MARITIME ECONOMICS PANEL OF THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS
TRANSPORTATION RESEARCH BOARD / MARINE BOARD OF THE NATIONAL ACADEMIES

WORKSHOP: THE ECONOMICS OF DOMESTIC SHORT SEA SHIPPING

HELD SEPTEMBER 28, 2004
IN WASHINGTON, DC

SUMMARY OF PROCEEDINGS

The Maritime Economics Panel of the Society of Naval Architects and Marine Engineers and the Transportation Research Board / Marine Board of the National Academies held a workshop on September 28, 2004 to explore the economics underlying development of Short Sea Shipping in the United States. Although much attention has been given to the development of engineering designs for ships to serve in hypothetical short sea roles, little attention has been paid to the economics of short sea shipping services and the structure of their markets, where these services form but one link in an intermodal chain. A series of presentations were used to posit an economic framework for domestic short sea shipping and explore options for financing a short sea shipping venture. With these discussions as a reference, participants then addressed "case studies" that examined some of the economic and financial challenges faced by existing domestic operators.

INTRODUCTION

The workshop opened by describing some of the basics of short sea shipping and explaining the U.S. Maritime Administration's role in promoting it. Increasing congestion on the nation's highways is the driving force behind the recent interest in domestic short sea shipping. Other modes of transport are approaching saturation. Thus, short sea shipping will not so much replace capacity on other routes as supplement the existing transportation infrastructure. The necessary ingredients for a successful service are reliability, frequency, and competitive pricing. Europe has subsidized short sea shipping – particularly start-up ventures – viewing it as a social imperative; however, the United States has been less aggressive in its promotion. The Maritime Administration has several initiatives in this area, notably the Short Sea Shipping Cooperative Program ("SCOOP").

AN ECONOMIC FRAMEWORK

In this session, an economic framework was developed by first defining the market and touching on similarities and differences between the domestic market and other regional markets in Europe, Asia, and Japan. This was followed by a detailed discussion of economics and how they apply to short sea shipping. Two presentations then challenged the market as defined, by showing its compatibility with the bulk shipping market and the passenger ferry market, and introduced pragmatic considerations and complexities to supplement the economic model.

Defining Short Sea Shipping. The workshop planners had previously formulated a definition for the domestic short sea shipping market:

> Freight service operations carrying either containerized or trailerized cargoes (or empties) via the coastal waters and river systems of North and Central America, having at least one port of call in the United States, and in particular those services where there is a true "intermodal choice" to be made by the shipper between moving units by water and using one or more land-based alternatives (*i.e.*, highway and/or rail).

Within this definition, a relatively large number of services exist on all three coasts, in riverine traffic, and in non-contiguous service to Alaska, Hawaii, and the Caribbean. Most operations are container-on-barge, although some ship-based roll on/roll off and lift on/lift off services exist. Most of the operations involve low-speed, time-indefinite movements of non-urgent freight. The question is whether markets exist for freight having more sensitivity to time and, if so, where these markets might be located. One answer is that these markets may develop in response to congestion, as alternatives to I-95 and I-5, the two coastal North-South interstate highways.

Developing a Marine Alternative. Injecting a marine alternative into the freight transportation system provides a new option having the potential to reduce pressure on other modes and add flexibility and resilience to the system. Estimating the potential demand for a marine alternative involves determining the traffic for which the alternative might be practicable, what other modes it would compete against, and what advantages and disadvantages it might have. Would its costs be in line with the quality of service it would provide? Is there a natural niche for it?

The analysis should focus on customers and their needs and preferences. Shippers and consignees are basically indifferent to mode or route as long as their cargo reaches its destination and their other needs and concerns are met. A variety of factors can create the potential for disrupting or delaying the movement of cargo. Other factors create the potential for loss or damage to cargo en route. These factors may be quite different among highway, rail, air, and marine modes. Shippers may be overly concerned about those pertaining to the less-understood marine mode, so a detailed examination of them should be made.

The economic perspective involves making decisions that will meet society's needs (as reflected in demand for products and services) while making the best possible use of scarce resources (in other words, minimizing both monetary and non-monetary costs). The decisions balancing society's needs to the application of scarce resources must consider not only the near term but the entire time when the effects of those decisions will be felt. And those effects should be accounted for not just for the system of immediate interest but for every component of the larger system within which it will operate. The degree of success in minimizing the costs of resources employed is measured in terms of profitability. Long-term profitability is estimated by calculating the net present value of the series of profits (and losses) projected over the future years.

It is important to recognize that for a commercial system, these decisions should be made with the objective of optimizing them at the level of the whole company, not at a lower level such as the marine department or the distribution division. The profitability measure used at the company level should be some form of cash flow after all expenses, including taxes, have been accounted for. Every decision, even technical decisions involving vessel subsystem choices, should be made with an eye to its effects on that final cash flow.

A shipper will compare his alternative modes, evaluating a ship or barge against the highway, rail and air alternatives, to decide how to ship his freight. Therefore the vessel developed for an short sea shipping system should be the best of all possible marine service alternatives for the particular trade. That is to say, if the marine alternative does not yet exist, any of a number of possible alternatives might be candidates for acquisition. Those alternatives might include, for example, a single large ship, a pair of medium-size ships, a group of smaller ships, a tug pushing a train of conventional barges, or a tug pushing a single very large barge of a new design. Each of those general types could be further broken down into lower-level alternatives. The group of smaller ships, for example, could consist of various numbers of smaller ships of different speeds able collectively to carry the required amount of freight on the required delivery schedule. Once the potential revenues and costs (and thus profitability) of each such alternative have been estimated, it may turn out that a previously unsuspected marine alternative will be shown to be the best competitor against the existing non-marine modes.

The choice of a marine alternative is also closely associated with the constraints imposed by ports, terminals, and landside facilities. The current paradigm for the port and terminal system is a major impediment to development of short sea shipping in this country. Regulatory constraints, labor practices and agreements, and inefficiently configured and operated facilities all work against short sea shipping. It is possible that to achieve success in short sea shipping a company will have to bypass the existing landside system entirely and establish a new one appropriate to short sea shipping's needs.

Besides the usual technical and programmatic factors involved in the development of a new system there are exogenous factors such as cost trends, changing tax or subsidy regimes, political and environmental issues and regulations, evolving economic and competitive conditions, and so on, that may also influence the choice of alternatives.

Considerable time and resources will be expended in establishing a service, and these costs must be taken into account. Up-front activities that must be funded include: overall planning; conducting studies; determining the required vessels and facilities; obtaining authorizations, licenses, leases and permits; and locating and garnering financing to support development of the operation, acquire the necessary facilities, vessels and equipment and meet a multitude of other expenses.

Incubators for the Market. One pertinent question is: where will developments in the short sea shipping market be generated? It is possible that the future markets may grow as part of a hub and spoke distribution as international trade expands. It is also possible that domestic short sea shipping will develop from expanding regional trade. The current domestic marine shipping market comprises services that move large quantities of agricultural products (principally grain) and energy products (principally crude oil, oil products, and coal). Much less in volume are shipments of intermodal cargoes. Project cargoes comprise a fourth area.

It is important to understand the major differences in culture between the "blue water" international carriers, the "blue water" U.S.-flag ship operators, the "blue water" coastal tug and barge operators, and the "brown water" river operators. Likewise, shippers, freight forwarders, and third-party logistics entities have a separate culture, as do ports. The major hurdle to developing domestic short sea shipping could be navigating through the mindsets of these different entities.

Will the short sea shipping market be expanded through major investment (such as the Port Authority of New York/New Jersey's recent initiatives) or by bootstrapping on existing services (such as Osprey's piggybacking on existing bulk movements)? Where will short sea shipping take root? Certain port environments are more favorable than others. Ingredients that may foster development of short sea shipping include: ready access to cargo; a local culture that values its port; convenient port facilities; and good intermodal connections.

Participants discussed the role of short sea shipping in the development of the port of New York – cargo moving along the Erie canal (essentially short sea shipping) was instrumental in the port's development. New Orleans is another location where cargo is plentiful. Memphis likewise has good access to cargo as well as a port culture favoring development. In many ways it is an "ideal" port for development of short sea shipping. There may be other locations. Lighter Aboard Ship ("LASH") technology had the advantage of allowing cargo to move on a single bill of lading and may lend itself to short sea shipping in some markets. Participants questioned why the Waterman LASH service failed.

Designing a New Service. An entirely new service postulated for the relatively benign water conditions of the Chesapeake Bay was presented. It would be designed as a combined passenger ferry and freight service. The service would follow a 180-mile North-South route (rather than an East-West direction across the bay), within the 200-mile rule of thumb for short sea distance. The service would have to respect the bay's sensitive ecological balance. Wake wash was also cited as a potential issue, following an incident in the James River.

In planning the service, it was necessary to do extensive background work and develop a market rationale incorporating not only the vessel, but also the landside scenario. It was important to study current movements of passengers and freight, and the potential for developing a destination market. Examining the docking locations at each end of the

proposed service was essential, including water approaches, potential for construction of terminals and docks, and access to road and rail infrastructure. The intermodal potential of locations was also examined.

Matching vessel selection to an imperfectly defined scenario is an iterative process involving constant reexamination. Vessel considerations include the common issues of speed, size and configuration. Foreign designs, including those of Austal and Incat, dominate. The promise of even more advanced technology (for example, significantly higher speeds) must be weighed against the apparent shortcomings and strengths of known systems.

The operating scenario must consider the expected mix of vessel payloads – passengers, vehicles, freight – frequency, schedules, operating speeds, and loading and offloading capabilities. In this instance, speed may not assume the importance it might in other passenger services because of the traffic and safety concerns associated with high speed operation in an area having a substantial volume of both commercial and pleasure craft. Speeds of 30-40 knots may raise safety issues. Moreover, analysis shows that the loading and offloading operations are where speed is most important. The benefits of high vessel speed may be lost to slow port operations.

There is also the potential for passenger fares to subsidize the freight rates. Passenger service brings the operation within the "sail and drive" hospitality regime, which may command more robust fares. Due to its passenger component, the freight service would be able to avoid the Harbor Maintenance Tax (however, it was cautioned that the customs service interprets the Harbor Maintenance Tax differently in different districts). The tax puts short sea shipping at a disadvantage compared to truck and rail.

With respect to financing, long gestation periods are typical of start-up operations, and there is a need to tap into capital to finance the planning and start up period. Another key decision involves the level of investment to be spent in docking facilities and shoreside infrastructure. The cost of vessel construction is significant, as is the burden of ramping up to profitability. The length of time before a service becomes profitable is crucial to success. Short sea shipping provides a major opportunity for private/public partnership; however, many states such as Virginia define transportation as being roads. That mentality needs to change.

The proposed service would run from Baltimore to Hampton Roads. This service has the opportunity to open Hampton Roads to economic development, and counter the city's self-impression that it is in a cul-de-sac, being somewhat removed from the I-95 corridor. The service has been targeting a relationship with small package shippers, but has had some trouble convincing them to relinquish their traditional fly/drive culture. The coastal shipping experience of two small package shippers – FedEx in China and DHL in Europe – may make them more willing to consider marine options.

FINANCING FOR DOMESTIC SHORT SEA SHIPPING

For the purposes of looking at financing options, short sea shipping operations may be separated into three classes: (1) ferry-based services operating in metropolitan areas or offshore locations; (2) barge-based short or intermediate range services; and (3) long-haul container and roll on/roll off ("Ro/Ro") services. Class 1 ferry services may be owned by a public authority or private sector entity, while Class 2 and Class 3 services are typically privately owned.

With respect to financing for the privately-owned services, operators in all classes most frequently use existing terminals or obtain public financing for new terminal facilities. Vessel costs for Class 1 and 2 services typically are such that they can be financed easily by established operators. New operators of Class 1 and 2 services may use debt financing through the engine manufacturer or an established banking connection. Engine manufacturers offer a practical financing solution when the amounts of money needed are relatively modest: Caterpillar, for example, limits per-vessel financing to $80 million and per-customer financing to around $125 million, although the company may be willing to participate in an attractive larger project.

Privately-owned Class 3 long haul services use Ro/Ro or container vessels that most often require federal financial assistance, particularly in the case of new services. These services may employ vessels that cost well in excess of $100 million per copy, and may require several such vessels to establish a viable service. The U.S. Maritime Administration's Title XI program will very likely be required in these circumstances.

If, as many believe, the greatest potential for removing a large number of 53-foot trailers from I-95 is through introduction of high speed Class 3 long-haul services operating between port pairs, a number of actions are needed to assist the process, including some or all of the following SEA 21 proposals developed by the Department of Transportation, Federal Highway Administration and Maritime Administration:

- Repeal the Domestic Harbor Maintenance Tax
- Revitalize Title XI debt financing guarantees
- Extend the Maritime Administration's Capital Construction Fund ("CCF") program to the domestic coastwise services
- Establish a Transportation Infrastructure Finance and Innovation Act ("TIFIA") program for terminals in the $20 to $60 million range.

Where a U.S. operator is undertaking a fleet expansion, it can use the CCF program to defer taxes on earnings set aside for vessel acquisition, thereby accelerating the accumulation of equity needed to purchase vessels or reducing lease financing costs where lease financing is used to acquire vessels. To date, $1.9 billion has been deposited in CCF program accounts, some portion of which would become available to fund

shipbuilding for domestic coastwise service were the law to be extended. Such a proposal was introduced as H.R. 2190, a bill sponsored by the Shipbuilders' Council of America; however, the American Waterways Operators opposed the proposed legislation, asserting that it would result in massive overbuilding for the coastwise trades.

In addition, a program is needed to attract vessel leasing capital for new Coastwise operations. While the Title XI program provides government protection for lenders, vessel lease financing will not play an important role so long as the equity portion of these transactions remains at risk. A targeted program that would allow vessel owners to purchase some form of equity insurance (akin to Title XI debt insurance) is needed. Such a program should be of limited duration (perhaps five to seven years) so as to "jump start" Coastwise shipping. And, it should be limited to vessels certified as "militarily useful" by the Department of Defense (assuring that defaulted vessels will be useful additions to the Reserve Fleet). With equity insurance in place, one should expect to attract U.S.-citizen lessors which have to date remained on the sidelines, and the non-citizen equity sources authorized in 1996 under 46 U.S.C. § 12106(e).

Success for short sea shipping in the near term will likely depend on whether existing operators support or oppose the Department of Transportation's SEA 21 proposals.

CASE STUDIES

Using the above information as background, participants explored two case studies. The first examined decisionmaking for a fleet renewal program. The second portrayed the myriad considerations facing a start-up short sea shipping venture which is on the verge of commencing operations.

Case Study 1: Fleet Renewal – the "Orca Class" Ro/Ro Vessel.

Totem Ocean Trailer Express ("TOTE"), a part of SaltChuck Resources, Inc.'s American Shipping Group, has been in operation since 1975 between Alaska and Washington state. In December 1999, TOTE contracted with NASSCO for two Orca Class Ro/Ro vessels to replace the two vessels that had been serving that route since the mid 70s. The new ships were delivered in April and August 2003 and have been in service for approximately a year.

TOTE operates a niche Ro/Ro liner service characterized by a 66 hour transit at 24 knots, requirement to turn the vessel in ten hours – with actual experience of six to eight hours – while having the flexibility to load all equipment types and need to carry vehicles. The service has a 98 percent on-time record where on time is defined as vessel docked at 7:00 AM and ready to start unloading. By 1:00 PM, freight is delivered to most clients.

TOTE competes in a market consisting of liner and barge services as well as overland transportation. The one-way trip is 1,450 miles. Vessels can be subjected to wind gusts of up to 100 knots and seas of up to 60 feet. Cook Inlet is choked with ice for five months of the year and has a six to seven knot tidal current and a 35 foot tidal range.

With these challenging conditions, it was decided to design the replacement vessels specifically for the market. TOTE's existing "Ponce Class" ships were designed for the Puerto Rican trade, a trade characterized by relatively benign weather conditions but have since been modified for Alaskan Trade conditions including a recent Life Extension program. Two of these vessels have been involved in Operation Iraqi Freedom.

TOTE did seakeeping model tests using existing wave spectra data as well as its own operating experience. TOTE tested not only the new design but also a model of its existing ships so that it would have a fuller understanding of how the model test results would relate to full scale performance.

At 839 feet, the Orca class vessel is nearly 50 feet longer than the Ponce class. Its beam of 118 feet is 13 feet wider than the prior ships. Service speed remains unchanged at 24 knots, but the engines are diesel-electric rather than the Ponce's steam turbines. The new vessels allow TOTE to move 60 percent more freight for the same fuel.

Four main engines and two auxiliary generators driving dual shafts and propellers allow the ships to achieve a variety of operating speeds ranging from 12 to 25 knots. Even with one propulsion motor out of operation, the ship can achieve 16 knots on one shaft.

The Orca class vessel can accommodate 550 trailers and 300 autos, compared to the 385 trailers and 110 autos of the Ponce. The most significant difference, however, is that the Orca class vessels can load 120 53-foot trailers compared to seven for the Ponce. Whereas the trailers carried on the Ponce ships consisted mainly of 40- and 45-foot units, on the new ships trailers are mainly 53- and 48-foot units with some 40-foot units.

The Orca class has a significantly higher number of internal ramps – 12 compared to the Ponce's five – which facilitates rapid loading and unloading. This, coupled with the new ships' broader beam, wide lanes, reduced number of stanchions and fewer number of bulkheads enhance cargo handling.

The new ships tackle conditions unique to the route with a variety of features including ice bands (built to ice class I-C), unusually large freeboard, and a whaleback forecastle that sheds boarding seas. The fuel oil tank is double-hulled and well protected to ensure against environmental damage resulting from a collision or grounding incident. The award-winning ships incorporate other environmental design features such as: an up-to-date ballast management system (90 percent of ballast is fresh water kept internally and shifted to meet needs); a fuel-efficient diesel-electric power plant; 4-cycle engines that are clean burning and have low emissions of sulfur oxides and nitrogen oxides; a state-of-the-art sewage treatment plant; and shoreside trash disposal using a licensed contractor.

In introducing the new ships, the primary concerns of TOTE's customers were whether the replacement vessels would result in rising rates. The company spent considerable effort to convince its clientele that the new ships would not result in higher freight rates – that the investment expense would be offset by greater efficiencies of the ships and the market would dictate the freight rates as in the past. The efficiency of the vessels was

stressed as all benchmark areas of cost savings have been met by the Orca's in their first year of operation. The higher initial cost of a Jones Act ship amortized over its 25-year service life is an incremental cost that is relatively insignificant.[1]

The market growth in the Alaskan Trade is about one percent per year; however, the transition from 40- and 45-foot containers to 53-foot units is noted, enhanced by the flexibility of the Orca Class vessels.

Case Study 2: The Barge Feeder Service for the Port of Bridgeport.

Bridgeport Port Authority is initiating a barge/container service between the Ports of NY/NJ and Bridgeport, CT. The service will be a roll on/roll off system using a ramp mounted on the barge. The terminal will be based on a 15-acre parcel located in the Bridgeport Regional Maritime Center ("BRMC"), also home to Derektor Shipyard and the Tallmadge Oyster Company.

The service proposes to utilize a 400-foot by 100-foot deck barge and the economics were calculated on a utilization rate of 60 percent. By the end of its second year of operation, the barge/feeder service is anticipated to remove approximately 33,000 containers from I-95 with anticipated ancillary benefits of lowering the risk of a major traffic incident and a possible (though marginal) reduction in air pollution. With respect to air pollution, Tier 2 truck engines will be very low in emissions compared to marine diesel engines so it is unclear what, if any, the actual reduction in air pollution would be.

The cost savings associated with a reduction in trucking time are also hard to quantify because truckers are paid either on a per-mile basis or a flat rate – not an hourly rate – in other words, the burden of congestion falls on the trucker. The section of I-95 in question was designed to move 60,000 vehicles per day but is presently handling 100,000 vehicles per day. Of these vehicles, 15,000 are trucks and between 900 and 1,000 are sea containers. The barge feeder service seeks to capture 60 of these containers per day. Moreover, 15 percent of overseas cargo is overweight containers and the remaining 85 percent is cubed out. The region hopes to create employment in the warehousing and distribution sector by stripping and stuffing operations – for example, repacking three 40-foot containers into two 53-foot trailers. Warehouses are increasingly becoming "fulfillment centers" where cargo owners are using warehouses as strip-and-ship locations.

The State of Connecticut is providing the initial funding to implement the service, thereby creating a public-private partnership in an area where the private sector would not act alone. The money provided by the state will have a limited time line, after which the service is expected to become financially viable. Bridgeport Port Authority will have oversight of terminal operations in Bridgeport, operations of the tug/barge, and truckers.

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[1] One participant stated that although shipping costs were blamed for the high cost of goods in Hawaii compared to the continental United States, in fact the shipping costs added only a small amount to the cost of the goods: about 50 cents on average.

Longshoremen will own the terminal operation but stevedore management will be by a Canadian firm.

The presentation discussed design of the terminal and barge. Only a small amount of frontage on the water is envisioned with most of land for receiving and inspection, and the trucking terminal removed from the waterfront. The present port facilities are good but underutilized. One banana boat presently calls at the facility.

The proposed Ro/Ro tug-barge system will use a barge-mounted ramp. The barge's ramp design has not been determined; the ramp may be bow, three-quarters, or midship mounted. Ro/Ro will reduce the capital investment required for the initial period, the principal savings over a lift on/lift off operation being the elimination of cranes and crane operations – no elaborate landside facilities are required. Containers on chassis can be moved using yard hustlers. Not only is Ro/Ro less costly than lift on/lift off, it is more efficient in terms of units loaded or unloaded per hour. Thus, Ro/Ro reduces the vessel turn time and increases vessel utilization.

Initially, it is envisioned that one deck barge and tugboat will be employed in daily service.[2] The operating plan is based on making a complete round trip in 24 hours. The schedule allows eight hours for transit of the 70 nautical miles in each direction, three hours to discharge and load in Bridgeport, and five hours to load and discharge in the port of NY/NJ (based on a concept of serving two NY/NJ terminals). The Northbound leg is projected to be full containers on chassis, whereas Southbound traffic is anticipated to be 25 percent loaded and 75 percent empty container/chassis units. In the start-up phase, customs will be performed in New York; however, later on, containers will clear customs in Bridgeport. No outside movements by truck will be required at the New York end of the service. The tug/barge will call directly at each of the terminals where containers are to be picked up or discharged that day.

Initial investment by the State of Connecticut is $1,000,000 in the first year and $500,000 in the second year. Capital improvements for the marine terminal are $5,600,000 in the second year. The Port Authority of NY/NJ will contribute $1,200,000 ($200,000 for marketing and $25 per loaded box). Breakeven for the venture is at 65 percent utilization, and there is an option in the contract allowing the operator to buy out the Bridgeport Port Authority's interest, thereby becoming a private entity. The goal is for the service to be self-sustaining in two years.

Sales and marketing are the keys to success – one shortcoming of the present feeder service to Albany is that it is not getting the Canadian cargoes (another is that the service operates only weekly, rather than daily). Bridgeport also anticipates relieving the need for satellite facilities in NY/NJ thereby reducing operating cost. Drayage between Hartford and Bridgeport is about $200. Alternatively, trucking between Hartford and the

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[2] Hellgate currents may affect sizing of the tug/barge operation. Although the original proposal was based on a single 400-foot by 100-foot barge, either two smaller barges will be required to sustain a daily service or greater power will be required to overcome the strong currents.

New York piers runs about $6-700 plus a 7 percent fuel surcharge. In addition, although an ILA port fee of $25 applies equally to shipment by water and truck, the remainder of the $135 box assessment fee applies only to movements by truck – savings of $110 flows to the shipping lines. The goal is for a through bill of lading to Bridgeport on a fixed price. The Bridgeport operation would have responsibility for the onward movement of freight.

The service is scheduled to begin nine months after the Connecticut Department of Transportation approves the contract and issues a letter to proceed. That authorization had been obtained just prior to the time of the workshop.

SPEAKERS (IN ORDER OF PRESENTATION)

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