



**Facilities Engineering** Seminar Panel III: Intermodal Rail Container **Operations and** Design

CaroLinks Automated Intermodal Terminal Port of Charleston, SC

**January 11, 2006** 



# **Automated Intermodal Terminal Development**

Panel III Agenda



#### **CaroLinks**

- Headquartered in Charleston, SC
- Business Process Integrator
- Identified need for cargo container velocity improvements
- Focused on intermodal solutions



### **Problem**

- National marine terminals are operating at/near capacity
  - Intra-terminal
    - Storage capacity
    - Demurrage
  - Inter-modal
    - Roadway gridlock
    - Railway deficiencies
    - Waterway congestion



### Solutions

- Six major steps for improving the system
  - Improve productivity, efficiencies and through-put
  - Encourage development of alternative west coast ports for Asian traffic
  - Invest in intermodal rail to increase the velocity of equipment moving container cargo
  - Prioritize public freight project funds
  - Develop better trade and transportation facilities
  - Promote and improve infrastructure to support Asian trade

The Waterfront Coalition, May 2005

### **Panel Speakers**

John Vickerman Principal,
 TranSystems Corporation

Gordon Locatis Vice President,
 Stevens Towing Co. Inc.

Marty Crosby
 Vice President Operations,
 CaroLinks,

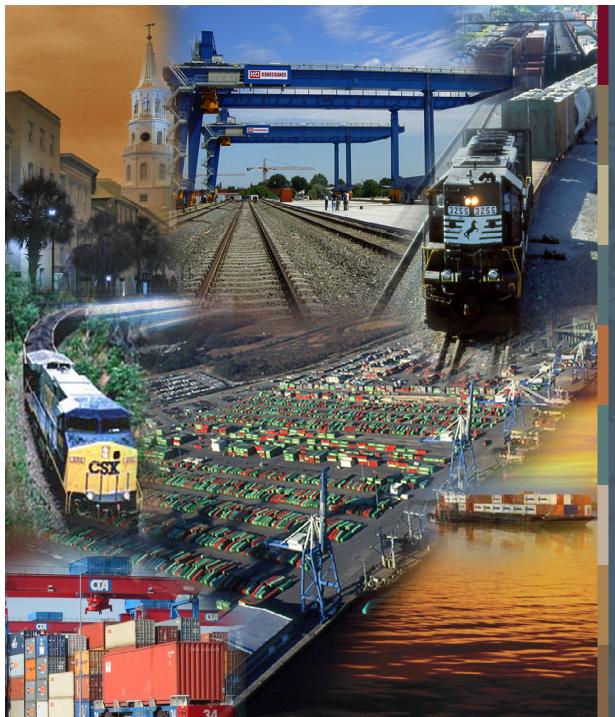


John Vickerman Principal,
 TranSystems Corporation

Gordon Locatis Vice President,
 Stevens Towing Co. Inc.

Marty Crosby
 Vice President Operations,
 CaroLinks,









Macro Market Driven Demand Drivers







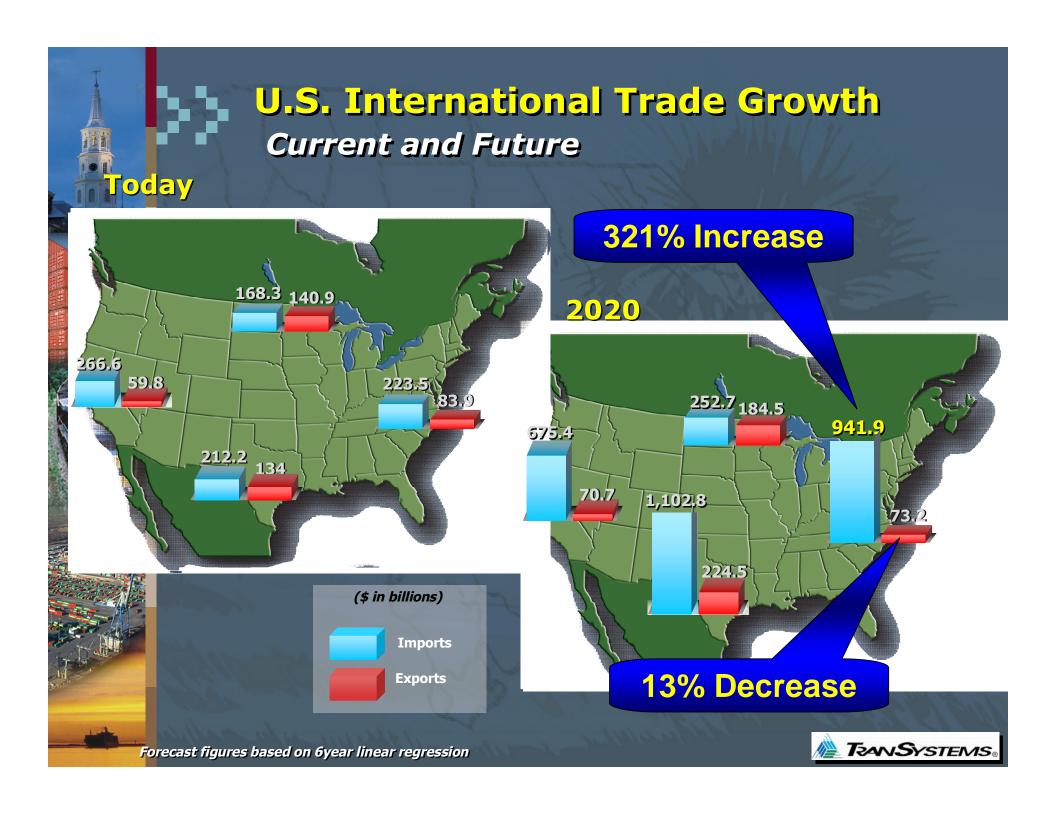


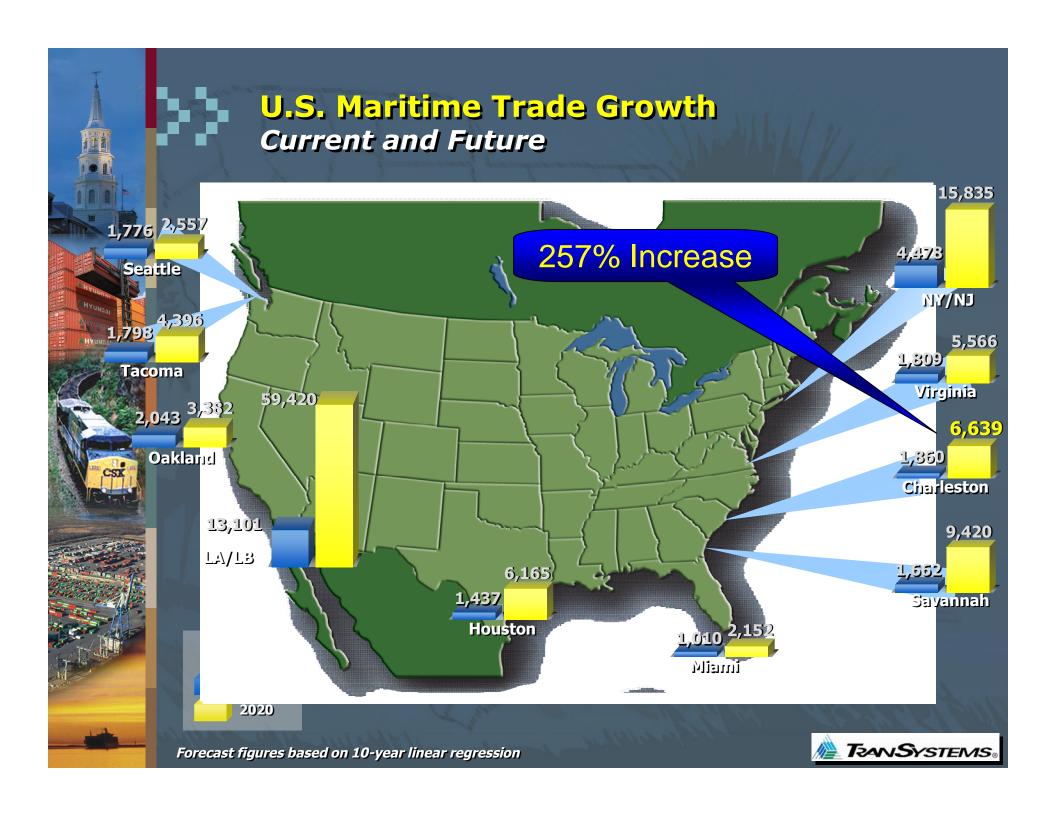
We do not have an "intermodal system" as such.
Rather we have an aggregation of multiple,
private and public modes, each of which are
"stove-piped" within their own individual areas
of interest with little or no true cross
communication and collaboration.



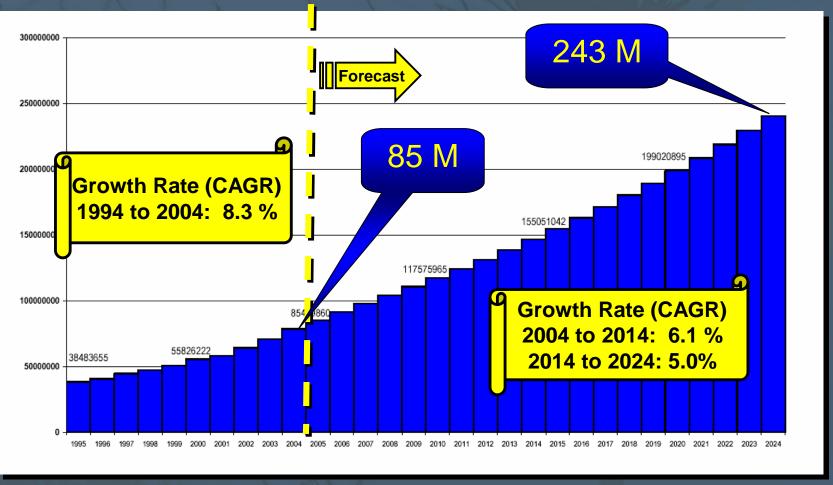








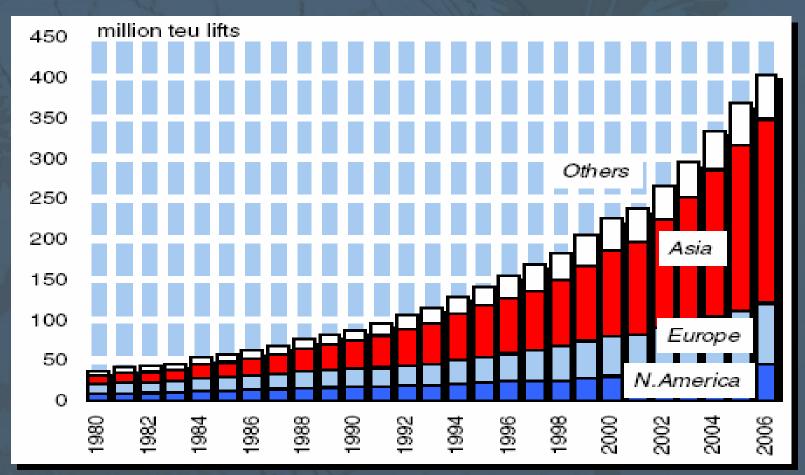
## World Container Forecast to 2024 in TEUs (186% Increase in Next 20 Years)



Source: Global Insight, 2004



## Global Interdependent Economics Have Resulted in a Major Product Sourcing Shift to Asia



**Source: Clarkson Research Studies** 



## **CN's New Transcontinental Double Stacked Intermodal Bridge Prince Rupert Port Authority** the new world port opening a new world of opportunity Canada China Mexico





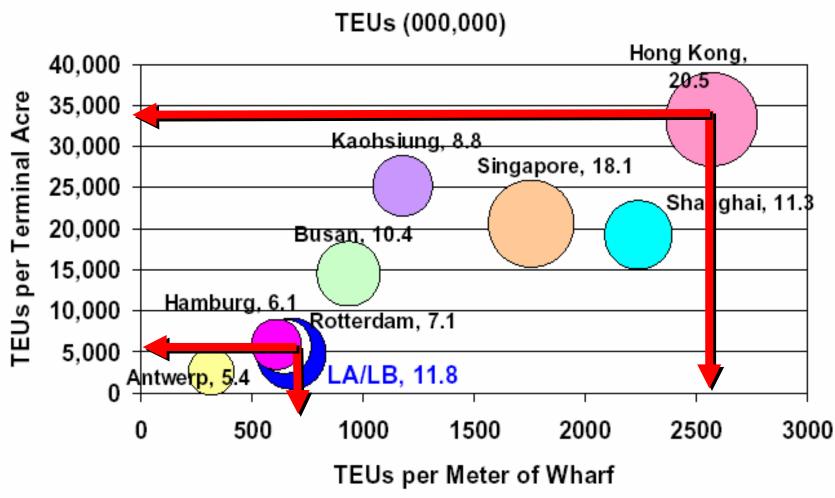
ATLANT OCEAN

> South America

GULF of MEXICO



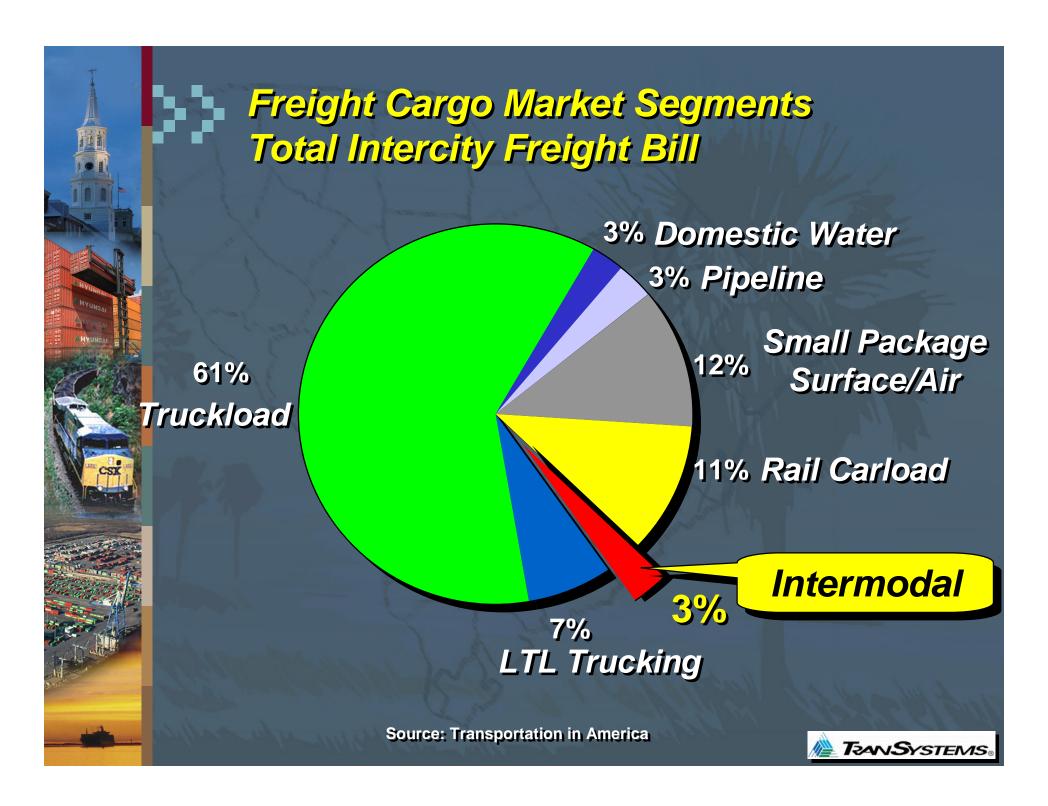
## 2003 International Port Productivity (Top 10 Ports in Millions of TEU Throughput)



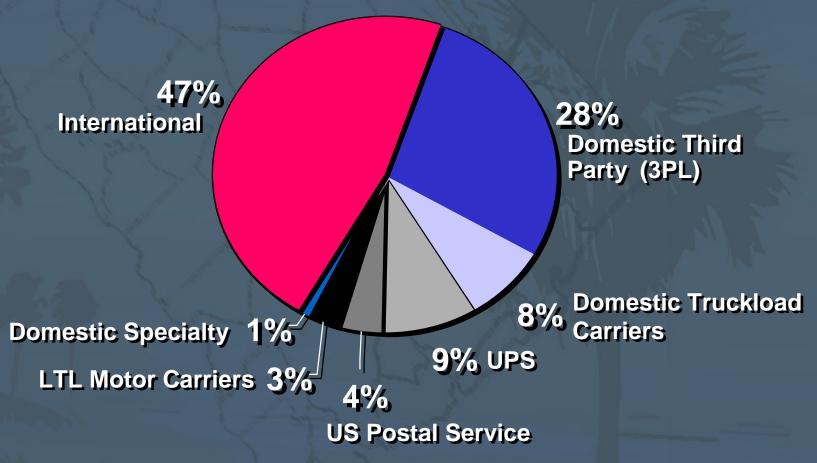
Source: Computed from Seaports of the Americas – 2003, Containerization International Yearbook - 2003 and port-provided data bases/interviews







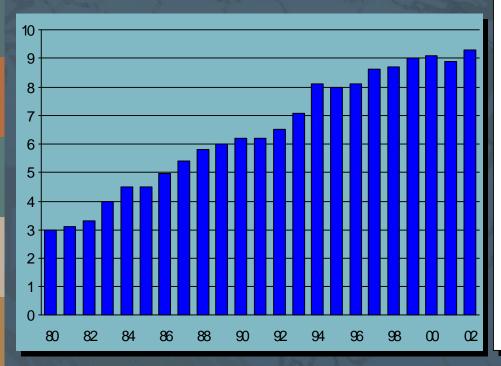
### Major Intermodal Market Segments





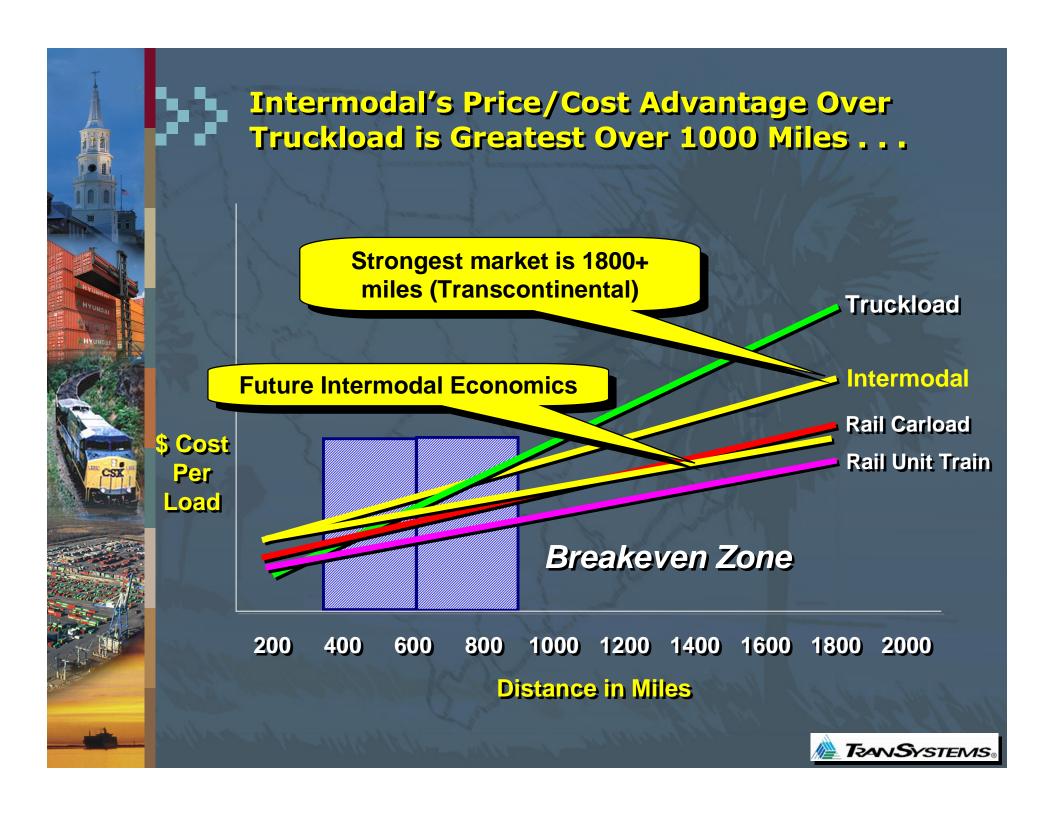
## Intermodal Rail Cargo has been the U.S. Railroads' Biggest Growth Sector

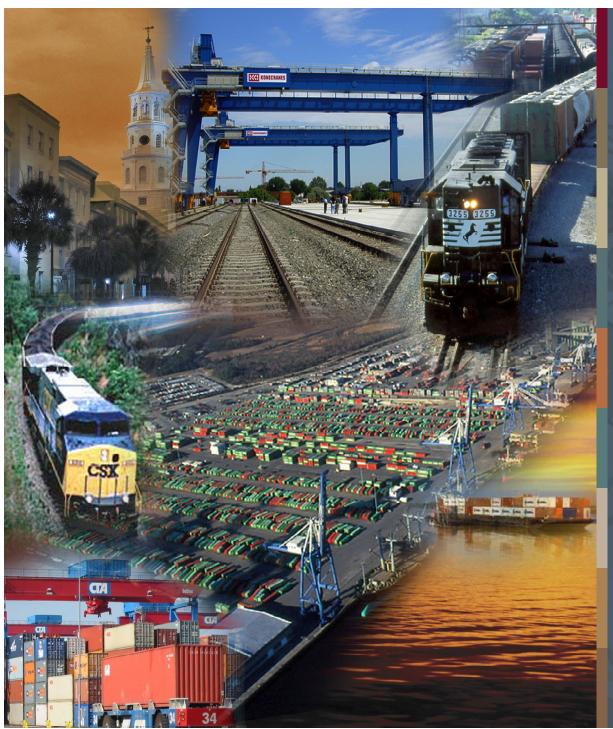
U.S. Rail Intermodal Traffic: 1980-2002 (Millions of Units)



- Intermodal traffic has been the railroads' greatest source of volume growth – about 6 percent per year since 1980
- Overall, rail traffic grew at just 2.2% per year
- U.S. industrial production grew at 3.1% annually
- International traffic makes up about half of railroads' intermodal business





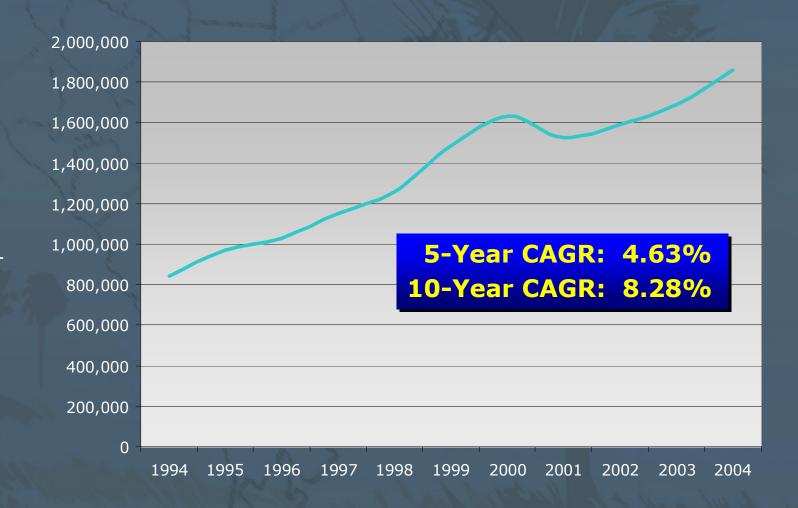


safe Pports



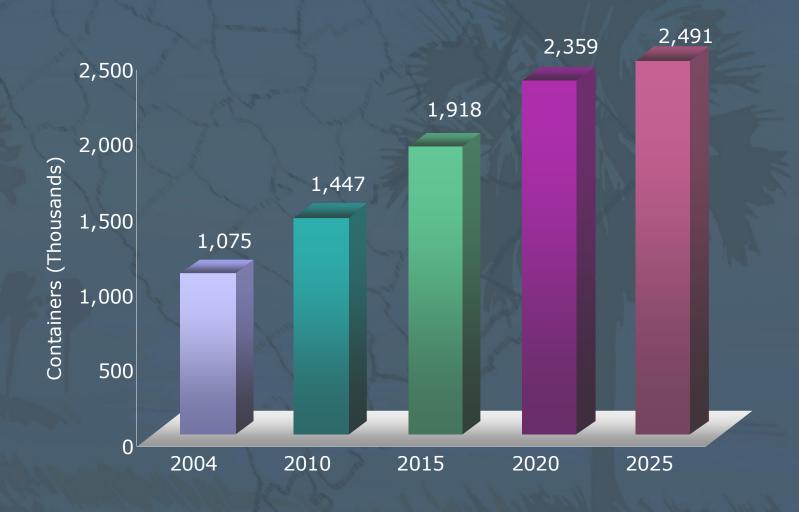
Port
of
Charleston
Forecasted
Demand

#### Port of Charleston Historical Throughput



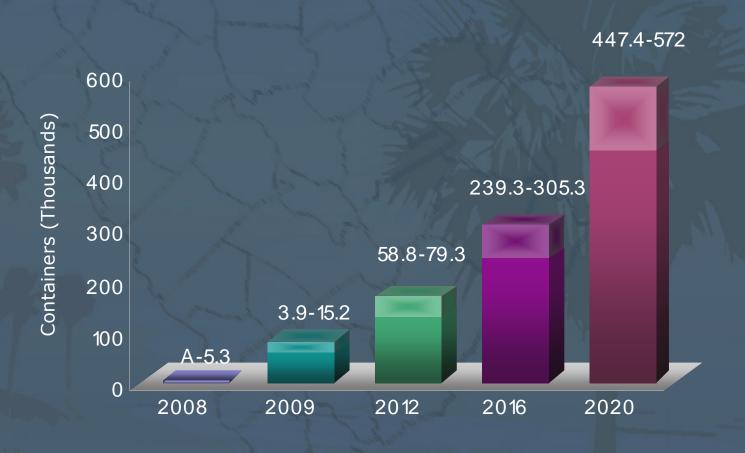








## Port of Charleston Intermodal Growth Potential



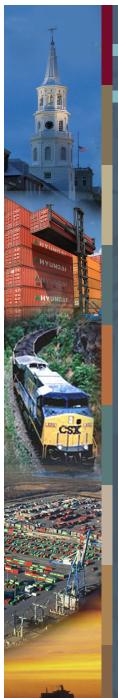


Base - 25 to 30% Growth



Aggressive – Up to 35% Growth

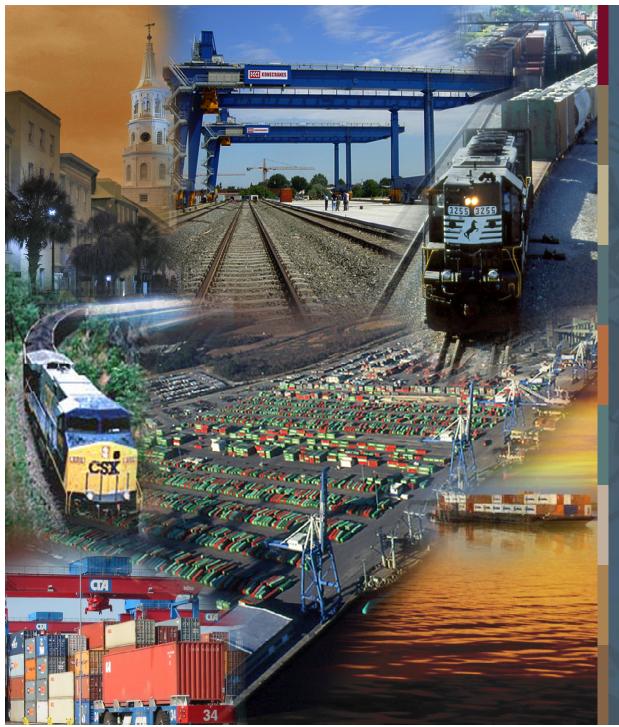




## Port of Charleston 2025 Intermodal Forecast (Containers per Year)

Container Terminal	2025 Throughput	2025 Intermodal Base 25-30%	2025 Intermodal Aggressive 25-35%
Wando Welch	878,357	263,507	307,425
North Charleston	398,672	119,602	139,535
Columbus Street	228,663	68,599	80,032
Navy Base	985,738	295,721	345,008
Total	2,491,430	747,429	872,000



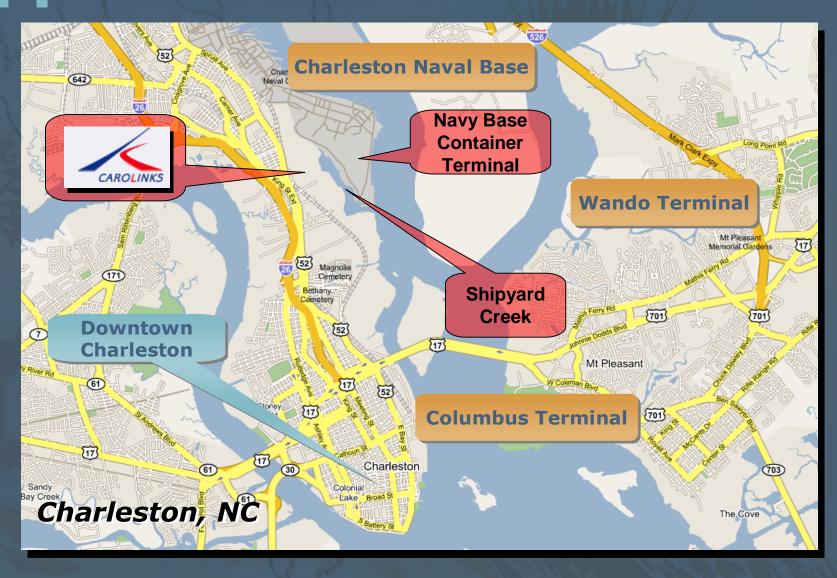






CaroLinks
Automated
Intermodal
System
Development
Project
An Overview

### CaroLinks - Port of Charleston Vicinity





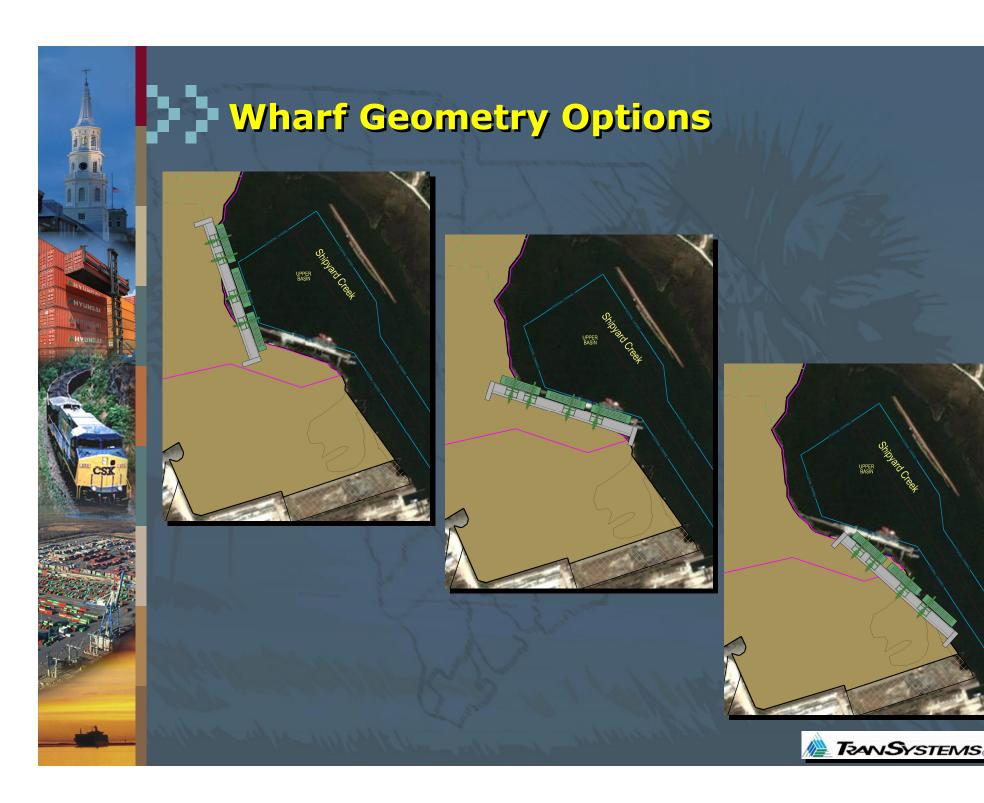




Name of Channel	Width (Feet)	Length (Naut. Miles)	Depth MLLW (Feet)
Wando River Upper Reach	400-850	0.25	45
Wando River Lower Reach	400-1500	1.3	45
Drum Island Reach	600-1300	0.7	45
Myers Bend	600-900	0.4	45
Shipyard Creek Main Channel	300-1200	1.0	30
Shipyard Creek Upper Basin	600	0.15	30

Source: NOAA Nautical Chart 11524

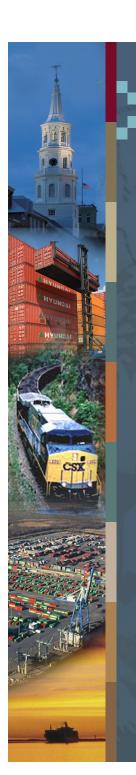










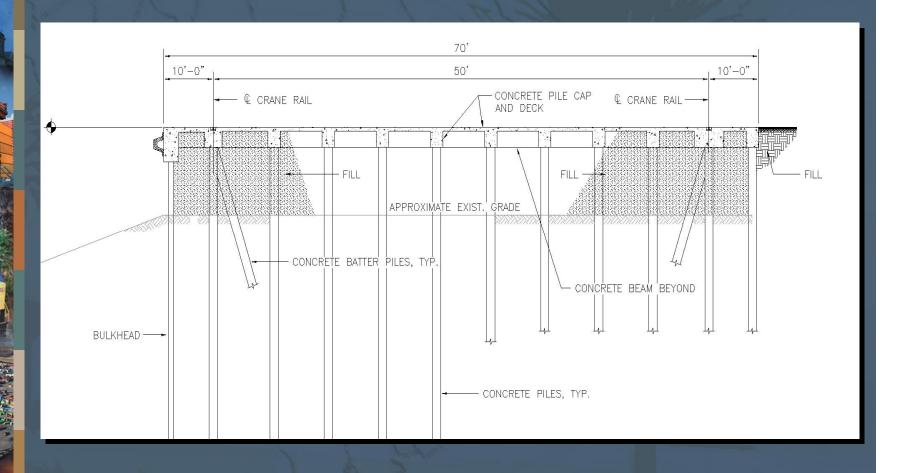


## MacAlloy Site Existing Pier



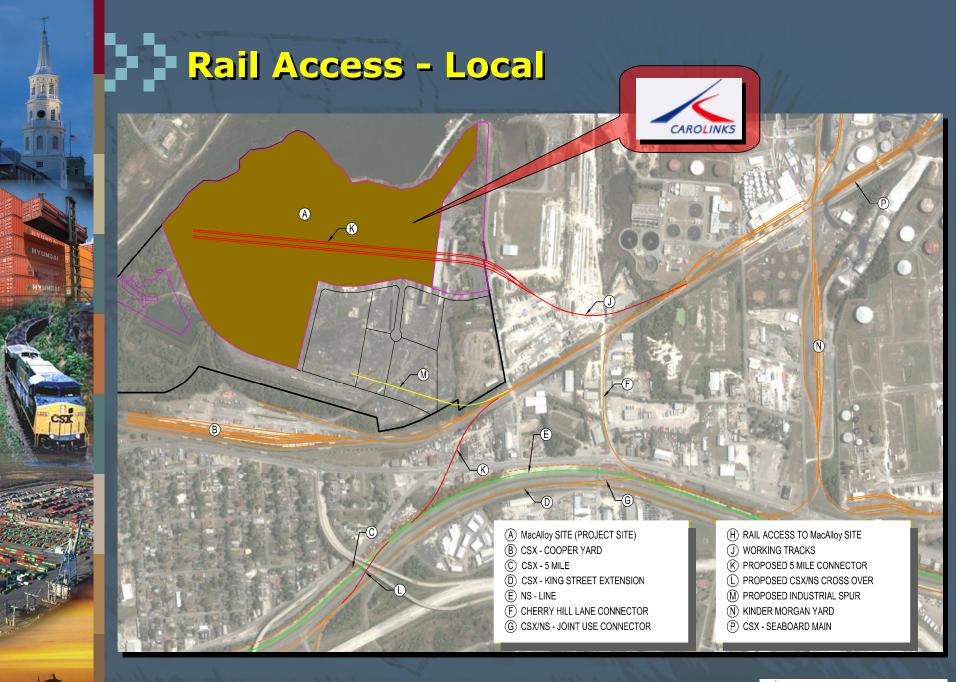






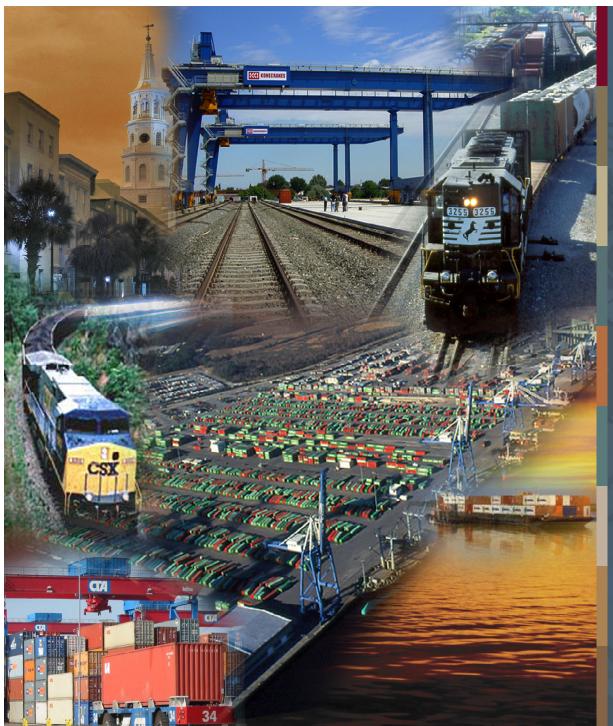










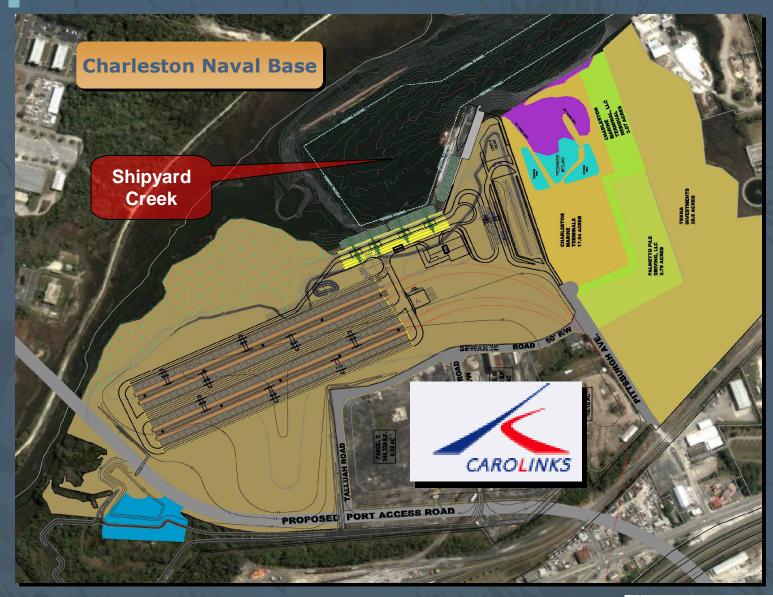






Automated
Intermodal
Terminal
Components





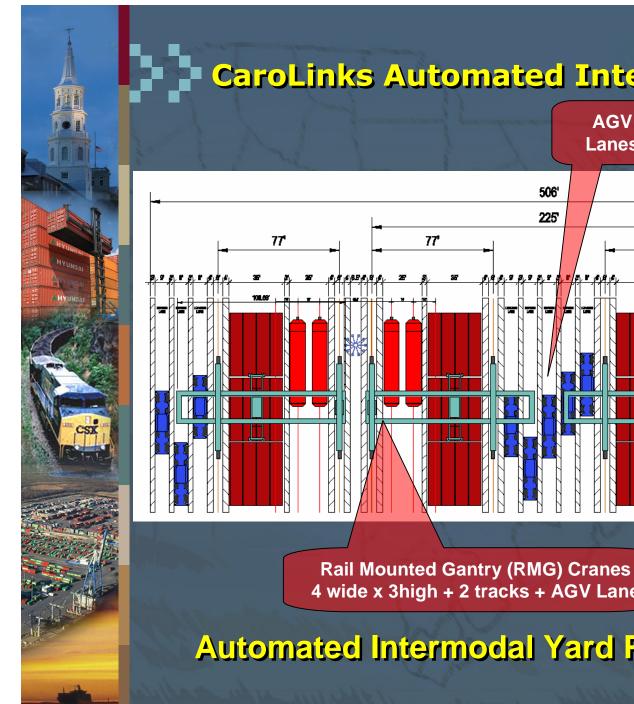


## CaroLinks Automated Intermodal Terminal **Charleston Naval Base** 2 Berth Barge + LayBerth Fixed Boom **Rail Mounted** Gantry

Rail Mounted Gantry (RMG) Cranes
4 wide x 3high + 2 tracks + AGV Lane

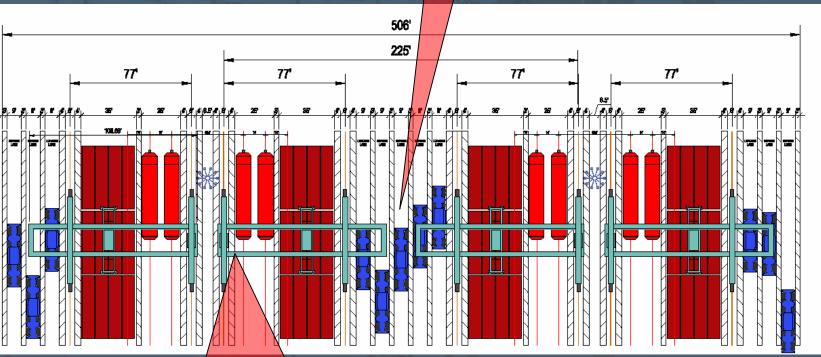


Rail Mounted Gantry Local Move



#### CaroLinks Automated Intermodal Terminal

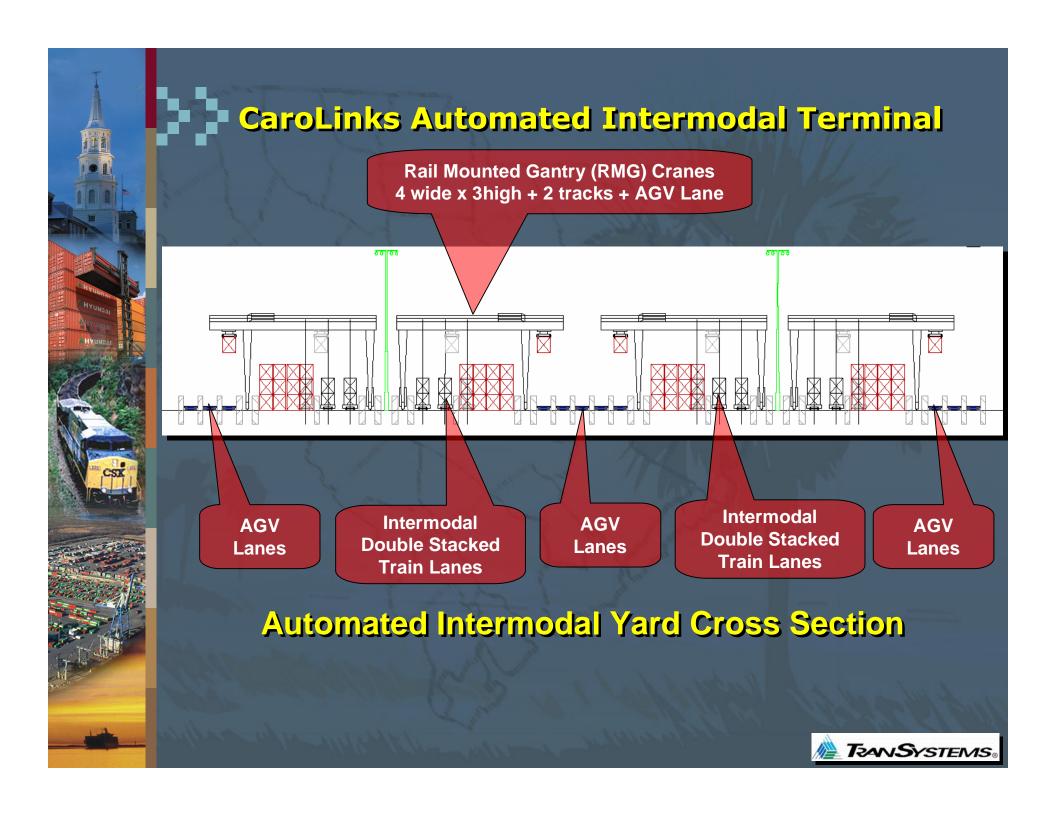
**AGV** Lanes



4 wide x 3high + 2 tracks + AGV Lane

**Automated Intermodal Yard Partial Plan View** 





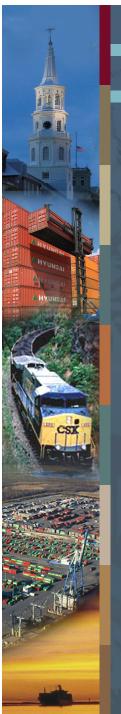






- Automated Guided Vehicle
- Unit Cost: \$500,000Euros (\$586,690 U.S.)
- Units: 15
- Total: \$8,800,350 U.S.

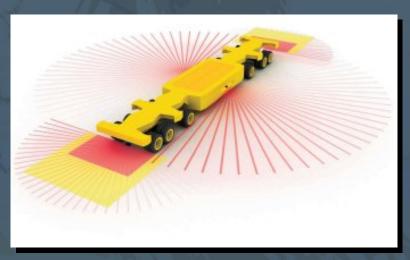




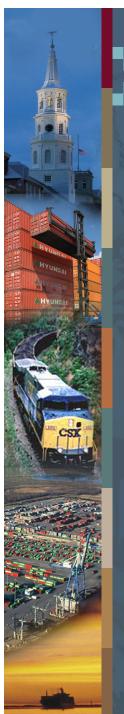
### Performa Intermodal Equipment

- Laser navigation system for AGV
- Manufacturer: TTS Marine Inc./Lazerway
- Unit Cost: \$500,000Euros (\$586,690U.S.)
- Units: 1
- Total: \$586,690 U.S.





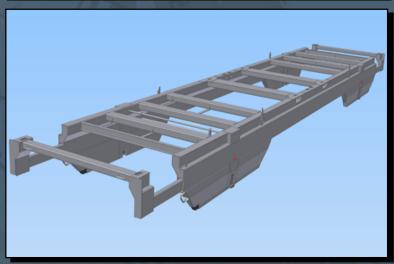




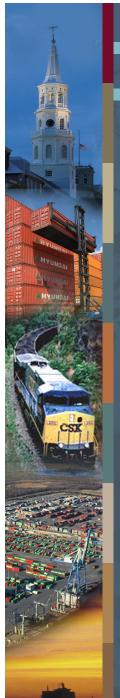
### Performa Intermodal Equipment

- Cassette
- Manufacturer: TTS Marine Inc.
- Unit Cost: \$9,000Euros (\$10,559U.S.)
- Units: 100
- Total: \$1,055,900U.S.









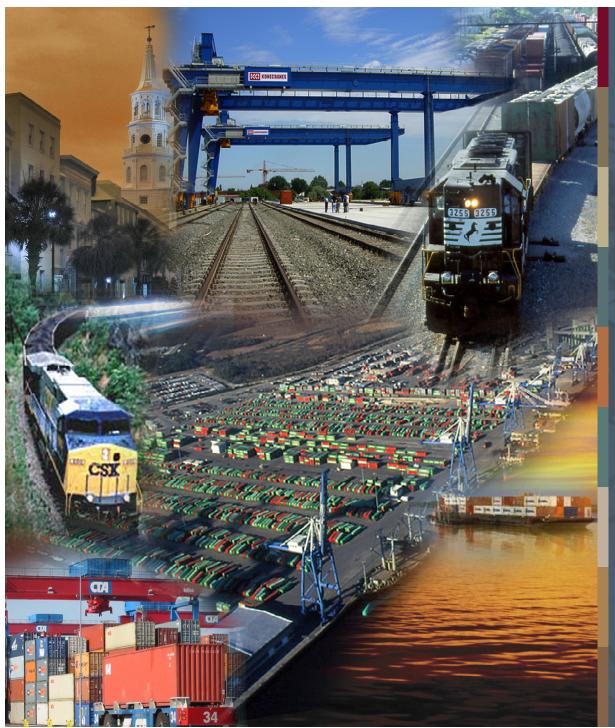
#### Performa Intermodal Yard Equipment



- Rail Mounted Gantry Crane
- Manufacturer: KCI Konecranes
- Unit Cost: \$2,800,000
- Units: 8
- Total: \$22,400,000 U.S.

Performance Data of Konecranes RMG Cranes		
Load under spreader	Up to 50 LT	
Span range	19 50 m	
Lifting height	1 over 3 (12.6m) 1 over 5 (18.4 m)	
Outreaches	Up to 15 m	
Hoisting speed with load	30 m/min	
Hoisting speed with empty spreader	60 m/min	
Trolley traverse speed	Up to 150 m/min	
Gantry travel speed	Up to 240 m/min	
Slewing trolley (optional)	12 rpm	

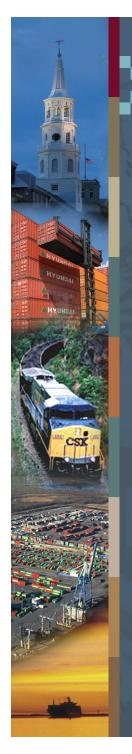








CaroLinks
Inland
Intermodal
Port
Sites



#### CaroLinks Inland Port Network

Safe Ports will develop a sprint train intermodal network system in South Carolina including three rail yards:

- 1. Near-dock Intermodal Terminal adjacent to Shipyard Creek and the New Container Berths in the Port of Charleston
- 2. Inland Intermodal Rail Terminal adjacent to 195/126 Interchange, in Orangeburg County, SC (one northwest of the Port of Charleston)
- 3. Inland Intermodal Rail Terminal in a 200 mile radius

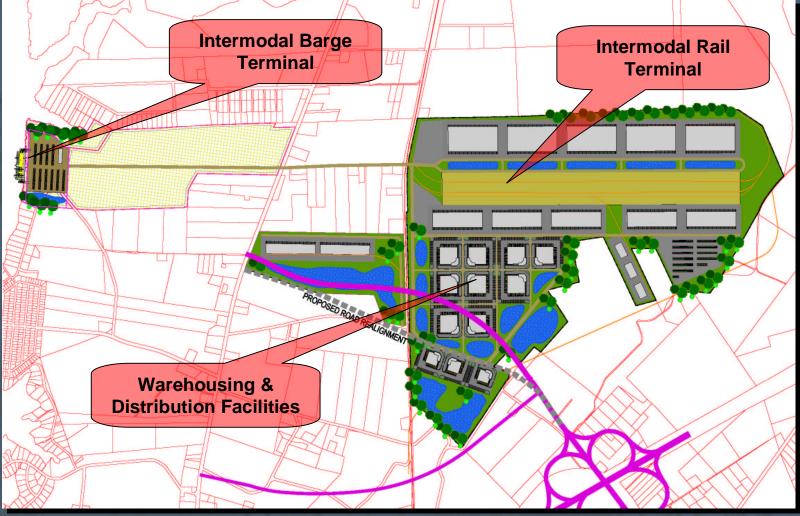


## Orangeburg Inland Intermodal Site Vicinity Exhibit 1 WETLAND APPROXIMATION

SOUTH CAROLINA

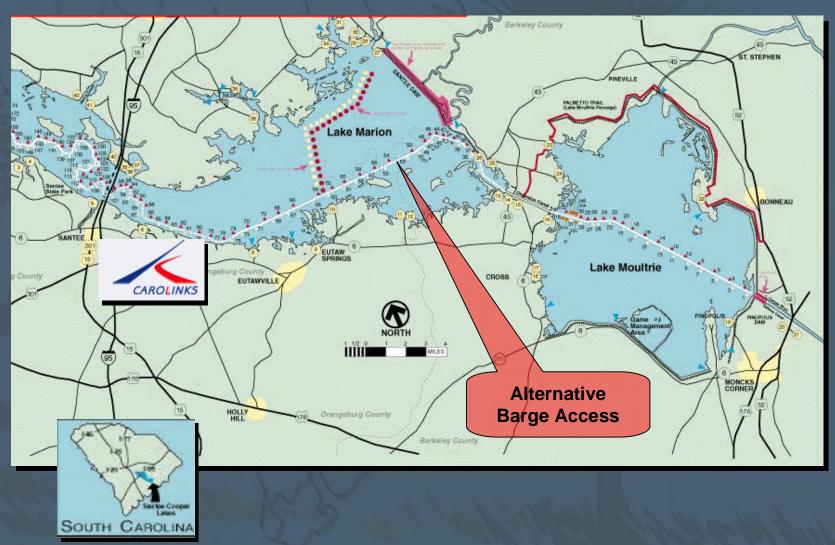


# Orangeburg County SC Inland Intermodal Terminal Site – Conceptual Plan Intermodal Barge Intermodal Rail





## Alternative Barge Access to Inland Intermodal Terminal





## CaroLinks Project

Overview



## Intermodal Transportation System

- Links ports to consumer markets
- Manufacturing and distribution centers
- Agricultural production and procession facilities
- Combined; waterways, railroads, highways, distribution warehouses, container yards and terminal facilities are the Container Transportation System

### **Shipyard Creek**

Semi-automated intermodal facility operation

Marine barge containers between terminals

Rail shuttle "unit" trains to inland depots

Road limited boutique service

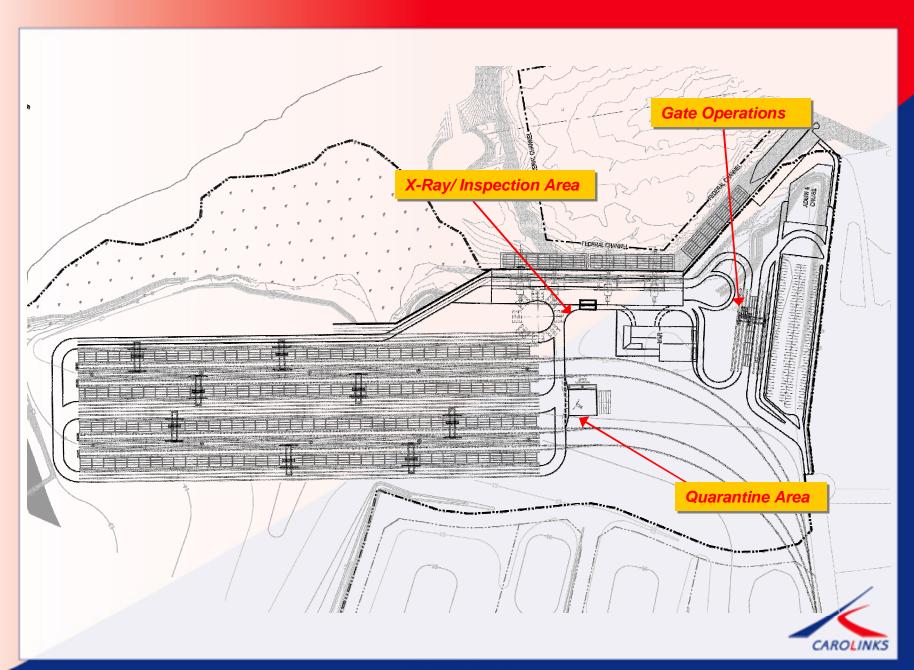
Cranes off/on load barges

AGVs move containers within system

CLC container logistics center

SMC security monitoring center





#### **Timelines**

Permitting process April 2006

Construction July 2006

Partial Operations July 2007

Full Operations January 2008



### **Panel Speakers**

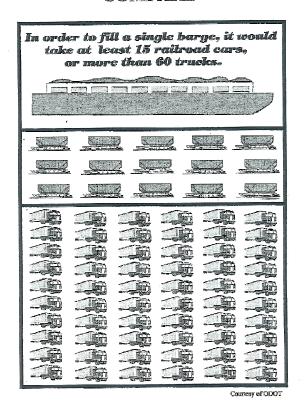
John Vickerman Principal,
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 Vice President Operations,
 CaroLinks,



#### **COMPARE**



#### **BARGE CARGO CAPACITIES**

The cargo capacity of a barge is 15 times greater than one rail car and 60 times greater than one Semi trailer. Wow!

#### Shipping by Waterway:

#### **Energy Efficient, Time and Cost Competitive**

Barge transportation is one of the most energy-efficient forms of transportation and is also much faster than most people think.

#### **Transportation Cost Comparisons**

	Cents Per Ton Mile	BTUs Per Ton Mile
Barges	.0097¢	500
Pipeline	.0078¢	1,850
Railroad	.0253¢	750
Truck	.0750¢	2,400





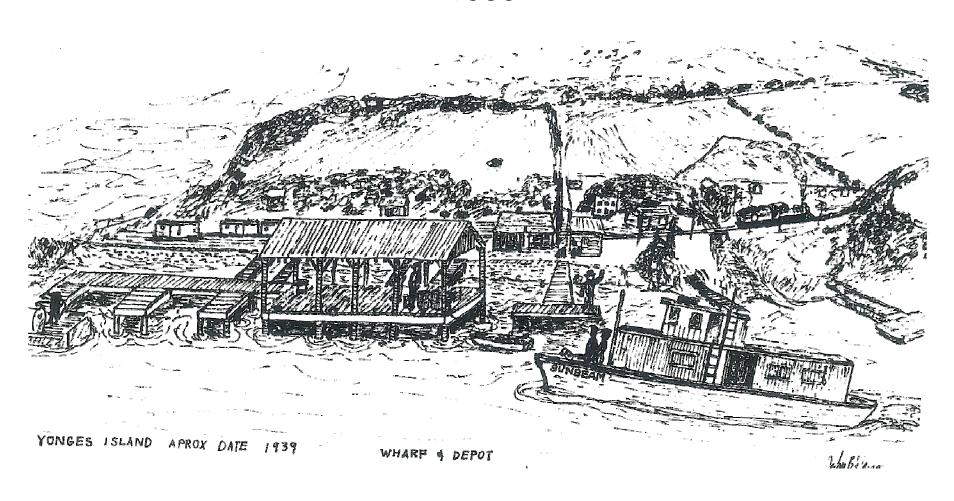
STEVENS TOWING CO., INC. MARINE THANSPORTATION SINCE 1913



#### Daytona Beach #1 - Circa 1922



## Steven's Towing Wharf and Depot at Young's Island, SC 1939



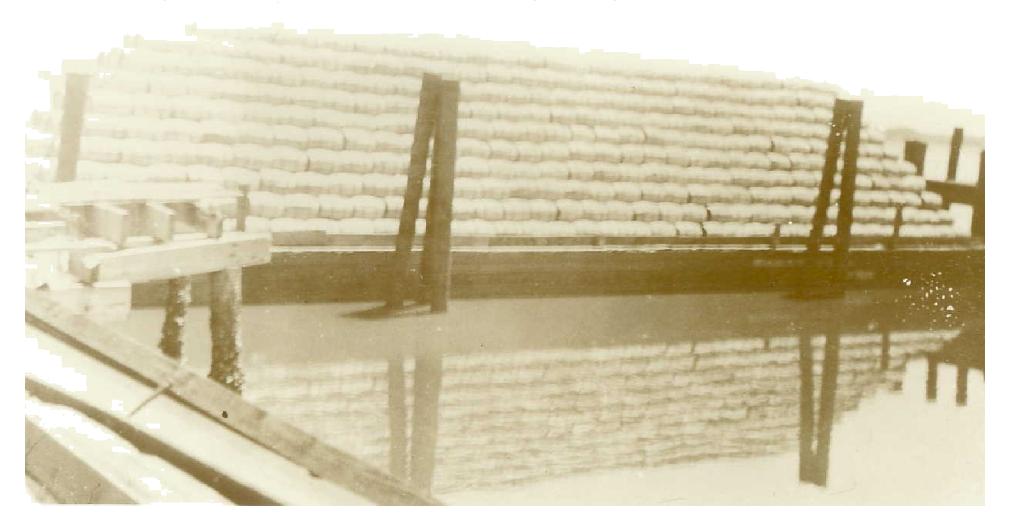
Freight Boat - Capt. McGuire: transporting freight and passengers between Edisto Island and Seabrook Island to The rail passenger terminal at Young's Island, SC.

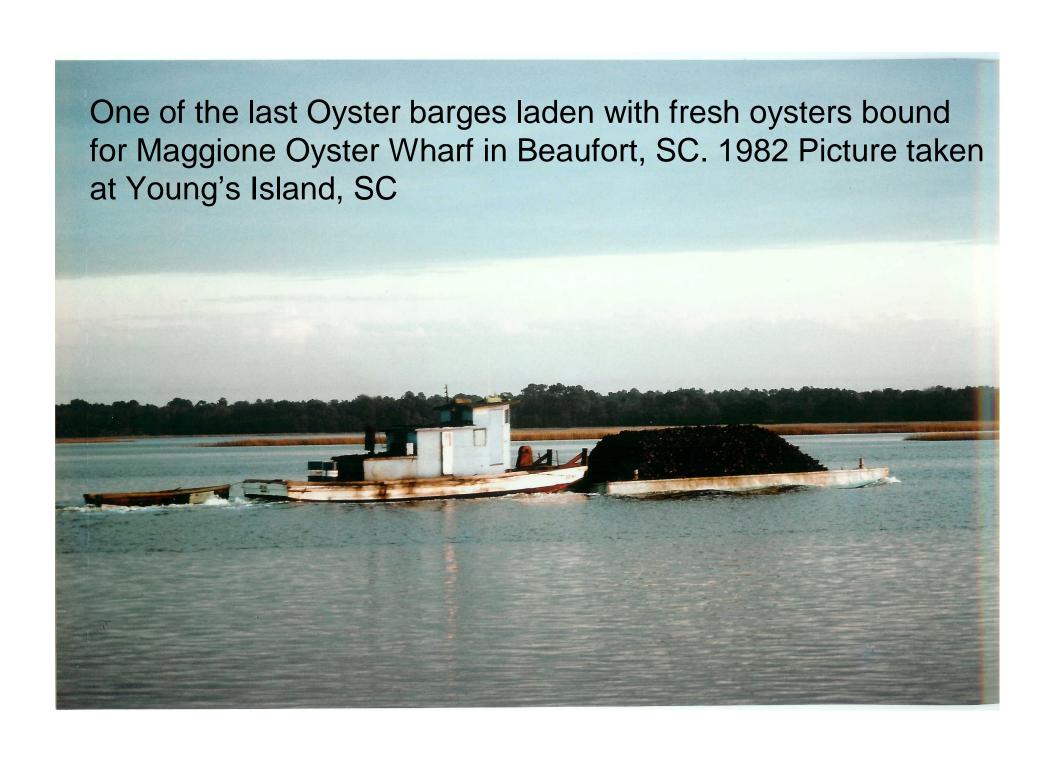


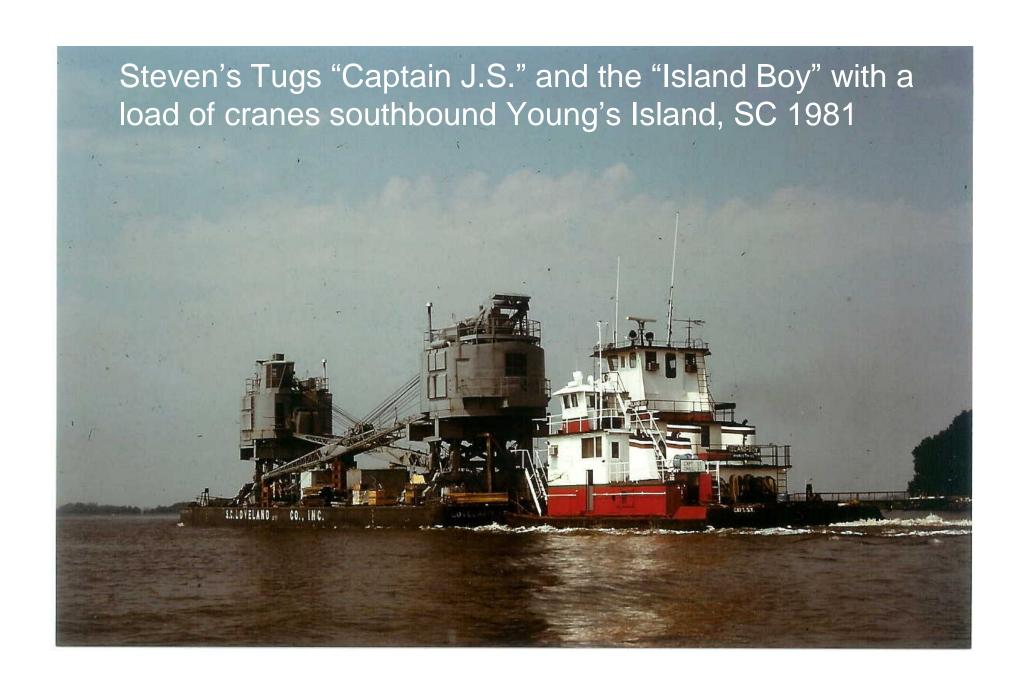
Steven's typical freight vessel - Circa 1930's



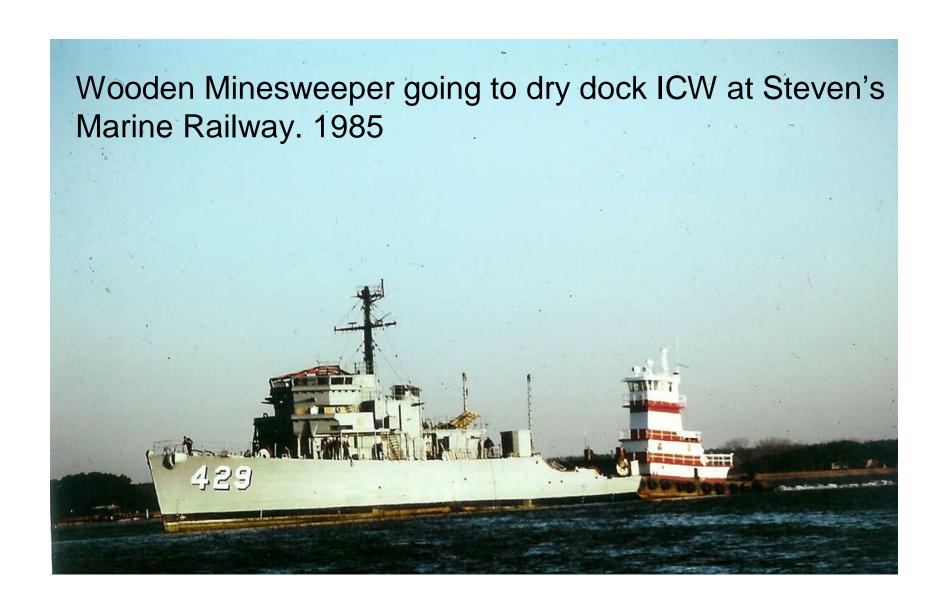
New potatoes going to the Charleston City Market on a barge waiting for the Lime House swing bridge to open (about 1931)

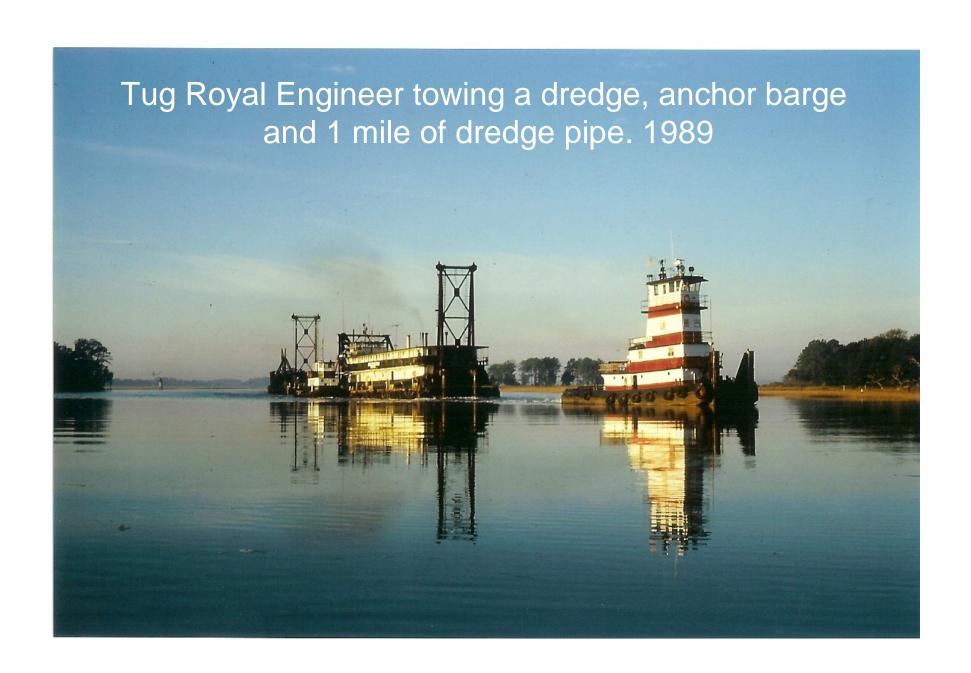






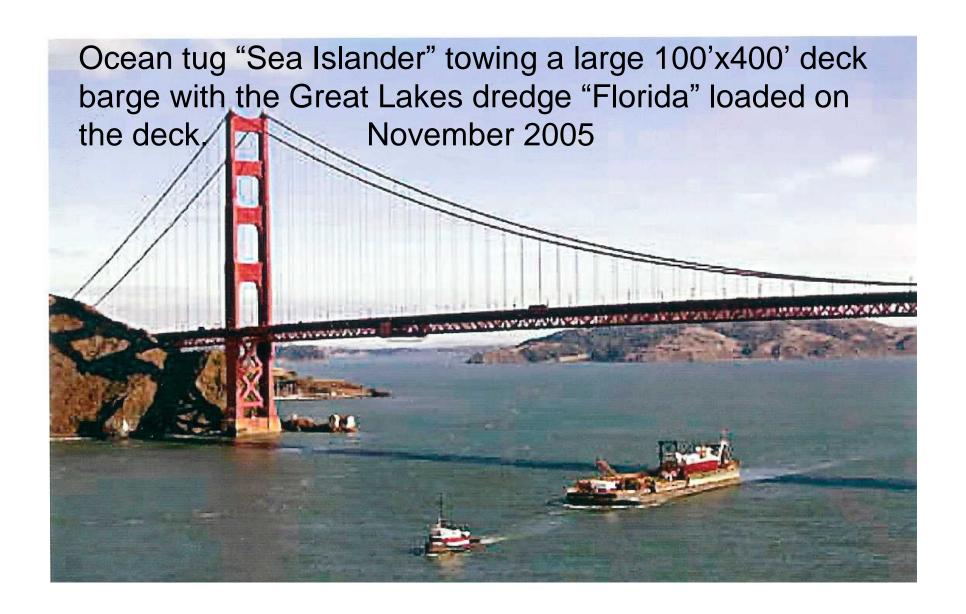






Barge cargo of modular units for a chemical plant expansion being pushed through a lock on the Ohio River by the ocean tug, "Sea Islander" and the "Island Trader" from Goose Creek, SC to Sistersville, WV. 2001





### **TABLES**



#### Compare Land and Water Transportation

#### Cargo Capacity



15-Barge Tow 22,500 Ton 787,500 Bushels 6,804,000 Gallons

2-1/4 Unit Trains



Jumbo Hopper Car 100 Ton 3,500 Bushels 30,240 Gallons

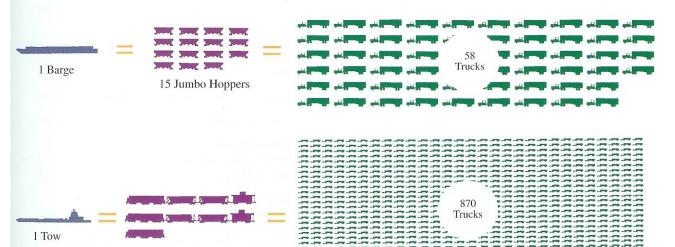


100-Car Unit Train 10,000 Ton 350,000 Bushels 3,024,000 Gallons



Large Semi 26 Ton 910 Bushels 7,865 Gallons

#### **Equivalent Units**



#### **Equivalent Lengths**





2-1/4 Miles 2-1/4 Unit Trains



34-1/2 Miles Assuming 150 ft. between trucks





55-212 260' x 54' x 12' 12/04

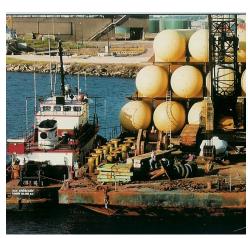






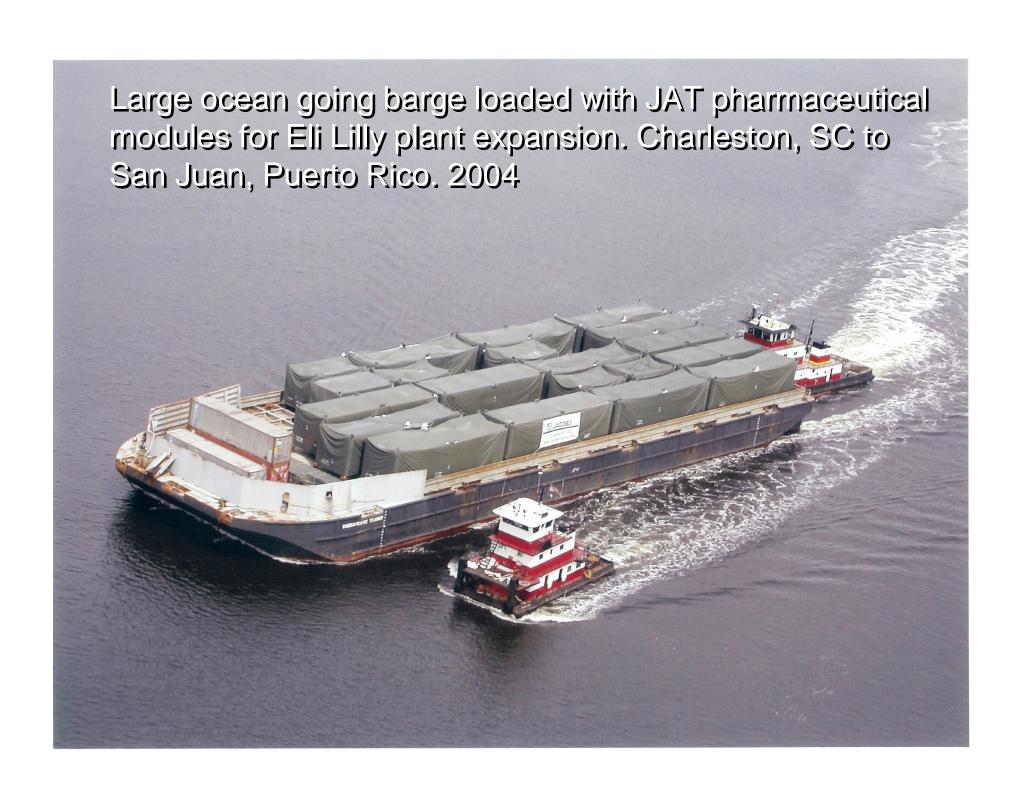






Beam: 38 ft Draught: 7 ft 1800 Horse Power





## Sea Land containers moving by barge from Savannah to Charleston via the inland waterway in 1982.



## **Everything is bigger in Alaska!**



Savannah port docks showing old style container cranes and Steven's container barges coming in for discharge. 1979



Small container barge "CERES" on the intercoastal waterway going to Charleston, SC.



## **Environmental Advantages:** Inland Barge Transportation

U.S. Department of Transportation Division of Domestic Trade, Maritime Administration

Inland barges carry approximately 15 percent of the nation's freight at the lowest unit cost while offering an environmentally-sound alternative to other land modes.

#### THE INLAND BARGE INDUSTRY . . .

#### Is Energy Efficient

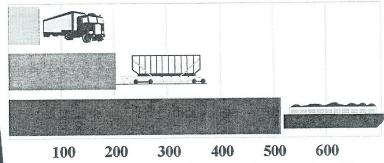
The measure of energy efficiency in transportation is the amount of energy used for the service provided, and can be expressed as the number of BTUs required to move one ton of cargo one mile (a ton-mile). In studies comparing rail, truck and water, shallow-draft water transportation has proven to be the most energy efficient method of freight transportation for moving bulk raw materials.

An analysis of rail and waterway fuel efficiency shows the average BTUs expended per ton-mile totals 433 for water transport and 696 for rail transport. It is much more efficient to move cargo through water than over land.

# The Inland Barge Industry is Energy Efficient

#### Source: Maritime Admin., USDOT

#### **RELATIVE ENERGY EFFICIENCIES**



The number of miles one ton can be carried per gallon of fuel.

#### **Cargo Capacities**

Size is the key to water transport's efficiency. The capacity (1,500 tons) of an inland barge, which can carry five times its own weight, is impressive and the industry as a whole has enormous capacity. The cargo capacity of a barge is 15 times greater than one rail car and 60 times greater than one semi trailer. To move the same amount of cargo transported by a standard tow (15 barges) would require a freight train 2-3/4 miles long or a line of trucks stretching more than 35 miles. On the lower Mississippi, one

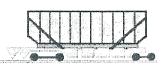
10,000-hp towboat can push 40 barges that have the carrying capacity of 600 railcars or more than 2,400 trucks.

Barge transportation is a low-energy form of transportation and shifts of traffic to high-energy forms would be inconsistent with the nation's energy conservation efforts. The environmental advantages of water transport should be weighed when considering any activity that would result in a shift of cargo from the waterways to a land form of transport.

## TRANSPORTATION MODE COMPARISIONS



1 Barge 1,500 Tons 52,500 Bushels 453,600 Gallons



15 Railcars 100 Tons 3,500 Bushels 30,240 Gallons



60 Trucks 25 Tons 875 Bushels 7,560 Gallons

#### Is Extremely Safe

Transporting cargo safely is an important measure of environmental responsibility, and water transport has very few accidents, fatalities or injuries.

Shallow-draft water transportation has definite advantages over competitive modes: it generally involves less urban exposure than either truck or rail; operates on a system that has few crossing junctures; and is relatively remote from population centers, all factors that reduce both the number and impact of waterway incidents.

For the amount of tonnage carried, barge spills occur quite infrequently. Barges, because of their much larger capacity, require far fewer units than either rail or truck to move an equivalent amount of cargo, and so the chance of a spill is less likely. Also, design features of barges such as double hulls and navigational aids help reduce accident frequency

For any hazardous liquid material shipped by water, the U.S. Coast Guard maintains a comprehensive list of safeguards and controls that govern the design and construction of vessels and equipment and personnel manning qualifications.

Construction of tank barges must be approved by the Coast Guard, and once in service, they are inspected annually. Coast Guard statistics show that water transportation not only is subject to a high degree of regulation, but also operates under a stringent regulatory program.

### Causes Little Congestion

The steady increase in highway traffic in the U.S. has far outstripped any increase in infrastructure capacity, resulting in delays, safety problems, and congestion, costing the nation up to \$100 billion annually.

The results of this congestion are reflected in more accidents, increased energy consumption, environmental damage, increased commuting times, and greater social tension. Water transport - in contrast-does not have congestion problems, and seldom causes them for others. The fact is that far from being congested, the country's water transport system is underutilized.

### Produces Little Air/Noise Pollution

Some of the most pervasive and intrusive sources of noise and air pollution are transportation systems. Noise levels have been rising. Air pollution caused by transportation includes pollutants directly emitted by engines as well as secondary pollutants formed by chemical reactions.

Even though air pollution resulting from water transport operations is negligible, the waterway industry has been, and is, installing vapor control systems to capture any emissions. Cumulatively, the barge industry has a relatively minor effect on air quality, consumes much less energy (and as a result, produces less air pollution) per ton-mile of freight carried than either rail or truck. For the most part, waterway operations are conducted away from population centers, which reduce the impact of its exhaust emissions.

Towboats operate well away from shore, with the sound of their engines muffled below the water line, and any noise levels are hardly audible beyond the immediate area of the tow.

#### Has Minimal Land Use/Social Impact

For the most part, inland river transport has little impact on densely populated areas. These shallow-draft vessels operate in mid-river, well away from shore and because of the large tonnage moved at one time, tow passages are infrequent. This low-profile type of operation is one of the transportation industry's best kept secrets.

Since most of the right-of-way for water transport is provided by nature, inland navigation is less likely than other transport forms to compete with non-transportation uses for land area, an important consideration in urban locations. Apart from a few connections and waterside terminals, waterways preempt very little land.

#### **Produces Multiple Benefits**

Besides navigation, transporting cargo by barge has a number of other benefits and many beneficiaries.

When anew navigation project is completed, more than water transportation benefits. The other major beneficiaries of developed waterway systems include recreation, flood control, public water supply, wildlife habitat, irrigation, and industrial use. And oftentimes, the benefits of these other purposes are as important as the waterway itself—which is an economic spur to the particular region where it is located. Navigation not only creates opportunities for new industries, but may also change trade patterns that can have a major economic impact on local and regional development.

In addition to navigation, commercial waterway activity has been a good environmental neighbor. In the process of building waterway projects, provisions are made to preserve, enhance, or create wetland and aquatic habitats. National wildlife refuges and designated areas along the rivers are home to many species of fish and wildlife, and are used by both migratory and resident bird populations.

#### Conclusion

There is a growing national commitment to restoring and preserving our environment, a goal that has become a priority for the inland navigation industry.

The companies that make up the barge and towing industry have a reputation for a strong environmental stewardship and are dedicated to improving the compatibility of their operations with the environment in an effort to reduce environmental incidents to an absolute minimum. Pollution control, protection and enhancement of the environment, and maintenance of the ecological balance have long been major concerns of the waterway industry.

#### For Further Information

Division of Domestic Trade Maritime Administration 400 Seventh Street, S.W. Washington, D.C. 20590 (202) 366-4374 FAX: (202) 366-5522



#### **Department of Transportation**

#### **Maritime Administration**

Text Version

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#### **DOMESTIC SHIPPING:**

#### **Domestic Shipping Overview**

Domestic waterborne transportation is safe, reliable, efficient and an established mainstay of America's national transport system. The domestic shipping operations of the American merchant marine provide essential services to 41 States reaching 90 percent of the national population.

#### **Coastal Shipping Initiative**

MARAD is spensoring a project to examine the development of a coastwise shipping system for the advancement of waterborne trade along the Nation's coasts to relieve congested highways. The study's preliminary phase provided a framework for future research to improve coastwise shipping. The next phase has begun and will have active participation by domestic carriers, ports, shipbuilders and a number of federal agencies, including the Federal Highway Administration and Bureau of Transportation Statistics. The ultimate goal of this study is to demonstrate the feasibility and benefits of a robust coastal liner shipping system along the Nation's East, West and Gulf coasts for intercity general cargo.

#### **Inland Container on Barge**

MARAD initiated a Cooperative Agreement with the Port of Pittsburgh Commission, to assist the Port in studying the feasibility and marketability of running a container on barge service between the Port of Pittsburgh, PA to Monterrey, Mexico, via Brownsville, TX.

The portion that MARAD and the Port of Pittsburgh are working on is to organize and establish a Shippers Council in Pittsburgh, PA and Monterrey, Mexico. Research will be done to identify potential shippers in the Pittsburgh area, and additional shippers on the waterway corridor between Port of Pittsburgh and Brownsville, TX for cargo moving onward via truck to Monterrey, Mexico. The same will be done with shippers on the same water corridor for cargo moving to the Northeast.

## Containers in Hopper Bonges

#### **Osprey Completes Record 15 Barge Tow**

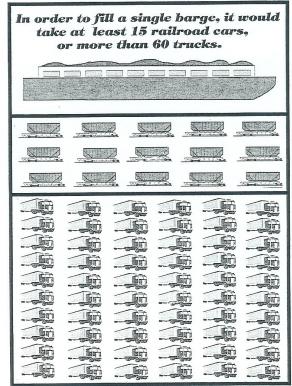


Osprey Line completed what it reports trade in Europe. is the largest single unit tow container movement in the history of the U.S. Inland Waterway System. The 15 barge tow was loaded with 375 containers (750 TEU) of agricultural products from Memphis to New Orleans and Houston. Osprey Line worked closely with six major steamship lines to move the cargo to Gulf of Mexico ports for export on container vessels. The volume transported is everal times larger than the majority of vessels employed in the short sea shipping

"This voyage is an illustration of what we are accomplishing here at Osprey Line. The service is a great alternative to truck and rail on routes along the inland waterway system and the Gulf of Mexico. The U.S. Inland waterway system is an amazing resource that can readily be used to alleviate congestion along existing rail and highway corridors. When you combine Osprey Line's inland service with our Gulf of Mexico service, we provide an allwater system extending from the heartland of the United States to ports such New Orleans, Baton Rouge, Houston, and Tampa. With partners like Kirby Corpora tion and Cooper T. Smith, we have th resources to respond to projects such a this container move and provide consis tent reliable service," said Christian O'Neil, vice president, Osprey Line.

Kvichak Awards

#### **COMPARE**



Courtesy of ODOT

#### **BARGE CARGO CAPACITIES**

The cargo capacity of a barge is 15 times greater than one rail car and 60 times greater than one Semi trailer. Wow!

## **Panel Speakers**

John Vickerman Principal,
 TranSystems Corporation

Gordon Locatis Vice President,
 Stevens Towing Co. Inc.

Marty Crosby
 Vice President Operations,
 CaroLinks,

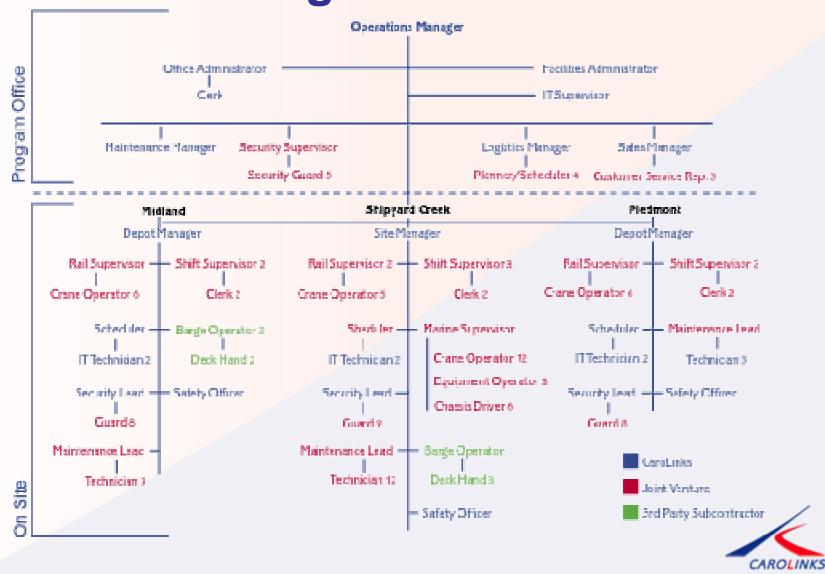


## CaroLinks Project

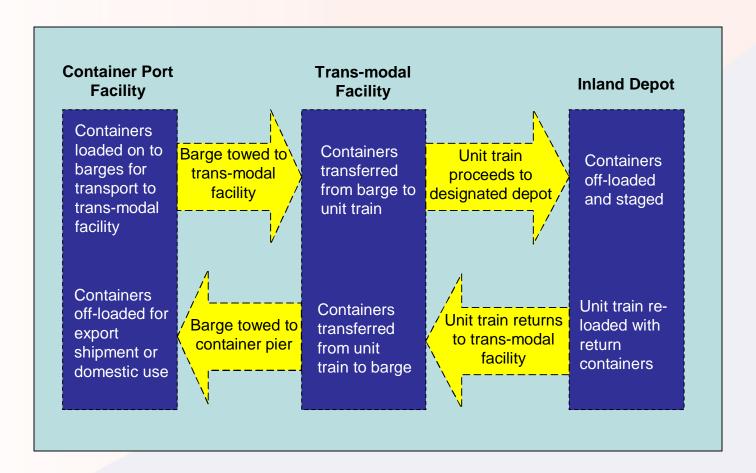
**Execution and Management** 



## **Organization**

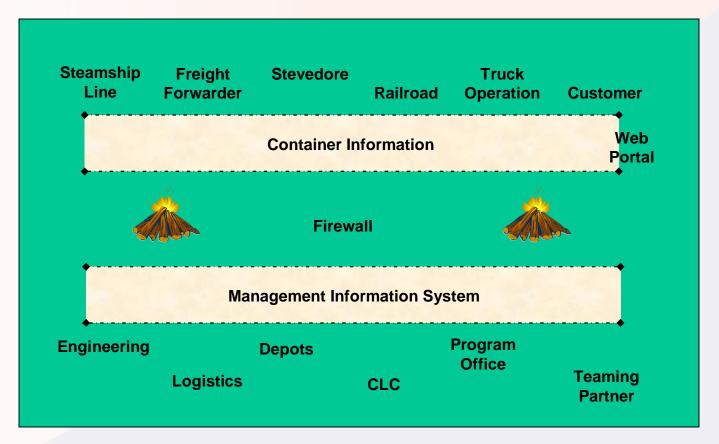


## **Container Flow**





## Container Logistics Center





CaroLinks is creating the first automated trans-modal facility of it's kind on the East coast of the United States



## Questions & Answers

