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16. Abstract This report examines the potential effects of short sea shipping (SSS) development on the Texas transportation system. The project region includes Texas, Mexico, and Central America. In the international arena, the most likely prospects are for containerized shipments using small container ships. In the domestic arena, the most likely prospects are for coastwise shipments using modified offshore service vessels or articulated tug/barges. Only three Texas ports handle containers consistently (Houston accounts for 95% of the total), and three more handle containers sporadically. Other ports could potentially offer a limited container service but will most likely require equipment and infrastructure upgrades to be competitive. The report identifies several triggers, which—if they were to occur—could abruptly change the level of SSS activities in the region. Even with a doubling of current SSS volumes, the effects on the Texas highway and rail systems will most likely be insignificant, with the possible exceptions of Freeport and Brownsville.					
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SHORT SEA SHIPPING INITIATIVES AND THE IMPACTS ON THE TEXAS TRANSPORTATION SYSTEM: TECHNICAL REPORT

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

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EXECUTIVE SUMMARY

INTRODUCTION

Short sea shipping (SSS) is one component of the marine transportation system that has attracted a substantial amount of discussion at the national level. Project 0-5695 was undertaken to examine whether there is significant potential for SSS operations in Texas and whether the effects of an increase in SSS on the highway and rail networks in Texas should be included in TxDOT's planning process.

THE RESEARCH

The scope of this project is limited to dedicated freight, combined freight, and passenger traffic, but the project does not examine the recreational cruise industry. The project defines SSS as “normally consisting of cargo moving within a single continent over coastal waters” (1) and limits the geographical area to Texas, Mexico, and Central America.

The project researchers examined international trade with Texas and non-Texas ports in the project area from a recent historical perspective and identified likely commodities that could be targeted for future SSS operations. The project researchers also reviewed domestic trade via the Gulf Intracoastal Waterway (GIWW) and open-water routes including important factors affecting commodities carried and carrier operations. Container feeder services are also discussed in this context. Focusing on container trade, the project researchers reviewed vessel types that are the most likely candidates for expanded SSS operations in the project region. This information was combined to identify SSS operational requirements.

The project researchers reviewed Texas port infrastructure and equipment capabilities and identified ports that would be most likely to be able to support operational requirements associated with rapid growth in SSS traffic in the near future. An analysis of the effect of such traffic on landside operations and infrastructure was performed. Finally, the project researchers developed overall project conclusions and recommendations for TxDOT.

CONCLUSIONS

Rapid growth in SSS is limited by several factors. International trade is dominated by dry and liquid bulk cargoes that have not been conducive to the development of new SSS operations. Although the container trade is more promising, current markets are already captured by existing services, and new operators will have trouble competing for small shipments with the larger carriers since the latter can charge low rates just to fill otherwise empty space. Given that SSS trade with Mexico and Central America does not account for a large percentage of Texas port traffic, most Texas ports are not actively pursuing SSS cargo in comparison to Asian, European, or South American traffic. Several ports have identified possible SSS niche markets, but they have not invested significant resources in developing them.

There are certain triggers that could lead to rapid development in SSS trade. These include:

- completion of the Panama Canal expansion and initiation of associated feeder services;
- disruption in Trans-Pacific trade; and
- changes in cabotage rules, specifically the creation of a North American Flag for Canada, Mexico, and the U.S.

Certain governmental measures were also identified that could have the indirect effect of encouraging more SSS shipments by water. These include:

- tightening of enforcement for overweight trucks;
- elimination or restructuring of the Harbor Maintenance Tax; and
- additional restrictions on hazardous materials movements.

GIWW traffic may grow if more chemical and hazmat shipments can (and are required to) be routed via water. However, the project researchers concluded that any significant growth in SSS traffic would most likely consist of containerized cargo. Because container-on-barge operations are niche-oriented, they are unlikely to generate a significant increase in waterborne traffic in the short term.

If new SSS operations do occur, start-up services would probably seek to acquire an existing vessel for retrofit. Older offshore supply vessels, already successfully used for one SSS operation, appear to be the most likely candidates. Another possibility is the utilization of articulated tug/barge operations, similar to what is already being used for the transport of liquid cargo.

Six Texas ports appear to be in a position to capture significant SSS containerized cargo. Houston, Freeport, and Galveston already have existing containerized operations. Three other ports—Beaumont, Brownsville, and Port Arthur—have the docks and equipment for handling a mid-volume container operation (50,000–150,000 TEUs¹), although Beaumont is limited by the reach of the crane it would use. However, even a doubling of current SSS volumes would not produce a significant impact on Texas highway or rail traffic. The effects would probably be more noticeable in Brownsville or Freeport, but even in those two cases, the effects would not be substantial.

The potential for SSS as a mitigation tool for regional air quality, congestion, hazmat concerns, etc., may be a reason for government to investigate measures to stimulate waterborne commerce rather than waiting on economic factors alone to encourage development of the sector. Changes in U.S. regulatory or fiscal policy associated with environmental, economic, and social issues, or modification of U.S. trade policy, might increase opportunities for SSS and similar interregional trade and should be investigated in further research as warranted. Ports that are interested in pursuing a detailed analysis of their ability to develop SSS business may want to consider a decision tool developed by Maritime Transport and Logistics Advisors in 2005. More information can be found at:

<http://www.marad.dot.gov/MHI/documents/Decision%20Tool%20White%20Paper%20for%20Short%20Sea%20Shipping%20Revised.pdf>.

¹ TEU = Twenty-foot Equivalent Unit (ocean container), the standard unit of measurement for container traffic.

CHAPTER 1: INTRODUCTION AND BACKGROUND

PROJECT PURPOSE

In recent years, there has been much discussion regarding the potential of short sea shipping (SSS), a term which loosely refers to coastwise shipping or shipping that does not cross oceans or connect continents, to improve the nation's transportation capacity. Interest in short sea shipping has been driven by strong support from federal agencies such as the U.S. Maritime Administration (MARAD) and by the comparative success of SSS in other countries. Many seminars have focused on this subject, and a large number of articles have been written about the technical and economic aspects of SSS. The development of a robust short sea network could, in theory, significantly alter the role of Texas ports in the state and national economy, particularly that of shallow draft or smaller deep-sea ports.

If SSS is going to develop significantly in Texas, it is important to know which ports might handle the projected increase in SSS-related cargo and the effects this increase would have on the surface transportation system. This research project was undertaken to examine the extent to which current conditions favor the development of SSS in Texas and whether the effects of an increase in SSS on the highway and rail networks in Texas should be included in TxDOT's planning process. The scope is limited to dedicated freight, combined freight, and passenger traffic but does not examine the rather unique aspects related to the recreational cruise industry.

This research examines the potential for SSS in the context of today's regulatory and fiscal environment. Although potential changes in the existing regulatory structure are mentioned, the report does not contain specific prescriptions for structural change nor gauge the magnitude of the potential effect of policy or economic incentives on the existing paradigm. This project takes a bottom up approach in which existing data on trade flows within the region and the ports that participate in this trade are used to analyze the prospects for SSS in the region.

PROJECT BACKGROUND

The Landside Picture: Growing Congestion on All Modes

In North America, regional, national, and trans-national cargo movement has been transformed from a largely maritime enterprise during the first centuries of continental development to a predominantly land-based enterprise with the extensive development of national railroad networks in the nineteenth century and national highway networks in the twentieth century.

Freight movement over these networks has expanded through their ability to meet shipper needs for reliable, time-sensitive services at costs that the market can bear.²

However, according to the Government Accountability Office, “Increases in freight volume coupled with current rail, roadway, and port capacity problems...are stressing the capacity of the U.S. transportation system and interfering with the efficient movement of...goods. Estimates made in 2003 suggest that growing international trade and domestic production will increase overall freight traffic by 70 percent by 2020. Adding this much freight to the transportation system is particularly worrisome since the system is currently showing signs of strain (1).” In addition to the problem of severe congestion, air quality is becoming a severe problem in a growing number of metropolitan areas.

The growth in goods movement is actually accelerating, with:

- truck traffic projected to double by 2025,
- international container traffic expected to quadruple, and
- rail traffic projected to increase by 70 percent (2).

International trade is projected to reach two billion tons within the next 20 years —twice today’s level (3).

With the continuing demand and growth in international trade, the emergence of severe congestion along major trade corridors could paralyze portions of national industrial sectors dependent on this trade and have substantial adverse impacts on other sectors as well. The U.S. Chamber of Commerce claims that congestion is already becoming a drag on U.S. competitiveness. As policy makers and stakeholders seek mitigating solutions to the possibility of landside freight transport network paralysis, maritime transport has again emerged as a potential solution and outlet for interregional North American trade.

At the same time that the volume of cargo is swelling at the nation’s ports—including the gulf ports—a shortage of truck capacity is developing. Approximately 17,000 trucking companies have gone out of business in the last few years (4). While the highway system remains the backbone of freight movement in the United States, the uncomfortable marriage of forcing freight and passengers to share the same capacity is becoming less feasible. According to the National Chamber Federation’s “A Study of North American Port and Intermodal Systems,” the highway system that carries 60 percent of domestic freight has experienced a doubling of vehicle miles traveled in the past 20 years while total highway miles have increased 1 percent (5). Officials from MARAD have stated in multiple presentations that the approximate cost to construct a new mile of highway is \$32 million and that it costs \$100 million for an interchange. At an average cost of \$32 million per mile, a 15-mile, four-lane section of interstate highway costs \$1.9 billion, without the cost of interchanges or bridges and the associated environmental

² Some of the information presented in Chapter 1: Introduction and Background has been borrowed from a previous TTI report: *Analysis of Start-Up Cross-Gulf Short Sea Shipping Activities With Mexico Since 1990: Problems and Opportunities* by C.J. Kruse, D.H. Bierling, and N. Vajdos. SWUTC/04/473700-00021-1. Southwest Region University Transportation Center, College Station, Texas. August 2004. Borrowed sections include those on commodities, cargo types, vessels, and overview U.S. Gulf port system. The borrowed information has been reviewed, updated, and augmented for this study, as applicable.

impacts (6). Furthermore, every new asset that is added to the existing land system also adds a new financial burden in terms of maintenance and upkeep that will need to be funded in perpetuity.

Taken as a whole, this evidence suggests that if the United States devotes its resources entirely to the further development of surface freight transportation while not simultaneously developing its marine assets, it will continue to see diminishing returns to scale. U.S. history shows that marine transportation once played a vital role in domestic freight commerce before being displaced by faster and, in most cases more direct, land corridors. Now that those land corridors are at capacity and are not quite as fast as they once were, the pendulum may be swinging the other way. However, the question of whether it has swung far enough for marine commerce to begin to accommodate substantial volumes of cargo from the more established truck and rail modes is still open. In the trans-Texas corridor concept, freight is envisioned to shift from routes that are more direct to routes that are sometimes less direct but more reliable. The potential success of coastal transportation relies on the same basic principal.

Short sea shipping is one component of the marine transportation system that has attracted a substantial amount of discussion at the national level. A precise and universally accepted definition of short sea shipping has not been established; however, most will agree that while deep-sea shipments “normally consist of cargo moving over open ocean between continents,” short sea shipping operations “normally consist of cargo moving within a single continent over coastal waters...(7).” MARAD uses a definition of short sea shipping that includes cargo moving along navigable inland waterways³, and others consider it to include trans-continental shipping via the Panama Canal (8). This project uses the narrower (first) definition, and will limit the geographical area to the U.S., Mexico, and Central America. Any service operating in the coastal zone from Texas to Panama would most likely schedule a series of coastwise movements, which is a classic case of SSS. The islands of the Caribbean are not included given their close proximity to Florida, and the low probability that an increase in U.S.-Caribbean trade would significantly impact Texas. Furthermore, these services have no land alternative and are therefore not instructive of the ability for short sea shipping to compete against other modes.

The perceived success of the European experience with short sea shipping has been a major factor driving interest in the United States. There has been a great deal of discussion in trade literature about the extensive movement of containerized freight on Europe’s inland waterway system and lessons that be applied to the U.S. context. However, it is important to recognize that important geographic and economic differences may make some comparisons unsound. Primary among them are the differences in population density and geographic dispersion of industry. Europe has a much higher overall level of congestion on its roadways. Furthermore, the freight rail system in Europe is, in general, less well developed than the passenger rail system. The European Union also facilitates trade among member states—a tool that is not present in the region included in this project.

Short sea shipping has been promoted to advance different, but often interrelated, goals. For example, a shift to SSS has been promoted as a method for reducing the impact of freight

³ The current Maritime Administrator, Sean Connaughton, has directed his agency (MARAD) to begin using the term “Marine Highways” as opposed to “Short Sea Shipping.” This report will use the term “SSS.”

transportation on air quality. Not only do short sea vessels produce fewer pollutants per ton/mile than trucks, the combustion also occurs further from population centers. Marine transportation can also be an extremely energy efficient method of transporting large quantities of freight. Depending on the cargo type, marine transport can relieve congestion from existing road or rail systems. Additionally, it provides a superior way to handle hazardous, overweight, and/or oversized cargoes under certain scenarios.

In the United States, the primary proponent of SSS within the federal government has been the U.S. Maritime Administration. MARAD held its first conference on short sea shipping in 2002 and incorporated the development of a short sea network into its strategic plan (9). MARAD has developed a website entitled “Welcome to America’s Marine Highway Initiative,” which brings together important information related to SSS (10). To date, MARAD has not been able to contribute financial assistance to SSS operators. Rather its role has been limited to the facilitation of information exchange such as organizing conferences and forums and creating an electronic clearinghouse for SSS-related research. MARAD has also participated in research efforts investigating several aspects of SSS.

Characteristics of Short Sea Shipping

The elements that make up short sea shipping from a conceptual framework are illustrated in Figure 1.

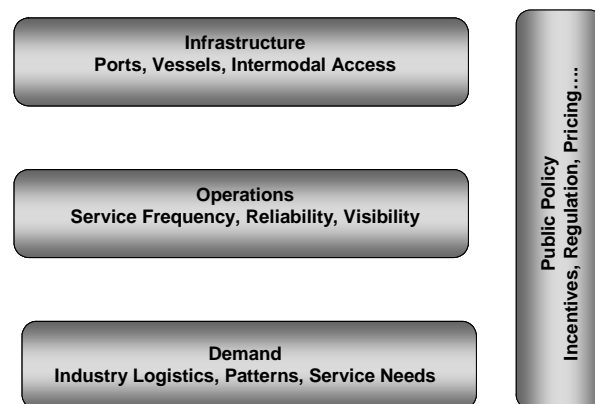


Figure 1. Characteristics of Short Sea Shipping.

Adapted from “Demand for Short-Sea Shipping: Key Issues and Next Steps”
presented by Jim Brogan to 3rd Annual Short Sea Shipping Conference
October 14, 2004
www.iei-corp.com/sssc2004/BroganPT1_MARADSSSConf.pdf

Cargo Handling Methods

As interest in short sea shipping has grown in recent years, so has the availability of recent literature on the technical aspects included in this topic. The literature discusses, particularly in the context of ventures and national programs in various regions of the U.S. (other than the Gulf Coast) and Europe, definitions of commodity handling, vessel characteristics, and existing policies and programs that are of influence. Some literature focuses specifically on SSS; other

literature focuses on SSS as part of a larger system of freight movement in general. One such report is the I-95 Corridor Coalition Multi-Client Port Access Project (7). This report provides a description of cargo handling methods, adapted as follows:

Short sea shipping operations typically handle several types of cargoes:

- **Bulk/breakbulk** – commodities such as coal, grain, lumber, steel, or petroleum. These types of commodities are well suited to shipment by barge, as they are high-weight and low-value goods and are typically not time-sensitive.
- **Roll-On/Roll-Off (RO/RO) cargo** – normally consists of rolling cargo, such as automobiles, trailers, or other chassis-mounted cargo. These types of shipments are well suited to short sea movements, as they do not need cranes for loading or unloading, and hence can be loaded and unloaded at congested or less-developed ports with little or no shore-side infrastructure.
- **Specialized cargo** – that which is too heavy or cumbersome to be transported by truck or rail. [Specialized cargo is sometimes referred to as project cargo.] Examples of such cargo include large electrical generation equipment, cranes, assembled drilling platforms, or other oversize/overweight cargo.

The I-95 Corridor Coalition report also includes containerized cargo and empty container repositioning as commodity categories. Ocean and domestic shipping containers are sometimes categorized with wheeled chassis in the use of the term intermodal. The Journal of Commerce defines short sea shipping intermodal cargo more narrowly:

- **Intermodal cargo** – “the concept of a waterborne intermodal system – an over-the-water version of the existing intermodal rail system that allows truck trailers, ocean containers, and domestic intermodal containers to be taken off of the road for the long-haul segment of their move” (8).

Another cargo category not particularly defined in the I-95 Corridor Coalition report is general cargo.

- **General cargo** – cargo “consisting of goods shipped unpacked or packed, for example, in cartons, crates, bags or bales, but specifically not cargo shipped in bulk, on trailers, or in shipping containers” (11).

Our approach is to examine short sea shipping trends in the Gulf of Mexico region that might affect Texas ports. In this context, all cargo modes, distances, volumes, etc. are considered so long as they are focused on the Gulf region.

Commodities

Table 1 shows a list of commodities handled at Gulf of Mexico ports (both U.S. and Mexican) compiled from information provided by the ports regarding their cargo operations. As shown in

the table, a large number of commodities are handled at these ports in all cargo type categories. Product listing is in no particular order of significance or importance.

Table 1. Commodities Handled at Gulf of Mexico Ports (12).

Bulk Cargo: <ul style="list-style-type: none"> • Petroleum/chemicals <ul style="list-style-type: none"> ○ General chemicals and petrochemicals ○ Carbon coke and coal ○ Fertilizer ○ Synthetic resins ○ Polyethylene ○ Ethylene glycol ○ Crude, diesel and gasoline ○ Liquid propane ○ Dimethylterephthalate ○ Terephthalic acid ○ Urea • Agricultural and food products <ul style="list-style-type: none"> ○ Sugar, honey, molasses ○ Orange juice and citrus pellets ○ Coffee ○ Soybeans ○ Vegetable oil ○ Grains <ul style="list-style-type: none"> • Bulk Corn • Bulk wheat • Bulk white corn • Bulk sorghum • Bulk Rice ○ Beer ○ Potable water • Bulk minerals <ul style="list-style-type: none"> ○ Iron ore and scrap ○ Fluorite, limonite, rutile ○ Zinc concentrate ○ Sodium sulfate ○ Bulk alumina ○ Sulfur and salt ○ Phosphate and lime ○ Sodium, potassium, selenium • Clay, limestone, aggregates, silica • Cement and concrete • Barite/drilling mud • Wood Products <ul style="list-style-type: none"> ○ Woodchips ○ Pulp wood 	Breakbulk and General Cargo: <ul style="list-style-type: none"> • Metallurgical <ul style="list-style-type: none"> ○ Steel (in various forms) ○ Sheet steel ○ Steel pipe ○ Metals ○ Steel ingots ○ Structural steel ○ Aluminum ○ Copper • Agricultural and food products <ul style="list-style-type: none"> ○ Bagged sugar ○ Bagged rice ○ Fruits <ul style="list-style-type: none"> • Bananas • Pineapples • Fresh fruits ○ Bagged grains ○ Bagged corn ○ Cotton ○ Cotton bales ○ Powdered milk ○ Meats <ul style="list-style-type: none"> • Poultry • Frozen poultry • Other meats • Gypsum sheetrock panels • Auto parts • Paper • Tiles • Henequen products • Wood products <ul style="list-style-type: none"> ○ Lumber ○ Plywood ○ Mahogany • Stone products <ul style="list-style-type: none"> ○ Aggregate ○ Sand, rock, stone ○ Granite ○ Limestone • Rubber 	RO/RO Cargo: <ul style="list-style-type: none"> • Containers (on chassis) • Trailers • Machinery and equipment • Automobiles • Heavy equipment • Rail cars and equipment Specialized (Project) Cargo: <ul style="list-style-type: none"> • Machinery and equipment • Metal structures • Heavy equipment • Oil field supplies and equipment • Pressure vessels (reactors) • Rail cars and equipment Containerized Cargo: <ul style="list-style-type: none"> • Chemicals and petrochemicals • Machinery and equipment • Automobiles and auto parts • Electrical appliances • Fruits and vegetables • Grains • Furs • Gypsum sheetrock panels • Perishables • Paper • Beer • Honey • Tiles • Auto parts • Perishable food products • Powdered milk • Products manufactured from henequen • Textiles from maquiladoras • Honey and perishables • Wood and stone for construction • Explosives • Twine
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Vessel Types

Vessel usage in maritime transport is driven by a number of factors, including

- availability,
- cargo volumes,
- shipping frequency and schedule,
- port infrastructure, and
- navigability (maximum drafts and sea conditions).

Given cargo demands and logistics considerations, the vessels used in shorter-distance regional short sea shipping operations are generally smaller than those used in trans-oceanic trades where high-volume economics drive vessel utilization.

Other considerations are the markets served and services provided by short sea shippers. Some operations focus exclusively on niche markets, for example transport of certain types of containerized traffic (refrigerated or food-aid) or petrochemical transport. Other operations function more as general cargo or “tramp” type services, adapting vessel usage, schedules, and operations according to available business and shipper needs.

The I-95 Corridor Coalition report presents a good discussion of vessel types typically used in SSS operations, adapted as follows:

There are several different types of vessels involved in short sea shipping operations, including pull barges, push barges, load-on/load-off (LO/LO) ships, RO/RO ships, and high-speed vessels.

- **Pull Barges** have a capacity of between 400 and 700 TEUs and are capable of handling between 150 and 270 53-foot domestic containers. Containers are secured on deck and stacked three or four high. These barges also handle bulk and breakbulk cargo. Barges are typically pulled by 5000 horsepower tugs at a speed of approximately 10 knots (11.5 miles per hour). Pull barges are common in U.S. short sea shipping operations due, in part, to federal regulations governing domestic maritime trade.
- **Push Barges** are similar to pull barges with the exception that there is a cut-out in the stern of the barge for a tug. The tug and the push barge are lashed together to act as a single vessel, allowing for greater speed and efficiency as compared to traditional pull barges.
- **Load-On/Load-Off Vessels** are used to transport containers in short sea shipping operations. They are self-propelled vessels similar in design to large, ocean-going container ships, but are much smaller, with capacity between 100 and 1000 TEUs. Some LO/LO vessels include deck-mounted cranes. Although these cranes reduce storage capacity on board the vessel, they allow for easy loading and unloading of containers at ports without adequate shore-side cranes.
- **Roll-On/Roll-Off Vessels** are used in short sea shipping of rolling cargo. RO/RO vessels typically call on smaller and less-developed ports, reducing

the need for cargo handling systems and personnel and lowering port costs. These vessels carry trailers, chassis-mounted containers, cars, and other rolling machinery, and sometimes use a “drive-through” system with access both forward and aft that speeds the loading and unloading process. The capacity of RO/RO vessels is typically half that of a LO/LO vessel of similar size, as cargo cannot be stacked (due to wheels) and significant space is needed for on-load and off-load ramps. The reduced capacity of RO/RO ships is at least partially offset by the reduced cargo handling and port costs accrued by these vessels.

- **High-Speed Vessels** are capable of attaining speeds of 28 knots (32 mph) or higher. There are several types of fast ships, including catamarans, hydrofoils, and traditional displacement ships utilizing lighter construction materials. These ships can attain speeds well above traditional tug-barge combinations and containerships, decreasing the transit time between ports-of-call. Though prototypes of several fast ships are currently in use along short-sea and coastal routes in the South Pacific and Europe, they have not yet been deployed in the U.S.

The I-95 Coalition Corridor report also discusses high-speed vessels that are “capable of attaining speeds of 28 knots (32 mph) or greater,” noting that these types of ships “have not yet been deployed in the US.” (7) Other vessel types not defined in the I-95 Corridor Coalition report but typically encountered in short sea trade in the Gulf of Mexico include tankers and general cargo ships:

- **Tankers** are “ships designed for the carriage of liquid in bulk, her cargo space consisting of several, or indeed many, tanks. Tankers carry a wide variety of products including crude oil, refined products, liquid gas, and wine. Size and capacity range from the ultra large crude carrier (u.l.c.c.) of over half a million metric tons to the small coastal tanker of a few hundred metric tons. Tankers load their cargo by gravity from the shore or by shore pumps and discharge using their own pumps” (11).
- **General Cargo Ships** are ships designed to carry general cargo, “often having several decks because of the number of ports served and the range of products carried” (11).

Another vessel design which may merit future consideration is the **Float-on/Float-off vessel (FO-FO)**. With this design, the ship is partially submerged during loading and discharging. Traditionally, this type of vessel has been used to permit oversized indivisible cargo to be floated into position for deck stowage. The reverse procedure is used at the destination port where the load is floated from the submerged deck that is ballasted down for the outturn. The vessel travels with its deck and load above the water.

Potential Effect on Texas

There are several subcategories of short sea shipping that may be developed in the Gulf region:

- shipping between U.S. and Mexican/Central American ports (international),

- Dedicated U.S.-Mexico service
- Piggyback on existing rotations of international carriers
- coastwise shipping between U.S. ports (domestic), and
- shipping via the Gulf Intracoastal Waterway.

A significant increase in these activities could result in the need for upgraded or additional waterfront facilities at one or more Texas ports. Additionally, as cargo volumes increase, so will train and truck traffic related to landside distribution of that cargo. Dredging could become a concern in certain instances, particularly for affected ports with shallower channels and berths.

OVERVIEW OF U.S. GULF PORT SYSTEM

The United States portion of the Gulf of Mexico supports a well-developed port system comprised of ports and terminals with a wide range of capabilities. These facilities range from small shallow-draft ports to some of the nation's largest port complexes. Thirty-one of these ports have joined together to promote the port industry and share best management practices under the auspices of the Gulf Ports Association of the Americas. Geographically, they cover an area from Brownsville, Texas, to Tampa Bay, Florida. The Association also has a Mexican component stretching from Altamira to Progreso with which these ports interact.

“Most [U.S. Gulf] ports are autonomous local governmental entities, one [Galveston] is a municipal utility, and two [Gulfport and Mobile] are state port authorities.... Gulf ports contribute over \$50 billion annually to the U.S. economy and provide almost three-quarters of a million jobs directly related to port activity” (13).

Gulf ports handle the vast majority of bulk cargo that is imported into and exported out of the United States, most of which is crude and petrochemical related. They occupy 13 spots among the top 25 ports in the country for foreign cargo volume (seven are in the top 10). Almost 1.2 billion tons of cargo moved through the Gulf ports in 2005 (14).

In 2006, Houston handled roughly 70 percent of all container traffic in the Gulf. Gulfport handled about 9% and New Orleans was third, handling approximately 8% of the Gulf's containerized trade (15).

Finally, Gulf ports play a significant role in national defense efforts. Two Texas ports—Beaumont and Corpus Christi—collectively handled one-third of the military cargo shipped in support of Operation Enduring Freedom/Iraqi Freedom. The U.S. Navy has ships homeported in Pascagoula, Mississippi, and Ingleside, Texas (16). The Ports of New Orleans, Houston, and Beaumont are home to MARAD National Defense Reserve Fleet vessels, with training ships located in Mobile and Galveston (17). Several Gulf ports are also home to major shipbuilding sectors of national defense contractors.

It is important to keep in mind that tonnage figures reported for these ports do not necessarily reflect tonnage moved through the port-owned facilities. In most cases they represent a port complex as defined by the Army Corps of Engineers. For example, tonnage reported for the Port

of Houston reflects tonnage handled at both publicly-owned and privately-owned facilities along the length of the Houston Ship Channel.

Service Providers

A wide variety of service providers are required to make a short sea shipping service successful. Among them are:

- vessel operators,
- stevedores,
- chassis pool managers (for containerized cargo),
- warehouse operators,
- terminal owners,
- container inspectors (repairs, and certifications),
- customs brokers, and
- freight forwarders.

Existing Services

At the time of this report, there were only a few successful services in the Gulf that met the researchers' definition of short sea shipping services. They include:

- American Eagle Tankers,
- CG Railway (a subsidiary of International Shipholding Corp.),
- Industrial Maritime Carriers,
- Linea Peninsular, and
- Osprey Line.

CG Railway's rail-on-ship service to Mexico has been expanded recently by investments in the reconstruction of two vessels to double their capacity.

ORGANIZATION OF REPORT

[Chapter 2](#) examines the current trade between Texas and Mexico/Central America. It provides an overview of the commodities that flow between ports in this region and the ships that carry them. Container traffic is analyzed separately from all other types due to the unique infrastructure and equipment employed in the container trade. The chapter concludes with observations on what the data indicate for Texas and possible triggers that might cause an abrupt increase in SSS activity in the region. While none of the triggers are highly likely to occur in the short term, they could have a strong impact in the event they do come to pass.

[Chapter 3](#) examines the potential role of the GIWW in handling coastwise trade and the possibilities of developing a viable oceangoing coastwise domestic trade in the Gulf. While not the primary focus of the project, the chapter also discusses the effect that a feeder service from a Caribbean port could have on Texas by allowing shipments to arrive closer to their final destination rather than arriving at a load center port and then proceeding by truck to a wide range of destinations.

[Chapter 4](#) looks at the types of vessels that would most likely be used in a developing SSS industry. Because of the high capital cost involved in building new vessels, it is most likely that in the short to medium term SSS operators would acquire existing vessels and retrofit them to meet their specific requirements. The chapter also discusses a new SSS operation that has been announced for Freeport, Texas.

[Chapter 5](#) brings the previous three chapters together in an analysis of the likely effects of SSS on the Texas transportation system in the short to medium term. It specifically looks at the:

- adequacy of channels and docks,
- available cranes,
- vessel dimensions, and
- required storage space.

It also provides a very high level view of the potential highway traffic effects of SSS and identifies areas that might merit further examination.

[Chapter 6](#) provides a summary and conclusions derived from this research effort. It also identifies potential planning or research next steps that might be pursued in the analysis of SSS effects.

CHAPTER 2: INTERNATIONAL SHORT SEA SHIPPING POSSIBILITIES (TEXAS-MEXICO, TEXAS-CENTRAL AMERICA)

OVERVIEW

In an effort to gain a thorough understanding of the short sea shipping market between the U.S. and Mexico/Central America as it stands today, the researchers examined the port pairs that are involved in trade between each other. While trade between Texas and Mexico continues to grow, this trade is almost exclusively dependent on trucks and as such, leads to significant transportation cost penalties for several interior regions of Mexico. The penalties of inefficient transportation are even more pronounced for Central America. The increased use of marine transport for trade between Texas and its trading partners in Mexico and Central America has the potential to lower transportation costs and thereby retain a logistics cost advantage over China and other East Asian competitors. Because of the different types of cargoes that move within the region, it was necessary to look at cargoes first on the basis of tonnage and then on the basis of container volumes measured in TEUs. The data reported here are for calendar year 2005.

PORTS

The geographic locations of ports in Texas, Mexico, and Central America that were analyzed are shown on [Figure 2](#). The port names and countries that were included in the study are listed in [Table 2](#).



Figure 2. Geographic Location of Ports Included in Study Analysis.

Table 2. Listing of Ports Included in Study Analysis.

Texas Ports	Mexican and Central American Ports
Beaumont	Altamira (Mexico)
Brownsville	Tuxpan (Mexico)
Corpus Christi	Veracruz (Mexico)
Freeport	Coatzacoalcos (Mexico)
Galveston	Dos Bocas (Mexico)
Houston	Progreso (Mexico)
Port Lavaca-Point Comfort	Punta Venado (Mexico)
Port Arthur	Puerto Barrios (Guatemala)
Texas City	Santo Tomás (Guatemala)
	Puerto Cortes (Honduras)
	Puerto Limón (Costa Rica)
	Colon (Panama)

SERVICES

There are very few SSS services currently operating exclusively between the U.S. and Mexico/Central America that are not captive to a particular enterprise. None of these non-captive services call any of the Texas ports. There are two such services worthy of mention.

- Linea Peninsular travels between Progreso, Mexico and Panama City, Florida
- CG Railways, Inc. travels between Coatzacoalcas, Mexico and Mobile, Alabama.

There is container service offered by Maersk and Seaboard Marine as part of a larger rotation. Great White Fleet and Dole Ocean Liner Express serve primarily Chiquita and Dole but also accept third-party cargoes. In addition, both of these operations offer service to regions outside the defined research area.

Linea Peninsular

This container service has been in operation for more than 20 years, connecting the ports of Panama City, Florida and the port of Progreso, Mexico. The service was recently based in Port Bienville, Mississippi, but moved to Florida after Hurricane Katrina. The most relevant characteristics of this service are: (18)

- a three-day ocean transit,
- five round-trip voyages each week, and
- a fleet of six European-designed vessels that are capable of handling both containerized and non-containerized cargo services.

CG Railways, Inc.

This service carries railcars between the ports of Coatzacoalcas, Mexico, and Mobile, Alabama. CG Railway, Inc. is a subsidiary of International Shipholding Corporation that connects the railways of Southern Mexico to the railways serving the United States and Canada (19). The most relevant characteristics of this service are:

- sailing frequency of four days,
- 60-car capacity per voyage (the company is adding a second deck to the vessels in order to double the capacity),
- direct connection to the Mexican railway network,
- when required, single Bill of Lading and invoicing, and
- two-vessel fleet.

Texas Transportation Institute's (TTI's) 2004 report to the Southwest Region University Transportation Center titled Analysis of Start-Up Cross-Gulf Short Sea Shipping Activities With Mexico Since 1990: Problems and Opportunities (hereafter referred to as the SWUTC SSS start-up report) also describes historical SSS services between U.S. Gulf Ports and Mexico. The report discusses associated barriers and incentives to operations identified by shippers and ports.

ANALYSIS OF CURRENT TRADE

Information obtained from the Journal of Commerce's Port Import Export Reporting Service (PIERS) for vessel calls at Texas ports in calendar year 2005 was analyzed to identify existing cargo movements by commodity and port between Texas and Mexico/Central America. Commodities were grouped by Harmonized System Codes at the 2-digit level. These data are used in the following analyses.

Dry and liquid bulk cargoes dominate trade between Texas and Mexico/Central America. The literature and researcher experience indicate that these bulk cargoes are not likely to contribute to the growth potential of SSS in general. For purposes of this analysis, all liquid cargoes consisting of oil or related products were removed from the database. These cargoes are often tied directly to specific plants and are solely dependent on those plants. Dry bulk was included in the analysis to identify whether potential opportunities might exist in that area.

2005 Trade Analysis by Tonnage

Ports Included in Tonnage Analysis

Some non-Texas ports either have very small trade volumes, or their trade volume with any Texas port does not exceed 100,000 tons. These ports include:

- Progreso,
- Puerto Cortes,
- Tampico,
- Dos Bocas, and
- Colon.

Analysis of trade between Texas and these ports was eliminated, leaving nine non-Texas ports to analyze.

Exports from Texas to Non-Texas Ports by Tonnage

Ninety-six percent (96%) of the total exports by tonnage from Texas to ports in Mexico and Central America are concentrated in five commodity groups:

	<u>Metric Tons</u>
Organic Chemicals ⁴	1,780,748
Cereals ⁴	1,263,738
Plastics & Articles Thereof	295,945
Inorganic Chemicals ^{4,5}	160,445
Animal, Vegetable Fats and Oils	132,039

⁴ Expected to benefit from trade agreements with Mexico

⁵ Expected to benefit from CAFTA-DR

Analysis of Texas Export Cargoes:

Organic chemicals: Approximately 1,044,650 tons (59% of total) was exported to Altamira. Another 357,612 tons (20%) went to Coatzacoalcos and 331,688 tons (19%) went to Tuxpan. Approximately 83% of these exports originated in Houston/Texas City.

Cereals: Some 95% of the cereal exports went to Veracruz. Approximately 68% of this amount was shipped from Houston, while 32% was shipped from nearby Galveston.

Plastics: Of the total exported, 226,378 tons (76%) was shipped from Corpus Christi to Altamira. The remaining 24% was shipped from Freeport to Puerto Barrios.

Inorganic chemicals: Of the total exported, 117,919 tons (73%) was shipped to Altamira. Approximately, 58% of these shipments to Altamira originated in Port Lavaca-Point Comfort; 38% came from Corpus Christi. Another 21% of the total shipments went from Houston to Tuxpan.

Animal, etc.: Roughly 99% of this trade is from Houston to Veracruz.

Imports from Non-Texas Ports to Texas by Tonnage

Ninety-six percent (96%) of the total imports by tonnage to Texas from the target ports in Mexico and Central America are concentrated in four commodity groups, with limestone alone accounting for 77% of the total:

	<u>Metric Tons</u>
Salt, Sulphur, Earth & Stone, Lime & Cement ⁶	2,371,181
Edible Fruit, Nuts	384,851
Plastics & Articles Thereof	126,494
Articles of Iron or Steel ⁴	91,963

Analysis of Texas Import Cargoes:

Salt, Sulphur, etc.: 100% of these imports come from Punta Venado (limestone from Calica). They were distributed in Texas as follows:

- Houston 53%,
- Freeport 15%,
- Corpus Christi 11%,
- Port Arthur 11%, and
- Brownsville 10%.

Edible Fruit, Nuts: Of the total imported, 212,776 tons (55%) went from Santo Tomas to Galveston. Another 172,074 tons (45%) went from Puerto Barrios to Freeport. The cargo in this category was primarily bananas and other fruit.

⁶ Expected to benefit from trade agreements with Mexico

Plastics: Almost all (99.6%) of this trade was from Pajaritos to Port Lavaca-Point Comfort.

Articles of Iron or Steel: Almost all (98.5%) of this trade went from Veracruz to Houston.

2005 Trade Analysis by Container Traffic

Ports Included in Container Traffic Analysis

In Texas, only three ports are regularly involved in container trade: Houston, Freeport, and Galveston. Only four ports account for 88% of all container flows in the non-Texas project area:

- Puerto Cortes,
- Puerto Barrios,
- Puerto Limon, and
- Santo Tomas.

These are the only non-Texas ports included in the container trade analysis. Fifty-three percent (53%) of the trade with these four ports was from Texas to Central America, and 47% were imports into Texas.

Containerized Exports from Texas to non-Texas Ports

Sixty-six percent (66%) of the total containerized merchandise exported from Texas to the ports in Central America is concentrated in five commodity groups:

	<u>TEUs</u>
Plastics & Articles Thereof	25,203
Paper & paperboard, Articles of Pulp	5,676
Cotton	2,808
Vehicles, Parts and Accessories	2,437
General Cargo	2,185

Analysis of Containerized Texas Export Cargoes:

Plastics & Articles Thereof: Freeport accounted for 63% of exports in this category; Houston accounted for 36%. In 2005, 9142 TEUs were shipped to Puerto Limon, accounting for 36% of the total for this commodity group, and 6822 TEUs went to Puerto Barrios, or 27% of the total. An additional 5150 TEUs (20%) went to Santo Tomas, with the remaining 17% going to Puerto Cortes. These containers were primarily cargo shipped on the backhaul trip of fruit carriers, 81% of which (by TEUs) call at Freeport.

Paper & Paperboard: Houston accounted for 49% of the exports in this category, while Freeport accounted for 27% and Galveston accounted for 23%. The destinations for the TEUs in this category were distributed as follows:

- 1867 (33%) went to Santo Tomas,
- 1484 (26%) went to Puerto Cortes,
- 1318 (23%) went to Puerto Limon, and
- the remaining 18% went to Puerto Barrios.

As with plastics, these containers were primarily cargo shipped on the backhaul trip of fruit carriers, which call primarily at Freeport.

Cotton: Houston dominated cotton exports with 73% of the total; Freeport handled 27%. Of the total exports, 1243 TEUs (44%) went to Santo Tomas, 929 (33%) to Puerto Cortes, and the remaining 23% to Puerto Barrios.

Vehicles, etc.: This traffic was much more concentrated—2,322 TEUs (95%) went to Puerto Cortes. Approximately 49% departed from Houston, while the remainder was exported through Freeport. These are primarily used automobiles being transported by *transmigrantes* returning to Central America.

General Cargo: This is not well defined and therefore was not analyzed.

Containerized Imports from non-Texas Ports to Texas

Eighty-five percent (85%) of the containerized merchandise coming into Texas from the identified ports in Central America is concentrated in four commodity groups:

	<u>TEUs</u>
Fruit, vegetables, etc.	30,368
<i>Edible fruit, nuts</i>	28,334
<i>Other edibles</i> ⁷	2,034
Articles of apparel	4,783
<i>Articles of apparel, acc., not crochet</i>	3,728
<i>Other articles of apparel</i>	1,055
Rubber and articles thereof	3,540
Coffee, tea, mate, and spices	2,450

Analysis of Containerized Texas Import Cargoes:

Fruit, vegetables, etc.: Freeport receives 81% of the cargo in this category. Galveston receives 11%, and Houston receives 7%. Of the total imported, 18,721 TEUs (62%) came from Puerto Barrios; 6,856 (23%) from Puerto Cortes; 4,304 (14%) from Santo Tomas; and 486 (2%) from Puerto Limon.

Articles of apparel: Houston accounted for 84% of the imports in this classification, with Freeport handling the remainder. In this category, 4,209 TEUs (88%) came from Puerto

⁷ Oil seed, oleagious fruits, grain, seed, fruit, edible vegetables and certain roots and tubers, vegetable, fruit, nut, etc., food preparations, sugars and sugar confectionery, miscellaneous edible preparations, and fish, crustaceans, mollusks, aquatic invertebrates

Cortes. The remainder was split between Santo Tomas and Puerto Barrios. As a consequence of the increase in apparel imports into the U.S. from Asia, Central American countries have been experiencing a decrease in exports to the U.S. in this market. However, the implementation of the CAFTA-DR agreement might reverse this trend, especially since the U.S. and Mexico signed a customs cooperation agreement that allows apparel produced in Central America incorporating certain fabric and other inputs from Mexico to qualify for duty preferences when exported to the United States under CAFTA-DR (20).

Rubber: All (100%) of this cargo came from Puerto Limon and was imported through Houston.

Coffee, etc.: In the category of coffee, 964 TEUs (39%) came from Puerto Cortes, 918 (37%) from Santo Tomas, and 569 (23%) from Puerto Limon. All of this cargo was imported through Houston.

OBSERVATIONS

When traffic is analyzed according to tonnage, 96% of the total is constituted by five commodities. When containerized cargoes are examined separately, the commodities are somewhat more diverse. The containerized cargo is driven by the fruit/vegetable producers in Puerto Barrios and Puerto Cortes. The apparel traffic is driven by trade through Puerto Cortes. Four basic commodity groups account for 85% of the imports. The exports are much more diverse. They include supplies for fruit and vegetable producers and cargoes of convenience.

Limited Trade Volumes

As shown in Table 3, except at the ports of Freeport and Galveston, the proportion of trade between Texas deep-water ports and Mexican/Central American ports to the total trade volume is comparatively not very substantial in terms of tonnage and container movement. Frequency of service and lack of backhaul cargo, both tied to trade volumes, were top barriers to SSS start-up ventures as cited by carriers and U.S./Mexican ports in the SWUTC SSS start-up report.

Table 3. Share of Mexico and Central America in Total Trade by Tonnage and TEUs.

U.S. PORT	Percentage of Tons	Percentage of TEUs
Beaumont	7%	-
Brownsville	12%	-
Corpus Christi	11%	-
Freeport	23%	98%
Galveston	30%	96%
Houston	12%	5%
Point Comfort	4%	-
Port Arthur	16%	-
Texas City	18%	-

Note: This table does not include oil and its sub-products.

Competition and Service Operations

There appears to be only a small probability that a start-up venture would be able to successfully compete for any significant amounts of cargo in any of the commodity categories discussed previously, although a well-targeted niche service could succeed. The reasons are as follows:

- It would be difficult for a new dedicated service to compete for any cargo shipped by liner services in which the origin port and destination port are part of an existing string. Several containership lines already have regular strings that connect Houston with ports in Mexico such as Altamira and Veracruz. When a modest amount of new cargo materializes, liner services moving between these ports are usually able to fill empty space and can therefore be very aggressive on their pricing.
- Any interested party wanting to participate in the container trade is going to have to be able to provide a critical mass of containers. To date, this has been a major obstacle for start-up ventures and small operators. More than eighty percent of the container movement in the region is concentrated in four shipping lines, as shown in [Table 4](#):

Table 4. Percentage of Container Traffic by Shipping Lane.

Shipping Line	Traffic Percentage
Maersk Sealand	26%
Great White Fleet (U.S.) Ltd.	22%
Dole Ocean Liner Express	21%
Seaboard Marine	12%
Other	19%
Total	100%

Great White Fleet is the shipping arm of Chiquita Brands, but it accepts third-party cargo on a space-available basis. Dole Ocean Liner Express is also part of Dole Foods, but it, too, is seeking third-party cargo. Maersk and Seaboard Marine both offer their services within a larger rotation.

Any increase in traffic flow could most probably be absorbed by these companies, unless the increase was both sudden and substantial. All of these operations already have weekly, and in some cases bi-weekly, services between Texas and Mexico and/or Central America. [Figure 3](#) presents the existing scheduled container services in the region.



Figure 3. Scheduled Container Services in the Project Analysis Region.

- On the import side, the “salt, sulphur, earth & stone, lime & cement” category is by far the dominant commodity. Currently, one hundred percent of this cargo is limestone originating in Punta Venado, Mexico. It is distributed among five Texas ports. Houston receives 53%, while the other four handle roughly equal shares of the remainder. Assuming that a high percentage of the material imported into Texas is used in heavy construction, this distribution could change if the concentration of highway and heavy construction changes in the coming years.

Based on estimates contained in the TxDOT Transportation Improvement Plan for FY 2006–2008, Houston and Freeport could possibly gain more of this cargo at the expense of Port Arthur and Corpus Christi. [Table 5](#) provides a summary of the TxDOT construction budget by port of entry. It is important to note that this table indicates that 77% of the construction budget is for projects located within the immediate hinterland of the Port of Houston. However, shipping data indicate that some of the Houston area material is imported through Freeport. The shipping data indicates that it would be more appropriate to expect 61% of the total to come through Houston and 17% through Freeport.

Table 5. 2006–2008 Transportation Improvement Plan Construction Budget by Port Area.

Port of Entry	TxDOT Dist	Const. Budget (\$000's)	% of Total Const. Budget	% of Total Shipments	% of 2005 Imports
Port Arthur	Beaumont Lufkin	263,469	8	8	11
Houston	Houston Bryan	2,607,984	77	61	53
Freeport	Yoakum	40,611	1	17	15
Corpus Christi	Corpus Christi	142,005	4	4	11
Brownsville	Pharr	321,691	10	10	10

U.S. anti-dumping duties on Mexican cement are being phased out. As a consequence, Cemento Apasco and Cemex are planning to increase their cement exports from Mexico into the U.S. While virtually none of this cement is being imported through Texas ports at the present time, Cemento Apasco's plant near Veracruz is planning to ship 400,000 tons annually from that port to Houston by 2009. There is a strong possibility that existing services will add vessel calls to accommodate this growth.

- The edible fruits category is almost entirely bananas/fruit coming out of Central America on vessels controlled by the producers and discharging in Houston and Freeport. Dole, Chiquita, and Del Monte move their product in containers, while Turbana uses primarily pallets. When looking at weight, the market is split 55/45 Santo Tomas versus Puerto Barrios. However, when looking at containers the market split is 62/23 Puerto Barrios versus Puerto Cortes.

Again, it would be difficult for another entity to compete for this cargo. It would appear that the only way for any other port to benefit from this trade would be to convince one of the producers to move their entire importing operation to another port. The Port of Galveston indicated that they did not expect to see any appreciable changes in volume for fruit imports in the foreseeable future.

- For plastics and animal, vegetable fats, and oil, there does not seem to be a growth trend present that would require any additional capacity. Roughly 33% of the plastics tonnage is actually backhaul cargo for the fruit carriers in Central America. It would be extremely difficult for a new party to compete for this traffic.

The plastics imports are almost 100% shipments arriving at Port Lavaca-Point Comfort from Pajaritos. This cargo is destined for Formosa Plastics' facilities, and is strictly dependent on Formosa's production levels. There is no opportunity to divert this cargo.

- Roughly 99% of the imports of articles of steel and iron originate in Veracruz and terminate in Houston. It is beyond the scope of this project to determine the final destination of this shipments, but typically these articles are imported to facilities that do further processing or for the oil industry. It would be difficult to divert this cargo. It

should be noted that the auto industry is heavily dependent on steel and steel products, and auto manufacturing plants have announced plans to expand in Mexico and in Texas (e.g., Toyota in San Antonio). This industry might require additional steel and steel products in their production. However, given the high volatility in the steel market, it is difficult to predict the sourcing of these products.

- An entrenched shipping system was identified by carriers and U.S. ports as one of the more important barriers to SSS start-up ventures in the SWUTC SSS start-up report.

Trade Agreements

Exports of organic chemicals, inorganic chemicals, and cereals from the U.S. are all expected to benefit from trade agreements. NAFTA's 2008 changes in grain imports to Mexico are expected to increase the movement of corn into that country, principally through Veracruz. However, plans to increase ethanol production in the U.S. could have an effect on the amount of corn that is shipped to Mexico and other countries. There is the possibility that existing services might add vessel calls to accommodate growth. This would affect primarily the ports of:

Houston/Texas City	Organic Chemicals
Houston, Galveston	Cereal
Port Lavaca, Corpus Christi, Houston	Inorganic Chemicals

As shown in [Table 6](#), except at the ports of Freeport Vessel and Galveston, the proportion of trade with Mexican and Central American ports to the total volume is not very significant.

Table 6. Mexico and Central America Share of Tonnage and TEUs in Individual Ports.

U.S. PORT	SSS Tonnage as Percent of Port Tonnage	SSS TEUs as Percent of Port TEUs
Beaumont	7%	-
Brownsville	12%	-
Corpus Christi	11%	-
Freeport	23%	98%
Galveston	30%	96%
Houston	12%	5%
Point Comfort	4%	-
Port Arthur	16%	-
Texas City	18%	-

Note: This table does not include oil and its sub-products.

Vessel and Port Characteristics

As listed in [Table 7](#), the physical dimensions of the most common container vessels arriving to Texas ports from Mexico or Central America are well below the maximums allowed by the ports. This indicates that the effect of this trade on Texas port infrastructure will be minimal.

Table 7. Vessel Characteristics for U.S.-Mexico/Central America Trade.

Vessel Name	Vessel Type	Draft (meters)	DWT	TEU Capacity⁸
Olmecca	Chemical Tanker	9.2	15,472	-0-
Maya	Tanker	8.8	12,451	-0-
Aztecca S	Tanker	8.8	11,629	-0-
Santa Clara	Liquefied Gas Tanker	6.8	7,850	-0-
<i>Stolt:</i>				
Stolt Hikawa	Tanker	7.2	8,080	-0-
Stolt Taurus	Tanker	8.8	12,749	-0-
Stolt Titan	Tanker	8.8	12,691	-0-
Stolt Ntaba	Tanker	8.8	13,946	-0-
Ikan Veracruz	Bulk Carrier	10.7	37,681	-0-
Ionía	Bulk Carrier	11.1	37,522	-0-
Emerald Star	LPG Tanker	8.5	7,572	-0-
<i>Great White Fleet:</i>				
Courtney L	Container	8.3	15,593	950 (418 ref)
Edyth L	Container	8.3	15,672	950 (418 ref)
Frances L	Container	8.3	15,646	950 (418 ref)
Chiquita Belgie	Refrigerated Cargo	10.0	13,930	331
<i>Dole Ocean Liner Express:</i>				
Herm Kiepe	Container	9.2	13,059	942 (234 ref)
Dole Europa	Refrigerated Cargo	9.2	10,288	
Dole Costa Rica	Container	8.7	11,800	910 (384 ref)
<i>Seaboard Marine:</i>				
Orso	General Cargo	6.5	5,250	518
Seaboard Explorer	General Cargo	8.2	7,982	652 (84 ref)
CEC Meadow	General Cargo	8.2	8,973	653 (84 ref)
Mexica	General Cargo	9.1	12,768	428 (35 ref)
Anna K	General Cargo	9.1	12,685	436 (32 ref)
<i>Maersk Sealand:</i>				
Aurette A	Container	9.0	17,275	1,223 (126 ref)
Rothorn	Container	9.3	14,587	1,122 (150 ref)
Ara J	Container	9.0	16,833	1,122 (120 ref)
Weisshorn	Container	9.3	14,643	1,122 (150 ref)
Pollux	Container	10.2	18,425	1,129 (150 ref)
Jork	Container	9.3	14,700	1,122 (150 ref)
H Kirkenes	Container	10.8	20,887	1,550 (246 ref)
W H Blount	Bulk Carrier	13.0	65,402	-0-
Bernardo Quintana	Bulk Carrier	13.2	67,044	-0-
<i>Del Monte Fruit:</i>				
Valencia Carrier	Refrigerated Cargo	8.1	19,126	215 (32 ref)
Alicante Carrier	Refrigerated Cargo	10.1	15,200	400
Green Summer	Refrigerated Cargo	7.3	6,522	-0-
<i>Hapag Lloyd:</i>				
Bonn Express	Container Ship	12.5	45,977	2,803 (154 ref)
OOCL Fortune	Container Ship	12.5	44,433	3,161 (168 ref)
Tuxpan Reef	General Cargo	6.3	5,215	349 (45 ref)

Source: Lloyd's Register of Ships

⁸ "Ref" = "refrigerated"

WHAT COMMODITIES MIGHT BE A TARGET FOR SSS NEW SERVICE?

Corpus Christi

The Port of Corpus Christi is beginning to focus on the possibility of establishing a feeder service for cargo transiting the Panama Canal on vessels that may not be scheduled to come to the Gulf.

According to port executives, one enterprise is talking to the Port of Corpus Christi about moving cotton from other parts of the country to the proposed La Quinta terminal. However this service could not begin prior to the opening of the La Quinta terminal which will not begin operation prior to 2011.

Corpus Christi began moving about 45,000 tons/year for Frontera Produce in Edinburg, TX, starting in November of 2005. These movements occur primarily in the November to May period.

The research team has interviewed a business that is attempting to establish a RO/PAX⁹ service between Corpus Christi and Central America. This venture has progressed to the point where funding sources and the vessel to be used have been identified. At this time, the business is conducting a formal feasibility study in order to finalize financial arrangements.

Houston and Others

The Port of Houston Authority has identified some opportunities that may hold some promise for future short sea shipping activity. One area that is being targeted would be the imports of fruit and other goods from the Tabasco region of Mexico for H.E.B. and possibly other grocery chains. Also, there is the possibility of moving foodstuffs and maintenance materials to the hotel operations in Cozumel and Cancun.

The research team has interviewed one firm that is interested in establishing a SSS containerized service between Houston and southern Mexico. The target markets at this time are primarily beverages and foodstuffs.

Brownsville

According to port officials there are three potential short sea shipping operations that are currently being investigated. The National Shipping of America service, which plans to begin calling Freeport, has also been in contact with Brownsville officials; however, any expansion to Brownsville would probably not occur until after the Freeport service is well established. In addition, port officials have been in discussion with two container-on-barge carriers, one which would use an ocean going barge to reach Tampa, and the other which would use a deck barge to move containers to the Port of Houston via the Gulf Intracoastal Waterway. The Brownsville to Tampa service is estimated to cost about \$1100 per container on average.

⁹ "RO/PAX" is roll-on/roll-off and passenger service. This would involve primarily trucks, cars, and people.

There has been some effort to pre-arrange stable sources of containerized cargo in order to better ensure that these potential start-up services have a reliable customer base. Electronic manufacturers in Reynosa have been identified as one potential source of containerized cargo that could help a SSS operation in Brownsville achieve a critical mass of exports.

POSSIBLE TRIGGERS FOR FURTHER SSS DEVELOPMENT

Panama Canal Feeder Service

It is possible that as the Panama Canal expands its capacity and greater volumes of cargo move through that route, one or more major liner services may decide to establish a transshipment hub in Panama with a feeder service into the Gulf that would use more adequately sized, smaller vessels for that trade route. Should this occur, it could have a direct impact on Houston and Corpus Christi (once the La Quinta Terminal is constructed), and may allow the establishment of new container services in other Texas ports.

The expansion of the Panama Canal would likely result in a new lane of traffic parallel to the current Panama Canal through the construction of a new set of locks, which will double capacity and allow more traffic and longer, wider ships. This will allow large container ships to establish hubs on the Atlantic Ocean side of the Canal from where smaller feeder vessels could distribute cargo throughout the Gulf of Mexico and Central America. According to the Panama Canal Authority, the Caribbean and Central America TEU trans-load container volume through the Canal is expected to double from six to 12 million TEUs in the next 10 years (21). They do not distinguish between Central America and the Caribbean in their statistics, so it is difficult to determine how SSS volumes, as defined in this project, might be affected. Nevertheless, assuming they are correct, there could be a noticeable increase in SSS traffic as defined in this project.

Disruption in the Trans-Pacific Trade

In the summer of 2007, U.S. Senators from both parties repeatedly raised the possibility of trade sanctions against China. On July 26, the U.S. Senate Finance Committee approved legislation that would put higher duties on Chinese imports to compensate for an undervalued Yuan (22). Any significant disruption in U.S.-Chinese trade would likely cause a rapid shift in production to Mexico and Central America. The textile industry in Central America would be a possible beneficiary, as would the Mexican electronics sector. This is the type of rapid expansion that would cause a paradigm shift from trade between Texas and the project region that would eclipse the capacity of current services. For such manufacturing capacity to be established in Central America, it will be necessary to have an efficient SSS operation connecting those facilities to the United States.

Some established trade patterns have been changing recently. The increase in fuel costs and disruptions in supply chains from Asia to the U.S. market have caused some large manufacturers to shift production closer to the consumer. These factors and the implementation of the CAFTA-DR agreements would make Southern Mexico and Central America more attractive for production of U.S.-bound goods. Some maquiladora assembly plants have been re-established in

Mexico, closer to the consumer. A viable SSS operation from Southern Mexico and Central America could develop if manufacturers establish plants in sufficient volume in this region.

Changes in Cabotage Rules in North America:

Several studies have identified the Jones Act¹⁰ as an important limitation to expanding SSS in the region. Mexico has similar cabotage limitations that limit the expansion of these services in the Gulf of Mexico. There has been some discussion regarding the creation of a “NAFTA flag,” which would make it easier for a service to call at multiple ports in each country. Such changes in the rules could help SSS gain additional cargo that is currently moving over land.

As mentioned earlier, several initiatives to establish a U.S.-Mexico-Central America SSS operation are under analysis. Changes in the cabotage rules, not only in the U.S. but also in Mexico would make the feasibility of these operations much more likely. Operation costs would be reduced and operators could have a more flexible ship deployment plan between U.S., Mexico, and Central American ports.

No detailed analysis of the potential of a NAFTA flag has been made. At this point it is only a concept. Furthermore, it is not yet clear whether the interest groups that oppose any weakening of the Jones Act would be any more receptive to an arrangement that would only include NAFTA countries. However the Memorandum of Co-operation on Sharing Short Sea Shipping Information and Experience between the transportation authorities of the United States of America and Mexico that was signed in November 2003, could be the framework through which the implementation of a SSS operation in the Gulf of Mexico using the NAFTA flag could be analyzed.

Other Carrier and Port-Suggested Triggers

In the SWUTC SSS start-up report, shipping carriers suggested measures that they perceived would promote start-up SSS ventures between the U.S. and Mexico. The highest-rated of these measures include:

- development of better market data,
- federal shipbuilding assistance,
- exemption from harbor maintenance taxes,
- public/government education and marketing,
- use of highway funds for congestion mitigation, and
- tax incentives for vessels and capital investment.

As with shipping carriers, U.S. and Mexican ports suggested measures they perceived would promote start-up SSS ventures between the U.S. and Mexico in the SWUTC SSS start-up report. The highest-rated of these include:

- tax incentives for vessels and capital investment,
- better market data,

¹⁰ The Jones Act requires that cargo that has both its origin and destination in the United States must be handled by a U.S.-built, U.S.-owned, and U.S.-crewed vessel.

- federal funds for infrastructure development, and
- waiving the Jones Act.

CHAPTER 3: ANALYZE POSSIBILITY OF INCREASING COASTWISE TRADE AND FEEDER SERVICE TRADE

As discussed earlier, SSS could consist of either international or domestic cargo movements. [Chapter 2](#) analyzed international SSS movements in the study region. This chapter will focus primarily on U.S. domestic trade but will also briefly examine the potential impacts of feeder services that would operate from a Caribbean base.

IMPORTANT COMPETITIVE FACTORS

The variables at play in determining the potential use of short sea shipping for cargo movements between two domestic ports are different from the variables that impact international shipments. There are several external factors that may generally improve the competitiveness of waterborne freight traffic for domestic movements including:

- a sustained increase in the cost of energy (price of crude),
- an increase in federal or state diesel taxes (from which maritime vessels would be exempted),
- an expansion in EPA's Congestion Mitigation and Air Quality Improvement Program (CMAQ) or Texas Emission Reduction Plan (TERP) funding,
- increased congestion for competing modes,
- tightening of enforcement or the placing of surcharges for overweight trucks,
- restructuring of the Jones Act,
- elimination of the Harbor Maintenance Tax,
- further tightening of trucker hours-of-service regulations, and
- additional restrictions on hazardous materials movements.

From discussions with shippers and reviews of recent trends, the authors of this report concluded that the factors most likely to have a significant impact on domestic waterborne commerce in the near future would be:

- tightening of enforcement or the imposition of surcharges for overweight trucks,
- elimination (or restructuring) of the Harbor Maintenance Tax¹¹, and
- additional restrictions on hazardous materials movements.

Elimination of the Harbor Maintenance Tax

SSS proponents often mention the elimination of the Harbor Maintenance Tax (HMT) as a way to encourage domestic coastwise movements. Congress enacted the Harbor Maintenance Tax in 1986 to recover a portion of the cost of maintaining the nation's deep-draft navigation channels (the tax does not apply to the Inland Waterway System). The amount of tax paid by the shipper, who owns the cargo, was based on the value of the goods being shipped. In addition, a cost-

¹¹ "The Great Lakes Short Sea Shipping Enhancement Act of 2007" which would eliminate the HMT for Great Lakes shipments and set a precedent for the rest of the nation, was introduced to the House of Representatives on Feb 12, 2007.

share formula was implemented for improving (widening and deepening) harbors and channels, with local port sponsors paying a part of the cost and the federal government paying a portion from the general treasury.

Congress decided to fund 40 percent of maintenance costs from the HMT. An ad valorem tax, rather than a tonnage tax, was chosen to minimize the impact on U.S. exports, particularly price-sensitive bulk commodities. Originally, revenue for the Harbor Maintenance Trust Fund was generated by assessing a .04 percent fee (HMT) on the value of export, import, and domestic cargo moving through the nation's deep draft ports. In 1990, Congress more than tripled the HMT (0.125 percent) to recover 100 percent of maintenance dredging expenses. The U.S. Supreme Court issued a short, unanimous decision in March 1998 finding the HMT unconstitutional as applied to exports. The decision states that the HMT is a tax, not a user fee, because the ad valorem tax is not a fair approximation of services, facilities, or benefits furnished to the exporter. (Exports are protected from taxation in the constitution because of their importance to the health of the nation.)

Restructuring of the Jones Act

Factors such as an increase in diesel taxes and the restructuring of the Jones Act were judged to have significant potential to aid waterborne commerce but were also deemed unlikely. "Since cross-gulf shipping is international in nature, it would seem that the Jones Act would only affect the ability of a foreign vessel to call on more than one port in the United States and thereby increase its revenue potential" (12).

Cost of Energy

It is commonly assumed that higher energy prices due to the increased price of crude oil will aid waterborne transport. The authors however, have found evidence that in the short run, the opposite is likely to be true. While it is correct that water transport has inherent energy advantages over other modes, most shippers who currently use water transport are extremely sensitive to transportation costs. Therefore, while an increase in energy costs may induce some shippers to shift to the water mode, it is equally likely to force other shippers to not transport their cargo by any mode should prices become uneconomic (23).

Congestion

Congestion is another putative factor that was found not to be compelling, in most cases, in favoring mode shift to water. The reason is that shippers of non-time sensitive products, the type which would travel by water, have substantial opportunities to avoid road congestion if they so choose (24). Rail congestion, which is not tied as closely to time of day, is a potentially more salient factor. Still, it was found that the congestion abatement benefits of water transportation will likely be a more compelling factor for the associated public benefits than the private benefits realized by individual shippers.

Restrictions on Hazardous Materials Movements

In examining the comparative density of various cargo types, it is clear that chemical traffic between Houston and New Orleans and beyond is a key area where waterborne transportation

could take a larger role. The map from Union Pacific (Figure 4) shows that east-west rail traffic in chemicals is one of the highest in the nation; furthermore, it is the highest chemical corridor in the west or central United States that has a clear coastal alternative. The declining tolerance of the civilian population for hazmat shipments passing through residential areas also favors the greater utilization of water corridors for these cargoes. Still, chemicals are a highly profitable market area for the railroads. Union Pacific's revenue for chemical cargo has increased to over \$2000 per carload (25).

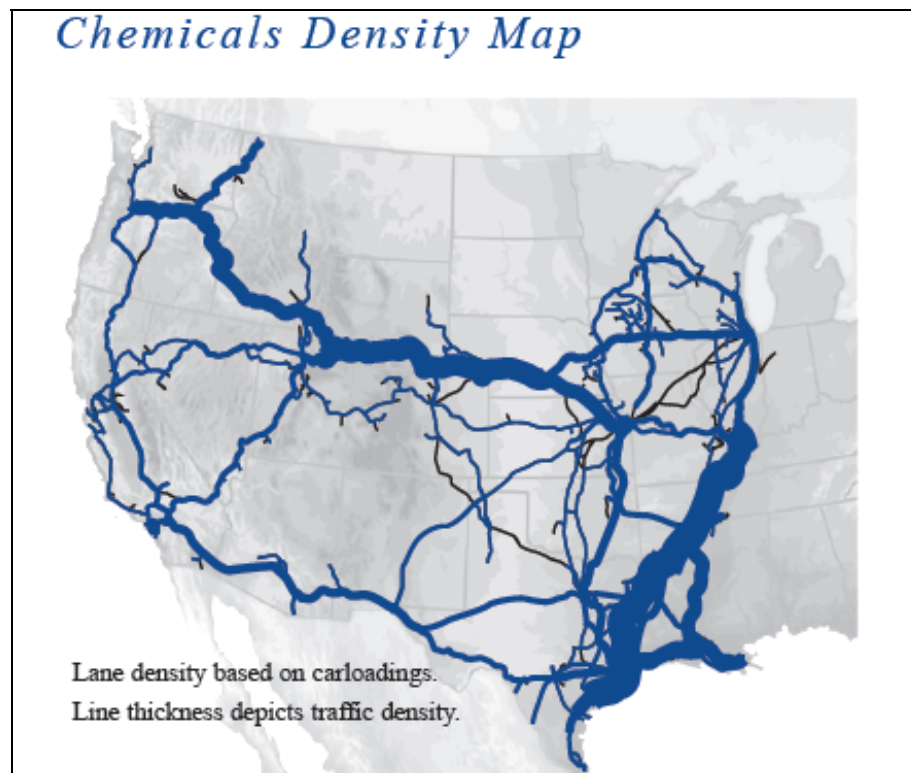


Figure 4. Major Chemical Corridors for the Union Pacific Railroad.

Source: Union Pacific

Shortage of Equipment

The researchers also found from interviews with towing companies that at present all of these factors are subsumed by more immediate concerns such as a shortage of barges and tugs. For this reason the researchers began the coastwise portion of the research project by examining the profile of marine assets available in Texas that could be used more effectively.

The following section analyzes options for better utilizing the GIWW for all cargo types. It then narrows the focus to containerized options by examining the potential transferability of the Osprey model for container-on-barge. The chapter then examines mode shift options that would not use the GIWW. It concludes by reviewing the overall best practices and strategies that were identified.

THE POTENTIAL ROLE OF THE GIWW

When considering options for increasing coastal trade, it makes sense to consider options that are limited to the GIWW separately from those that use the open ocean. The vessels are different for the two options and typically involve different types of operators.

The GIWW is one of two major intracoastal waterway networks in the United States. The GIWW, which runs from South Texas to Western Florida, has a sister system known as the Atlantic Intracoastal Waterway (AIWW) which runs from Virginia to Northern Florida. While the physical characteristics of the two waterways were similar at the time of construction, the role they have historically played in economies of their respective regions is quite different. U.S. Army Corps of Engineers Waterborne Commerce Data indicates that the GIWW carries over 120 million short tons of cargo annually. The Atlantic Intracoastal Waterway carries slightly over 2 million tons, a figure that has dropped precipitously in recent years. [Figure 5](#) illustrates the difference in volume.

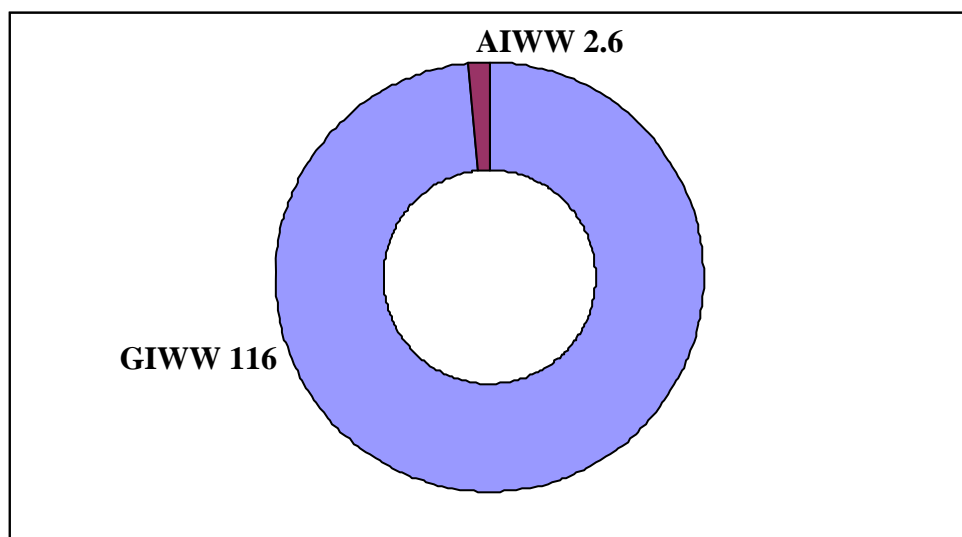


Figure 5. Comparison of Tonnage Between the Gulf Intracoastal and Atlantic Intracoastal Waterways (millions of short tons).

Source: USACE Waterborne Database Statistics Center, 2005

One of the most significant reasons for the dominance of the GIWW is the movement of petroleum, which makes up roughly half of the total tonnage on the waterway. However, even when the impact of petroleum is removed, the tonnage carried on the AIWW barely registers when compared with that of the GIWW. Under the original concept, the AIWW was supposed to have been connected to the GIWW by means of a barge canal built across Florida. While approximately 30% of the cross-Florida canal was completed, the project was abandoned due to cost and environmental reasons in the 1970s. After this occurred, the Gulf portion of the waterway continued to flourish independently as it connected 15 deep-draft ports with an even greater number of shallow-draft facilities. These economies did not exist on the Atlantic side, despite the fact that several of the country's larger container ports such as Hampton Roads, Savannah, and Jacksonville are linked together by means of the waterway. Funding by the Corps

of Engineers for maintenance dredging has gradually been scaled back and currently most of the waterway is unsuitable for commercial navigation with a controlling depth of 7–9 feet. The primary uses of the AIWW are now for commercial and sport fishing and recreational boating.

It is important to call attention to the plight of the AIWW to clearly demonstrate that if a critical mass of cargo is not maintained on the GIWW, it could possibly meet a similar fate. Given that funding for waterway dredging and maintenance is tied to cargo volumes, it is comparatively easy to envision a scenario where the GIWW could enter a negative feedback loop in which:

Funding cutbacks → reduced controlling depth → lighter vessel loading → higher transportation costs → modal shift away from water → reduced cargo volumes → further funding cutbacks

Figure 6 shows the composition of cargo that is currently handled on the GIWW. The composition of cargo is important because it gives an indication of which alternative mode would be most likely employed for these shipments if they could not use the GIWW. With the exception of petroleum, the cargo carried on the GIWW is similar to the cargo handled by railroads. Agricultural and manufactured goods currently make up a comparatively small share of total cargo on the waterway. However, these commodity types would be the primary niches for containers on the waterway should that sector develop further in the near future.

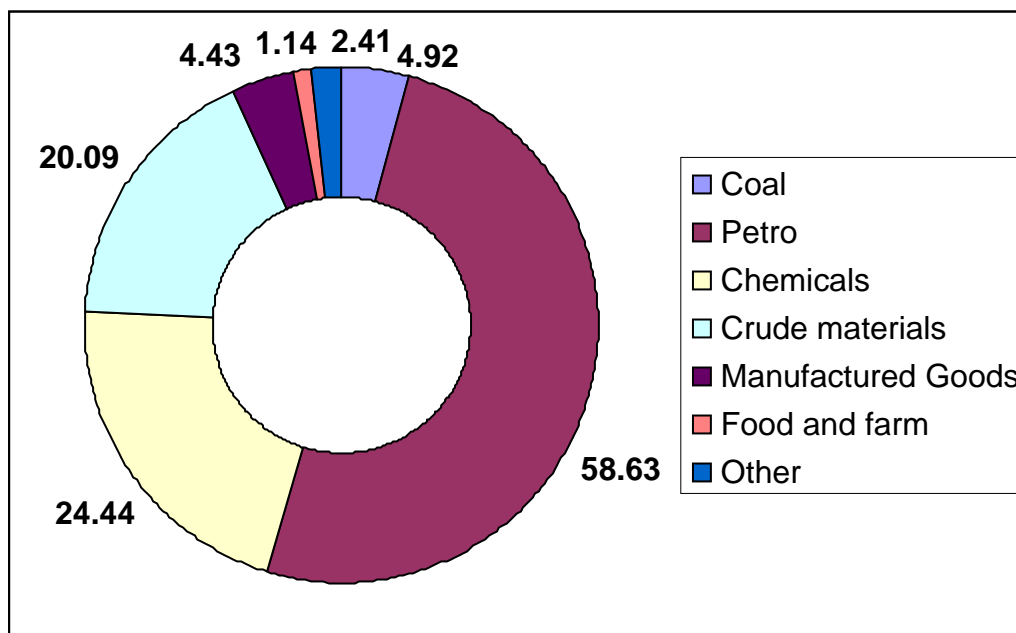


Figure 6. Cargoes Handled on the Gulf Intracoastal Waterway (millions of short tons).

Source: USACE Waterborne Commerce Statistics Center, 2005

Figure 7 and Figure 8 show the comparative differences in cargo volumes between Texas and the other gulf states. Inbound and outbound cargo is roughly balanced between Texas and Louisiana

yet highly imbalanced between Texas and Florida. Almost all of the cargo Texas sends to Florida via the GIWW is petroleum-based. As a result, a significant number of tank barges must move unloaded part or all of the way back to Texas. One of the more intuitive future products to move in these empty tank barges would be ethanol (26).

United States Envirofuels, a Tampa-based firm, is in the process of developing an 88 million gallon ethanol facility to be opened in 2008. While most of the initial production would be intended for the Florida market, they have examined the possibility of sending ethanol to the Port of Houston on tankers or liquid barges that currently return empty (27). This strategy could be replicated all along the Gulf Coast but could potentially be most successful in the Mississippi Delta due to the ability to bring in the feedstock (primarily corn) efficiently from the Midwest via river barge.

Another corn-based ethanol production facility is reported to be in development near Victoria, Texas (28). Lone Star Ethanol has plans for a production capacity of 100 million gallons annually (29).

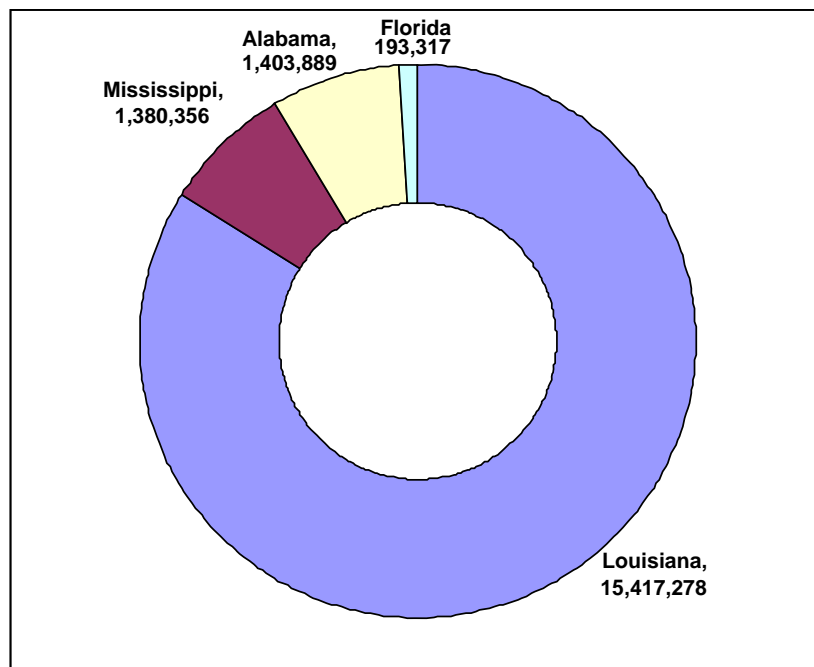


Figure 7. Shipments to Texas from Gulf Coast States (tons).
Source USACE Navigation Data Center 2004

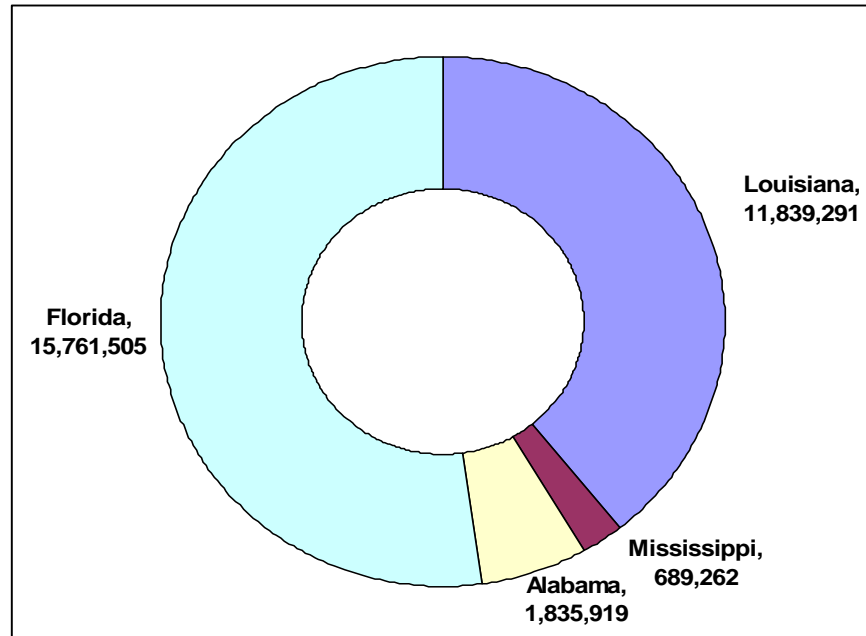


Figure 8. Shipments from Texas to Other Gulf States (tons).

Source: USACE Navigation Data Center 2004

THE OSPREY MODEL FOR CONTAINER ON BARGE

Osprey Line, based in Houston, is one of the most significant and well-known container on barge (COB) operators in the United States. It is also the only dedicated COB operator currently using the GIWW. In 2006, Osprey moved 45,000 TEU. The Osprey Houston-New Orleans service takes 3.5 days and can accommodate up to six barges per tow.

The researchers' interview with Osprey, confirmed by secondary sources, revealed that the Osprey business model has changed significantly since its takeover by Kirby Corporation in 2006. Kirby increased its ownership of Osprey from 1/3 to 2/3 in early 2006 with Cooper/T. Smith owning the other 1/3 share (30). Osprey has recently scaled back its operations somewhat. The *M/V Sea Trader*, which is a specially modified short sea vessel that was seen by some as a model for a future open water short sea fleet, was taken out of service after Hurricane Katrina due to the loss of its largest market. Another pivotal point was the decision for Osprey to end its lease at the Port of Baton Rouge, which had been seen as a key example of a successful COB operation at a smaller port. This decision was taken by Osprey primarily due to the need to more intensively utilize its assets in an environment of skyrocketing barge rates. These two cases shed some light on the current fragility of coastal container shipping operations.

Osprey representatives have indicated that they will continue to use the traditional tugs and barges rather than expanding into a self-propelled blue water fleet. Kirby's market strategy is dependent not so much on the types of vessels that they are using but rather on the future availability of cargo that would allow them to expand their current niche.

According to Osprey, it would be very difficult for another firm to open and compete with their business because of the symbiotic relationship that has now been established with Kirby. The pairing of Osprey and Kirby at first glance might seem odd given that Kirby is almost exclusively a tank barge operator. However, due to its size (as the largest tank barge operator in the United States), Kirby must often reposition its power units from one market to another. The fleet of container barges developed by Osprey gives Kirby a way to avoid deadheading by transporting Osprey container cargo primarily between Houston and New Orleans (31). This advantage would make it difficult for a start-up firm that would deal exclusively in containers to compete on price with Osprey/Kirby. Osprey's business will likely continue to grow in line with Kirby's, which in the last year saw its overall profit grow by 48%. However it currently appears unlikely that there will be a group of Osprey-style operators entering the market for long-haul COB transport in the near future (32).

NON-GIWW OPTIONS

Not all container-on-barge operators use barges that are limited to protected waterways. Columbia Coastal, a New York-based firm, is a COB operator that runs regular services along the East Coast such as between New York and Boston. The company's fleet of barges and tugs are exclusively ocean-going. Their tugs have approximately 4500 horsepower and a 20-ft draft. Their barge capacities range between 300–800 TEU. Ocean going barges and tugs for containerized cargo are relatively rare in the United States; however, they offer a number of potential advantages over tugs that use the protected waterways. One advantage is that they are able to sail as the crow flies which could represent a significant efficiency gain if shipments are going all the way to Florida. Ocean going barges can also utilize greater economies of scale due to their larger size and deeper draft.

Finally, ocean going barges do not have to queue for locks. Raymond Butler, Executive Director of the Gulf Intracoastal Canal Association (GICA), has estimated that the average barge and tow combination will spend 12 hours in queue to transverse the four locks between Houston and New Orleans (33). The primary disadvantage of the ocean-going barges is that they have decreased flexibility to utilize small ports that were designed around the limitations of the GIWW. For example, a Columbia Coastal vessel could theoretically serve the Port of Port Isabel in Texas but not the Port of Victoria. Tradeoffs such as these will be discussed in greater detail in Chapter 4.

OPTIMAL LENGTH AND TYPE OF HAUL FOR COB?

While the most well known container-on-barge service in Texas currently employs interstate routes that are meant to compete with intermodal rail or long-haul trucking, there is also a significant potential market for shorter-haul services that move between a port and a distribution center in a nearby urban area, thereby skipping over congested urban corridors.

The benefits of COB can be categorized in several ways including:

- potential abatement of congestion,
- pavement damage,
- energy consumption, and
- air pollution.

Some benefits such as pavement damage are roughly equivalent regardless of the time or place the abatement occurs, while others such as congestion and air quality are contingent on where and when trucks are removed from the roadways. Because the Port of Houston only operates its gates during the daylight hours, it is potentially highly beneficial to shift truckloads that would otherwise be taken to/from the port during daylight hours to an alternative mode such as water. Variables such as these would have to be quantified in determining the extent of potential public interest in competing COB options.

Recent studies such as the New York Bi-State Freight Ferries Study conclude that short haul freight ferry services have the best chance of success in niche markets, and until all of these potential markets have been exploited, water operators should not attempt to compete on price with land-based modes for general cargoes (34). Many of the short haul services would be roll-on / roll-off (RO/RO). Figure 9 is a photo of the Detroit-Windsor Truck Ferry, a classic RO/RO operation.



**Figure 9. The Detroit-Windsor Truck Ferry:
Example of a Short Haul RO/RO Service.**

It provides faster loading and unloading but far lower capacity than a comparative load on/load off service.

Source: <http://www.truckferry.com/>

THE FEEDER OPTION: RADIATE CARGO TO MORE TEXAS PORTS FROM CARIBBEAN TRANSSHIPMENT HUBS

To eliminate unnecessary truck trips from Texas roads, it may be more efficient in the long term to look earlier in the supply chain. Most of the COB options discussed previously assume that cargo has arrived in Houston and now must move to its eventual destination somewhere else along the Gulf Coast. Yet, if containers need to go to South Texas, for example, it would be more efficient for the container to arrive directly at a South Texas port without having to first stop in Houston.

Many lines that currently serve the Port of Houston first arrive at a transshipment port in the Caribbean. Feeder ships then take the containers on to Houston while the larger ships continue

to other destinations. For example, the CMA-CGM PEX2 service which delivers Asian cargo to Houston uses a feeder line from Kingston, Jamaica.

Feeder ships require draft of slightly over 20 feet when loaded and have a capacity of 500–600 TEUs. They are typically slower than the larger container ships (16-18 knots); however, some have speeds as fast as the low 20s.

Major transshipment hubs that could feed alternative Texas ports in the future include:

Kingston, Jamaica

Kingston has plans to expand from a capacity of 1.9 Million TEUs in 2005 to 3.2 Million TEUs by 2009. The expansion includes six new post-Panamax cranes (35).

Port of the Americas, Puerto Rico (under construction)¹²

The Port of the Americas will be the first major transshipment hub on U.S. territory. The growth of the Port of the Americas depends on both Asian and South American trade growth. The project was originally slated for 2.2 million TEU capacity but has been scaled down due to high construction costs and lowered growth forecasts. The Port of the Americas Master Plan calls for opportunities for adding value to most shipments. Therefore, the role of the Puerto Rico port would be somewhat different from that of the other ports in the region. Puerto Rico is also the only potential transshipment port that would have access to domestic 53 ft containers.

Distance to Texas ports: Assuming speed of 20 knots

- Brownsville: 3 days 17 hours
- Corpus Christi: 3 days 19 Hours
- Houston: 3 days 2 hours

Horizon Lines has a Jones Act fleet that services Puerto Rico with a direct call service to Houston from San Juan every ten days. The vessel is estimated to have an operating speed of 16 knots, with a five-day sailing time.

Freeport, Bahamas

Freeport, Bahamas is an eight-year-old port which currently processes 1.5 million TEU annually.

Distance to Texas Ports: Assuming speed of 20 knots

- Brownsville: 2 days 6 hours
- Corpus Christi: 2 days 6 hours
- Houston 2 days 0 hours

¹² Given the authority of Jones Act regulations on Puerto Rico, it is appropriate to regard direct or transshipment cargo emanating from Puerto Rico within the realms of domestic short sea operations.

Caucedo

This Dominican Republic hub is seen as a threat to some of the more established hubs due to its low labor rates. Hapag Lloyd switched its transshipment hub from Kingston to Caucedo in 2006 (36).

CHAPTER SUMMARY AND PRELIMINARY CONCLUSIONS

There are at least five primary opportunities already identified for domestic coastwise shipping that demonstrate the ways in which waterborne freight can take significant volumes of cargo off the major road and rail corridors.

Shorter Haul Container-on-Barge Utilizing the Gulf Intracoastal Waterway

These options should be focused on the coastal hinterland of the Port of Houston stretching from Victoria in the south to Beaumont in the east. These shorter services could possibly be competitive:

- with dray trucking as they can avoid gate congestion,
- are efficient for return empty cargo, and
- do not encounter locks.

There is currently comparatively less demand for additional longer haul COB services that would make use of the GIWW for destinations such as New Orleans. The longer-haul COB services such as Osprey will continue to grow in order to carry cargo such as agricultural goods and containerized hazmat. However the strongest growth potential is in shorter-haul dray-competitive shipments as opposed to shipments that compete with long-haul trucking. When the La Quinta container port opens, its coastal hinterland will likely stretch to the Rio Grande Valley. These services would become even more viable in a context of stricter enforcement against overweight trucks or regional emission reduction requirements.

Current Model:

Ship – POH – Dray – Distribution Center – truck – customer

Alternate model:

Ship – POH – Barge – Distribution Center – truck - customer

Domestic Cross Gulf Services Using Ocean-Going Tugs and Barges

As the market develops, it is more likely that longer haul domestic SSS services will use ocean going barges and tugs that are too large and deep to use the GIWW but present more compelling economies of scale. The services would also be faster since they would not be subject to congestion associated with locks on the GIWW and would have faster operating speeds.

Feeder Services to/from Emerging Caribbean Transshipment Hubs

The impact of feeder operations from Caribbean transshipment hubs is somewhat difficult to classify in this project's international vs. domestic dichotomy. While the cargo is international, the impact of a greater number of domestic spokes for containerized cargoes would have an

impact on the system that is quite analogous to using COB to move containers from Houston to other Texas ports. If feeder ships are able call ports such as Corpus Christi or Brownsville directly, they can eliminate the need to move cargo for nearby destinations. By all indications, there is a very good chance that feeder from the Caribbean is still in its infancy and will grow in the coming years.

Expansion of Traditional Cargoes on the GIWW

Rail is the largest carrier nationwide of grain, coal, aggregate, and chemicals. These commodities also frequently move on the GIWW. If more bulk cargoes now handled by rail move to waterborne transport, there may be more opportunities for rail to take intermodal traffic away from the roads.

Opportunities to Shift More Chemical/Hazardous Cargo to the GIWW

The rate of growth will be tied in part to possible stricter hazmat restrictions on rail. New types of hazmat commodities such as ethanol have only recently begun to substantially increase in the marketplace.

CHAPTER 4: TYPES OF VESSELS AND PORT FACILITIES

INTRODUCTION TO SSS VESSELS

[Chapter 1](#) includes a discussion of several different vessel types that have shown applicability to a variety of short sea shipping operations. This chapter discusses vessel types that could be used in the future, paying comparatively more attention to those vessels that are certified for domestic routing and appropriate for near-term deployment. For the purposes of simplicity, the chapter focuses only on options for containerized cargo. Vessel types and operations that are discussed in this chapter are not solely confined to the project region, but are those that have been identified by the research as having the potential for some role in SSS operations involving Texas ports.

Several Texas ports have expressed a broad and sustained interest in supporting short sea shipping. [Chapter 3](#) of this report discusses the potentially valuable role that the Gulf Intracoastal Waterway may play in this equation. At the same time, it should be noted that in order for a system of moving containerized cargo over water to be fully functional and compete with rail and trucks, the use of vessels capable of operating in the open sea will likely be required.

Predicting the proper mix of vessel types is important from a planning perspective, as it will help to determine

- the Texas ports that are currently best suited to host short sea shipping services¹³,
- upgrades to existing infrastructure that may be required to allow other ports to participate in future short sea shipping services,
- the magnitude of the potential impact on roadway congestion¹⁴, and
- the cargo types that might be candidates for modal switch¹⁵.

The calculus for SSS differs markedly for international vs. domestic options. For international SSS operations connecting Texas to Mexico or Central America, a large variety of vessels could potentially be used. The researchers believe that future international short sea vessels calling at Texas ports would be unlikely to differ markedly from the smaller container vessels that already call at existing container handling terminals such as Houston's Barbours Cut or Port Freeport. At burgeoning container ports such as Freeport, there has been a significant shift towards dock cranes as opposed to shipboard cranes. As opposed to the "dray competitive" container-on-barge options that were described in [Chapter 3](#) and their appropriateness for roll-on/roll-off, international movements are expected to be almost exclusively lift-on/lift-off.

For domestic short sea options, the current legal structure in the United States greatly restricts the availability of open-ocean-capable vessels. The United States shipbuilding industry does not have significant recent experience constructing small agile vessels for handling containerized

¹³ Based on draft requirements and crane availability

¹⁴ Based on available ship capacity

¹⁵ Based on vessel speed

cargo. However the U.S. remains competitive in the construction of certain ship types such as barges/tugs and vessels connected to offshore oil production. It is these ship types, therefore, that form the most logical foundation for a domestically built short sea fleet. This chapter focuses on ways in which the existing fleet of Jones Act-certified vessels could be reborn for short sea use and associated implications for TxDOT.

The two most promising vessels of this classification are:

- oceangoing (articulated) barges and tugs, originally designed for the movement of liquid bulk, and
- retrofitted offshore supply vessels (OSV).

The low margins associated with domestic waterborne transport suggest that the industry could not support dedicated new build ships at this stage of development without heavy subsidies. A third alternative ship type that may prove viable in certain circumstances are passenger ferries that can also carry a limited amount of freight. In the American context, operating subsidies for a ferry service that principally carries passengers would likely be more acceptable than for an exclusive freight carrier.

The availability of true container handling ships that are Jones Act-certified is extremely limited. Still, it is possible that a few Jones Act-certified container vessels may come available for new domestic services in the near future. The researchers spoke with Horizon Lines, the largest Jones Act carrier in the country, which is considering the redeployment of at least one vessel currently employed in the Puerto Rico trade to a mainland service. The researchers also spoke with National Shipping of America, a start-up carrier that has acquired a single Jones Act vessel and is planning to begin a service departing from Port Freeport in 2008.

MAJOR SHIP TYPES

Retrofitted Offshore Supply Vessels

The *Osprey Sea Trader*, the most famous short sea vessel in Texas, is a retrofitted OSV that was acquired by Mr. Rick Couch, President of Osprey Lines prior to Kirby Marine's takeover of the carrier, in order to move containers over the open ocean. At 286 feet, the vessel is significantly longer than most OSVs of its generation. The vessel was originally built in 1976 as a 220-ft supply boat. During the decline in oil prices in the 1980s, the vessel exited the oil industry and was retrofitted for handling containers. In the 1990s, the vessel moved containers between Puget Sound and Alaska. Then, in 2002, it was lengthened again and re-deployed to the gulf (37). The *Sea Trader* was actively utilized by Osprey for short sea shipping operations prior to its acquisition by Kirby.

The key to understanding the significance of what Osprey accomplished with the *Sea Trader* is determining whether this approach can be replicated. When an industry relies on retrofitting existing ships as opposed to building new ones, it is critical to understand the likely future availability of these ships. For this reason, the researchers reviewed the literature on the status of the OSV sector, including the economic and technological factors that drive market exits for

OSVs. This information was supplemented by interviews with key players such as vessel operators and builders.

The OSV Sector

An analysis of the offshore boat industry by Fortis Bank shows that there are currently two distinct generations of service boats. The first generation was built just prior to the oil bust of the early 1980s and has resulted in substantial over-capacity for most of the last two decades. An example of such a vessel retrofitted for the container trade is shown in [Figure 10](#). These vessels are being retired or scrapped and are being replaced by a new generation of boats that:

- are in general longer,
- have greater capacity and horsepower, and
- are more adept for deep water operation.



Figure 10. Photo of M/V Sea Trader (a modified OSV).

The precarious conditions under which supply boats operate place a premium on stability and maneuverability. Substantial new drilling activity in the outer shelf of the Gulf of Mexico, which remains the premier global market for boats of this type, is driving market trends [\(38\)](#). The offshore boat industry is dominated by Tidewater Inc., which has a fleet of over 650 boats operating in almost every area of the world.

As can be seen in [Figure 11](#), many boats can, in reality, operate far longer than the expected service life of 25 years. As is the case with tugboats, almost all components of the ship can be refitted with the basic hull structure remaining intact.

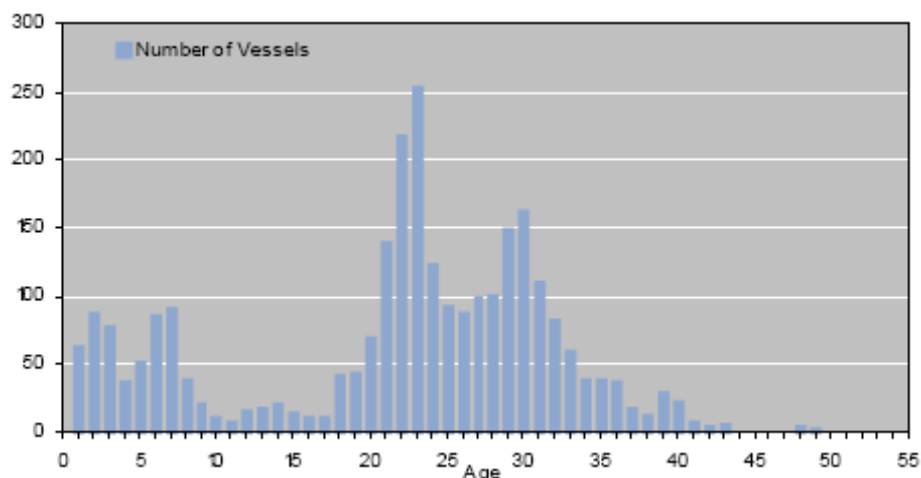


Figure 11. Age Profile of Active Offshore Service Boats.

Source: Fortis Bank

The project researchers spoke with Tidewater officials who stated that they had already sold several OSVs and platform supply vessels (PSVs) manufactured in the late 1970s and early 1980s to operators in Puerto Rico who now use them for container transport.

OSVs of this age are quite inexpensive, usually selling for around \$1.5 million. If the vessel retains its original dimensions, it can be retrofitted to handle containers with only modest modifications. Alternatively, the hull could be lengthened to boost the vessel's TEU capacity for a more substantial capital outlay. The most common length for vessels of this generation is 182 feet with a loaded draft of 10–12 feet. The boats could enter a 9-foot barge channel if they were light-loaded. The operating speed is between 11 and 14 knots. Newly built PSVs cost approximately \$12 million (39).

Tidewater officials indicated that several of their vessels were approaching obsolescence for platform or rig servicing operations and would need to find a second life if they were to remain in service.

The project researchers spoke with Mr. Charlie Knight at Bollinger Shipyards in Texas City to learn more about the technical challenges of retrofitting an OSV for container handling. Mr. Knight stated that the biggest challenge to such a modification would be the altered vertical center of gravity due to stowage of proportionally more cargo above deck rather than below (40). The maximum height of the container stack would be contingent on weather conditions and the distance that the vessel ventures from the coast. The proven stability of the vessel would also impact the insurance rate necessary to certify it. From a technological standpoint, Mr. Knight did not feel that such a modification would be particularly challenging and that there were several Texas shipyards, including Bollinger's Texas City yard, which would be capable of performing the retrofit.

Fortis Bank predicts that every new build that enters the market will reduce the ability of the older fleet to stay active (41). As the utilization rate for older boats falls, the attractiveness of maintaining them in the oil services sector will fall as well. Even if the daily rental rate commanded by an older OSV (approximately \$5000 day) remains significantly higher than the comparative benefit of using that vessel for short sea transport, the short sea option may win out if it can provide the vessel with a higher rate of utilization. Achieving high utilization rates in some SSS services has been a challenge. For example, in 2004 Trico Marine's vessels struggled to achieve more than a 40% utilization rate. Meanwhile, the daily rental rate for older boats has steadily declined in recent years.

OSVs and PSVs have three principal functions in the energy sector, which are to deliver:

- liquid mud for use in the extraction process
- deck cargo, and
- personnel.

Only one of these three functions carries over well to short sea operations. Older vessels have become obsolete not only due to their lack of the advanced stability control necessary for deepwater operation but also due to the slower speed at which they can discharge liquid cargo.

This wastes valuable time when docked next to the platform. Concerns regarding the widespread use of OSVs for short sea shipping operations include:

- relatively low operating speed,
- high fuel consumption, and
- high crewing requirements.

One advantage of OSVs and PSVs is that they are built to similar standards all around the world. Thus, they could be serviced from any number of domestic or international locations. The Gulf of Mexico is the primary locus of OSV activity, repair, and construction. Three of the largest operators—Tidewater, SEACOR, and Trico Marine—have offices in Houston. All three of these operators have significant numbers of older boats that are expected to leave the market in the near future. It has been established that OSVs can serve as short sea vessels. Further, a substantial share of the vessels currently in operation will leave the market in the near future as they are replaced by vessels that are more efficient for the highly specialized work of deepwater platform servicing.

New Builds on an OSV Platform

St. John's Shipbuilding is a newly established shipyard that provides small container vessels for G&G Shipping in Hollywood, Florida. These vessels are shallow-draft RO/RO container-carrying new builds on an OSV platform. The ships are used for services to the Caribbean. They have a 30-TEU capacity and dimensions similar to the smaller OSVs that are currently in use, with a length of 190 feet and a loaded draft of only 8 feet.

Mr. James Hampel, G&G Shipping's Chief Operating Officer, stated that the current construction cost for the vessels was \$3.5 million (42). In the long run, initial capital cost for vessels of this size is likely to be less relevant a factor than labor costs. The vessels require a crew of eight mariners. Given that their operating speed is only 12 knots, this would translate into 200 labor hours needed to move 15 containers¹⁶ from Houston to Brownsville. If those same containers were moved by 15 individual trucks, the eight-hour journey would require only 120 labor hours. Mr. Hampel stated that G&G is currently developing a LO/LO vessel that would be 234 feet with a capacity of 80 TEUs.

Necessary Modifications to Texas Port Infrastructure for OSVs

Modified OSVs could easily call at some Texas ports that do not currently handle large numbers of containers. The Port of Brownsville already has specific experience with such a service, having participated on a trial basis with a service that used the Osprey *Sea Trader* between Brownsville and Florida. Port of Brownsville Interim Port Director Donna Eymard stated that the Port has made significant capital improvements in the last five years that make it more conducive to a short sea shipping operation (43). These improvements include the acquisition of a container crane and the completion of a bonded container warehouse on port property. Vessels of this type could also be handled at Corpus Christi, Houston, Freeport, Galveston, or Beaumont.

¹⁶ Forty-foot equivalent units, or FEUs. Each FEU equals two TEUs.

Articulated Tug/Barge

While retrofitting supply boats may be the fastest way to put a Jones Act-certified fleet into service, it is not yet clear whether this option will provide sufficient capacity to make a noticeable impact on the nation's domestic container transportation capability. Even the longer OSVs such as the *Osprey Sea Trader* have a rather small TEU capacity.

Oceangoing tug and barge combinations have the ability to handle a far greater number of containers with a smaller crew size than is possible with OSVs. Moran Towing, for example, provides power for the Columbia Coastal fleet of oceangoing barges using 4000 HP tugs that require a crew of five mariners. The largest barges in the Columbia Coastal fleet have a nominal capacity of 912 TEUs, which is similar in size to the small self-propelled container ships used in European short sea shipping operations. However, while traditional oceangoing tug/barges have the potential to move substantial volumes of cargo at acceptable service speeds of up to 10 knots, they also have limitations.

The traditional model for coastal container barging, as utilized by Columbia Coastal, is to stack lashed containers on deck barges, a process that is time consuming. Also, operations in high seas are precarious as the vessel is inherently less stable than a cellular ship. In recent years, more deck barges equipped for open ocean operation have been fitted with hydralift skegs, which increase stability at sea. Normal skegs used for ocean design add 30–50% resistance over bare hull drag. The hydralift, however, adds only about 10% additional drag compared to a barge with no stability control (44).

The container barge is pulled by the tug using a specialized connector called a hawser cable. The most severe limitation for vessels that use a hawser cable is that they are weather dependent. The tug-barge unit is only as strong as the hawser cable that connects the barge to the tug. A pull system also greatly limits the navigational responsiveness of the tug-barge combo. One approach for increasing the responsiveness of the unit is to shorten the hawser length. However, this arrangement can be precarious given that a large towed barge has substantial momentum and can easily crash into a tug if the tug experiences mechanical problems.

Articulated tug/barge systems (AT/B) are currently the only oceangoing barges capable of operating in the same range of weather conditions as a self-propelled container ship. The researchers spoke with two of largest articulated tug/barge designers in the United States:

- Ocean Tug and Barge Engineering (OCTB) and
- Crowley Marine.

Ocean Tug and Barge Engineering

Mr. Robert Hill, the president of OCTB, helped found the concept of articulated tug/barges in order to permit operations in the open ocean at higher speeds with greater fuel efficiency and maneuverability. OCTB has been involved in the construction or conversion of 70% of the articulated tug/barges currently in existence in the United States (45).

OCTB is currently designing a series of four AT/Bs specifically for container services. These vessels range from 300 to 3000 TEUs. They are fully cellular LO/LO vessels designed for intermediate to long distance operations—for example a string from

- Halifax to Boston to Jacksonville,
- Norfolk to New Orleans, or
- Houston to Tampa.

The vessels are designed to have operating characteristics that would make them competitive with intermodal rail. Barges of this type could be designed around the existing port infrastructure if need be. Mr. Hill estimated that a 600-TEU AT/B would require 12 feet of draft when fully loaded. The largest currently proposed AT/Bs would require more than 20 feet of draft.

While AT/B combos are comparatively more fuel efficient than towed barges, they still have lower fuel efficiency per ton when compared with a similarly sized container ship. The fuel cost penalty is roughly 20% when compared with a container feeder ship of similar size and operating speed. If operating speeds over 14 knots are required, the efficiency disadvantage would increase (45).

Crowley Marine

The researchers also interviewed Crowley Marine, which is an AT/B operator that is active in Texas. Crowley has a significant AT/B fleet that provides liquid cargo services along the west coast of the United States and also in the Gulf of Mexico. According to Mr. Ray Barth at Crowley's Houston office, there is no technical reason why AT/Bs could not be used for dry cargo operations.

Further information was gathered from a Crowley engineer in California, Mr. Steve Collar, on the operating characteristics for AT/Bs and the tradeoffs involved in designing the barge for LO/LO vs. RO/RO. According to Mr. Collar, a dry cargo AT/B could be designed for either RO/RO or LO/LO operations. While RO/RO is generally quicker for loading and unloading, the volume of cargo is limited based on the amount of space consumed by the combined container and chassis. The comparative capacity for a LO/LO barge would be approximately three times higher than that of a RO/RO version. The most important issue in the design of a RO/RO barge would be the ramp and ballast system to ensure a smooth transition in all loading and discharge conditions.

Mr. Collar stated that the size and draft of the tug would probably be a limiting factor, given that tugs of this class typically have at least a 20-ft draft. These AT/B vessels would have a combined length of between 400 and 600 feet and have a nominal HP of 5000–10,000. Figure 12 is a photo of a Crowley AT/B.



Figure 12. Articulated Tug/Barge Used by Crowley Maritime for Petroleum Movements.

Source: www.crowley.com

Regarding operating economics, there would likely be an inflexion point, contingent on not only payload but also service speed and reliability, where the higher capital cost of the AT/B compared to a traditional tow barge would be eclipsed by superior operating characteristics. According to Crowley this inflexion point for liquid barges is around 15,000 DWT.

Jones Act-Certified Container Ships

National Shipping of America

The cost penalty for domestically built containerships has inspired some entrepreneurs to take unusual paths to establish adequate vessel capacity. For example, the start-up National Shipping of America (NSA) is planning to launch a short sea shipping service in Texas using a small container ship that is Jones Act-certified because it was seized by federal agents after being used in the cocaine trade (46). NSA states that the service will likely begin in early 2008 with a bi-weekly call linking Freeport, Texas, together with Chester, Pennsylvania.

The researchers spoke with Salvatore Presti, the president of NSA and former vice president of American President Lines, regarding the service. Mr. Presti stated that he had several reasons for choosing the ports of Freeport, Texas, and Chester, Pennsylvania. The first factor was selecting the critical mass of cargo volumes and also determining the types of cargo that would be most likely to use the service. A recent Global Insight study which examined cargo balance between the greater Houston area and the East Coast and alternatively the mid-Atlantic apparently carried significant weight in NSA's decision making (47). This trade lane offered sufficient volume and more importantly properly balanced cargo to make a short sea shipping service feasible. Another rationale for choosing this port pair was distance. Specifically, given that Mr. Presti has only one ship, he needed a port pair that would provide sufficient opportunity make one bi-weekly call. The 14-day call between Freeport and Chester provides for 10 full days steaming, one day at each end for loading and unloading, and one day on each voyage for surprises due to either weather or mechanical problems. Port Freeport had a location close to the Port of Houston and

to the open ocean, sufficient draft, and also a crane capable of handling containers¹⁷. Mr. Presti commented that he had modeled his business approach after Southwest Airlines by targeting secondary underutilized ports. Figure 13 shows the route Mr. Presti plans to follow.

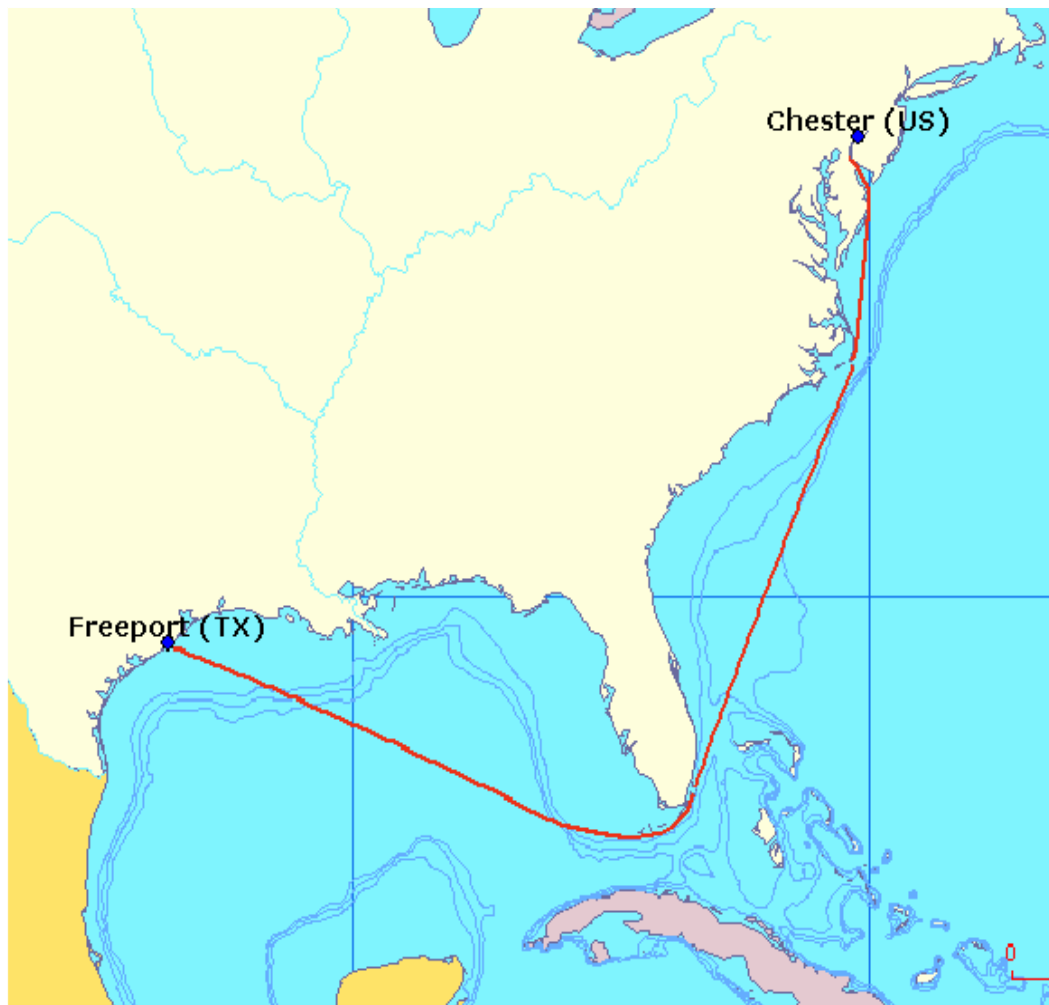


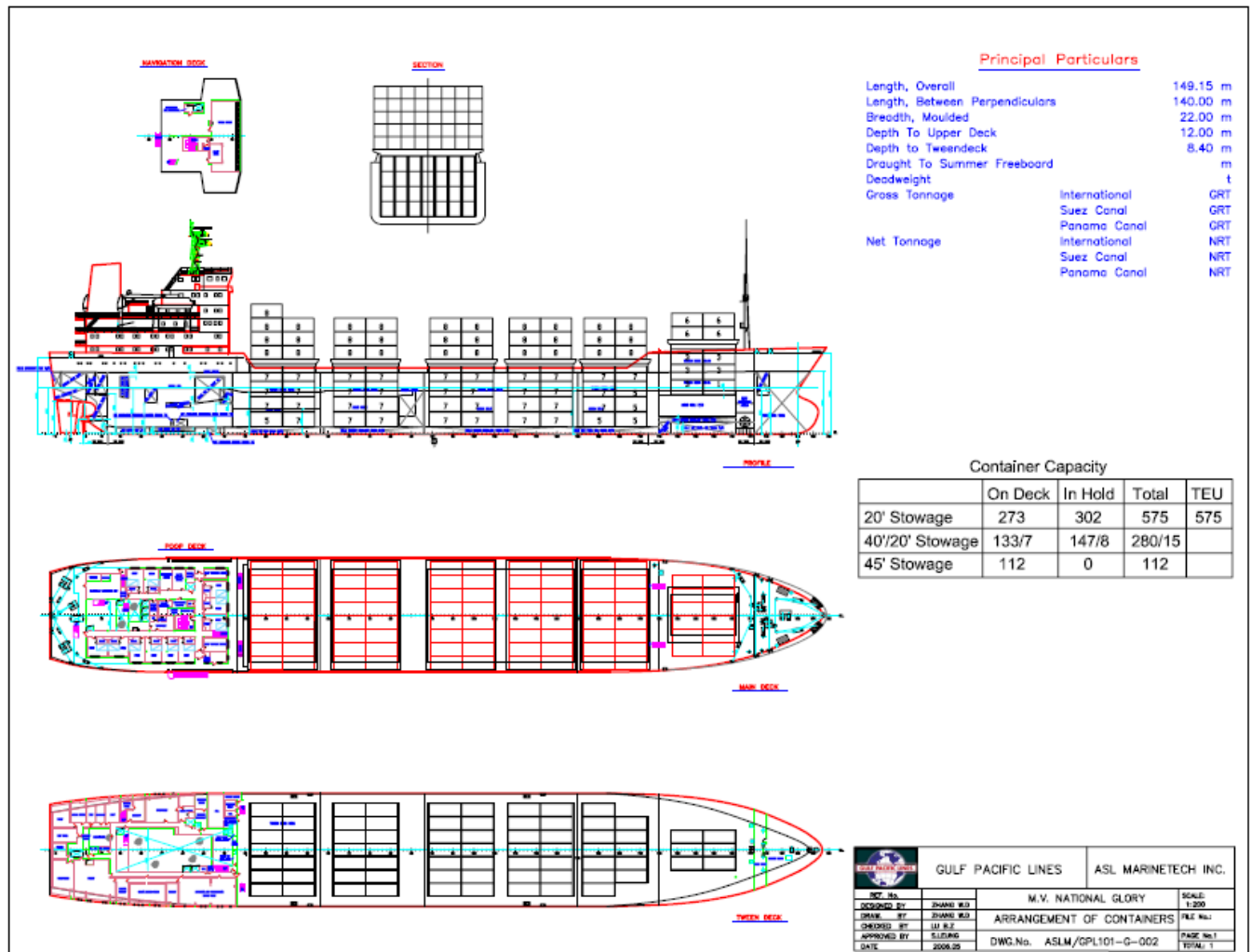
Figure 13. Proposed Route Linking Freeport, Texas, to Chester, Pennsylvania, Using the Retrofitted Jones Act Containership *M/V National Glory*.

Source: PowerPoint Presentation prepared by Torey Presti, President of National Shipping of America

The vessel that NSA will be using is the *M/V National Glory*. The *M/V National Glory* was acquired in a public competitive auction by NSA in 2004 for \$2.6 million. It has a nominal capacity of 575 TEUs. However, Mr. Presti stated that with the types of heavy cargo the service will carry—such as 20-ft boxes and out-of-gauge and liquid ISO tanks—he expects the typical fully loaded capacity to be no more than 400 TEUs (48). The ship was constructed in Poland in the late 1980s and served in a series of different services before falling into the drug trade in the

¹⁷ Port Freeport currently has a single Gottwald multipurpose crane that can be used for containers and/or project cargo. The port plans to acquire two additional Gottwald cranes in the next year (Interview with Mike Wilson, Director of Trade Development).

1990s. Substantial refurbishing, on the order of 10 times the original auction price, was required to transform the vessel into a modern LO/LO container carrier. Even with a net investment of over \$25 million, Mr. Presti felt the vessel would have been at least twice as expensive to build at a U.S. shipyard, assuming such a yard with spare capacity could be found. Figure 14 is a layout of the vessel.



There are a few characteristics of the vessel that are still lacking if compared with a container vessel that would be specifically designed for U.S. domestic commerce. For example, the ship can handle 20-ft and 40-ft ISO containers but cannot handle the comparatively more productive 48-ft and 53-ft containers that are predominant in domestic trade. Mr. Presti stated that if the vessel were being designed “from the ground up,” it would most likely be designed so that 40-ft containers could be held under deck while 53-ft containers could be stacked on deck. The vessel is significantly younger than most of the Jones Act containership fleet and is estimated to have between 10 and 15 years of future useful life.

Accommodating National Shipping at Port Freeport

Mike Wilson, Director of Trade Development for Port Freeport, stated that the port is making significant modifications in order to accommodate the NSA service and the dockside and landside impacts it will create. The port will expand its crane profile, acquiring two additional Gottwald multipurpose container cranes that will allow the ship to be loaded and unloaded in a timely fashion. The port is also preparing for the additional truck traffic that will be generated. NSA estimates that the service will be two-thirds 20-ft containers (the inverse of what one would expect for an international container service). The predominance of 20-ft containers will have the impact of greatly increasing the truck traffic associated with this service. According to the current plan, the NSA service would continue to operate from Freeport's general cargo docks, while the port's planned Velasco container terminal would exclusively serve international services (49).

Penn Terminals

The destination for the NSA service is a small privately operated terminal 12 miles south of Philadelphia. Its location is within 150 miles of New York City and Washington DC. It is also only 24 miles from Camden, New Jersey, which was cited in the Global Insight study as the most beneficial location, based on the availability of cargo and cargo balance, for a short sea service connected to the gulf. Table 8 shows the estimated daily truck volumes between the city pairs included in the study.

Table 8. Four Corridor Case Studies, Estimated Daily Truck Volumes (47).

		Destinations				
Origins		New Haven	Camden	Savannah	Florida	Beaumont
	New Haven			412	377	346
	Camden			1,132	585	729
	Savannah	892	1,961		206	649
	Florida	478	705	290		239
	Beaumont	700	2,037	1,080	677	

Source: Global Insight study

Horizon Lines

Horizon Lines is the largest Jones Act carrier in the United States. Its cellular LO/LOs serve all the major domestic trade lanes including Alaska, Hawaii, and Puerto Rico. Horizon is the only container shipper offering a regular call (every ten days) between San Juan and Houston. The researchers interviewed Mr. Duncan Wright, Director of Business Services for Horizon Services Group, regarding the potential availability of container capacity for coastal services. Mr. Wright stated that a downturn in the economy of Puerto Rico has led the firm to consider re-deploying some of its vessels to alternative domestic trades. The entrance of Sea Star Line into the Puerto Rico market has exacerbated this over capacity issue (50). Horizon may be the only firm in the United States that would be capable of re-deploying spare capacity to alternative trades.

Cargo/Passenger Ferry Systems

As mentioned in the chapter introduction, another avenue to introduce domestic container freight movement into the transportation profile of the United States would be to piggyback this cargo onto a ferry system that would be principally oriented around passengers. These roll-on cargo/passenger systems could be short haul or long haul, domestic or international. RO/PAX vessels have become extremely popular in Europe and Asia (51). These ships were designed and deployed principally as passenger carriers. However, they also carry significant amounts of container and trailer freight. While examples of these types of systems are scarce in the U.S., such a system operates between various locations within Alaska and Washington State—the Alaska Marine Highway.

Alaska Marine Highway

The Alaska Marine Highway (AMH) is perhaps the best known RO/PAX system currently operating in the United States. With an underdeveloped roadway network connecting Alaska to the lower 48 states, coastal shipping in Alaska has been an absolute necessity since statehood. The ferry system run by the Alaska Department of Transportation (Alaska DOT) serves as the de facto interstate highway. Certain aspects of the Alaska experience may be instructive to Texas planners in considering options for deploying a domestic passenger/freight ferry.

The researchers spoke with Mr. John Falvey and other officials at the Alaska DOT about the feasibility of longer haul, utilitarian marine transport and the potential advantages and disadvantages of services that carry passengers and freight simultaneously.

All eleven Jones Act-certified vessels operated by the Alaska DOT are equipped to handle freight as well as passengers. Most of the vessels stay within the coastal inside passage; only two are certified for use in the open ocean. The most common types of freight carried by the AMH vessels are perishable products such as meat, vegetables, and dairy products. The freight primarily moves northbound from Washington State to communities in Alaska (52).

The Alaska officials noted that the first question to ask for any service that will have a passenger component is whether the service will be geared principally towards tourists/vacationers or daily/regular travelers. There are different requirements and expectations for these two populations in that regular travelers will be much more sensitive to price and will be intolerant of slow travel speeds.

When a service attempts to carry both passengers and freight, it limits the types of freight that can be carried, particularly hazmat. In the case of the Alaska Marine Highway system, the U.S. Coast Guard is very specific regarding the types and amounts of hazmat that operators can carry along with passengers.

Alaska officials stated that the ideal role for freight in such a service is to provide a reliable baseline of revenue given the comparative lack of seasonality. Passengers are typically the gravy in the system.

The transportation of personal automobiles is also provided by the Alaska system. Mr. Falvey believes that auto carriage is an important component of the system, but it is a rarely the most profitable. From the perspective of a passenger, if the cost to transport a vehicle becomes too high, they can begin to utilize other options such as rentals.

High-Speed Ferries

The Alaska Marine Highway system is also notable in that it has recently deployed higher speed vessels. The *M/V Fairweather* and *M/V Chenega* have operating speeds of 32 knots, which is roughly twice the operating speed of the other ferries in the system. The increasing price of diesel has apparently had a substantial impact on the economics of operating the *Fairweather* and *Chenega* when compared with the monohull vessels in the fleet. The vessels, each of which consumes 60,000 gallons of diesel per week, were delivered at an average cost of \$35 million (53). In the original cost/benefit calculations used in deciding to construct the vessels, the price of diesel was assumed to be \$0.67 per gallon. A comparison of the horsepower requirements of the high speed ferries when compared with monohulls of similar size reveals that the high-speed ferries require over three times the rated horsepower. Therefore, if the decision were being made today, the vessels would most likely not have been ordered.

Figure 15 is a photo of the *M/V Fairweather*, one of the high speed ferries.



Figure 15. The M/V Fairweather.

Source: www.dot.state.ak.us/amhs/

The degree of subsidy required to maintain all of the Alaska Marine Highway services is substantial. In 2006 direct state assistance was \$90 million, constituting approximately 60% of the total operating budget. This ratio has increased from a roughly 50/50 split when the price of diesel was under a dollar per gallon. Given the importance of tourism in Alaska, the service has a higher revenue/cost ratio in the summer. However, at no point during the year does the service break even.

Table 9 lists the physical characteristics of the vessels currently utilized in the Alaska Marine Highway System.

Table 9. Characteristics of Vessels Used in Alaska Marine Highway System.

Source: <http://www.dot.state.ak.us/amhs/Sailing/Reports/documents/ATVR2006.pdf>

	MATANUSKA	MALASPINA	TAKU	TUSTUMENA	COLUMBIA	LECONTE	AURORA	KENNICOTT	LITUYA	FAIRWEATHER	CHENEGA
Date Built	1963	1963	1963	1964	1974	1974	1977	1998	2004	2004	2005
Length (feet)	408	408	352	296	418	235	235	382	181	235	235
Beam (feet)	74	74	74	59	85	57	57	85	50	60	60
Displacement (long tons)	5,569	5,552	4,283	3,067	7,683	2,132	2,132	7,503	647	787	787
Loaded Draft (feet-inches)	16'-11 5/8"	16'-11 3/8"	16'-11"	14'-4 1/2"	17'-6 1/8"	13'-10 7/8"	13'-10 7/8"	17'-6"	10'-6"	8'-6"	8'-6"
International Tonnage: Gross	9,214	9,121	7,302	4,529	13,009	3,124	3,124	12,635	n/a	3,442	3,420
(cubic capacity) Net	3,824	3,667	2,496	1,451	4,932	987	987	3,790	n/a	1,032	1,026
Domestic Tonnage: Gross	3,029	2,928	2,624	2,174	3,946	1,328	1,280	9,978	99	1,280	1,333
(cubic capacity) Net	1,235	1,253	1,494	898	2,683	566	453	7,354	66	870	827
Horsepower @ Service Speed	7,400	8,000	8,122	5,100	12,350	4,300	4,300	13,380	2,000	15,360	15,360
Service Speed (knots)	16.5	16.5	16.5	13.8	17.3	14.5	14.5	16.75	11.5	32	32
Fuel Use (Gallons/hour)	234	270	253	151	397	188	190	354	55	600	600
Crew Capacity	50	50	42	37	66	24	24	56	4	10	10
Passenger Capacity	499	499	370	174	499	300	300	499	149	250	250

CHAPTER SUMMARY

The research shows that, while the Jones Act certainly limits the choices available for establishing a domestic short sea shipping fleet, it may not be an impenetrable barrier. Two distinct classes of vessels/operating systems were identified that could provide significant SSS capacity in the near future. These vessels/systems have similar operating characteristics as the small container feeder vessels that are active in the European short sea shipping market. Retrofitted offshore supply vessels were found to be the best near term solution for establishing short sea shipping capacity given the fact that a significant number of the older vessels are currently exiting the market. Articulated tug/barge systems appear to be the most promising ship type for new build construction due to their operational similarity to small container ships and suitability for affordable domestic construction.

CHAPTER 5: DETERMINE POSSIBLE EFFECTS ON TEXAS COASTAL INFRASTRUCTURE AND TRAFFIC VOLUMES

Based on the commodity flows and opportunities analyzed in [Chapters 2 and 3](#), the primary prospects for near-term short sea shipping development center on containerized shipping (although general cargo may play an important role in reducing the cost of backhauls). In Texas, these cargoes will move to and from the port primarily by truck. [Chapter 4](#) identified vessel and operating characteristics that would likely meet SSS container transport requirements. These vessels have similar sizes and infrastructure requirements of smaller containerships currently engaged in feeder services between the Caribbean and mainland U.S.

In order to properly to assess the possible effects of SSS on the Texas transportation system, two basic questions must be answered:

- Which ports have the infrastructure required to handle significant volumes of containers from the types of vessels identified as conducive to short sea shipping operations?
- If these ports were to develop successful short sea shipping services, how much of an impact would the traffic generated by these services have on the ports and the surrounding landside infrastructure?

TEXAS PORT INFRASTRUCTURE

The researchers identified seventeen Texas ports that handle freight cargo:

- Beaumont
- Brownsville
- Cedar Bayou
- Corpus Christi
- Freeport
- Galveston
- Harlingen
- Houston
- Orange
- Palacios
- Port Arthur
- Port Isabel
- Port Lavaca-Point Comfort
- Port Mansfield
- Texas City¹⁸
- Victoria
- West Calhoun

¹⁸ All references to Texas City signify the existing facility managed by the Texas City Terminal Railway Company.

Channels and Docks

The two foundational elements that are required to handle containerized cargo are a shipping channel with sufficient width and depth and the appropriate dock structure. Several of the ports on the list shown above lack one or both of these elements and would not be candidates for handling SSS containerized cargo during the next five to ten years. These ports are:

Group A: Cannot Handle Containers

- Harlingen
- Palacios
- Port Mansfield
- West Calhoun

Cranes

A second group has been identified consisting of ports with the required channel and dock infrastructure but lacking in container handling equipment. These ports would be required to buy or rent equipment to manage any containers handled in their port.

In examining the availability of equipment, the focus is primarily on cranes for lift-on/lift-off (LO/LO) cargo. Only one port facility, Cedar Bayou, was identified as best suited for an exclusive RO/RO operation, which would eliminate the need for cranes. In this case, trucks would use the short sea vessel as a freight ferry by driving onto a vessel at one end of the waterborne movement and continue its journey by driving off at the other end. In other cases, it may be possible to handle cargo that would move on vessels that are equipped with ship's gear, in which case the vessel could handle the ship-to-shore or shore-to-ship movements on its own. However the supply of geared container vessels is limited.

The following ports do not currently handle containers and would be required to:

- rely on ship's gear,
- rent equipment, or
- focus exclusively on RO/RO cargo:

Group B: No Container Equipment

- Cedar Bayou
 - There is a real possibility of developing a RO/RO cargo service in Cedar Bayou. The cargo handled here would be primarily cargo coming from Bayport or Houston Barbours Cut facilities. These are such short distances that the cost of a lift-on/lift off operation would be prohibitive. However, if developed as a modified truck route, a cargo flow may be developed.

- Corpus Christi¹⁹
 - Corpus Christi has adequate channel dimensions and dock infrastructure, but to date it has relied only on ship's gear for container handling, and container movements have been negligible. The port seems focused on developing container business through the proposed La Quinta Container Terminal project as opposed to using general cargo docks and cranes
- Orange²⁰
 - As it stands today, Orange would most likely not be able to handle containers in a cost-effective manner. However, the port is seeking to acquire a crane that would allow it to handle a variety of cargo, including containers.
- Port Isabel
 - Port Isabel has docking facilities which could conceivably be used to handle containers. However, there is no equipment for handling containers, and the port is currently focused on developing other types of business. Port Isabel might also have to overcome a lack of rail service for certain cargo types.
- Port of Port Lavaca-Point Comfort
 - The Port of Port Lavaca-Point Comfort has historically focused on liquid cargoes. However, the Port has actively begun to seek out other cargoes. The port would have to rent or buy equipment to handle containers.
- Texas City
 - The Port of Texas City does not handle containers, does not have the equipment to do so, and does not have any plans to move in that direction in the foreseeable future.
- Port of Victoria
 - The Port of Victoria has made arrangements to utilize cranes and the docking facilities of one of its tenants (Equalizer, Inc.) to move containers when the need arises. To date, this arrangement has not been tested. While not actually within the Port of Victoria, Dow Chemical has constructed a distribution center on the Victoria Channel that may enable it to start diverting a significant amount of its current truck traffic to container-on-barge shipments. Since this facility would not be available to the general public, it is not included as an asset for the Port of Victoria.

¹⁹ Corpus Christi does not currently have the equipment to handle containers, although it has moved some military containers with ship's gear and construction cranes. The port is looking into buying a barge-mounted Gottwald mobile harbor crane which could be used to handle containers, but the timing is indefinite. The port is also pursuing the development of La Quinta Container Terminal, which could handle any vessels calling in the Gulf of Mexico.

²⁰ The Port of Orange is actively considering investing \$3.5 M in the first half of 2008 to purchase a mobile harbor crane that would be mounted on a spud barge and would give the port immediate capabilities to load containers on river and ocean barges in addition to small vessels. According to port executives, the port has been approached by local industry to provide this service.

The ability of these ports to acquire cranes may be affected by the international purchasing power of the dollar. Almost all mobile harbor cranes (the type most likely to be used in a start-up operation) are produced in Europe. With the value of the dollar falling against the Euro, these cranes have become much more expensive. The purchase of new cranes will most likely be limited until the dollar strengthens. Ports desiring to acquire equipment may be forced to resort to the used equipment market, which offers a limited supply.

Three ports do not currently handle containers, or only handle them in an intermittent fashion, but they have the equipment necessary to move containers through the port, whether the containers move by barge or oceangoing vessels. They are:

Group C: Ready to Handle Containers

- Beaumont²¹
- Brownsville
- Port Arthur

The gantry crane at Beaumont is limited to a lift of 15 short tons 70 feet out from the edge of the dock. At 50 feet from the edge of the dock the maximum lift is 30 short tons. Therefore, it would probably not be practical to work any vessel with a beam of greater than 50 feet. Brownsville's crane can lift 52 tons at 34 meters (110 feet). Port Arthur's crane can lift 60 tons at a reach of 110 feet. Therefore, Brownsville and Port Arthur's cranes are both of sufficient size to handle any of the vessels contemplated in this project.

The Port Arthur crane has a capability of 19 lifts per hour. The Brownsville crane reportedly has a lift capacity of 20–25 moves per hour. The lift capacity of the Beaumont crane could not be determined. By comparison, the Seagirt Terminal in Baltimore averages 35 moves per crane hour (54), West Coast ports average between 30–32 moves per crane per hour (55), and Boston's Conley Terminal averages roughly 26 moves per crane per hour (56). In Texas, Barbours Cut and Bayport are both averaging between 30 and 32 moves per crane hour. These rates were all achieved at terminals dedicated exclusively to container handling; therefore, the rates are not necessarily comparable to terminals that will handle containers along with general cargo, as would be envisioned with Beaumont, Freeport, or Brownsville. The Journal of Commerce reports, "Average moves per crane per hour at most U.S. ports are in the 20–25 range, without adjustments for interruptions such as equipment problems and coffee breaks, although southeastern ports such as Savannah and Charleston report higher totals that match those of efficient terminals in Asia" (57). Given that the ports in Group C would handle a variety of cargoes at a given dock and not focus strictly on containers, a rate of 20–25 moves per hour would likely be at the higher range of productivity.

It is important to recognize the distinction between the technical capability of a crane under optimal conditions, as is frequently reported by the manufacturer, and the real world efficiency per crane hour that can be hindered by external factors such as labor or physical layout. A port can therefore compensate for a somewhat slower crane by improving other landside efficiencies.

²¹ The Port of Beaumont is close to purchasing either a Gottwald or a Liebherr mobile harbor crane which will have heavy lift and container capabilities.

Bayport, for example, can be expected to reach 35 moves per hour due to its faster cranes and lack of landside congestion.

There are three Texas ports that currently handle containers:

Group D: Currently Handle Containers

- Freeport
- Galveston
- Houston

These three ports can handle containers carried by river barge or deep sea vessel. Galveston's container cranes are currently in a state of disrepair and it relies almost exclusively on ship's gear to handle containers. Freeport, however, has been using its own equipment to handle containers since acquiring a mobile harbor crane approximately three years ago²². For the current year, Port Freeport estimates it will handle two-thirds of the total TEUs with its own equipment. Houston has two dedicated container terminals at Barbours Cut and Bayport.

Table 10 provides a summary of the port classification scheme.

Table 10. Summary of Port Container Capabilities.

Port	Dock	Channel	Cranes	Currently Handle Containers
Group A:				
Harlingen	Y	Barges Only	N	N
Palacios	N	N	N	N
Port Mansfield	N	N	N	N
West Calhoun	N	Barges Only	N	N
Group B:				
Cedar Bayou	Y	Barges Only	N	N
Corpus Christi	Y	Y	N	N
Orange	Y	Y	N	N
Port Isabel	Y	Y	N	N
Port Lavaca	Y	Y	N	N
Texas City	Y	Y	N	N
Victoria	Y	Barges Only	Y	N
Group C:				
Beaumont	Y	Y	Y (Limited)	Y (sporadically)
Brownsville	Y	Y	Y	Y (sporadically)
Port Arthur	Y	Y	Y	Y (sporadically)
Group D:				
Freeport	Y	Y	Y	Y
Galveston	Y	Y	Y	Y
Houston	Y	Y	Y	Y

²² Freeport plans to acquire two additional Gottwald multipurpose cranes.

Vessel Dimensions

In [Chapter 4](#), the researchers reviewed the types of vessels that might be used to develop SSS in the near future, particularly for domestic Jones Act-certified services. Two of the most promising vessel types are:

- modified offshore service vessels (OSVs), and
- articulated tug/barges (AT/Bs).

[Figure 16](#) and [Figure 17](#) are photos of these two vessel types.



Figure 16. Photo of Offshore Supply Vessel.



Figure 17. Photo of Articulated Tug/ Barge.

OSV and Feeder Ship Infrastructure Requirements

One specific instance of a modified OSV that has received widespread attention is the use of the M/V Sea Trader by Osprey Lines. This vessel, which followed a Houston/Tampa/ New Orleans route, was a U.S. flag vessel that was 286 ft in length with a 62-ft beam and an 18-ft draft.

Another specific example is the new service that is about to start operating between Freeport, Texas and Chester, Pennsylvania. It will be utilizing a small container ship (*M/V National Glory*) that is 489 ft x 72 ft x 30 ft and will have a capacity of 575 TEUs. This vessel is a small container ship that was seized for participating in the drug trade and then auctioned to the private sector.

Lloyd's Register of Ships lists 920 U.S.-flag vessels that are categorized as offshore service vessels. [Table 11](#) and [Table 12](#) summarize the data. In [Table 11](#), N equals the number of non-zero observations. In [Table 12](#), the labels "1st Q" and "3rd Q" indicate First Quartile and Third

Quartile. Measurements falling between these two limits make up 50% of the population. Measurements less than or equal to the Third Quartile make up 75% of the population.

Given these dimensions, any of the ports in Groups B, C, and D (with the exception of Cedar Bayou and Victoria, both barge ports) could easily handle 75% or more of the total population of OSVs and PSVs. Therefore, they are all viable candidates for a service using modified OSVs and/or PSVs.

Table 11. PSV and OSV Dimensions.

Ship Type	Length			Breadth			Draft		
	N=	Min	Max	N=	Min	Max	N=	Min	Max
Platform Supply Vessel	538	56	320	538	21	60	457	7	23
OSVs (all other)	379	72	541	379	21	98	296	5	28

Compiled from *Lloyd's Register of Ships*.

Table 12. Averages and Quartiles for PSV and OSV Dimensions.

Ship Type	Length			Breadth			Draft		
	Avg	1 st Q	3 rd Q	Avg	1 st Q	3 rd Q	Avg	1 st Q	3 rd Q
Platform Supply Vessel	183	157	210	42	36	48	12	10	13
OSVs (all other)	165	139	181	34	28	40	10	7	12
Standard Deviation									
Platform Supply Vessel	44			9			3		
OSVs (all other)	46			9			4		

Articulated Tug/Barge Infrastructure Requirements

There are no AT/Bs currently in use for dry cargo transportation—they are all involved in bulk liquid commodities. However, CT Marine, Townsend Marine Design, and Ocean Tug & Barge have joined together in designing an AT/B that would be specifically used for container transport. The vessel they designed would measure 729 ft x 94 ft x 23 ft. For Brownsville and Port Arthur in Group C and all three ports in Group D, these dimensions are not a problem.

Storage Space

Should the SSS service in question turn out to be a RO/RO service, a storage area sufficient to stage the chassis or rolling stock will be required. There does not seem to be a design standard for this parameter. The actual required area is a function of the size of shipments that arrive or depart and the dwell time of the cargo in the storage area. The Port of Galveston has managed to effectively

handle RO/RO cargo using five acres of marshalling area at Pier 37. The cargo is primarily project cargo and drive-on/drive-off cargo that does not require a separate tractor. For those operations where a chassis is used and a tractor must be used to move the chassis, a larger amount of space is required. The Latin American Trade & Transportation Study produced by Wilbur Smith & Associates in 2001 included a planning module for RO/RO terminals that called for 30 acres of storage area. Given the range of space requirements, to answer the question of whether a particular port could handle SSS RO/RO cargo, a planner would have to consider both the type of cargo and the volume expected, but a good starting point would in the range of 20 to 30 acres.

EFFECT OF GROWTH IN SSS TRAFFIC

In 2005, roughly 58,000 TEUs were exported from Texas to the non-Texas ports in the project region and roughly 49,000 TEUs were imported. As discussed in [Chapter 2](#), approximately 38,000 TEUs of the exports were concentrated in five commodity groups dominated by Plastics & Articles Thereof. Approximately 41,000 TEUs of the import cargo were concentrated in four groups and were heavily dominated by fruits, vegetables, etc. The breakdown of the total flow by port is shown in [Table 13](#):

Table 13. TEUs by Texas Port.

Port	Import TEUs	Percentage	Export TEUs	Percentage
Freeport	26,581	55%	26,479	45%
Galveston	3,485	7%	1,461	3%
Houston	18,467	38%	30,266	52%
TOTAL	48,533	100%	58,206	100%

Of the 49,000 imported TEUs, approximately 30,000 were fruit and vegetable products. Port Freeport currently handles 81% of the import total for this category because the infrastructure and logistics expertise is already assembled at that location. It would seem likely that any appreciable growth in the containerized fruit and vegetable trade will probably occur at Freeport. However, it should be noted that Corpus Christi has relevant experience due to its cold storage facility which may translate well for future SSS ventures, especially for non-containerized cargoes or perishables requiring special handling.

The typical return trip for the fruit and vegetable containers consists of Plastics & Articles Thereof, and Paper & Paperboard, etc. Port Freeport handles roughly 57% of this total while Houston handles 38%, indicating that a sizable percentage of containers enters at Freeport but is exported back through Houston.

The shares of container traffic associated with the remaining cargo categories are fairly evenly split between Freeport and Houston.

The researchers analyzed what would happen if SSS trade volumes doubled in the short term future (which is highly unlikely in the absence of a major public sector-driven initiative), and if only the ports currently handling these containers would attract the additional cargo (the upper limit in terms of traffic density). In order to develop a rough estimate of the potential effect of

increased SSS business, the researchers assumed that any new SSS cargo would be split evenly between Houston and Freeport with a small amount going to Galveston. Using that premise, the researchers assigned 47% of the increase to Houston, 47% to Freeport, and 6% to Galveston²³. (Table 13 shows a current split of 46/50/4). The total of import and export TEUs in 2005 was 106,740. If another 100,000 TEUs were added to the mix, Houston would pick up 47,000, Freeport 47,000, and Galveston 6,000. All three ports could handle this increase without compromising port efficiency²⁴.

Because a large percentage of containers are actually 40-foot units, the number of TEUs handled by a port are typically divided by a factor of 1.6 or 1.7 to derive the actual number of containers. Using the 1.6 factor, the share of actual containers would be 29,375 at Houston and Freeport, while Galveston's share would be 3750. To estimate the potential truck traffic from these containers, it would be necessary to know how many trucks move empty in one direction. In the extreme case that only trucks would be used to move containers (i.e., no rail or barge) and that every truck would move with a container in one direction but empty in the opposite direction, 58,750 truck moves would be added to the mix in Houston (annually), another 58,750 in Freeport, and 7,500 in Galveston. It should be noted that certain types of cargo envisioned for short sea shipping are quite heavy, which may increase the percentage of containers that are 20-ft units when compared with the standard ratios used at container ports. Comprehensive data on this topic does not exist but will be informed for ports in the Houston area by the results of TxDOT Project 0-5684 (Impacts of Dray Systems along Ports, Intermodal Yards and Border Ports of Entry) which is studying patterns of drayage at the Port of Houston.

Further, it is possible that some of this cargo may arrive at the port or depart from the port by rail. However, given the history of Texas container movements to date and given the nature of the commodities involved (principally perishables), it can be assumed that the cargo origins and destinations will be located within a fairly tight radius of the Houston/Freeport area. At least 90% of all the container movements discussed above would be transported exclusively by truck. By way of reference, in the case of Linea Peninsular, the only existing SSS container service in the Gulf, 95% of the cargo containers arriving at the Port of Panama City (Linea Peninsular's home port) are cleared by truck. Occasionally material arrives at the port for export, but this percentage is not significant.

Given the above scenario, with an approximate doubling of SSS trade, an additional 53,000 annual truck trips could be generated in Houston, another 53,000 in Freeport, and 7,000 in Galveston. A successful start-up venture would not expect to attain these volumes for a number of years. To provide perspective, Linea Peninsular, which began operating some 20 years ago and is considered a successful operation, moves some 40,000+ TEUs annually. In 2006, Osprey Line moved approximately 45,000 TEUs in the coastal range.

In order to get an idea of the effect this increase would have on local traffic, the researchers consulted TxDOT District traffic maps. Annual Average Daily Traffic (AADT) counts for

²³ This premise is just an analytical scheme. An actual forecast would take into account origin/destination, type of cargo, any special handling required, and other factors.

²⁴ This additional volume would be roughly a 67% increase in volume for Freeport; however, Freeport has additional capacity already available and is in the process of constructing a new dock.

certain highway locations in 2003 are shown in [Table 14](#) (maps showing these locations are in the [Appendix](#)):

Table 14. Daily Traffic Counts.

Location	AADT
Brownsville, Hwy 48 SW of Port Entrance	16,800
Brownsville, FM 511 NW of Port Entrance	11,100
Corpus Christi, I-37 west of Hwy 286	51,000
Corpus Christi, Hwy 181 at Causeway	44,000
Freeport, Hwy 228/36 at FM 1495	4,100
Freeport, Hwy 288 at FM 332	24,000
Galveston, I-45 at Causeway	64,000
Beaumont, I-10 N east of Hwy 364	40,000
Beaumont, I-10 east of Hwy 380	89,000
Houston, Hwy 146 south of Hwy 225	65,000
Houston, I-10E at Beltway 8	163,000
Houston, I-45 north of Beltway 8	295,000
Port Arthur, Hwy 69 west of Hwy 87	19,100
Port Arthur, Hwy 69 east of I-10	68,000

To estimate the sensitivity of local traffic systems to the potential increase in SSS, the researchers took 50% of the potential increase described above, or 56,500 new truck trips per year, and assigned it to a port area that was identified as either ready to handle containers (Group C) or currently handling containers (Group D). This increase is the equivalent of 217 in Average Daily Traffic (ADT), using 260 days per year. Using the above table, the researchers calculated the percentage increase in ADT caused by an increase of 217 ADT for each location. [Table 15](#) provides the percentages.

Table 15. Effect of SSS Growth on ADT.

Location	Percentage of 2003 AADT
Brownsville, Hwy 48 close to Port	1.29%
Brownsville, FM 511 close to Port	1.95%
Corpus Christi, I-37 west of Hwy 286	0.43%
Corpus Christi, Hwy 181 at Causeway	0.49%
Freeport, Hwy 228/36 at FM 1495	5.29%
Freeport, Hwy 288 at FM 332	0.90%
Galveston, I-45 at Causeway	0.34%
Beaumont, I-10 N east of Hwy 364	0.54%
Beaumont, I-10 west of Hwy 380	0.24%
Houston, Hwy 146 south of Hwy 225	0.33%
Houston, I-10E at Beltway 8	0.13%
Houston, I-45 north of Beltway 8	0.07%
Port Arthur, Hwy 69 west of Hwy 87	1.14%
Port Arthur, Hwy 69 east of I-10	0.32%

To develop an accurate picture of the impact of the additional truck traffic, it would be necessary to first determine the variation in ADT by time of day and the timing of the additional traffic that would be superimposed on the system. Additionally, it would be important to know the volume-to-capacity ratio of those highway segments expected to handle the majority of the new truck movements.

As can be seen from the data shown above, the effect of a doubling of SSS-related traffic would have a negligible impact in areas directly affected by port traffic, provided that none of these areas are already at capacity. In the worst case, there would be a 5% increase in the immediate vicinity of Port Freeport, but the effect quickly dissipates as traffic leaves the port. There would be an effect of almost 2% on FM 511 at the Port of Brownsville. In all other cases, the actual effect would be 1.3% of ADT or less. For the Port of Brownsville and Port Freeport cases, additional investigation might be warranted to see if the timing and volume of additional truck traffic would affect the level of service. In other cases, the volumes should be absorbed into the existing system with only a minor effect, as long as none of the affected roadways are already at capacity. Further study is needed to determine if any of the identified port areas are so close to capacity that no further increases in traffic could be handled without a significant degradation in level of service.

If rail does indeed capture 10% of the theoretical increased SSS volume, this would imply an additional 6250 carloads in Texas annually. This is the equivalent of 24 rail cars per day, assuming 260 days of activity in a year. With the exception of Port Isabel and Freeport's public facilities (58), any of the ports in Groups B, C, or D could handle this additional cargo efficiently. Given that this additional cargo would probably move through more than one port, the effect on the rail system will be minimal, if it is noticed at all.

POTENTIAL FUTURE ANALYSIS

This project looked at Texas ports from a fairly high level. Tools are available to guide a very specific and detailed analysis of a given port's current status and its probability of being able to make the changes necessary to attract SSS business. One such tool is a decision tool titled Prospects and Opportunities for Short Sea Shipping developed by Maritime Transport and Logistics Advisors in 2005. This decision tool provides a fairly comprehensive list of critical decision factors that support or impede the initiation of SSS at a given port. More information can be found on this tool at:

<http://www.marad.dot.gov/MHI/documents/Decision%20Tool%20White%20Paper%20for%20Short%20Sea%20Shipping%20Revised.pdf>.

CHAPTER 6: CONCLUSIONS AND NEXT STEPS

There is a significant amount of literature regarding short sea shipping and factors that will contribute toward or detract from its success. Although Gulf of Mexico trade has unique geography and economic conditions, only one previous study (12) focused on SSS operations in the gulf region (between the U.S. and Mexico).

The research conducted for this project focused on trade between Texas ports and trading partners in the wider Gulf of Mexico region (including ports in Mexico, Belize, Guatemala, Honduras, Costa Rica, and Panama). This research included an analysis of detailed freight movement data, interviews of port officials, and an analysis of possible effects on the Texas transportation system.

CONCLUSIONS

The observations provided below are focused strictly on SSS traffic, as defined in [Chapter 1](#); they do not reflect on the overall container trade situation with other continents, islands, or industrial centers. The main findings are summarized below:

Limitations

- With regard to international movements, freight is dominated by dry and liquid bulk cargoes that have not been conducive to the development of SSS operations. The container trade is more promising, although not to a large degree. The primary non-Texas ports involved in SSS container trade currently are Puerto Cortes, Puerto Barrios, Puerto Limon, and Santo Tomas. A high percentage of this trade is composed of fruits and vegetables and the material used to pack and ship them.
- New operators will have trouble competing for small shipments with the larger carriers since the latter can charge low rates just to fill otherwise empty space.
- The inability to lock in a container pool of sufficient size has been a hindrance in developing SSS services.
- SSS trade with Mexico and Central America does not account for a large percentage of activity at Texas ports. However, the container trade occurring at Freeport and Galveston is almost 100% dependent on SSS activity.
- Most Texas ports are not actively pursuing SSS cargo in comparison to Asian, European, or South American traffic. Several ports have identified possible SSS niche markets, but they have not invested significant resources in developing them.

Potential Triggers

- The analysis in this report is predicated on a continuation of the current regulatory and fiscal regime in the region. There are certain “triggers” which, if they were to occur, could alter this paradigm quickly and lead to a rapid development in SSS trade:
 - the completion of the Panama Canal and the initiation of feeder services from the Atlantic side of Panama into the Gulf of Mexico,
 - a disruption in Trans-Pacific trade, and
 - changes in cabotage rules, specifically the creation of a NAFTA Flag for Canada, Mexico, and the U.S.
- Certain governmental measures not directly tied to SSS could nevertheless have the indirect effect of encouraging more shipments by water:
 - tightening of enforcement for overweight trucks.
 - elimination or restructuring of the Harbor Maintenance Tax, and
 - additional restrictions on Hazardous Materials movements.

Effect on Vessel Traffic

- The GIWW traffic may grow if more chemical and hazmat shipments can be routed via water. Container-on-barge operations are very much niche-oriented and would unlikely lead to a significant increase in waterborne traffic in the short term. Ocean-going barges might provide a coastal alternative to the GIWW in certain situations. These two options would be mutually exclusive due to the differences in the equipment used in each case.
- Because of the high capital cost involved in acquiring a vessel for SSS service, the researchers concluded that it is more likely that a start-up service would seek to acquire an existing vessel and retrofit it, if need be. Because of their availability and reasonable cost, older offshore supply vessels appear to be the most likely candidates for use in a new SSS operation, similar to what Osprey Line accomplished with the M/V Sea Trader. Another possibility, although not tested to date, is the utilization of an articulated tug/barge operation similar to what Crowley Marine and other enterprises use for the transport of liquid cargo.

Effect on Landside Infrastructure and Operations – Ports

- Based on other studies and the results of this investigation, the researchers concluded that any significant growth in SSS traffic will most likely consist of containerized cargo. Six Texas ports appear to be in a position to capture significant SSS containerized cargo. Houston, Freeport, and Galveston already have existing containerized operations. Three other ports—Beaumont, Brownsville, and Port Arthur—have the docks and equipment for handling a mid-volume container operation (50,000–150,000 TEUs), although Beaumont is limited by the reach of the crane it would use.

Effect on Landside Infrastructure and Operations – Highway and Rail

- Even a doubling of current SSS volumes would most likely not produce a significant impact on Texas highway or rail traffic. The effects would probably be more noticeable in Brownsville or Freeport, but even in those two cases, the effects would not be substantial.

RECOMMENDATIONS FOR FURTHER STUDY

- The conclusions provided above are based on the assumption that government—whether federal, state, or local—will not change its policy, regulatory, or fiscal approach to specifically encourage SSS. However, there are public policy reasons to encourage SSS—air quality, congestion, hazmat concerns, etc. These potential measures should be investigated in future research.
- This project focused on trade between ports in the immediate Gulf of Mexico region with alternatives for overland transport, and did not include ports in the Caribbean. An increase in trade with some islands (for example, trade with Cuba with the removal of U.S. trade sanctions) might increase opportunities for interregional trade similar to SSS trade discussed in this report and should be investigated in future research as warranted.
- This report did not attempt to analyze the competitive position of any particular port or its ability to make the changes needed to attract SSS cargo. Ports that are interested in pursuing a detailed analysis of their ability to develop this type of business may want to consider a decision tool developed by Maritime Transport and Logistics Advisors in 2005. This decision tool provides a fairly comprehensive list of critical decision factors that support or impede the initiation of SSS at a given port. More information can be found at <http://www.marad.dot.gov/MHI/documents/Decision%20Tool%20White%20Paper%20for%20Short%20Sea%20Shipping%20Revised.pdf>.

REFERENCES

1. *Freight Transportation: Short Sea Shipping Option Shows Importance of Systematic Approach to Public Investment Decisions*. Publication GAO-05-768. Government Accountability Office, Washington, DC, July 2005.
2. B. Mongelluzzo. U.S. Trade, Transportation on Collision Course. *Journal of Commerce Online*, February 2, 2006.
3. *The Wave of America's Future*. U.S. Maritime Administration, Short Sea Shipping Program, Washington, DC.
http://www.marad.dot.gov/Programs/sss_II.html Accessed February 13, 2006.
4. P.T. Leach, Can Short-Sea Measure Up? *Journal of Commerce*, Volume 5, Issue 16. April 19-25, 2004, pp. 30–31.
5. *Trade and Transportation: A Study of North American Port and Intermodal Systems*. National Chamber Foundation of the U.S. Chamber of Commerce, Washington, DC, March 2003.
6. Conference Report, 2nd Annual Short Sea Shipping Conference. U.S. Maritime Administration, November 4–6, 2003.
http://iei-corp.com/sssc2004/SSSCConference%20Report_25may2.pdf Accessed February 15, 2006.
7. *Multi-Client Port Access Project Final Report*. I-95 Corridor Coalition, September 2003, Chapter 4.
<http://144.202.240.28/pman/projectmanagement/Upfiles/reports/full186.pdf> Accessed February 16, 2006.
8. P. Tirschwell. Defining the Term Short-Sea. *Journal of Commerce*. Volume 4, Issue 47. November 24, 2003, p. 6.
9. R.G. Edmonson, Short-Sea Shipping Only a Few Years Away, Says MARAD Chief, *Journal of Commerce Online*, November 3, 2003.
10. Welcome to America's Marine Highway Initiative. U.S. Maritime Administration, Washington, DC. <http://www.marad.dot.gov/MHI/index.asp> Accessed August 2007.
11. P.R. Brodie, *Illustrated Dictionary of Cargo Handling*. Lloyd's of London Press, Ltd., London, England, 1991.

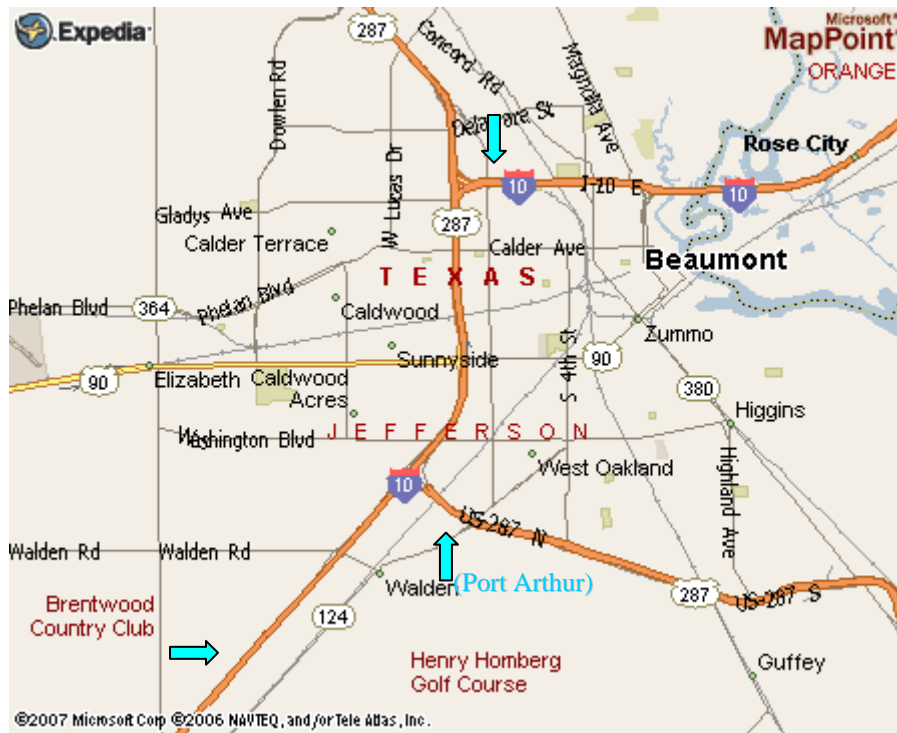
12. C.J. Kruse, D.H. Bierling, and N. Vajdos. *Analysis of Start-Up Cross-Gulf Short Sea Shipping Activities with Mexico Since 1990: Problems and Opportunities*. SWUTC/04/473700-00021-1. Southwest Region University Transportation Center, College Station, TX. August 2004.
13. About GPAA. Gulf Ports Association of the Americas.
www.gulfportsaa.com/gpaa_who_we_are.htm Accessed February 16, 2006.
14. *Tonnage for Selected U.S. Ports in 2005*. U.S. Army Corps of Engineers, Navigation Data Center. <http://www.iwr.usace.army.mil/ndc/wcsc/portname05.htm> Accessed July 6, 2007.
15. *North American Port Container Traffic 2006*. American Association of Port Authorities.
http://aapa.files.cms-plus.com/PDFs/2006_North_American_Container_Traffic.pdf
Accessed July 6, 2007.
16. List of Homeports: Homeports and the Ships Assigned as of August 19, 2005. The United States Navy. <http://www.chinfo.navy.mil/navpalib/ships/lists/homeport.html>. Accessed August 30, 2007.
17. National Defense Reserve Fleet Inventory: for the Month Ending July 31, 2007. U.S. Department of Transportation Maritime Administration.
http://www.marad.dot.gov/offices/ship/Current_Inventory.pdf. Accessed August 30, 2007.
18. Linea Peninsular website. <http://www.lineaships.com/>. Accessed July 6, 2007.
19. CG Railways, Incorporated website: <http://www.cgrailway.com/home.htm>, Accessed July 6, 2007.
20. Office of the United States Trade Representative.
http://www.ustr.gov/Document_Library/Press_Releases/2007/January/Schwab_Signs_Textile_Customs_Cooperation_Agreement_with_Mexico.html
21. Eduardo E. Lugo T., Pronóstico de Demanda de Tráfico Portuario en el Caribe y Centro América. Autoridad del Canal de Panamá (ACP), presentation made in May 2007.
22. China Should Use Reserves to Sway the U.S., Xia Says, *Bloomberg News*, August 6, 2007.
<http://www.bloomberg.com/apps/news?pid=20601087&sid=aEm7AiUf1FmI&refer=home>
23. L.F. Ruiz Meier. Transport Costs in a Ricardian Model with Multi-Stage Production. *Southern Economic Journal*, Volume 56, No. 4, p. 943.
24. Categories of Travel Time, Caltrans Division of Transportation Planning
http://www.dot.ca.gov/hq/tpp/offices/ote/Benefit_Cost/benefits/travel_time/categories.html

25. *Union Pacific Corporation 2006 Analyst Fact Book*. Omaha, NE.
<http://www.up.com/investors/attachments/factbooks/2006/factbook.pdf>. Accessed July 6, 2007.
26. L.M. Muench, Remarks to Governors' Ethanol Coalition. Midcontinent Office of The American Waterways Operators, July 12, 2002.
http://www.ethanol-gec.org/presentations/waterways_speech07-17-02.htm
27. Interview with Paul Hauck, U.S. Envirofuels, March 2, 2007.
28. \$200 Million Economic Boost to Victoria by Lone Star Ethanol. Port of Victoria Press Release. January 8, 2006. <http://www.portofvictoria.com/images/20070108125327667.pdf>. Accessed August 30, 2007.
29. V. Vaughan. *Ethanol is Drawing Lots of Farmers and Investors*. MySA.com. February 3, 2007.
<http://www.mysanantonio.com/business/stories/MYSA020407.1R.Ethanol.aefb25.html>
Accessed August 30, 2007.
30. Kirby Ups Stake in Osprey Line. *MarineLog*, February 17, 2006.
<http://www.marinelog.com/DOCS/NEWSMMVI/2006feb000174.html>
31. Interview with John Hallmark, Osprey Line, January 29, 2007.
32. T.L. Gallagher. Kirby Profit Jumps 48 Percent. *Traffic World*, October 27, 2006.
33. Interview with Raymond Butler, Executive Director, Gulf Intracoastal Canal Association. February 22, 2007.
34. R.E. Weisbrod, Freight Ferries In New York-New Jersey Harbor: How To Make Them Happen. *Transportation Research Record: Journal of the Transportation Research Board*, No. 1763, TRB, National Research Council, Washington, D.C., 2001, pp. 106-113.
<http://trb.metapress.com/content/e94573740u7456p3/fulltext.pdf>
35. Phase Five of Kingston Terminal Expansion Project near Completion. Jamaica Information Service. January 29, 2007.
http://www.jis.gov.jm/water_housing/html/20070126T090000-0500_11098_JIS_PHASE_FIVE_OF_KINGSTON_TERMINAL_EXPANSION_PROJECT_NEAR_COMPLETION.asp
36. Hapag-Lloyd Changes Caribbean Itinerary in Cost-Cutting Move. *Shipping Digest*, September 25, 2006.
37. Marcon International 2004 Sales and Charters.
<http://www.marcon.com/marcon2c.cfm?SectionGroupsID=31&SectionListsID=31&PageID=571>. Accessed, July 6, 2007.

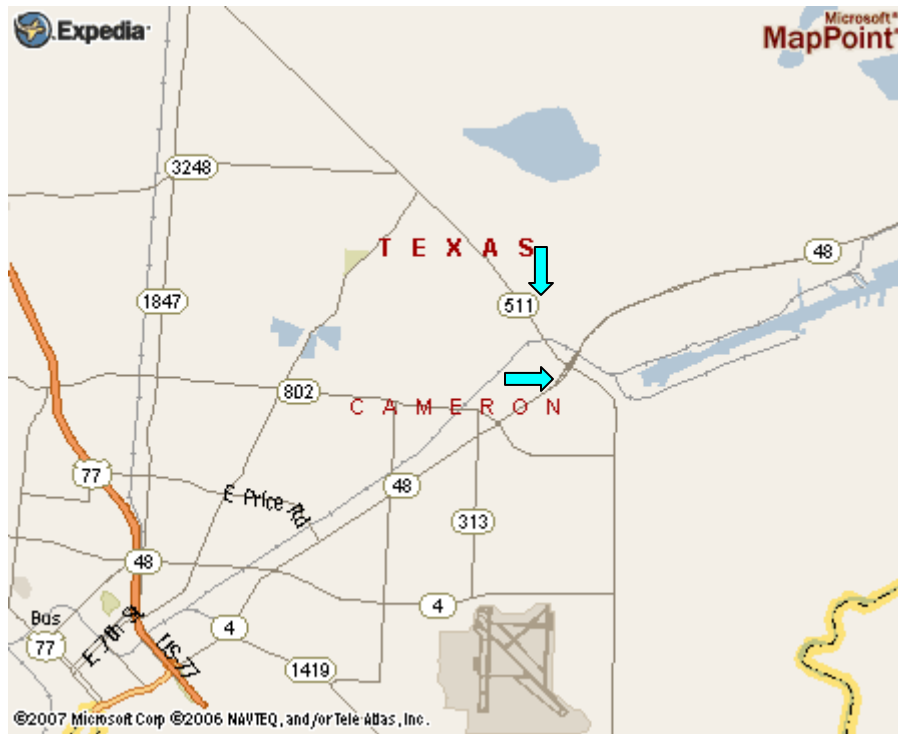
38. Dan Barrett. *The Offshore Supply Boat Sector*.
<http://www.rigzone.com/news/insight/download/supplyboatsector.pdf>
39. Current U.S. Shipbuilding Contracts (as of July 5, 2007). Maritime Business Strategies, LLC. <http://www.coltoncompany.com/shipbldg/contracts.htm>
40. Interview with Charlie Knight, Bollinger Shipyards, June 18, 2007.
41. D. Barrett, *The Offshore Supply Boat Sector*. Fortis Securities LLC, February 10, 2005.
42. Interview with James Hampel, COO for G and G Shipping, June 19, 2007.
43. Interview with Donna Eymard, Interim Port Director of the Port of Brownsville, June 18, 2007.
44. Hydralift Skeg Use Gaining Speed. MarineLink.com. November 8, 2002.
<http://www.marinelink.com/Story/Hydralift+Skeg+Use+Gaining+Speed-9887.html>
45. Interview with Robert Hill, President of Ocean Tug and Barge Engineering, May 7, 2007.
46. R.G. Edmonson, Coast to Coast. *Journal of Commerce*, Vol. 8, Issue 13, April 2, 2007, p. 29.
47. *Four Corridor Case Studies of Short Sea Shipping Services*. Publication Ref. #DTOS59-04-Q-00069. Submitted to: U.S. Department of Transportation, Office of the Secretary/Maritime Administration by Global Insight and Reeve and Associates, August 15, 2006.
<http://www.marad.dot.gov/Programs/America's%20Marine%20Highways/Four%20Corridor%20Studies%20Final.pdf>
48. Interview with Salvatore Presti, President of National Shipping of America, June 4, 2007.
49. Interview with Mike Wilson, Director of Trade Development for Port Freeport, June 6, 2007.
50. Interview with Duncan Wright, Horizon Services Group, June 11, 2007.
51. <http://www.directferries.com/>. Accessed July 6, 2007.
52. *Annual Traffic Volume Report: 2006*. Alaska Marine Highway, State of Alaska, Department of Transportation and Public Facilities.
<http://www.dot.state.ak.us/amhs/Sailing/Reports/documents/ATVR2006.pdf>. Accessed July 6, 2007.

53. *Alaska Marine Highway System Vessels*. Alaska Marine Highway, State of Alaska, Department of Transportation and Public Facilities.
<http://www.dot.state.ak.us/amhs/Sailing/Vessels/index.html>. Accessed July 6, 2007.
54. Seagirt Terminal Breaks 2006 Record for Container Moves Per Hour. Maryland Port Administration Press Release, March 31, 2006.
<http://www.marylandports.com/news/press/2006/RecordContainerMoves.pdf>
55. ILWU Stages Widespread Work Slowdowns from Seattle to Los Angeles Ports; PMA to Close All West Coast Terminals Beginning with Night Shift Today. Pacific Maritime Association Press Release, September 27, 2002.
http://www.pmanet.org/docs/index.cfm/id_subcat/35/id_content/2142588534
56. Double Digit Increases in the Port of Boston; Steepest Increases Seen in Exports. Massport Press Release, February 9, 2005.
http://www.massport.com/about/press05/press_news_port04.html
57. R.G. Edmonson. Virtual Reality. *Journal of Commerce*, Volume 8, Issue 9, March 5, 2007, pp. 46-50.
58. D.H. Bierling, C.A. Morgan, A.P. James, J.E. Warner, G.A. Chabot, T.A. Sain. *Current and Future Rail Access Needs of Western Gulf-Texas Ports*. SWUTC/03/473700-00011-1. Southwest Region University Transportation Center, College Station, Texas. November 2003.

APPENDIX: LOCATION OF DAILY TRAFFIC COUNTS



Beaumont Area



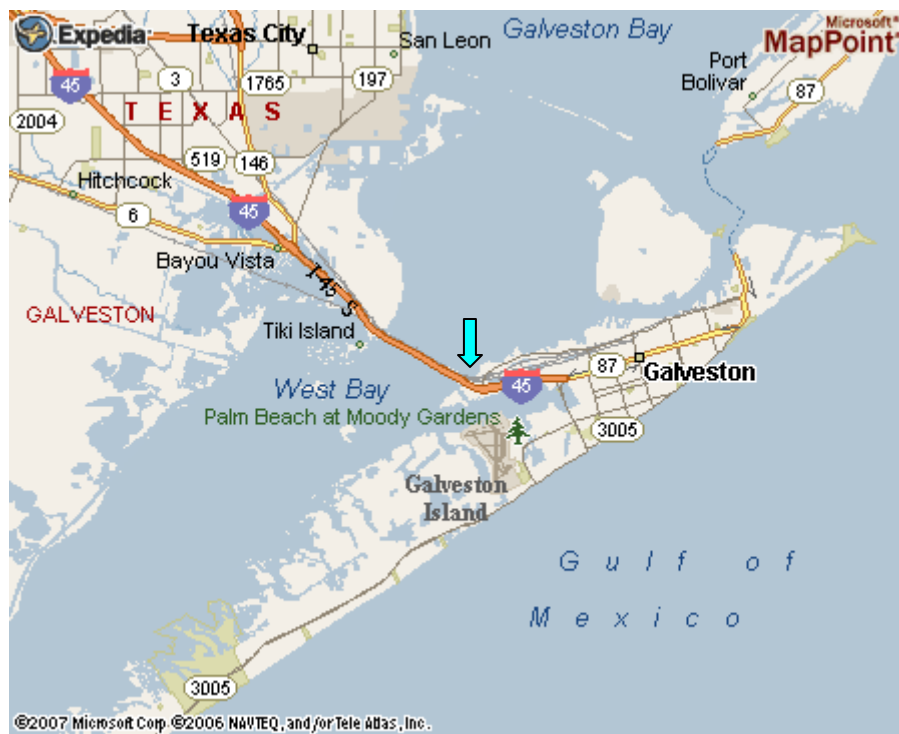
Port of Brownsville Area



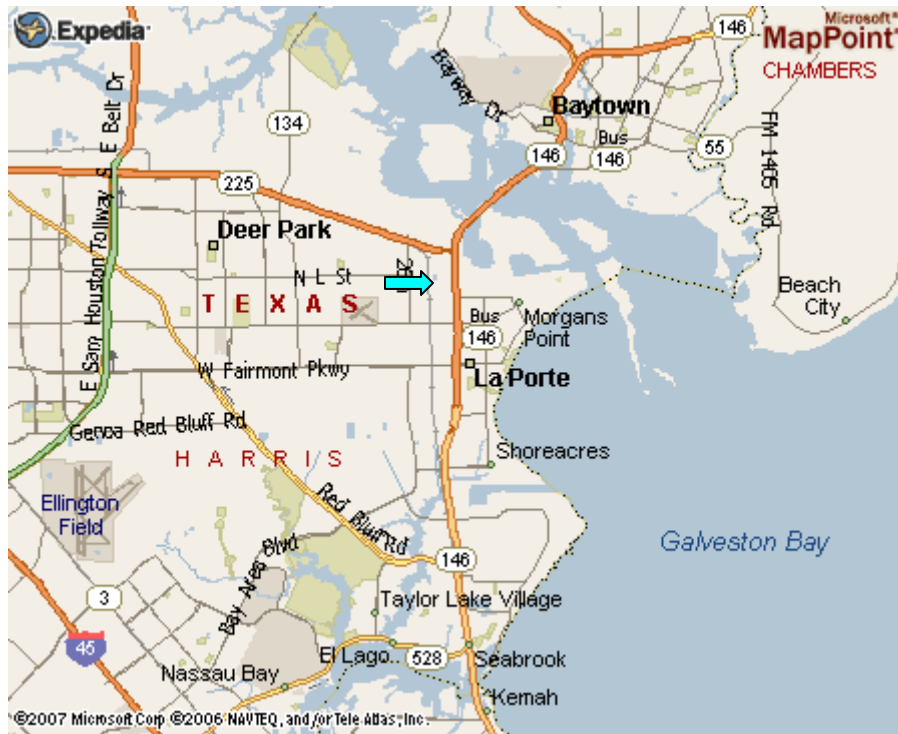
Corpus Christi Area



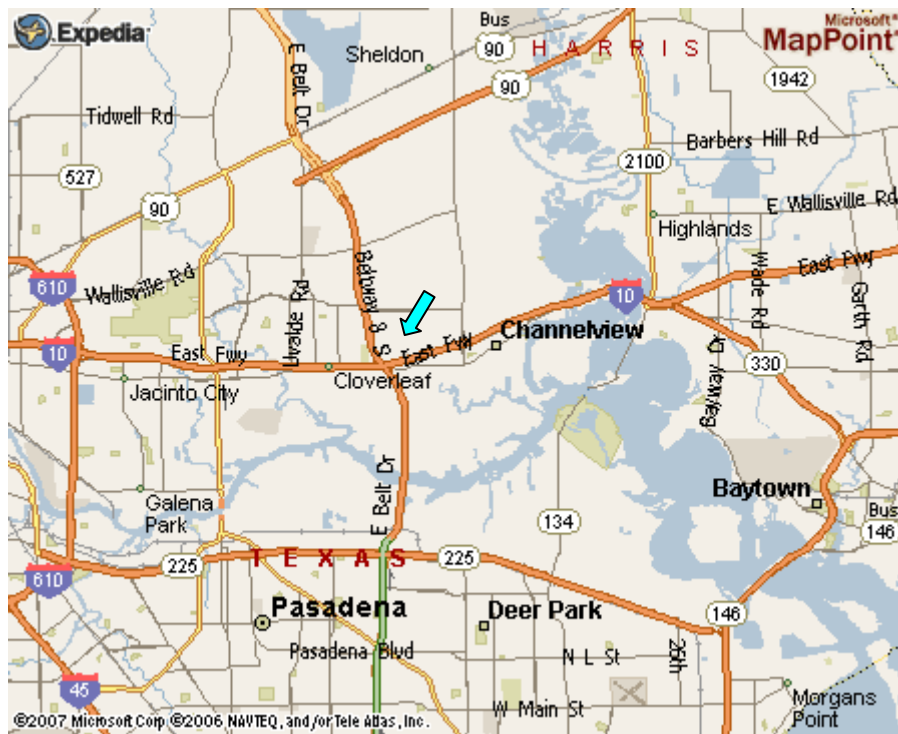
Freeport Area



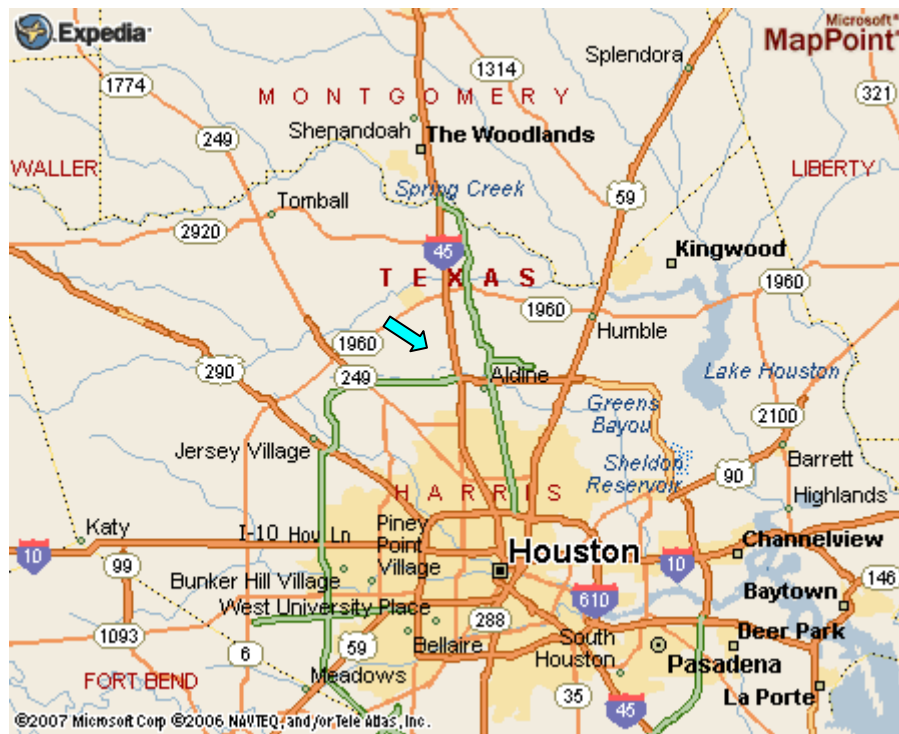
Galveston Area



Houston: Highway 146



Houston: I-10E at Beltway 8



Houston: I-45N North of Beltway 8



Port Arthur Area

