of free enterprise. This has meant divesting much of the public ownership of industry, and allowing business to take the leadership role in promoting economic growth, especially in the areas of trade and investment. Growth, trade, and investment are being stimulated by government assistance in infrastructure development, in conjunction with, and more sensitive to, private interests. The recent approval of several mergers among U.S. rail firms is a prime example of the federal government's attempt to increase the mode's efficiency. Both ISTEA and NEXTEA are attempts at integrating an intermodal system for the purpose of promoting trade and economic growth into the next century. Further efforts toward deregulation of the U.S. shipping industry are on the horizon, and devolution in this country should continue moving in that direction.

4.4 Conclusion

Responses by stakeholders in both the public and private sectors to the new magnitudes of containers being handled by megaships have been slow. Lately, the public has lost some of its faith in the efficacy of the high levels of government spending that occurred over the era of big government that has existed through most of this century. By the same token, private investors are not inclined to support projects that the public is reluctant to endorse. The public is also just beginning to see the congestion that can be caused by 4000-TEU containership operations, even though some of these vessels have now been in service for several years. Up to now, these vessels have been few enough that they have generally been handled as special cases. But with the arrival this year of increasing numbers of ships well over 5000 TEUs and the prospects of even 8000-TEU vessels in the near future, these large ships can no longer be considered special cases, but instead must be taken as a new standard. The delays caused by traffic congestion and other bottlenecks have, in many cases, not been fully addressed because the scope and magnitude of the infrastructure involved is essentially national, and so requires the investments of multiple levels of government and years to implement once funding is in place to correct the problems.

The five-year, $1.8-billion Alameda Corridor is only part of the infrastructure requiring change in southern California. New port terminals, crane acquisitions, and additional channel dredging must also be completed, as must investments by the railroads and the affected ocean carriers before the infrastructure is in place to handle the problems caused by these larger ships calling at the ports of Los Angeles and Long Beach. The ships have already begun calling, but it will take another five years for the corridor to be completed. While the Alameda Corridor project is perhaps the most pressing example of the confluence of forces that must organize to plan infrastructural changes for the coming of megaships, the ports of Seattle, New York, Charleston, Oakland, and other cities are not far behind in their planning and encouragement of these partnerships.

CHAPTER FIVE: LOAD CENTER PORTS ON THE GULF OF MEXICO

5.1 Introduction—Demand Trends Relating to Gulf Coast Trade

In 1994, the U.S. Congress passed the North American Free Trade Agreement (NAFTA), which created the largest free-trade zone in the world. In that year, waterborne trade among the three trading partners of the agreement—the United States, Canada, and Mexico—reached the level of 154 million short tons (2000 lbs), with a value, in U.S. dollars, of almost $18 billion. Trade among the three countries has increased each year since the agreement was signed. Total NAFTA trade (moved by all transportation modes) will reach about $385 billion this year (U.S./Canada $275 billion, U.S./Mexico $110 billion), and is expected to continue this kind of growth for the foreseeable future.

Much of this trade among the three countries of the NAFTA agreement can be translated into twenty-foot equivalent units (TEUs). Unfortunately for ports and shipowners, trucks currently move a large majority (over 80 percent) of the total tonnage between the U.S. and Mexico. However, the movement toward privatization of Mexico's rail system and the potential expansion of NAFTA in the next few years to include some countries in South America—particularly Chile on the South American west coast, and Brazil and Argentina on the east coast—mean that intermodal cargo movements should increase between these countries and the U.S.

The loosening of trade restrictions among countries in this hemisphere means that trade along north-south routes is likely to increase in importance over the first half of the 21st century. Because east-west trade has dominated U.S. trade with the rest of the world, growth along the north-south routes is important, and is particularly so between the ports of the U.S. Gulf Coast and those along the South American Atlantic and Caribbean Coasts (Argentina, Brazil, Uruguay, and Venezuela).

Lately, there have been encouraging signs that virtually all of the South American countries mentioned above are also expressing an interest in expanding the north-south trade routes to North America. In July of this year, in a special report devoted to Latin American ports, *The Journal of Commerce* reported that economic booms in Brazil and Chile and a recovery from a couple of economic crises in Venezuela are driving those countries' imports to unprecedented levels.[97]

There are also movements in Brazil and Uruguay to increase those countries' exports, to privatize their ports, and to increase their intermodal capacities. For example, in Brazil—South America's largest economy—the governments of several states, including Rio de Janeiro and Sao Paulo, are leading the effort to make their ports private and container-friendly, which should relieve congestion at Santos, the largest Brazilian port and Latin America's busiest. Meanwhile, at Santos, in the state of Sao Paulo, private interests are financing most of a (U.S. equivalent) $2-billion modernization program. In Rio de Janeiro, the Port of Sepetiba is undergoing a $450-million modernization program that includes channel dredging and an intermodal rail connection. So, even though the amount of private investment in Brazilian port infrastructures is not expected

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[97]Hall, "North-south trade grows," 1C.

to reach its peak for several more years, total investment this year alone will affect some thirty-six Brazilian ports with total expenditures at those ports equivalent to many billions of U.S. dollars.[98] In Uruguay, the Port of Montevideo is scheduled to begin a privatization process later this year, and a major part of that plan includes a 30-year concession agreement with a consortium of private companies—possibly including U.S.-based Maersk—to operate a container facility there. These plans also bode well for north-south trade because Montevideo handles about eighty percent of the total port traffic in Uruguay, and because Montevideo is the headquarters of the Mercosur trade bloc.[99]

The U.S. gulf ports need not depend solely on the emergence of these new north-south routes for an increase in trade. Seven other emerging markets, which hold nearly half of the world's population and represent about a quarter of its gross domestic product (GDP), are expected to contribute heavily to the demand for U.S. exports well into the next century. These markets include the Association of Asian Nations (Brunei, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam), the Chinese Economic Area (China, Hong Kong, and Taiwan), India, Poland, South Africa, South Korea, and Turkey.[100]

Certainly not all of the potential trade with these markets will move through gulf coast ports—much will move from and to ports along the U.S. east and west coasts, and will utilize truck or rail to deliver the cargo from inland origins and to inland destinations. But these markets are already well represented in gulf coast trade, and should grow along with the Association of Asian Nations and the Chinese Economic Area countries' GDPs, which are

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[98]Thurston, 1C.
[99]Luxner, 7C.
[100]Sharp, 6-7.

expected to double by about the year 2020, so growth of these markets should enhance trade opportunities along the Gulf of Mexico, even if NAFTA projections are overly optimistic. For example, in 1995, total exports from Texas to the rest of the world were about $65 billion. Of that total, about $38 billion—a little more than half—were shipped to ten markets (the seven above, plus Mexico, Argentina, and Brazil). A little over half of those went to Mexico, leaving about a fourth of the total among the seven other emerging markets.[101] So, these markets are already significant buyers of goods shipped through gulf coast ports and should become much more important in the near future. Again, containerized freight should be an important and growing portion of the total trade.

In 1995, the leading U.S. and Mexican ports on the Gulf of Mexico handled (nonempty) container cargoes equaling 794,000 TEUs at the Port of Houston; 265,000 TEUs at Veracruz, Mexico; 261,000 TEUs at New Orleans; 153,000 at Gulfport, Mississippi; 48,000 TEUs at Freeport, Texas; and 34,000 TEUs at Lake Charles, Louisiana.

The fact that gulf ports are making efforts toward containerized freight handling is good news for the overall U.S. trade, given that it is in our best interest to reduce the trade deficit that we have experienced over the last several years. Any efforts that make our goods cheaper and more attractive to other countries increases the demand for our exports. And, we should be pleased that NAFTA has increased U.S. trade with our two leading trade partners, Canada and Mexico. More important for this study, however, is the fact that, U.S. gulf coast containerport trade has grown from 922,000 TEUs in 1985 to about 1,500,000 TEUs by 1995 and almost

[101]Sharp, 7.

1,615,000 TEUs by 1996, an increase of about 75% over that 12-year period, or close to a 5-% annualized growth rate.[102]

On the other hand, the total container freight at the Port of Tokyo, Japan, in 1995 was about 2,200,000 TEUs; at Rotterdam, the total was about 4,800,000 TEUs; Singapore's total container tonnage, alone, was nearly 11,000,000 TEUs (about seven times the combined gulf coast tonnage for that year); and Hong Kong's total container tonnage was about 12,500,000 tons (about eight times the total for all the U.S. gulf ports combined)! In the U.S., the combined tonnage of the west coast neighbor ports of Los Angeles and Long Beach was about 5,400,000 tons in 1995, well over three times the total for the entire gulf coast.[103]

Even if we disregard the large discrepancy between the world's major ports and the largest U.S. ports, the U.S. gulf coast port container trade numbers were far short of the container tonnage numbers recorded at U.S. west coast ports and at several of those on the U.S. east coast. In the United States, for example, the leading containerport in 1994 was Long Beach, California, with total container loadings/unloadings of almost 2,600,000 TEUs. And, by 1996, those numbers had grown to over 3,000,000 TEUs—an increase of about 7% per year over those two years. But total U.S. container trade grew at only about 6% per year in the late 1980s and early 1990s, compared with a world average of about 9%. Given that several east and west coast ports experienced container growth well above these numbers, it should be clear that on the gulf coast the news was not as good. The gulf ports did not fare as well as east and west coast ports because there is little trade between the gulf coast and Canada and because much of the trade

[102]Vickerman, Background Paper 1, 1.
[103]Vickerman, Background Paper 1, 1.

with Mexico has not yet embraced intermodalism. Further, as we have seen, compared to the largest world containerports, the gulf ports fell far short of the tonnage that was handled by those mostly Asian (and a few European) ports. The east-west routes have clearly dominated containerized cargo movements much in the same manner as they have most other cargoes.

However, over the last decade or so, a few gulf ports—particularly Gulfport, Mississippi and Houston—did experience large gains in containerized freight from the north-south routes, and this trend is expected to continue. So, again, maybe the news is good after all! Further, the U.S. Department of Transportation projects that, of all the regions of the United States over the next 10 to 15 years, the ports of the gulf coast should experience the highest rate of growth in containerized freight movements, with an increase of about 13% per year from Miami to El Paso over that period. Comparatively, the west coast ports—currently our leading containerports—should experience only about 6.3% annual increases in container cargoes.[104]

The high world growth rate in container traffic, as was discussed in more detail in Chapter 2 and mentioned earlier in this chapter, is expected to remain around 7.8% through 2010. But if the forecasts for the gulf coast ports come true, that region of the U.S. will make substantial inroads into closing the gap between its major ports and the largest U.S. and foreign ports in the increasingly important trade in containerized freight.

In the current international intermodal framework among the countries of North America, most of the freight traffic tends to flow between origins and destinations within the United States and between U.S. and Canadian origins and destinations—and these are along and across the U.S./Canadian border, and most of the U.S./Mexico trade is across the Texas/Mexico and

[104]Vickerman, Background Paper 1, 2.

California/Mexico borders. It seems clear, then, that given the forecasts, international trade among the current and potential NAFTA countries, and especially the trade between the gulf coast of the United States, Mexico, and the east coast of South America, should experience a significant increase over the next several years. While much of that trade is expected to continue to flow across the borders of Texas by truck or rail, greater portions of that traffic should begin to flow through the ports on the Gulf of Mexico.

Because the 13% projected growth in containerized trade through Gulf of Mexico ports (from Miami to El Paso) is double the 6.5% growth rate projected for overall U.S. containerized trade, it is important to extend these projections to trends in the overall ocean-going container industry, and to overall movements of containers through intermodal means. The high growth projections for gulf coast port container trade lend some credence to the proposition that the domination of the east-west trade patterns is fading somewhat and that the north-south patterns are strengthening, at least for container trade. With such increases in container traffic, we can expect that the overall trend toward megaships and megaports, along with the increased trade between the U.S. and South America, will cause major changes in the operations of several ports and other components of the transportation infrastructure along and near the Gulf of Mexico by early in the next century.

5.2 Load Center Ports Defined

Ports not positioned and equipped to take advantage of the increases in ship size stand to lose out on these gains in container traffic. Currently, there are very few ports in the United

States, and even fewer along the gulf coast, that have the infrastructure to handle the largest post-Panamax container vessels in today's fleet. Given the trend toward even larger ships of the 4000- to 6000-TEU class and orders coming for those above 6000 TEUs, ports on the gulf coast will be forced to improve their facilities if they are to share in the growth in container trade that has been projected for the region.

While Panamax containerships (2500 to 3999 TEUs) are projected to maintain their current 36% share of the cargo, the biggest share of traffic (about 40%) will be handled by 4000- to 8000-TEU post-Panamax vessels. This means that, to remain competitive for container trade, a port should at least be able to efficiently accommodate Panamax vessels. Currently, efficient accommodation of even these "smaller" vessels is beyond the infrastructural constraints of all but a few gulf coast ports. Ideally, to take advantage of the economies of scale provided by megaships, a port must develop an infrastructure that avoids the loading- and unloading-time delays, the traffic congestion, and other problems that might prevent these economies of ship size to be realized. These infrastructure improvements mean the vessel should be provided a wide and deep passage to a safe and efficient berth and, upon its arrival at the port have access to the wharfage, cranes, terminals, yard storage facilities, information interchange systems, labor practices, landside transportation connections, and other infrastructure that minimizes the vessel's time in port and that delivers the cargo to that vessel from the shippers or from that vessel to the cargo's consignees in the most time- and cost-efficient manner possible.

A **"load center" port** is a port that fits the criteria mentioned above. It is a port that handles a significant portion of a region's cargoes, both in volume and in variety. While a port may call itself a "load center" for a particular cargo if it handles a significant amount of that single kind of cargo, given the demands of today's freight market, a true load center port cannot specialize in or depend on only one type of cargo or only provide a limited access to landside storage and transportation facilities. That is, it must be versatile—capable of handling many types of cargo at the same time without congestion, and it must be able to store these cargoes as well as provide efficient transportation services in the land modes and even in air cargo services. In short, it is a port that handles a large concentration of cargoes because it is able to offer a broad array of efficient services to a wide variety of customers at low cost to them relative to costs at other ports. In order to be competitive with other ports within a region or among potential trade routes, a port must recognize that ALL of the stakeholders in the transportation chain—not just shippers and shipowners—must be able to take advantage of economies of scale and scope by operating through the port. Ports that merely provide a low-fee port call for a ship but which, at the same time, suffer from inefficiencies that make the costs too high for rail or truck lines to make connections there will not see very many ships calling. Such ports will find that they are losing cargoes to the more efficient "load center" ports.

The increase in the importance of containerization and intermodal transportation is issuing in a change in the overall functions of particular ports. The U.S. port system is developing into a "hub-and-spoke" system in a manner similar to the way our airline/airport system has evolved since air transportation was deregulated beginning in the late 1970s. What this means for ports is that certain ports that are versatile and significant cargo handlers—i.e., load center ports—will become hub ports for a number of carriers, while smaller ports will either become primarily transshipment ports or merely regional ports handling mostly inland and coastal traffic for localized industries. This is not to say that all of the small ports will be losers in this new system; it simply means that the role of small ports will change.

It stands to reason that the evolution of our port system from its present form to a megaport/transshipment hub-and-spoke port system will take longer than has been the case for the same kind of evolution in the airport system. Waterborne vessels and port infrastructure are generally more expensive and take longer to construct than air transportation facilities. However, over the next fifteen to twenty years, this hub-and-spoke system should emerge, as it has with airports. During that period, adjustments to larger ship size will take place. As we discussed earlier, by about 2010, about 30 percent of containerized cargo will be transported by ships in the 4000- to 6000-TEU class and another 10 percent or so will be transported by vessels larger than 6000-TEU capacity. Given current vessel orders, however, Panamax vessels are expected to maintain their current share, around 36 percent, of container traffic. Since most of the ports on the Gulf of Mexico do not currently have the facilities to handle the largest ships currently in service, in the interim period from the present until 2010, the majority of container cargo shipped through gulf ports is expected to be carried by Panamax vessels. But in this interim time period, any gulf port that expects to be a megaport of the future must make the necessary changes in its infrastructure to accommodate the larger vessels, or its role will change to that mentioned earlier for the smaller ports. It can expect to lose container traffic to other more versatile and more efficient hubs, and will likely become a transshipment port for these larger load center ports. So, the gulf port managers must recognize now what the stakes are in this emerging containerport game, because even those few ports that now have facilities to handle Panamax vessels must face the fact that, in the period starting about 2010, carriers will have already selected their hub ports and abandoned others, so as the fleet ages (even those Panamax vessels now on order), new orders will likely be for more larger vessels. So, even if the larger containerports are “safe” for now from the expected changes in the system, the plans they are making now will likely set the course they will have to follow after the first few years of the twenty-first century. After all, megaports, like Rome, cannot be built in a day!

As larger and larger vessels call on fewer and fewer ports, any gulf port aspiring to become a load center port must make some significant changes in its infrastructure. The longer, wider, and deeper-draft vessels will require a greater number of longer berths, with deeper water at the berths and in the channels. Most ports, to become a load center, will need to dredge their harbors in order to provide deep enough passage, and some channel widening may be required. Some ports will need to expand their turning basins in order to allow these longer vessels to maneuver in and out of port.

Given that there will be more high-capacity vessels calling a hub port at the same time, more cargo at a time must be loaded or discharged. This means that these ports will need more wharf acreage. These wharves should be heavily reinforced to support the extra cargo, the heavier Beyond post-Panamax (BPP) cranes required to move the cargo, and any other equipment such as dockside rail and more yard cranes used to move the cargo to and from the wharves. And there must be more yard acreage and more sophisticated storage facilities to handle the additional containers, whether full or empty. The wharf cranes loading and unloading the cargoes must have longer horizontal and vertical reaches and greater lifting capacities. The yard cranes should also be of greater capacity, and there should be other means of moving cargo to and from the wharves. If standard rail facilities are not nearby, some of the newer drayage devices such as RailRunner™ technology should be available to move the containers to the longer-haul rail connection or to the storage facility.

Connections to landside transportation facilities must be plentiful and must not be congested. There is probably not a single gulf port that should not improve at least some aspect of its landside connections, given the increase in cargo it will face as a load center port. It is, of course, not entirely within the port's abilities to effect changes in all of the transportation facilities and connections. There may not be a major freeway or airport near the port, for example, or the local highway infrastructure may limit double-stack rail carriage because of low overpasses. Such situations as these require even more planning and cooperation with government and others who may be able to eliminate these shortcomings in the port's landside connections. However, the port should improve any transportation linkages within the port facility itself and in its immediate vicinity in order to allow more efficient access.

Given all of the above, is it now possible to set some criteria for a single optimized container terminal that can accommodate calls by megaships? In his report to the U.S. Department of Transportation, *Impacts of Structural Changes in Ship Design*, M. John Vickerman derived such a set of standards. A single optimized megaship terminal should have, at a minimum, these physical characteristics:

- 2500 linear feet of berthing for megaships; this amounts to two 1250-foot megaship berths;
- 3000 linear feet of berthing for mixed vessels; this amounts to three 1000-foot post-Panamax berths, or a greater quantity for smaller vessels;

- 50-foot water depths in channel and at berths; 800- to 1000-foot channel width; 1430- to 1650-foot turning basin;
- high rates of berth occupancy (targeted at 50% or greater); this means, for example, that, given two berths, both would be occupied 25% of the time, one occupied 50% of the time, and both empty 25% of the time;
- three or more large, heavy-lift Beyond post-Panamax (BPP) cranes per berth; this means that, given the berth occupancy targets above, there will be three cranes available per vessel 33 percent of the time and six cranes per vessel 67 percent of the time, for an average of five cranes per vessel; this number of cranes should provide an "adequate" vessel turnaround time;
- wharves with heavier load-bearing capacity to support the heavier cranes, dockside rail, and other ancillary equipment;
- 75 acres of terminal space per megaship berth and 50 acres per standard berth; this translates to 150 acres per 3000 linear feet of berthing; and
- a gate complex and dockside rail system using the latest available technologies.

A container terminal that has these minimum physical characteristics should have the capability, depending on hours of operation, ancillary equipment, and other related factors, of a throughput of 450,000 to 900,000 TEUs per year, a range equivalent to 3000 to 6000 TEUs per year per acre.[105] In addition, of course, to the terminal's own physical requirements, there must be adequate landside transportation connections to move the cargo to and from the terminal.

[105]Vickerman, Background Paper 2, 3.

Assuming that dockside rail moves 40 percent of these containers, moving the containers in and out of the port's gate via truck and rail (that is, assuming no transshipment) would require between 1730 and 3460 "standard" truck trips per day in a typical 5-day week, and between two and four unit trains calling per day in a 7-day week! Without dockside rail, the number of truck trips required would increase to between 2880 and 5770 per day per 5-day week![106] Such heavy truck traffic would create congestion at all but the most efficient terminals and place an additional burden on most any highway system near the port. But as striking as these numbers are, it is more important to recognize that, while these minimum physical standards may be sufficient for efficient operation of a single megaship container terminal, a port that is to be a load center for the Gulf of Mexico should have more than one such terminal—perhaps even several—each with its accompanying landside connections. By comparison, last year, Houston—the Gulf's largest containerport—handled about 800,000 TEUs, including transshipments. With possibly this one exception, there is currently no port on the gulf coast that meets the criteria for a load center port.

5.3 Need for a Gulf Coast Megaport

Any forecast of the total number of Gulf Coast megaship berths or megaship ports that will be needed is, of course, subject to many underlying factors. First, the time period is important. If that period is the present or immediate future, the correct answer is probably "none." But port managers along the gulf cannot afford to be so shortsighted, given the way the

[106]Vickerman, Background Paper 2, 5.

transportation system is evolving. So, a more pertinent period is one well into the 21st century, to 2010 and beyond. Further, while projections for container transportation growth in the gulf are promising, there are no guarantees that such growth will materialize. In spite of these problems in estimation and the fact that a port's "location, location, location" is indeed important, it is undeniably true that the number of load center hub ports that will be needed along the gulf is also a function of the available infrastructure at the ports, including landside connections and container terminal facilities in place. While the "if we build it, they will come" cliché may not always hold, it is nonetheless evident that if we don't build it, they certainly won't come! Current estimates suggest that gulf container traffic will be able to support 14 total megaship berths, or one to two megaship load center ports over the suggested time period.[107]

5.4 Characteristics of Gulf Coast Ports

This section examines the physical characteristics of twenty-nine ports along the Gulf of Mexico—twenty-four in the United States and five in Mexico—to compare current facilities with the standards described earlier for a load center port. The study encompasses a brief, very general "inventory" of facilities at each port, with that inventory providing a basis for comment on the likelihood of that port becoming a load center port for the gulf, under the assumption that demand for such a port exists.

[107] Vickerman, Background Paper 2, 7.

5.5 Port Access to Landside Transportation

Table 5.1, parts A through F, summarizes the landside transportation connections currently available at each port. A port that is lacking in any of these connections, or that is already experiencing congestion in a particular mode, is not a likely candidate to become a load center port without major transportation infrastructure improvements. Of course, not all of the transportation problems are equal. Ready access to air or barge transportation may not be as important as is an uncongested rail linkage. But with expected growth in these two modes as carriers in the intermodal chain over the next half century or so, we cannot ignore the importance of a port's access to them either.

Table 5.1A shows that at Mobile—Alabama's only gulf port, there is access to all modes of landside transportation, and its strengths lie in rail and highways—the two most important modes for intermodal container carriage.

Table 5.1B shows mode proximity for the Florida ports. From this basic information, it is pretty clear that, given St. Petersburg's lack of rail and air connections, it is not currently a candidate for intermodal load center port status. Port Manatee is deficient in inland barge connections, which may limit its container carriage of certain bulk cargoes. Given the fact that phosphate fertilizers an other bulk cargoes move from Florida's inlands to foreign ports, this limitation may be significant for Port Manatee. Panama City's port does not have sufficient air connections—not so important now but possibly significant later.

Table 5.1

Port Proximity to Landside Transportation Connections

Table 5.1A

Alabama Ports

	RAIL	BARGE	AIR	HIGHWAY
MOBILE	4 major carriers	yes	2 airports	2 interstates

Table 5.1B

Florida Ports

	RAIL	BARGE	AIR	HIGHWAY
PANAMA CITY	yes	yes	no	yes
PENSACOLA	2 major carriers	yes	3 miles	yes
PORT MANATEE	yes	no	3 intl 45 min	yes
ST PETERSBURG	no	yes	no	yes
TAMPA	yes	yes	yes	yes

Table 5.1C

Louisiana Ports

	RAIL	BARGE	AIR	HIGHWAY
NEW ORLEANS	yes	yes	yes	congested
ST. BERNARD	yes	no	no	yes
PLAQUEMINES	yes	yes	no	yes
BATON ROUGE	yes	yes	yes	congested
LAKE CHARLES	yes	yes	yes	congested
PORT OF S. LA	yes	yes	no	yes

Table 5.1D

Mississippi Ports

	RAIL	BARGE	AIR	HIGHWAY
GULFPORT	yes	yes	1 major airport	yes
PASCAGOULA	yes	yes	yes	yes

Table 5.1E

Texas Ports

	RAIL	BARGE	AIR	HIGHWAY
BEAUMONT	yes	yes	no	yes
BROWNSVILLE	yes	yes	yes	yes
CORPUS CHRISTI	yes	yes	yes	congested
FREEPORT	limited	yes	no	yes
GALVESTON	yes	yes	1 municipal	congested
HOUSTON	yes	yes	2 major airports	congested
ORANGE	yes	yes	no	yes
PORT ARTHUR	yes	yes	yes	yes
PORT LAVACA	capabilities	yes	no	yes
TEXAS CITY	yes	yes	2 major airports	congested

Table 5.1F

Mexico Ports

	RAIL	BARGE	AIR	HIGHWAY
ALTAMIRA	yes	yes	yes	yes
TUXPAN	yes	yes	yes	yes
VERACRUZ	yes	yes	yes	yes
COATZACOALCOS	yes	yes	yes	yes
TAMPICO	yes	yes	yes	yes

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.1C shows that, for the ports of Louisiana, there are problems of access to air transportation at the Ports of St. Bernard, Plaquemines, and the Port of South Louisiana.

Additionally, the Port of St. Bernard has no direct inland access by barge. Most important for Louisiana ports is the fact that three of the larger ports—New Orleans, Baton Rouge, and Lake Charles—all have congested highway connections. Any hope of evolving into a load center hub port for containers depends on eliminating such bottlenecks for truck transportation.

Table 5.1D show that the two Mississippi gulf ports have reasonable access to landside transportation connections. Both are near Interstate 10, and both are near major rail lines. There is also nearby barge and air transportation.

Table 5.1E shows the landside connections at Texas ports. A cursory look shows that Freeport and Port Lavaca have some limitations in rail service. The Ports of Beaumont, Freeport, Orange, and Port Lavaca have limited air service, and Galveston has no significant commercial air cargo service. Again, more important are problems with highway connections. The ports of Corpus Christi, Galveston, Houston, and Texas City all have highway congestion problems. But the general data do not necessarily tell the whole story here. For example, the Port of Galveston, which is located on Galveston Island, is serviced by only one major highway to the mainland, Interstate 45. The congestion there is potentially a significant factor in the movement of cargo by truck, and the problem cannot be solved without major expenditures on bridge and/or alternate highway construction. On the other hand, Houston's congestion problems primarily involve feeder highways around the port and the fact that truck entrances to the port are near major arteries for Houston's regular commuter traffic. There is currently major construction taking place on the interstate and feeder roads near the Port of Houston, so some of the congestion that currently exists may be ameliorated in the near future.

Table 5.1F shows that the ports of Mexico all have landside connections to all transportation modes.

Given the importance of all forms of transportation to a port's ability to move container cargo intermodally, the summary data for the gulf ports' accesses to landside transportation allow some general conclusions about the likelihood of particular ports to become container load centers. In Florida, the ports of Panama City, Port Manatee, and St. Petersburg are unlikely choices. In Louisiana, the Ports of St. Bernard, Plaquemines, and South Louisiana are also poor candidates. Also, unless some highway congestion problems are addressed, three other Louisiana ports, including the Port of New Orleans, will make poor choices. In Texas, the ports at Beaumont, Freeport, Orange, and Port Lavaca have some sort of limitation in their landside linkages, with the most severe of these being the lack of adequate rail facilities at Freeport and Port Lavaca. Four other Texas ports must address highway congestion problems in order to be considered a candidate for load center status. As mentioned earlier, the Port of Houston is currently addressing its highway congestion with several projects underway.

5.6 Facilities at Individual Gulf Ports

A more thorough comparison of the gulf ports as candidates for a load center is possible if we examine the existing infrastructure at the individual ports. Several aspects of the ports' facilities are particularly important. Specifically, we need to look at the water depth at berths, the length of berths, land acreage and storage facilities available, and cranes having a capacity and reach adequate to move cargoes on and off the wider and taller vessels. The inventory of facilities presented in this study was extracted from a variety of sources, primarily *The 1997*

AAPA Directory: Seaports of the Americas and *Containerisation International Yearbook 1997*. Where additional information on new equipment acquisitions or other changes was made available, it was included. Nevertheless, we make no claim that the information provided here is perfectly accurate because ports are constantly evolving entities.

Tables 5.2 through 5.30 present the data on the individual gulf ports, with the U.S. ports listed by state in the first twenty-four tables, and the Mexican ports listed in Tables 5.26 through 5.30. The discussion groups the ports together by state and addresses them as a group, then does the same for the Mexican ports.

Table 5.2 shows the facilities at Alabama's only gulf port, the state docks at the port of Mobile. In 1995, their Wharves & Warehouses general cargo terminal handled 170,476 short tons of containerized freight, the ninth largest reported total for that year among the gulf ports. There are currently no berths at the terminal of a length adequate to accommodate the larger current megaships, and the 39-foot depth at berth is not sufficient to handle even the larger Panamax vessels. Therefore, the most likely scenario for Mobile is as a transshipment port to move cargo by feeder vessels to and from inland locations.

Table 5.2

Port Facilities: Mobile, AL

	BERTHS	LENGTH	DEPTH
BULK MATERIAL	2	1400 FT	40 FT
MCDUFFIE	3	860-1000 FT	45 FT
PUBLIC GRAIN	2	799 FT	39 FT
WHARVES	28	400-1000FT	39 FT

CRANES:

*One 45-ton Paceco container crane

*One 50-ton gantry crane

*One 600-ton floating derrick

*Two Hyster (20.4-ton, and 28.3-ton) and two Taylor (20.4-ton) front-end handlers/reachstackers

CONTAINERIZED FREIGHT HANDLED 1995: 170,476 short tons

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas*

Tables 5.3 through 5.7 examine Florida's gulf ports. Panama City (Table 5.3) reported no container traffic in 1995, and the port's five general cargo berths at the Port Panama City docks together comprise only 2500 linear feet, a total length enough to accommodate two megaships. However, the major limiting factor is the 32-foot depth at berth, too shallow to accommodate large vessels.

At the Port of Pensacola (Table 5.4), the depth at berth is also the major factor, only 32 feet at the Port of Pensacola terminal, the lone berths where container-handling capabilities exist.

At Port Manatee (Table 5.5), Berths 6, 7, 9, 10, and 11 handle some container traffic. The 40-foot water depth is, of course, a limiting factor, but the more severe problem is berth length at the existing container berths. Only at Berths 9 and 10, where the two 600-foot berths can be turned into a single 1200-foot berth is there enough length to accommodate a single megaship. Given the channel depth limitations, the current berth lengths are reasonable for the smaller vessels that call at the port.

The Port of St. Petersburg (Table 5.6) is used solely as a cruise port and has no facilities for containerized freight. Its 22-foot water depth is also a severe limiting factor in the accommodation of any but small cargo vessels.

At the Port of Tampa (Table 5.7), Berths 201, 201/202, and 208/209 are equipped to handle containerized cargoes, with more associated cranes, rail facilities, and warehouse space than most of the gulf ports. But, except for the 1500-foot length at Tampa Bay International Terminal Berth 208/209, berth length is a factor and, even without this limitation, the water depth of about 33 feet throughout the port creates a severe obstruction for large vessels.

Another consideration at Tampa, Manatee, and St. Petersburg is that, given the well-established container trade already occurring at the nearby Port of Miami on the Atlantic, it is not likely that many container carriers will want to move their operations to any of these three ports or, for that matter, to any of Florida's other gulf ports.

Table 5.3

Port Facilities: Panama City, FL

	BERTHS	LENGTH	DEPTH	STORAGE
PORT PANAMA	5	2500 FT	32 FT	N/A
BARGE TERMINALS	1	600 FT	12 FT	N/A

CRANES:

*One heavy-lift capacity 45-metric ton gantry crane at 155 ft. out from center point

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.4

Port Facilities: Pensacola, FL

	BERTHS	LENGTH	DEPTH	STORAGE
PORT PENSACOLA	9	3499 FT	32 FT	4 ACRES
COASTAL FUELS	2	400-476 FT	34 FT	N/A
FREEPORT	2	400-500 FT	18-35 FT	N/A

CRANES:

*none

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.5

Port Facilities: Port Manatee, FL

	BERTHS	LENGTH	DEPTH	WAREHOUSE	OPEN LAND
BERTH 5	1	350 FT	20 FT	35000 SQ. FT	N/A
BERTH 6	1	412 FT	40 FT	35000 SQ. FT	N/A
BERTH 7	1	720 FT	40 FT	60000 SQ. FT	N/A
BERTH 8	1	508 FT	40 FT	140000 SQ. FT	N/A
BERTH 9	2	600 FT CONTINUOUS	40 FT	N/A	N/A
BERTH 10	2	600 FT CONTINUOUS	40 FT	N/A	100 ACRES
BERTH 11	1	480 FT	40 FT	58000 SQ. FT	N/A

CRANES:

*One fixed gantry loader

CONTAINERIZED FREIGHT HANDLED 1995: 68,200 short tons

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas*

Table 5.6

Port Facilities: St. Petersburg, FL

	BERTHS	LENGTHS	DEPTH	WAREHOUSE	STORAGE
CRUISE TERMINAL #1	1	600 FT	22 FT	N/A	N/A
CRUISE TERMINAL #2	1	500 FT	22 FT	N/A	N/A

CRANES:

*none

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: The 1997 AAPA Directory: Seaports of the Americas

Table 5.7

Port Facilities: Tampa, FL

	BERTHS	LENGTH	DEPTH	WAREHOUSE	TRANSIT SHED
BERTH 2	1	500 FT	29 FT	N/A	N/A
BERTH 21	1	230 FT	20 FT	N/A	N/A
BERTH 22	1	700 FT	33 FT	N/A	N/A
BERTH 24/24B	2	715/225 FT	14-32.5 FT	N/A	N/A
BERTH 31	1	1000 FT	43 FT	N/A	N/A
BERTH 201	1	900 FT	33.5FT	N/A	N/A
BERTH 201/202	2	900/750 FT	33.5-33 FT	130000 SQ. FT	NA
BERTH 205	1	580 FT	33.5 FT	N/A	N/A
BERTH 208/209	2	1500 FT	32 FT	90639 FT	N/A
BERTH 210/211	2	1200 FT	34-38 FT	N/A	N/A
BERTH 219	1	1000 FT	39 FT	N/A	N/A
BERTH 22O	1	1000 FT	39/5 FT	N/A	N/A
BERTH 223/224	2	600/520 FT	33/14 FT	N/A	N/A
BERTH 226/227	2	880 FT each	40 FT	N/A	N/A
BERTH 232	1	130 FT	22 FT	N/A	N/A
BERTH 251/252	2	1200 FT	30-32.5 FT	N/A	37000 SQ.FT

CRANES:

*One 40-short ton whirly crane

*One 40-short ton multi-purpose crane

*One 55-short ton container crane, five 44-short ton container cranes, three 40-short ton container cranes, and five 50-short ton container cranes

*four transtainers

*four 55-short ton post-Panamax container cranes

CONTAINERIZED FREIGHT HANDLED 1995: Container tonnage not separated from general cargo in report

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Tables 5.8 through 5.13 show the facilities data for the gulf ports of Louisiana. At the Port of Greater Baton Rouge (Table 5.8), which reported no container traffic in 1995, only the Baton Rouge Port Commission general cargo docks have combined linear-foot berth length, depth at berth, and storage facilities to accommodate even one vessel larger than Panamax class.

At Lake Charles (Table 5.9), the port handled about 549,000 short tons of container cargo in 1993. But the port's berths are mostly short (except at Bulk Terminal 1) and the channel depth is generally below 40 feet (9 out of the 11 berths at the City Docks have water depth of 36 feet deep). So, the port is not likely to attract even Panamax containerships without channel dredging and a number of additional facilities.

Tables 5.10A and 5.10B show the data for New Orleans. The 3,593,747 short tons of containerized freight handled by the port in 1995 make it the second largest containerport on the Gulf of Mexico. Sea-Land, Ceres, and several other container carriers own or lease terminal space at the port. The port's Nashville Avenue Terminal complex has just installed two new multipurpose gantry cranes with lift capacities of 40 tons. About fifteen of the port's terminal sites have container-handling capability; however, only a few of these terminals have berths of sufficient length to accommodate a megaship. And of these, only the Governor Nicholls Street wharf has a depth at berth of as much as 40 feet—a more common depth at New Orleans is 35 feet. So, while New Orleans has more wharf and storage space than almost any other gulf port, only a major dredging project would allow megaships to call at the port. But the port has no immediate plans to deepen the channel and berth accommodations there.

The Port of Plaquemines (Table 5.11) reported no container traffic in 1995. Most of its terminals are privately owned by petroleum companies and are designed for liquid cargoes, and the remaining facilities handle mostly, coal, sulfur, and other dry and breakbulk cargoes. The port currently has virtually no container-handling facilities. Current berth lengths are also a limitation at this port, though the 55-foot main channel depth and berth depths mostly between 40 and 55 feet at the public facilities are greater than at most ports along the gulf. Still, this port is very unlikely to see much container traffic without major changes in its infrastructure, especially given its proximity to the more container-friendly facilities existing at nearby New Orleans and Houston.

Though the Port of South Louisiana (Table 5.12) handles large amounts of cargo by weight, it handles few containers. Virtually all of the port's container traffic moves through its Globalplex Intermodal terminal. But the two berths at that port are not long enough to accommodate more than an early-generation Panamax vessel, and the port has few other facilities for container handling at terminals other than at Globalplex.

The Port of St. Bernard (Table 5.13) handled very small amounts of containerized freight in 1995 at its two terminal sites. This port's ability to handle large containerships is severely restricted by the 36-foot depths at the sites and the fact that the berth slips are cut into the banks of the Mississippi River, making navigation of a large ship into the berths difficult even if channel depth were sufficient.

Table 5.8

Port Facilities: Baton Rouge, LA

	BERTHS	LENGTH	DEPTH	TRANSIT SHED
BATON ROUGE	5	3000 FT	45 FT	462000 SQ. FT
GENERAL	1	450 FT	12 FT	N/A
INLAND RIVERS	1	985 FT	12 FT	N/A
BATON R. BARGE	1	800 FT	45 FT	N/A
PUBLIC GRAIN	1	990 FT	45 FT	N/A
WESTWAY	1	800 FT	45 FT	N/A
PORT COMM.	1	990 FT	45 FT	N/A
PETROLEUM FUEL	1	864 FT	45 FT	15 MILLION GALS

CRANES:

*four mobile cranes up to 150-ton capacity, and one 250-ton mobile crane

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.9

Port Facilities: Lake Charles, LA

	BERTHS	LENGTH	DEPTH
CITY DOCKS	11	550 FT EACH	36-40 FT
BULK #1	1	1200 FT	40 FT
BULK#2	1	400 FT	36 FT

CRANES:

*Ship/barge loader

*Gantry with chute and conveyor system

*Clam-bucket type unloader and conveyor

*One 100-ton railcar rollover

CONTAINERIZED FREIGHT HANDLED 1993: 549,000 short tons (est.)

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas*

Table 5.10A

Port Facilities: New Orleans, LA

	OPEN AREA	OPEN LAND	OPEN WHARF	BACKUP LAND	MARSHALLING	WHARF
HENRY CLAY	170858 SQ. FT	154125 SQ. FT	N/A	N/A	N/A	N/A
NASHVILLE A	N/A	110000 SQ. FT	463000 SQ. FT	N/A	N/A	N/A
NASHVILLE C	N/A	N/A	N/A	N/A	N/A	N/A
NAPOLEAN A	N/A	N/A	129766 SQ. FT	N/A	N/A	N/A
NAPOLEAN C	28313 SQ. FT	22903 SQ. FT	N/A	N/A	N/A	N/A
NAPOLEAN LC	118420 SQ. FT	363000 SQ. FT	N/A	N/A	N/A	N/A
MILAN ST.	65000 SQ. FT	N/A	269352 SQ. FT	N/A	N/A	N/A
LOUISIANA E&F	N/A	1221243 SQ. FT	N/A	92486 SQ. FT	N/A	N/A
HARMONY ST.	114380 SQ. FT	N/A	N/A	N/A	N/A	N/A
SEVENTH ST.	134911 SQ. FT	N/A	N/A	N/A	N/A	N/A
FIRST ST.	99440 SQ. FT	N/A	N/A	N/A	N/A	N/A
GOV. NICHOLLS ST.	N/A	N/A	37694 SQ. FT	N/A	N/A	N/A
POLAND AVE.	96257 SQ. FT	N/A	N/A	N/A	N/A	N/A
ESPALANDE AVE.	N/A	N/A	N/A	N/A	N/A	N/A
MANDEVILLE ST.	N/A	N/A	N/A	N/A	N/A	N/A
PAULINE ST	N/A	N/A	N/A	N/A	N/A	N/A
ALABO ST.	182821 SQ. FT	N/A	N/A	N/A	207849 SQ. FT	N/A
PERRY ST.	N/A	N/A	N/A	N/A	N/A	14734 SQ. FT
FRANCE RD. 1	N/A	34.6 ACRES	N/A	N/A	2.6 MILLION SQ. FT	147 FT WIDE
FRANCE RD. 4	N/A	N/A	N/A	N/A	1.3 MILLION SQ. FT	120 FT WIDE
FRANCE RD. 5&6	N/A	N/A	N/A	N/A	N/A	N/A
JOURDAN RD.	N/A	N/A	N/A	N/A	N/A	N/A

Table 5.10B

Port Facilities: New Orleans, LA

	BERTHS	LENGTH	DEPTH	TRANSIT SHED	APRON
HENRY CLAY	1	842 FT	35 FT	95000 SQ. FT	62 FT (WIDE)
NASHVILLE A	5	2759 FT	35 FT	756000 SQ. FT	62 FT (WIDE)
NASHVILLE C	3	N/A	N/A	172000 SQ. FT	N/A
NAPOLEAN A	2	1099 FT	35 FT	144876 SQ. FT	48 FT (WIDE)
NAPOLEAN C	2	1000 FT	35 FT	199859 SQ. FT	43 FT (WIDE)
NAPOLEAN LC	1	375 FT	35 FT	N/A	N/A
MILAN ST.	1	767/1263 FT	35 FT	107081 SQ. FT	231.5 FT (WIDE)
LOUISIANA E&F	2	1590 FT	35 FT	N/A	N/A
HARMONY ST.	2	1289 FT	35 FT	125653 SQ. FT	49 FT (FRONT)
SEVENTH ST.	2	1196 FT	35 FT	119280 FT	50 FT (FRONT)
FIRST ST.	2	1275 FT	35 FT	140655 SQ. FT	N/A
GOV. NICHOLLS ST.	2	1270 FT	40 FT	156617 SQ. FT	N/A
POLAND AVE.	2	932 FT	35 FT	84328 SQ. FT	35 FT (WIDE)
ESPALANDE AVE.	1	584 FT	35 FT	99031 SQ. FT	30201 SQ. FT
MANDEVILLE ST.	1	1121 FT	35 FT	146035 SQ. FT	56461 SQ. FT
PAULINE ST	1	582 FT	35 FT	N/A	N/A
ALABO ST.	2	1313 FT	36 FT	N/A	N/A
PERRY ST.	2	1009 FT	50 FT	160000 SQ. FT	N/A
FRANCE RD. 1	1	830 FT	30-33 FT	67019 SQ. FT	N/A
FRANCE RD. 4	1	700 FT	30-33 FT	N/A	N/A
FRANCE RD. 5&6	2	1700 FT	30-33 FT	N/A	N/A
JOURDAN RD.	2	1400 FT	33 FT	N/A	N/A

CRANES:

*300 reefer jacks

*Three 30-ton container cranes, one 33.5-ton container crane, and four 40-ton container cranes

CONTAINERIZED FREIGHT HANDLED 1995: 3,593,747 short tons

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas*

Table 5.11

Port Facilities: Plaquemines, LA

	BERTHS	LENGTH	DEPTH
FREEPORT	5	2200 FT	40 FT
COOPER/T.	2	N/A	N/A
INTL MARINE	2	1200 FT	45 FT
B.P. OIL	2	1205 FT	40+ FT
AMAX	2	700 FT	35 FT
ELECTRO-COAL	3	3000 FT	55-80 FT
HARVEST STATE	1	790 FT	40 FT
INTL MARINE	2/1	N/A	N/A
BASS	2	200 FT	25-30 FT
CHEVRON	2	60/500 FT	10/25 FT
CONOCO	1	900 FT	10-18 FT
MARATHON OIL	1	500 FT	17-24 FT
MARATHON	1	1000 FT	40 FT
SHELL OFFSHORE	1	1000 FT	9.5-15 FT
TEXACO PIPELINE	1	80 FT	8 FT
HSPV,L.L.C.	1	540-982 FT	50 FT

CRANES:

*One crane that can be moved up and down river

*One 15-ton hydraulic crane

*One 40-ton crane alongside

*One 2-ton electric mast and boom derrick/20 ft

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.12

Port Facilities: Port of South Louisiana, LA

	BERTHS	LENGTH	DEPTH
MARATHON OIL	5	1000 FT EACH	45 FT
ADM/GROW1	1	858 FT	50 FT
GLOBALPLEX	2	420/570 FT	50 FT
MFP	1	984 FT	45 FT
ADM/GROW3	1	800 FT	40 FT
CARGILL	1	1200 FT	58 FT
HAL-BUCK	1	850 FT	15 FT
ADM/GROWMA	1	55O FT	50 FT
AGRICO CHEM	1/2	625/300 FT EACH	40 FT
AGRICO CHEM	1	880 FT	40 FT
BAYOU STEEL	1	300 FT	40 FT
BUNGE CORP	1	470 FT	45 FT
CARGILL TERRE	2	1627 FT	48 FT
COLONIAL SUGAR	2	363 FT	42 FT
DELTA BULK	1	1500 FT	45 FT
DRAVO BASIC	1	N/A	44 FT
KAISER	3	1143 FT	60 FT
EAGLE ASPH	1	500 FT	30 FT
ST. JAMES	2	1800 FT	N/A
WEBER MARINE	1	N/A	N/A
ZEN-NOH	1	1189 FT	50 FT
OCCIDENTAIL4	1	740 FT	40 FT
OCCIDENTAIL5	1	410 FT	50 FT
CAPLINE	4	800-1100 FT	40 FT
CHEVRON	1	200 FT	N/A
E.I. DUPONT	2	320 FT	40 FT
ERGON	2	1225 FT	46 FT
G.A.T.X.	4	100-180 FT	45-50 FT
INTL MATEX	11	UP TO 900 FT	45 FT
KOCH GATHER.	3	1840 FT	35 FT
MONSANTO	3	1202 FT	25-30 FT
SHELL OIL	3	2400 FT	45-90
STAR	2	1710 FT	40 FT
TRANSAMERICAN	2	903 FT	25 FT
UNION CARBIDE	3	725 FT	30 FT

CRANES:

*One 1200-ton shiploader

*One Manitowoc 4600 swing crane with hopper

*One 800-tons/hour screw-type loader

*Cranes, dozers, loaders, and other equipment as needed

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.13

Port Facilities: St. Bernard, LA

	BERTHS	LENGTH	DEPTH
ARABI #1	3	1300 FT	36 FT
ARABI #2	3	1500 FT	36 FT

CRANES:

*None

CONTAINERIZED FREIGHT HANDLED 1995: 3800 short tons

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas*

Tables 5.14 and 5.15 present data for port facilities on Mississippi's gulf coast. Container traffic at the Port of Gulfport (Table 5.14) has grown in recent years, to a reported 997,889 short tons in 1995. But the port has several important constraints as a candidate for load center containerport status. First and foremost is its current channel depth of 36 feet. In addition, none of its eleven berths are long enough to accommodate large vessels. And third, any attempt by the port to increase its acreage at its main facility is restricted by the fact that there is fierce competition for the limited land near the port because of acreage demands by the Mississippi gulf coast's burgeoning casino gaming industry.

There was no container traffic reported by the Port of Pascagoula (Table 5.15) in 1995. The port serves primarily as a shipping point facility for liquid, dry- and breakbulk cargoes such as woodpulp, lumber, plywood, bagged grain, and pipe. The major constraint to candidacy to load center containerport status is its 38-foot channel depth. In addition, the lengths of all of the port's current berths restrict them to calls by smaller vessels. Only Terminals E/F (1252 linear feet) and G/H (1072 linear feet) have enough continuous berth length for the port to accommodate a larger vessel, even if the channel were deep enough.

Table 5.14

Port Facilities: Gulfport, MS

	BERTHS	LENGTH	DEPTH	WAREHOUSE	OPEN WHARF
GULFPORT	11	550-600 FT	36 FT	TOTAL 105833 SQ. FT	N/A

CRANES:

*Two Paceco Portrainer cranes, 30-long ton capacity

CONTAINERIZED FREIGHT HANDLED 1995: 997,889 short tons

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas*

Table 5.15

Port Facilities: Pascagoula, MS

	BERTHS	LENGTH	DEPTH	WAREHOUSE	OPEN WHARF	OPEN AREA
TERMINAL A	1	500 FT	38 FT	145000 SQ.FT	N/A	N/A
TERMINAL B	1	544 FT	38 FT	N/A	N/A	N/A
TERMINAL C	1	718 FT	38 FT	TOT 158500 SQ. FT	121000 SQ. FT	N/A
TERMINAL D	1	732 FT	38 FT	175000 SQ. FT	N/A	N/A
TERMINAL E/F	2	1252 FT	38 FT	175000 SQ. FT	N/A	N/A
TERM. G/H	2	1072 FT	38 FT	175000 SQ FT	N/A	N/A
G EXTENSION	1	695 FT	15 FT	N/A	N/A	32216 SQ. FT

CRANES:

*None

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Tables 5.16 through 5.25 present the facilities data for Texas ports. While the Port of Beaumont (Table 5.16) reported no container traffic in 1995, it does have facilities capable of handling some container traffic and related project cargoes for the military at its Main Docks, Harbor Island, and Carroll Street terminals. While berthing lengths could accommodate a few larger vessels at these three facilities, the channel depth of 40 feet is a constraint that must be overcome by dredging before Panamax or larger vessels can call at the port. Other concerns include the availability of wharf acreage and the limited acreage available for longer-term cargo storage at these terminals.

At the Port of Brownsville (Table 5.17), which reported no container traffic in 1995, though the main channel depth of 42 feet would allow some smaller Panamax vessels into port, the 24- to 35-foot depths at berth at its General Cargo docks prohibit any large vessel from calling at the port. In addition, in their current configuration, most of the current berths are too short to accommodate larger vessels.

The Port of Corpus Christi (Table 5.18) is primarily a shipping point for petroleum-based liquid cargoes. It reported no container traffic in 1995, but has some limited container-freight facilities and probably could handle more containers than it does. However, though the port's main channel depth is 45 feet, only three of its six general cargo berths have a 45-foot depth beside the dock. None of these three is more than 865 feet long, too short to accommodate a megaship. There are other landside constraints, mostly involving apron widths and availability of longer-term storage space.

The Port of Freeport (Table 5.19) handled 249,136 short tons of containerized freight in 1995, placing it among the top five containerports on the Gulf of Mexico. However, the port faces several obstacles to expansion into a container load center. First, it has only 2190 feet of continuous berthing which constitutes the five berths at its Port of Freeport general cargo terminal. And, while the main channel's 45-foot depth could be dredged to allow deeper-draft vessels, the depth at berth at its container-handling berths is only 36 feet.

The container traffic situation at the Port of Galveston (Table 5.20) warrants special attention. In 1995, the port was among the largest containerports on the gulf, handling 348,406 short tons of containerized freight. Those numbers fell precipitously last year as the port lost several carriers to other gulf ports. But earlier this year, the port agreed to lease its East End container terminal to the Port of Houston for the next twenty (or more) years. This agreement should revive somewhat the port activity at Galveston, a port that was once Texas' largest port but which has suffered major losses of customers over the last several years. There are some limitations to Galveston's resurgence as a containerport. First, only two berths are dedicated to containers, depth at berth (and the main channel's depth) is only 40 feet, and the channel is not wide enough to handle a megaship. But parts of the port not currently dedicated to containers, including some berths on nearby Pelican Island, could be made to accommodate a few more container vessels if the need arises. Such may be the case if Houston and Galveston are willing to expand their partnership if container freight demands increase at these ports. Still, the Port of Galveston's physical restrictions will prohibit its becoming a load center containerport, except perhaps as a branch of the Port of Houston.

The Port of Houston (Table 5.21) is the largest containerport on the Gulf of Mexico. In 1995, it handled 6,005,796 short tons of containerized cargo, nearly twice that of New Orleans, its closest gulf-coast rival. Houston's main container facility at Barbours Cut has six berths that total 6000 feet, at a dockside water depth of 40 feet. Berth 6 has just been completed and will be occupied beginning next year (the first year of a 30-year lease) by Sea-Land, which currently operates out of the smaller Berth 3. Acreage for a seventh berth is available at the terminal for future occupancy. Houston also handles containers at the Turning Basin, Woodhouse, and Care terminal facilities, where dockside water depths range from 38 to 40 feet. The port's main channel depth is 40 feet. While this depth is not adequate to accommodate megaships, the port is scheduled to undergo a major dredging project to both widen and deepen the ship channel. Further, as mentioned above, the port has expanded its facilities by leasing the East End container terminal at the Port of Galveston and is developing other facilities for expected increases in container traffic. It has also recently invested $30 million to improve its rail connections at the Barbours Cut terminal, has just purchased two post-Panamax wharf cranes and will install six new yard cranes at the terminal next year. The port has also installed a second wharfside container crane at the Turning Basin terminal earlier this year. Also at Turning Basin, the port is planning to build an intermodal transfer station to reduce container turn-around time. There is also a new terminal at Bayport in the planning stages which is expected to be Houston's container terminal of the future. The port is also benefiting from ongoing improvements to the primary highway access routes. Even with these improvements, the Port of Houston's natural physical limitations may prohibit its accommodation of the very largest megaships as their drafts continue to increase. But, given the programs and projects that are underway to improve the port's overall infrastructure, Houston is the most likely U.S. gulf port to become a load center containerport.

The Port of Orange (Table 5.22) reported no container traffic in 1995 and its 30-foot main channel depth presents a major obstacle in its ability to handle large container vessels. Currently, its Alabama Street terminal is the only facility at the port with either the potential berth length or dockside depth to accommodate even early generations of Panamax vessels.

Port Arthur (Table 5.23) handled no containers in 1995, but has some minor potential in that cargo area because it has three new berths with an overall length of 2125 linear feet and a channel depth of 40 feet. This port cannot expect to develop into a megaship port, but it may benefit from its infrastructure improvements by seeing an increase in container transshipments if it adds some new storage facilities and cranes. Dockside rail is available at some of the berths.

Port Lavaca (Table 5.24) has only two general cargo berths with 750-foot lengths and a dockside depth of 36 feet, which is also the minimum main-channel depth. It handled no containers in 1995, and is not likely to increase its container trade substantially.

The Port of Texas City (Table 5.25) is primarily a dry- and liquid-bulk cargo facility used as a shipping point for petroleum-based products and chemicals by several major oil companies. Texas City reported no container traffic in 1995, and it is not likely to see great increases in such traffic given lack of container facilities and its proximity to the Port of Houston.

Table 5.16

Port Facilities: Beaumont, TX

	BERTHS	LENGTH	DEPTH	OPEN WHARF	STORAGE	APRON
MAIN DOCKS	5	3391 FT	32-40 FT	121000 SQ. FT	N/A	N/A
HARBOR	2	1368 FT	40 FT	N/A	18 ACRES	N/A
CARROLL ST.	2	1465 FT	40 FT	N/A	8 ACRES	N/A
GRAIN TERMINAL	1	543 FT	40 FT	N/A	N/A	N/A

CRANES:

*One 60-ton gantry crane on marginal track

CONTAINERIZED FREIGHT HANDLED 1995: None reported, but handles containers for military cargoes

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.17

Port Facilities: Brownsville, TX

	BERTHS	LENGTH	DEPTH	OPEN WHARF	STORAGE	APRON
GEN. CARGO	12	6000 FT	24-35 FT	N/A	N/A	450000 SQ. FT
LIQUID CARGO	5	N/A	32-42 FT	N/A	N/A	N/A

CRANES:

*None

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.18

Port Facilities: Corpus Christi, TX

	BERTHS	LENGTH	DEPTH	OPEN AREA	APRON (WIDE)
CARGO DK8	1	865 FT	45 FT	N/A	N/A
CARGO DK9	1	660 FT	38 FT	38280 SQ. FT	N/A
CARGO DK10	1	665 FT	45 FT	N/A	N/A
CARGO DK12	1	200 FT	45 FT	N/A	58 FT
CARGO DK14&15	2	1000 FT	36 FT	N/A	49 FT
PUB ELEVATOR	1	210 FT	45 FT	N/A	N/A
BULK TERM. 1	1	396 FT	45 FT	N/A	N/A
BULK TERM. 2	1	1270 FT	45 FT	N/A	N/A
OIL DOCK 1	1	1000 FT	45 FT	N/A	N/A
OIL DOCK 2	1	260 FT	16 FT	N/A	N/A
OIL DOCK 3	1	246 FT	16 FT	N/A	N/A
OIL DOCK 4	1	850 FT	45 FT	N/A	N/A
OIL DOCK 6	1	600 FT	16 FT	N/A	N/A
OIL DOCK 7	1	850 FT	45 FT	N/A	N/A
OIL DOCK 8	1	1000FT	45 FT	N/A	N/A
OIL DOCK 9	1	350 FT	45 FT	N/A	N/A
OIL DOCK 10	1	400 FT	14 FT	N/A	N/A
OIL DOCK 11	1	850 FT	45 FT	N/A	N/A
OIL DOCK 12	1	290 FT	16 FT	N/A	N/A

CRANES:

*One mobile crane with 250-ton capacity

*One 1500-ton radial shiploader

*Hoppers

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.19

Port Facilities: Freeport, TX

	BERTHS	LENGTH	DEPTH
PORT FREEPORT	5	2190 FT	36 FT
DOW CHEM	1	705 FT	35 FT
DOW CHEM A8	1	705 FT	38 FT
DOW CHEM A22	1	675 FT	MAX 45 FT
PHILLIPS	3	N/A	38 FT

CRANES:

*One front-end handler/reachstackers

*One yard tractor

CONTAINERIZED FREIGHT HANDLED 1995: 249,136 short tons

Source: *Containerisation International Yearbook 1997; The AAPA Directory: Seaports of the Americas*

Table 5.20

Port Facilities: Galveston, TX

	BERTHS	LENGTH	DEPTH	WAREHOUSE	BACKUP	OPEN LAND
SEAWAY	2	N/A	N/A	N/A	N/A	N/A
BASF NH3	1	735 FT	29 FT	N/A	N/A	N/A
EAST END	2	1346 FT	40 FT	N/A	N/A	N/A
PIER 16/18	1	1203 FT	31 FT	59750 SQ. FT	8 ACRES	N/A
PUBLIC ELEV.	1	850 FT	40 FT	N/A	N/A	N/A
FARMLAND	1	1000 FT	40 FT	N/A	N/A	N/A
QCI OFFSHR	1	N/A	N/A	44000 SQ. FT	N/A	5 ACRES
IMPERIAL	1	642 FT	31 FT	N/A	N/A	N/A
WALLENIUS	1	1160 FT	N/A	75000 SQ. FT	N/A	N/A
PELICAN	9	697-1157 FT	VARIOUS	N/A	N/A	N/A

CRANES:

*Two IHI and two Hitachi ship-shore container cranes

*One Marathon LeTourneau yard gantry

*Three 38-ton Taylor, two 33-ton Taylor, two 38-ton Hyster, and one 28-ton Kalamar front-end handlers/reachstackers

*Thirty-two Ottawa yard tractors

CONTAINERIZED FREIGHT HANDLED 1995: 348,406 short tons

Source: *Containerisation International Yearbook; The 1997 AAPA Directory: Seaports of the Americas*

Table 5.21

Port Facilities: Houston, TX

	BERTHS	LENGTH	DEPTH	WAREHOUSE	MARSHALLING
BARBOURS CUT	6	6000 FT	40 FT	200000 SQ. FT	240 ACRES
TURNING	39	20000 FT	38 FT	2 MILLION SQ. FT	20 ACRES
WOODHOUSE	3	1910 FT	40 FT	235000 SQ. FT	YES
BAYPORT	3	N/A	40 FT	N/A	N/A
JACINTOPORT	3	1830 FT	38 FT	300000 SQ. FT	YES
PUBLIC GRAIN	1	600 FT	40 FT	N/A	N/A
BULK MAT.	1	650 FT	40 FT	N/A	N/A
CARE TERM.	1	800 FT	36 FT	45900 SQ. FT	YES

CRANES:

*Twelve 30/50-ton capacity container cranes

*One 500-ton barge crane

*Seven 300-ton shore cranes

*Two 50-ton Kranco-Morris ship-shore container cranes

*One 80-ton Link-Belt mobile crane

*Four 40-ton Morris and six 30-ton Paceco rubber-tired yard gantries

*Two 30-ton Peiner yard gantries

*Three 14.5-ton, and two 40-ton Marathon LeTourneau Le Tro-Port front-end handlers/reachstackers

CONTAINERIZED FREIGHT HANDLED 1995: 6,005,796 short tons

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas; Port of Houston* (various issues)

Table 5.22

Port Facilities: Orange, TX

	BERTHS	LENGTH	DEPTH
ALABAMA ST.	4	2300 FT	30 FT
CHILDERS	1	N/A	12-20 FT
PIER RD	1	N/A	18 FT

CRANES:

*None

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.23

Port Facilities: Port Arthur, TX

	BERTHS	LENGTH	DEPTH
BERTHS 1&2	2	1200 FT	40 FT
BERTHS 3-4-5	3	2125 FT	40 FT

CRANES:

*None

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.24

Port Facilities: Port Lavaca, TX

	BERTHS	LENGTH	DEPTH
GEN. CARGO	2	750 FT	36 FT
LIQ. CARGO	2	1100 FT	36 FT

CRANES:

*None

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.25

Port Facilities: Texas City, TX

	BERTHS	LENGTH	DEPTH
DRY& LIQUID BULK	43	N/A	40 FT

CRANES:

*Bucket unloader, conveyor system

*Loading tower, conveyor system

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: *The Ports of Galveston and Texas City, Texas: Port Series No. 23, 1996*

Tables 5.26 through 5.30 show the facilities at Mexico's ports on the Gulf of Mexico. In the first three quarters of 1996, the Port of Altamira (Table 5.26) handled 80,006 TEUs of containerized freight. The port has container facilities both at its Altamira Terminal and Infraestructura Mexicana facilities. However, the single berth at the Altamira Terminal is only 900 feet long and has a wharfside depth of 39 feet, equal to the depth of its main channel. The two berths at Infraestructura Mexicana comprise 1350 linear feet, with wharfside depth the same as elsewhere at the port. All of these berths also handle any other cargoes coming through the port, so there is competition for space between containers and other cargoes at both of these facilities. It is not likely that this port will see a dramatic increase in container cargoes given its proximity to the Port of Houston in the United States and to a much larger container facility in Mexico at the Port of Veracruz.

The Port of Coatzacoalcos (Table 5.27) reported no container traffic in its latest survey, having moved its container facilities to the nearby Port of Veracruz. Coatzacoalcos presents an interesting case because its overall channel and wharfside depths are greater, on average, than are those at Veracruz. Also, the port's landside intermodal linkages include a rail landbridge of approximately 150 miles from the gulf to the Pacific port of Salina Cruz. This landbridge may become an important alternative to passage through the Panama Canal as vessel size increases and given the uncertainties surrounding the canal after it reverts to Panamanian control in 1999. The port has several infrastructural limitations that inhibit its container megaship capabilities. Though blessed with deeper water than Veracruz, its wharfside depths are all below 40 feet, ranging from 21 to 39 feet. Further, the port's longest berths are 820 feet, long enough for most

Panamax vessels whose drafts allow them to traverse its channel at its current depth, but not for the new generations of post-Panamax and larger vessels.

The Port of Tampico (Table 5.28) handled 56,799 TEUs of containerized cargo in 1995. Of its ten terminals, eight are privately owned, and only its Recinto Fiscal terminal has container-handling capabilities. The terminal has nine berths with a total length of 4900 linear feet and a wharfside water depth of 32 feet. The main channel depth is 36 feet. As is true for many other gulf ports, Tampico's major constraint restricting larger vessels is its channel and wharfside water depth.

The Port of Tuxpan (Table 5.29) has only one berth whose water depth is only 24 feet, making it inaccessible to large vessels.

The Port of Veracruz (Table 5.30) handled 2,684,000 short tons of containerized cargo in 1996, placing it third among the gulf's ports and first among Mexico's gulf ports. Veracruz handles containers at its public Piers 1, 2, 6, 7, and at the privately owned Container Terminal. The overall berth lengths at these facilities do not pose major restrictions on vessel size but, again, the more severe problems involve channel and especially wharfside water depth. Most of the berths are in 30-foot waters, though the main channel is 40 feet. Only the private Container Terminal has as much as a 36-foot depth at berth. No large containerships can call at this port without significant dredging to deepen the channel and berths.

Table 5.26

Port Facilities: Altamira, MX

	BERTHS	LENGTH	DEPTH
ALTAMIRA TERM.	1	900 FT	39 FT
INFRAESTR.	2	1350 FT	39 FT

CRANES:

*Yard gantries

*Two 40-ton Marathon LeTourneau SST100

*One 30.5-ton Mi-Jack

*One 14-ton front-end handler/reachstacker

CONTAINERIZED FREIGHT HANDLED 1996 (Jan-Sept): 80,006 TEUs

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas*

Table 5.27

Port Facilities: Coatzacoalcos, MX

	BERTHS	LENGTH	DEPTH
ONE EAST	1	525 FT	35 FT
ONE WEST	1	525 FT	35 FT
TWO EAST	1	625 FT	39 FT
TWO WEST	1	722 FT	39 FT
THREE EAST	1	787 FT	39 FT
FOUR EAST	1	755 FT	39 FT
FOUR WEST	1	787 FT	39 FT
FIVE	1	690 FT	39 FT
SIX	1	755 FT	39 FT
THREE WEST	1	755 FT	39 FT
RECINTO 1	1	820 FT	34 FT
RECINTO 2	1	820 FT	34 FT
RECINTO 3	1	820 FT	34 FT
RECINTO 4	1	820 FT	34 FT
RECINTO 5	1	820 FT	34 FT
RECINTO 6	1	820 FT	34 FT
RECINTO 7	1	820 FT	34 FT
RECINTO 8	1	820 FT	34 FT
RECINTO 9	1	328 FT	21 FT

CRANES:

*None

CONTAINERIZED FREIGHT HANDLED 1995: None (facilities moved to Port of Veracruz)

Source: *The 1997 AAPA Directory: Seaports of the Americas*

Table 5.28

Port Facilities: Tampico, MX

	BERTHS	LENGTH	DEPTH	STORAGE
RECINTO FISCAL	9	4900 FT	32 FT	69,000 m2
TERMINAL M&M	2	1000 FT	32 FT	45,000 m2
PROTEINAS	1	525 FT	32 FT	1 WAREHOUSE
MARITIMA (PEMEX)	7	6560 FT	32 FT	N/A
TERMINAR	1	790 FT	30 FT	2 WAREHOUSES
MINERA AUTLAN	1	590 FT	32 FT	OPEN STORAGE
DEL GOLFO	2	1700 FT	27 FT	60,000 m2
CEMENTOS	2	1640 FT	27 FT	1.5 HECTARES
CONSTRUCTORAS	10	2300 FT	20 FT	N/A
ASTILLERO	3	1640 FT	28 FT	N/A

CRANES:

*None

CONTAINERIZED FREIGHT HANDLED 1995: 56,799 TEUs

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas; Puertos Mexicanos: Port of Tampico, Mexico*

Table 5.29

Port Facilities: Tuxpan, MX

	BERTHS	LENGTH	DEPTH
PORT TUXPAN	1	900 FT	24 FT

CRANES:

*One 300-ton P&H mobile crane

CONTAINERIZED FREIGHT HANDLED 1995: None reported

Source: Port of Tuxpan

Table 5.30

Port Facilities: Veracruz, MX

	BERTHS	LENGTH	DEPTH	STORAGE
PIER NO. 1	2	1080 FT	30 FT	N/A
PIER NO. 2	2	1092 FT	30 FT	N/A
PIER NO. 4	5	2388 FT	30 FT	N/A
PIER NO. 6	5	2172 FT	30 FT	N/A
PIER NO. 7	3	1647 FT	30 FT	N/A
CONTAINER	1	1017 FT	36 FT	277000 m2
MULTIPURPOSE	1	480 FT	30 FT	N/A
GRAIN	1	555 FT	33 FT	N/A
ALUMINUM	1	540 FT	30 FT	N/A
CEMENT	1	1095 FT	N/A	N/A
SHIPYARD	5	3388.5 FT	33 FT	N/A
MOLASSES	1	270 FT	30 FT	N/A

CRANES:

*Two 30.5-ton Takraf ship-shore container gantries

*Two 40.5-ton Mitsubishi

*Five Marathon LeTourneau yard gantries

*Two 40-ton Taylor

CONTAINERIZED FREIGHT HANDLED 1996: 2,684,000 short tons

Source: *Containerisation International Yearbook 1997; The 1997 AAPA Directory: Seaports of the Americas; Puertos Mexicanos: Port of Veracruz, Mexico*

5.7 A Brief Note on Cranes, Other Container Equipment, and Their Implementation at a Megaship Terminal

Tables 5.2 through 5.30 list a number of cranes and other related equipment available at each port. Again, given changes that are occurring every day at the ports, we make no claims to perfect accuracy of the inventory. Nor is all of the listed equipment necessarily suitable for container loading, unloading, or transport. But the major concern of the study involves long-reach wharf cranes and associated equipment that can be used for loading and unloading megaships and enough transtainers and other yard cranes to move the containers to and from storage facilities or to landside modes.

An examination of all of the port facility tables demonstrates that most of the ports' container terminals in this study are deficient in the numbers and capacities of cranes suggested for optimal megaship terminals. Given the optimum of a minimum of three BPP cranes per berth recommended by the Vickerman study, even the most well equipped container facilities on the gulf must acquire a number of new (and of course larger) cranes to attract megaships and provide them with a rapid turnaround time. This result should not be too surprising, of course, because none of the ports actually have megaships currently calling, nor could they accommodate such large vessels—even with adequate crane systems—given other infrastructural constraints.

A look at an existing terminal allows us to picture a hypothetical scenario that suggests some of the potential problems with implementing cranes and improving other infrastructure to adapt the facility to accommodate megaships. For example, at the Barbours Cut facility in Houston—arguably the most modern and best-equipped container terminal on the gulf coast—

there will be twelve wharf cranes available for the six working berths after the terminal's two newest cranes are in place. This means that (assuming all of the cranes have adequate capacities and reaches) the facility is at least six cranes short of its optimum number. The actual deficiency may be even greater because only four of the existing cranes can actually be considered to be of BPP capacity. So, at least some of the eight other existing cranes at Barbours Cut will need to be modified or replaced if the terminal expects to handle megaships. When Berth 7 opens at some later date, the terminal will need to acquire at least three more BPP cranes. Then, if the necessary dredging takes place and other facilities and landside intermodal linkages are upgraded, Barbours Cut should be able to provide half of the fourteen megaship berths that are projected as needed on the gulf coast by sometime next century. But, unfortunately, the problem is still not solved because berth length at Barbours Cut, while substantial, is only 1000 feet per berth, which means that the terminal cannot accommodate seven megaships at the same time even if all other infrastructural limitations are overcome. So, the port will need to make more infrastructural changes elsewhere to provide berthing, perhaps at its planned Bayport facility or at its leased space in Galveston. Or, some other gulf port, like New Orleans, will need to undergo a dredging project, acquire more cranes, improve landside intermodal linkages, etc., etc. So, while the ports on the gulf tend to think of themselves as independent, competing entities, the infrastructures of the individual ports are not truly independent of each other but are tied together in a complex symbiotic relationship.

5.8 Conclusion—A Load Center Megaship Port on the Gulf?

One clear conclusion that should emerge from the data presented in the previous section is that transforming any port on the Gulf of Mexico into one capable of accommodating the new classes of large containerships will not be an easy, inexpensive, or overnight undertaking. There are formidable obstacles facing every port on the gulf, many caused by the physical characteristics of the port's location—the most common constraints being channel depth and water depth at berth. While all of the gulf ports face this problem if they are to have the 52-foot depth required of the 6000- to 8000-TEU vessels that carriers may insist on by sometime next century, those already blessed with the deepest channels have an advantage over the others. Ports that are already established as versatile entities that are willing to accommodate a broad range of customers are also at an advantage over their sister ports. And ports that have attempted to improve their landside intermodal rail and highway linkages (and sufficient air- and inland-waterway facilities), and that have constructed and maintained the most modern of container terminal facilities also have a lead over the other ports in the race to become a load center containerport. Ports with propitious locations are also more favorably positioned to become the choice of carriers to become their hub port.

The above characteristics eliminate, for all practical purposes, almost all of the twenty-nine ports surveyed from load center containerport consideration. The Port of Houston emerges as the leading candidate. It has one of the gulf's deepest channels and already operates a container terminal—Barbours Cut—whose existing characteristics place it closer to the optimally defined megaship terminal than any other on the gulf. Though Barbours Cut alone is not sufficient—and cannot by itself be made sufficient—to supply even half of the fourteen megaship berths suggested for the gulf, the Port of Houston's infrastructure is closer to that required than that of its sister ports. Further, the port is planning a future container facility at Bayport, and has entered into a partnership with the Port of Galveston to improve and utilize the containership infrastructure at that latter port. It is certainly not clear that, assuming that these fourteen berths are needed, Houston will be able to, or even want to, provide them all. But it seems that the Port of Houston is most likely to be the major contender for load center status on the gulf, and should supply a majority of the berths called by the coming megaships in the next century.

CHAPTER SIX: A MODEL OF THE FUTURE LOAD CENTER PORT FOR THE GULF COAST

6.1 Introduction—Revisiting the Issues Involved in Modernizing a Port for Megaship Accommodation

Chapter 4 of this study discussed the major impacts on the port infrastructure that the emergence of large containerships is expected to initiate. Chapter 5 reviewed some of the existing facilities at ports on the Gulf of Mexico, examined deficiencies in these facilities, and made some predictions with regard to the adaptability of these ports to accommodate future containerships. This chapter revisits and summarizes the infrastructural requirements for a load center containerport. Then it hypothesizes as to how such a port might be expected to evolve, using the Port of Houston as the foundation on which to base the future port.

The big question is: How can a port on the gulf coast attract and retain container carriers as customers, given that their natural U.S. markets have tended toward those on the Atlantic and Pacific coasts? Because the major trade lanes for U.S. imports and exports have historically been east-west routes, these other ports have had a locational advantage over gulf ports. Further, the naturally deep-water ports in the United States are mostly located along the Pacific or Atlantic coasts. Regardless of any natural advantages a port might have, however, over the last several years virtually every port that expects to attract containerships has been forced by the emerging alliances to develop new terminals, dredge approaches and/or berthing areas, acquire or modify cranes, improve landside connections, and make other significant changes in its infrastructure.

6.2 The Terminal

Efficiency is the underlying basis for any terminal's physical layout and design. The longer that a vessel is forced to remain at berth to load or discharge cargo, the greater will be the idle time for trucks and rail cars that have to wait for those operations to be completed. The bottlenecks caused by inefficient cargo-handling operations raise the costs of transportation to the carriers, the landed costs to shippers and, ultimately, the prices of the goods to consumers. Therefore, a terminal that does not provide facilities that allow for high productivity of both labor and capital equipment used to load and discharge cargo will see fewer carriers calling at the port. When the terminal is laid out in a manner that supports high productivity, the production line used for loading and discharging vessels promotes a smooth and fast vessel turnaround and lowers the goods' landed costs. Chapter 5 presented some minimum standards for physical facilities at an optimal container terminal.

6.3 Location, Location, Location

One of the problems that ports on the Gulf of Mexico have little power to overcome is the matter of their location along major trade routes. Because the major U.S. routes have historically been east-west, the gulf ports are typically smaller than their Atlantic and Pacific counterparts. But, with world trade increasing and world trade patterns changing, it is anticipated that north-south routes will increase in importance over the next twenty to thirty years, a prospect that creates a fair degree of optimism among gulf ports for significant increases in activity. The expectation of freer trade between the United States and its Latin American trading partners enhances that optimism. So, location is projected to be less of an obstacle in the next century.

6.4 Water Depth in Channel and at Berth

The most significant naturally occurring characteristic of gulf ports that tends to impede calls by large containerships and other vessels is water depth. Dredging is a fact of life at U.S. gulf ports, more so than at most sister ports on the Pacific and Atlantic Coasts. Besides the actual monetary cost of dredging to turn a 40-foot channel into one that can accommodate a megaship with a draft of 46 feet or more (and perhaps widening the channel as well), the environmental effects of relocating dredge spoil must be weighed into the equation. The United States seems to be more concerned with this latter issue than are most countries, which puts U.S. ports at a disadvantage vis-à-vis other world ports when such channel deepening is required. Extended debate among environmental groups, port managers, and the U.S. Army Corps of Engineers regarding the costs and benefits of dredging projects slows down virtually every attempt at channel dredging, sometimes for a period of years. This fact means that port managers must plan well in advance of any needed channel- or berth-deepening project.

6.5 Cranes

Terminals most often use a two-station wharf crane system for loading and discharging container cargoes at shipside. Rubber-tired gantries (RTGs) or similar mobile cranes move the containers from rail and truck to the marshaling yard. Top lifters and chassis tractors move the containers over short distances throughout the terminal to rearrange the containers and place them in the best positions for the crane operators to load the vessel. The various pieces of equipment and their operating personnel must all act in concert if they are to attain maximum performance efficiency from their equipment and keep their carrier customers happy.

Ports are investing in larger (longer vertical and horizontal reach and greater lifting capacity), faster, and more efficient cranes in order to reduce turnaround times and attract more carriers. Most ports are taking the strategic path of "more is better." For example, with larger vessels calling, more terminals are using a third shipside crane station to speed loading and unloading. Adding an extra crane increases the port's fixed costs, but it allows an extra eight or more containers per hour to be moved to and from the vessel, assuming additional RTGs and other yard equipment are also available to complement the additional wharf crane station. Ports that are using such setups now may be in better position to move to the three- to six-crane system that will be required for megaships.

However, expansion of facilities has a downside that manifests itself in duplication of equipment, excess capacity, idle resources, and increased costs if vessel calls or vessel sizes do not increase. The real key to attracting carriers is quality of service. But while service quality is usually directly related to productivity of inputs, it is not always perfectly related to the amount of available equipment. Therefore, a port's managers must carefully plan the equipment acquisitions based on the best projections they have regarding carrier demand. How successful these plans are depends on a number of factors, including whether or not their demand forecasts come true.

6.6 Labor and Equipment Costs

The labor costs for employment of equipment operators run approximately $600 per day per crane operator at a typical U.S. gulf coast port (but much less at the Mexican ports). The typical cost of crane use is about $500 per crane per hour. But, given the high fixed costs of cranes and the lost revenues due to idle equipment, greater efficiencies in equipment use could be achieved by operating existing cranes to move cargo around the clock. More efficient equipment use results in lower throughput charges to carriers and increases the quantity of service demanded. However, the current agreements between most U.S. ports and port labor do not encompass 24-hour port operations. Also playing a part in labor negotiations with port managers are the issues of job security and jurisdictional authority. Several U.S. ports have recently experienced difficulty in achieving harmonious and productive relationships between management and labor. As container volumes increase, job security should become less of an issue, though labor's authority at the port may continue to be a prickly issue in negotiations. Analysts generally agree that concessions by labor that allow 24-hour port operation will be difficult to achieve in the near future, but these concessions may be critical for a port's continued existence as vessel sizes increase.

6.7 Landside Transportation Linkages

Landside linkages to rail, truck, and air transportation are important problems for U.S. ports because only some of those problems are under the direct control of the port itself. Ports that are striving for greater efficiency in turnaround of all kinds of vessels that call at the port—the ships, the trains, and the trucks—recognize the need for improvements in linkages to these modes within the port's gates. Inside the gates of the port, the integration of ship side and land side operations is important to avoid a percentage of the containers being stacked, shortening dwell time and streamlining through put. Outside the gates, however, some of these linkages become beyond the port's control. In both of these instances, but particularly in the external situation, the movement toward downsizing of government and reduced government spending will affect a port's ability to improve these linkages.

Most ports suffer from some traffic congestion in at least one landside mode, and often in all modes. Highways may be inadequate, highway bridge heights may impede double-stack rail service, rail service itself may be inadequate, crossings between the two modes may create impediments to movements of traffic via one or both modes, or some other problem may exist that slows the movement of cargo to and from the port. But the port's ability to correct these problems depends particularly on public understanding of and support for infrastructural improvements. Given the current taxpayer sentiments toward lower taxes and smaller government, solving these external, publicly funded infrastructure improvements may be a difficult task for ports over the next several years.

6.8 Information Technology

If a container terminal strives to use state-of-the-art technology in the movement of containers, it must also strive to transfer information efficiently. The implementation of the latest transportation-related applications of information technology and telecommunications (IT) is perhaps the area where the greatest benefits can be achieved in turn-around time at the least long-run cost. Recall that the Port of Rotterdam had twenty-two separate but related IT projects underway in 1995. One problem that improvements and innovations in computer and telecommunications hard- and software should correct in the near future is any impediments to the smooth flow of cargo that are caused by unavailable or incorrect information about cargo or equipment status or location. Electronic data interchange (EDI) technology is capable of reducing paperwork for U.S. Customs inspectors and for carriers, speeding container throughput, and reducing vessel turnaround time for the various carriers in the intermodal chain. Smart cards, bar codes, load sequencing, weighing-in-motion and global positioning system (GPS) technologies, and several other technologies are already in place at some ports, and their use should increase as ports and carriers begin to accept the benefits from such technologies. The biggest problems with implementation so far have involved the unwillingness of carriers to share proprietary information with each other. As shipping alliances and other mergers among carriers beget more cooperation, this problem should become less severe.

6.9 The Future Gulf Load Center Port Model—The Port of Houston Example

The Port of Houston's goal is to become the load center port for its geographic region, either for the entire Gulf of Mexico or, if two ports emerge as projected, at least the load center for the western gulf region. The port is currently accomplishing this goal, having established itself as the gulf's tonnage center for a number of cargo types, and by handling a substantial portion of the gulf's container traffic. The port's Barbours Cut facility is the leading container terminal on the gulf. But the Port of Houston cannot remain the leading port on the gulf without improvements in its facilities. What tools does the port's management consider to be necessary for Houston to maintain its status by capturing megaship trade?

Charlie Jenkins, Operations Manager at the Barbours Cut terminal, lists the following direct tools necessary for the Barbours Cut terminal to maintain its load center status even for the next few years in the advent of larger vessels and increased container traffic:[108]

- general infrastructure improvements;
- facilities able to handle megaships;
- cranes beyond post-Panamax capabilities;
- terminal space able to handle the throughput and transshipment needs of 4000- to 5000-TEU or greater vessels; and
- deep-water access not restricted by channel or berth depth—45 feet in the near period and 50 feet or more in the future.

[108]Jenkins, August 1997.

Landside improvements to intermodal linkages should include general improvements to both rail and highway linkages, starting with two current projects:

- $30-million improvement to rail facilities at Barbours Cut, including expansion of the rail ramp and additional track; and
- renovation and upgrade of Highway 225 to improve this main trucking connection in and out of Barbours Cut and relieve congestion there.

But the expansion of Barbours Cut is restricted by acreage limitations, landside access bottlenecks, and other physical restrictions that cannot be completely overcome simply through renovation. Because the Barbours Cut terminal alone does not have the capacity to support the fourteen megaship berths projected for the Gulf of Mexico, management at the Port of Houston also recognizes that other tools and facilities will be needed. Specifically, Jenkins suggests that the port should put into place:

- new facilities at Bayport and the leased Galveston facility as needed in order to fulfill carrier demands; and
- IT systems at all facilities, again dictated by customer demand.

These tools are designed to achieve the objectives of lowering vessel production costs as well as truck and rail production costs. Port management's basic desire is to find ways to decrease the costs of the entire package—the entire set of costs incurred by everyone involved in a vessel's call at the port. In order to achieve this goal, the port must aggressively attack bottlenecks that affect costs directly in the port's control, and also must consider ways to lower other costs that a stakeholder might incur though not directly charged or caused by the port.

The Port of Houston has maintained a mentality that it should not be first in the implementation of new technologies that appear to be successful; instead, it should always be second! State-of-the-art technologies are usually not cost-justifiable in their first implementation. Therefore, Houston's goal is to choose the best available technology that has been proven through its use. Though the Barbours Cut facility is one of the gulf's more modern container facilities, it is already getting old and faces several physical and other constraints that drive costs up at the terminal. For example, delivery of containers to rail requires a 1.5-mile drayage. Included in the port's plans for a future containerport is the development of a new terminal facility at the 600-acre Bayport site that will be more flexible to users than is Barbours Cut. Still in the early planning stages, the Bayport facility promises to provide much-needed acreage for container storage, and it will have a rail connection within close proximity of the calling vessels. Further, Bayport will be equipped with new computer and gate systems that facilitate cargo movement in and out of the port by land-based transportation. Current plans, however, do not call for the installation of automated cranes such as some that might be found at Rotterdam, because their cost is not yet justified. Such plans are certainly subject to change before the facility is completed, however.

Because the Port of Houston's managers are well aware of the projections for gulf-traversing megaships and the development of hub-and-spoke load center ports, they are taking the infrastructural needs of this future containerport system into consideration in the planning of the Bayport facility. The 600 acres represents a considerable increase in available storage over the some 250 acres available at the Barbours Cut facility, and the 6000 linear feet of berthing is to be set up in a way that allows the facility to advertise "one berth, 6000 feet." That is, the berth length should be adjustable to handle whatever vessels are calling at the facility. There will be more acreage for marshaling and other short-term storage, stronger wharves, bigger and faster cranes, dockside rail, and uncongested access to the landside modes.[109] While the final version of this facility is not yet on the drawing board, it is certain that its final blueprint will fit the mold of a modern container terminal for the time when it is being constructed. Though the facility is expected to be under construction within the next three or four years, it is likely that the Bayport facility's infrastructure will encompass technologies that this study cannot address because they have not yet been developed or have not yet proven themselves to be cost effective.

Tom Smith, Director of Intermodal Services at Barbours Cut, suggests several changes planned at the port that will help improve its overall intermodal service. First, the dockside rail service at the new Bayport facility will vastly improve cargo movement between ship and rail. Second, carriers' storage systems evolving to "just-in-time" processes mean that it will be more important for carriers to coordinate operations and communicate more readily with other affected parties. Such changes should expedite the implementation of EDI and other parts of IT systems. Third, with the merger of Southern Pacific and Union Pacific railroads, some changes may occur in ramp operation at the port. Southern Pacific may control ramp operations. If this scenario occurs, there will likely be more efficient service to the rail with fewer workers. However, if the rail company operates the rail, competitive rail lines may be afraid to operate at the port because of fear that service will not be provided in a proper way or seen as a priority by Southern Pacific. The projection for improved rail service, however, is that service from the Port of Houston to Long Beach, a process that now takes four days, might be shortened to as little as two days with

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[109]Jenkins, August 1997.

the planned rail expansions and upgrades. The growth of intermodalism should mean that rails will, sometime in the near future, change track priority, now given to passenger traffic, to containerized and other intermodal traffic.[110]

Once the Bayport facility is in place sometime early in the next century, it should accommodate several megaships. On the other hand, the Barbours Cut terminal and perhaps facilities at the Galveston site have a major hurdle to overcome by way of the problem of cargo allocation to the terminal there. Ships calling at Galveston want to unload full containers and then load others for the return leg of a voyage. Finding ways to make the delivery of cargo by truck or rail to the Galveston facility cost effective to shippers and carriers is a problem that must be solved for the facility to remain viable. Given some of the bottlenecks inherent in Galveston's location, landside congestion will continue to be a problem unless these cargo allocation issues are addressed and improvements are made. If the ports of Houston and Galveston can continue as partners in solving these cargo allocation problems, the Galveston facility can take on the role of handling some of the Panamax and smaller container traffic that will retain a large percentage of the container business for the next fifteen to twenty years. By that time, development of Barbours Cut's Berth 7 and renovations of some of the other berths at that facility may be necessary to support a few additional vessels up to megaship size.

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[110]Smith, August 1997.

6.10 Conclusion

While the Port of Houston, under its current infrastructure, is not capable of handling calls by megaships of the sizes projected to emerge by the year 2010, the port has already established itself as the most modern container facility on the gulf coast. But the port's management is not satisfied with merely maintaining the *status quo*. Instead, it continues to improve current facilities and plan for the development of future facilities that are intended to keep the Port of Houston among the leaders in the important containership trade through the next quarter of a century and beyond.

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Over the last thirty years, containerized carriage has become the fastest growing and most efficient method of moving many types of cargo, and new kinds of specialized containers continue to be designed that allow cargoes previously carried by traditional breakbulk, dry bulk, or other carriage to now be moved in containers via intermodal transportation methods. Innovations in landside vehicle design, such as unit trains, double-stack rail, and larger double and triple trailers have produced cost savings for these carriers. Desires by carriers to achieve any economies of scale, density, or scope that exist in the industry are driving changes in the manner that freight companies operate. Not only are they finding cost savings by use of larger vessels, they are also finding that mergers, acquisitions, equipment- and vessel-sharing arrangements, alliances, and other forms of cooperation are providing benefits that lower the carriers' costs and allow them to offer more attractive freight rates to customers without destroying their profits. In the United States, movement toward deregulating most of the land-based modes has spurred competition in the industry, but has also led to larger and fewer firms, and to increased cooperation among those that remain.

Now ocean-going carriers are also recognizing the existence of benefits that might be derived by achieving economies of scale in their operations. Alliances and mergers have been common among carriers, and some of this merger activity is spilling over into integrations of a variety of stakeholders in the transportation chain, such as those between rail companies and ocean-going carriers. And the recognition that cost savings may be attained by increasing vessel size—a fact that was discovered by liquid cargo carriers several years ago—is now beginning to affect the containership fleet. The first megaship capable of carrying 6000 TEUs, the *Regina Maersk*, was put into service last year. Now orders for other container vessels in that same class are becoming common, and orders for even larger vessels—up to 8000-TEU capacity—are predicted to dominate containership orders into the next century, so that a greater and greater proportion of the overall fleet capacity will be contained by a small but growing number of large-capacity ships.

But, since time spent in port loading and/or discharging cargo is the "unproductive" portion of a ship's voyage, the emergence of larger ships will become cost effective to carriers only if those vessels make fewer port calls and only call at ports that can get them in and out in the least time possible. This means that we are beginning to see the emergence of a hub-and-spoke port system, characterized by a few large ports that offer cargo-handling versatility and efficiency, which operate in concert with smaller regional transshipment, or feeder ports for more localized pickup and delivery of cargoes.

The general growth in containerization, coupled with some changes in world trade patterns and shipping routes that are resulting from new agreements among countries to reduce trade restrictions, and the emergence of several Latin American and Asian counties as trading partners with the United States, mean that the Gulf of Mexico should see a significant increase in containerized cargo traffic over the remainder of this century and into the foreseeable future. One or two load center containerports should develop, with a total of about fourteen megaship berths to handle the new traffic carried by the larger-capacity fleet.

The physical and locational restrictions that characterize most ports along the Gulf of Mexico are most significantly related to the shallow water depths at channel and berth, landside transportation mode congestion problems, or the proximity to more established, more efficient ports, such as the Florida Atlantic ports. Berths that are too short and the lack of proper container-handling equipment are other problems that most gulf ports face. The Mexican ports suffer from all of these problems, as well as from the uncertainties surrounding political changes taking place in that country and the relatively untested movement towards privatization in the economy there.

Taking all of these factors into consideration, this study concludes that the Port of Houston is the most likely candidate to capture the role of load center containership megaport for the gulf. While it is possible that New Orleans, Gulfport, Veracruz, or even Tampa may continue to grow in container trade, none of these is likely to displace Houston as the leading containerport on the gulf, especially given the efforts underway by the Port of Houston's management to improve their facilities in preparation for container growth in the next century.

7.2 Recommendations

The management of the Port of Houston appears to be well aware of projections for growth in container traffic on the gulf coast well into the next century. It is likely, therefore, that management has already addressed most, if not all, of the issues that have been raised in this study. A few general suggestions for management's consideration may be in order, however, based on the conclusions of this study.

1. Make every effort to plan for needed dredging activity well in advance. Though the port is about to enter into a dredging project to assure 45 foot depths, it may be necessary to consider the deepening of the ship channel and berths to 50 or 52 feet sooner than currently planned.
2. In planning the Bayport terminal facility, make sure that the advertised "one berth of 6000 feet" is, in reality, a berth that allows such flexibility. Such flexibility, of course, includes associated gates, cranes, dockside rail, and storage facilities necessary to load and discharge such a vessel. While the port may not actually see 1000-foot or longer vessels calling for a number of years, if at all, preparation for such a vessel's accommodation will certainly enhance the possibilities that Houston will continue to serve as the gulf's load center containerport. The Bayport facility should be capable of accommodating four to five of these megaships at a time if current projections come true.
3. Consider landside access bottlenecks well in advance. With newly formed rail alliances and projected reductions in federal spending levels, the port must make every effort to consult with these important stakeholders to assure that potential access and congestion problems with landside modes will have viable solutions before the terminal is constructed.
4. Develop or acquire the most modern yet cost-effective information transfer systems possible, after consultation and agreement with U.S. Customs, carriers, shippers, and others that will benefit from improvements in data interchange.
5. Begin now to consider future use of the Barbours Cut Terminal (BCT) as it ages. If the Bayport facility is flexible enough to handle, say, four to five megaships at a time,

BCT may still be useful for handling "smaller" vessels, whatever that term may mean thirty years from now. That possibility must be considered in any renovation plans at BCT.

6. Develop and continue partnerships with neighbor ports, particularly the Port of Galveston, where improvements in leased facilities there can relieve congestion existing at the Port of Houston's other terminals. Consideration should be made by both ports to enter into longer agreements that include development of currently unused land for more container berths at Galveston. Here again, however, landside access problems must be addressed and new facilities developed.
7. Continue efforts to bring labor into the planning process. Because carriers will expect improved vessel turn-around time, longer hours of operation may be necessary for the Port to remain competitive into the next century. Without cooperation by labor, such improvements in turnaround time may not be achievable. Every effort should be made to find ways, agreeable to labor, to increase their productivity.

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