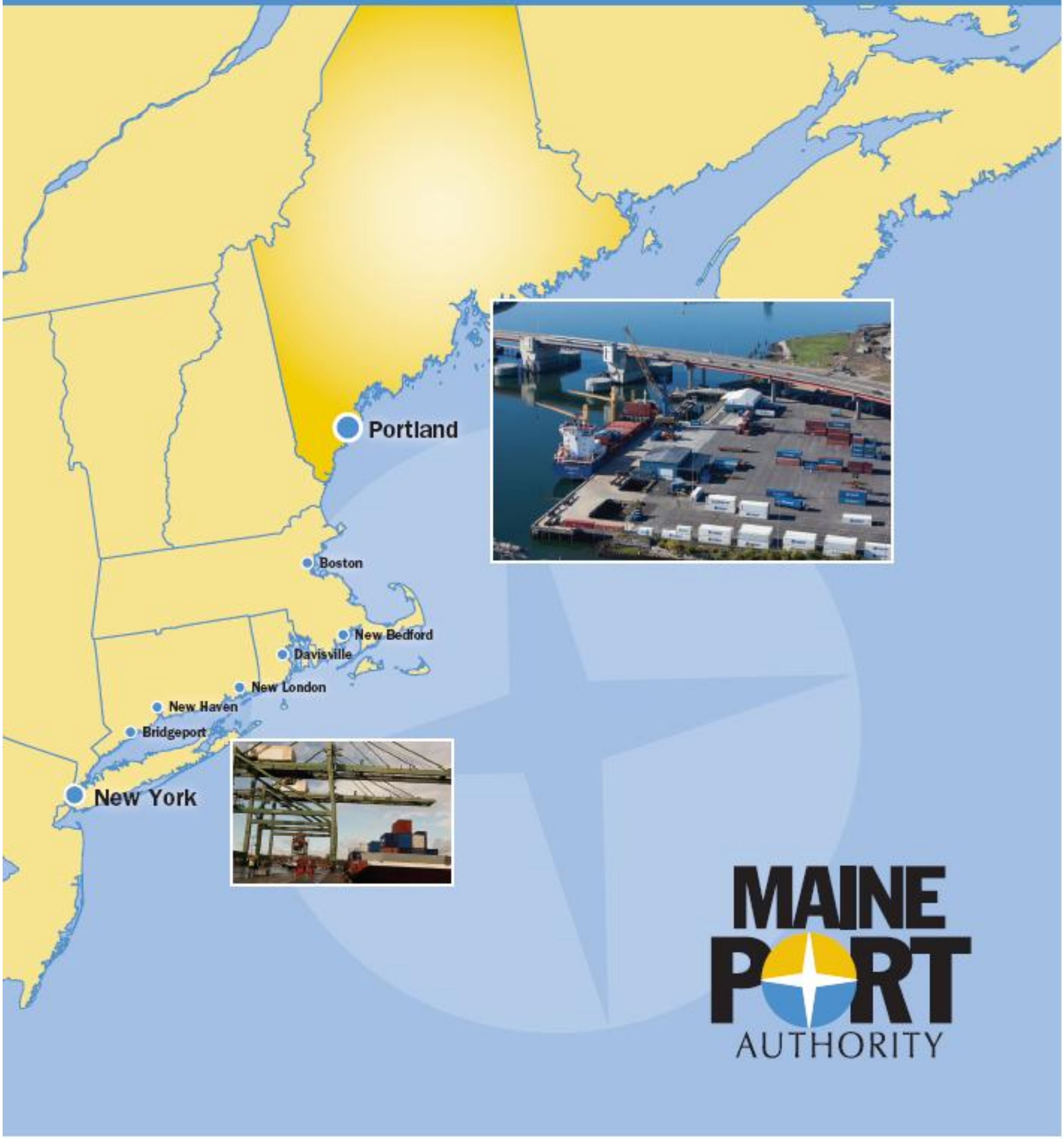
New England Marine Highway Project
Service Design

October 15, 2013



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Service Design

15 October 2013

Prepared for: The United States Maritime Administration (MARAD)

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Executive Summary

The US Marine Highway System presents a significant opportunity to stimulate economic growth, reduce congestion and wear on roads and highways, and cut down on emissions from freight transportation. By freight ton-mile, short-sea shipping (the goal of the Marine Highway Program) is less expensive and cleaner than other modes of freight transportation. The focus of this study is the realization of these benefits along the M-95 Marine Highway by way of the New England Marine Highway Project (NEMHP).

Since its designation in 2010 by USDOT Secretary Ray LaHood, the objective of the NEMHP has been to design, build, and operate a containerized Articulated Tug Barge (ATB) service between Northern New England and the Port of New York/New Jersey. By focusing on prospective customers' needs, the NEMHP will stimulate growth for American manufacturers, food processors, beverage producers, and those providing the raw materials to these operations.

This growth will stem from some key benefits that come as a result of the successful development of the NEMHP:

- Lower freight transportation costs per freight ton/mile
- Increased market access for lower-margin freight (which otherwise isn't moving)
- Increased weight capacity per unit of transportation (heavier loads in each container)

These three key benefits will lower costs for existing businesses, and will stimulate growth in underdeveloped sectors of the regional economy. Furthermore, effective investments into the Marine Highways cost less per unit of freight moved than their shore-side counterparts, and pay for themselves over time (by reducing wear to roads, bridges, and highways).

The Maine Port Authority, the sponsor of the NEMHP, with its contracted partners, Soli DG, Inc. and McAllister Towing and Transportation, has produced this design study of the containerized ATB vessel and service specifications for the U.S. Maritime Administration (MARAD).

Influencing transportation decision making, especially when proposing a modal shift, is difficult. Customers with a functioning system are reluctant to change that system unless there is a measurable benefit: can the freight be moved cheaper? Faster? More reliably? When shopping for cheap airfare, there are myriad websites that allow for a side-by-side comparison of fares and departures/arrivals: this structure does not exist for intermodal freight transportation. In order to provide a tool to effectively compare these factors across modes (road vs. rail vs. ship), this study includes the framework for an objective model of comparison.

This study also includes the optimal target market for the NEMHP (low-margin, high-density freight), and the specifications for the vessel that will operate on the service. It also includes the financial projections for the service, proposed routes, fuel usage, crewing… all details to illustrate that the NEMHP will sustain itself without ongoing subsidy.

Overview

This document provides a strategic overview of how to capitalize on waterborne freight transportation, with a focus on the New England Marine Highway Project (NEMHP). The analysis section of this document opens with a brief review of relevant factors affecting the mode of transportation, provides an overview of transportation decision making, and concludes with market analysis of the relevant market(s). Following the analysis section of this document is a discussion of the design considerations to date regarding the articulated tug/barge (ATB) that is to operate on the NEMHP.

The theses contained herein include:

- Transportation and logistics decisions should be made on an objective basis, utilizing axes of comparison among all transportation options. Making transportation and logistics decisions in such a manner will serve the best interests of the shippers and the public
- Each mode of surface transportation has a different set of characteristics which lend each towards certain categories of freight
- Commodities that are low margin, heavy, and able to accept a long transit time are ideal for waterborne freight movement
- There is a demonstrable market for a waterborne freight service between Portland, ME and the port of New York/New Jersey

These theses were arrived at through an analysis of existing data, comparison of modal characteristics, and a wide base of customer information.

To provide a more comprehensive view of the information and analysis, this document provides some contextual information for the Marine Highway Program, the New England Marine Highway Project (NEMHP), and the state of transportation logistics in the US.

Transportation and logistics decisions should be made on an objective basis, utilizing axes of comparison among all transportation options.

This document contains a number of comparisons among freight transportation options. Air freight is omitted from these comparisons, because it is not realistically in competition with maritime freight due to the differences in cost, transit time, and capacity.

Background

In 2007, the U.S. Congress wrote into law the Energy Independence and Security Act. Included in this act were provisions for the creation of the Marine Highway Program. The intent of the Marine Highway Program, as per the Act, is to “Offer a waterborne alternative to available land-side transportation services using documented vessels" and "Provide transportation services for passengers or freight (or both) that may reduce congestion on land-side infrastructure using documented vessels."[1] This legislation initially focused Marine Highway Program development on the mitigation of growing congestion issues on landside transportation options. In 2012, legislation was added to further "[expand] the program beyond reducing landside congestion to efforts that generate public benefits by increasing the utilization or efficiency of domestic freight or passenger transportation on Marine Highway Routes between U.S. ports."[2]

Waterborne freight transportation is less deleterious to the environment, consumes less energy, and passes less of its costs on to taxpayers than shoreside transportation options.

The Maine Port Authority (MPA) received designation from MARAD for the New England Marine Highway Project in 2010. The scope of the Project is to build an articulated tug/barge (ATB) and operate a service between the ports of Portland, Maine and New York/New Jersey. This service would operate on the M95 Marine Highway, which is the waterborne counterpart to US I-95. McAllister Towing and Transportation was selected through a competitive process to be the operating partner for the service. The goal for the service is to provide a low-cost freight alternative to shoreside logistics options. Currently, domestic and international containerized freight transiting between Northern New England and NYC Metro area is moving overwhelmingly by truck.[3]

A body of research indicates that waterborne freight transportation is less deleterious to the environment[4], consumes less energy[5], and passes less of its costs on to taxpayers than shoreside transportation options[6]. These factors were the focus of the MPA's application for MHP designation. This document focuses on the feasibility and execution of a sustainable waterborne service.

To understand the impetus behind the Marine Highway Program, it is important to briefly review the current state of American freight transportation. At present, the US government subsidizes trucking considerably more than rail or maritime

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[1]US Senate and House of Representatives, 1st session, Energy Independence and Security Act of 2007, Washington: Government Printing Office, January 4th 2007

[2] US Department of Transportation Maritime Administration, America's Marine Highway Program

[3] Rodrigue, Jean-Paul. *The Challenges of Freight Distribution in the New York Metropolitan Area.* Department of Economics &geography, Hofstra University, 2005.

[4] American Physical Society. Consumption of Oil for Transportation http://www.aps.org/policy/reports/popa-reports/energy/transportation.cfm (Accessed 2013)

[5] American Association of State Highway and Transportation Officials (2013). Waterborne Freight Transportation Bottom Line Report. Washington DC

[6] Institute, T. T. (2007). A Modal Comparison of Domestic Freight Transportation Effects on the General Public. Houston, Texas: Center for Ports and Waterways.

transportation. Below is a breakdown of the US Department of Transportation's 2013 budget by department:

Administration	2013 Budget Request	% of USDOT Budget
FAA (Air)	$15,172,000,000	20.37%
FHWA (Truck)	$42,569,000,000	57.15%
NHTSA (Truck)	$981,000,000	1.32%
FMCSA (Truck)	$580,000,000	0.78%
FRA (Rail)	$2,698,000,000	3.62%
MARAD (Maritime)	$344,000,000	0.46%
Other	$12,144,000,000	16.30%
USDOT Total	$74,488,000,000	100%

Table 1: USDOT Budget Distribution[7]

The American Society of Civil Engineers (ASCE) has put out infrastructure ratings for the US since 1988. On the 2013 report card, American road infrastructure received a grade of "D."[8] ASCE also noted that approximately $91billion is spent of State, Federal, and local funds on US roadways. USDOT estimates that $170billion USD is needed to improve the highway system annually.[9] Domestic maritime freight movement has been in steady decline since the creation of the Interstate Highway system.[10]

Freight Transportation Decision Making

In order to understand what market opportunities exist for NEMHP, it is necessary to examine how freight transportation decision making functions. There are a multitude of factors that constitute freight transportation decision making, including: package size, pallet size, weight of freight, order fulfillment, location of the resource, location of factory, location of distribution center, location of customer, and so on. The confluence of optimal factors determines how the transportation decision maker is going to move his or her freight. All considerations are not created equal, however. The primary factors that determine the transportation decisions are:

1. **Cost** – how much it costs to get freight from origin to destination
2. **Consistency** - the regularity of the arrival/departure of freight
3. **Transit Time** - the amount of time it takes to get from origin to destination

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[7] Transportation, U. D. (n.d.). *Budget Highlights Fiscal Year 2013.* Washington DC: Office of the Secretary of Transportation.

[8] Engineers, American Society of Civil. *2013 Report Card for America's Infrastructure.* 2013. http://www.infrastructurereportcard.org/a/#p/home (accessed 2013).

[9] US Department of Transportation. (2012) New Department of Transportation Report on Highway and Transit Conditions Underscores Need for Transportation Investment [Press Release]

[10] "Effects of Freight Movement." *Federal Highway Administration* . n.d. http://www.fhwa.dot.gov/environment/air_quality/publications/effects_of_freight_movement/chapter02.cfm.

Each type of freight holds these three factors at varying degrees of priority. A major determinant of priority is the margin of the freight: the net profit realized by the freight. High-margin freight will pay what it needs to for faster transit times and consistency; cost is a tertiary consideration. Low-margin freight will accept slower transit times if it means less cost. By way of example, in many commodity or raw material markets, the cost of transportation will determine if there is any margin for the shipper to even attempt to access a particular market.[11]

The primary determinants in freight transportation decision making are **Cost, Consistency,** and **Transit Time**.

Each mode of freight transportation is able to provide a different level of service in each of these categories. In general, trucking has the lowest transit times and the highest costs, maritime freight has the lowest costs and highest transit times, and rail is in the mid-range for each factor.

There is currently no standardized system for comparing rates and transit times for a given freight move. Consequently, transportation decisions are currently made based on the expertise of the entity coordinating the freight move (usually a steamship line, third party logistics provider, or freight forwarder). In order to maximize benefit to shippers and the public, a standardized system for freight transportation decision making is needed. Such a model is proposed in this document. It is prefaced by a comparison of the basic metrics (cost and transit time).

Freight Transportation Decision Making - Modal Comparison

As the baseline metric (given its relevance to the NEMHP), transit times and rates are based on transporting freight from Portland, Maine and New York, New York.

	Truck	Rail	Maritime
Cost per Ton-Mile	$ 0.13	$ 0.10	$ 0.06
Shipping Time	5 Hrs	10 Hrs	35 Hrs

Table 2: Cost and Shipping time for this Study- Soli DG, Inc

Rates and transit times are perhaps the most important points of comparison, but are highly variable. In order to generalize the data to a larger body of freight moves, the differences among the modes will be expressed in terms of ratios.

[11] Slack, Dr. Jean-Paul Rodrigue and Dr. Brain. "Intermodal Transportation and Containerization." In *The Geography of Transport Systems*. New York: Routledge, 2013.

Maritime	Rail	Truck
1	1.67	2.17

Table 3: Ratio of Costs between Modes- Soli DG, Inc

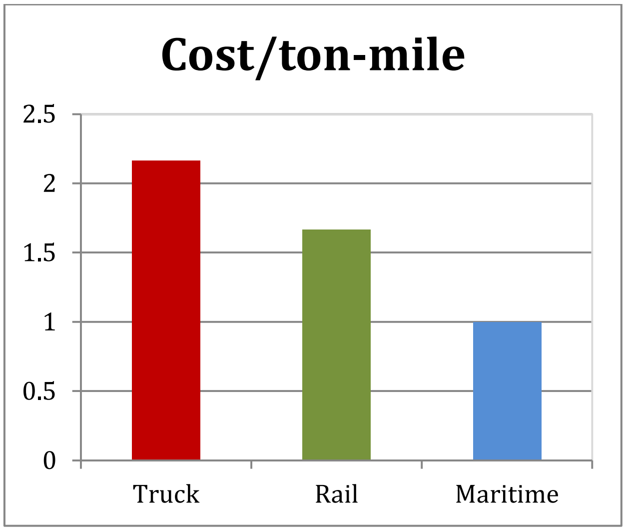

Figure 1: Cost per Ton-Mile ratio- Soli DG, Inc

Truck	Rail	Maritime
1	2	7

Table 4: Ratio of Shipping Time between Modes- Soli DG, Inc

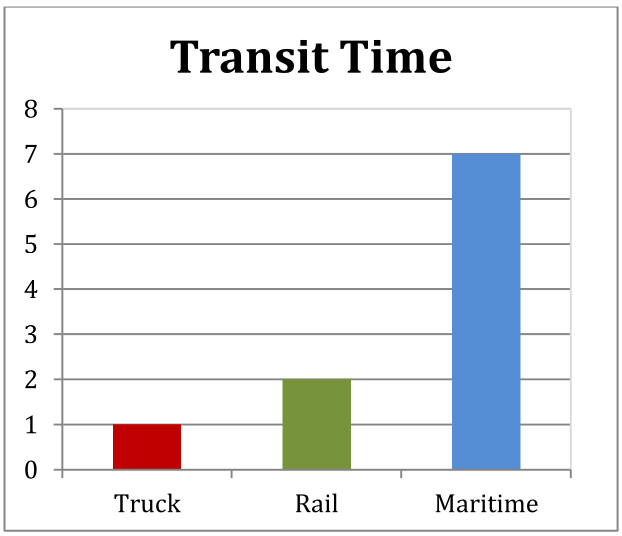

Figure 2: Transit Time Ratio- Soli DG, Inc

With these ratios as baseline axes of comparison, a data-driven model of modal comparison is now possible.

Freight Transportation Decision Making - The Viability Formula

To compare the different modes, a metric of comparison is needed - for this model the metric will be called "viability." Viability is defined as "the likelihood that a customer will (or should) use a given mode to transport their freight." Viability is a function of the cost of transportation and the other factors that make a freight option appealing or unappealing: transit time, reliability, distance, frequency, referred to here as "transit." Thus:

$$\text{Viability} = \text{Cost} + \text{Transit}$$

Equation 1: Viability- Soli DG, Inc

$$\text{Transit} = \text{Time X Reliability X Frequency X Distance}$$

Equation 2: Transit- Soli DG, Inc

Transit time is the time it takes to get from point A to point B, and it is determined by the mode of transport. Reliability is the likelihood that all of the freight will reach point B intact and on time. Frequency is the frequency with which a service calls on a modal hub (this is especially important for water and rail). Distance is the increase in cost and attrition incurred by transiting freight over a longer distance. For the purpose of this study, Time and Cost are the focus.

$$\text{Viability} = \text{Cost} + \text{Time}$$

Equation 3: Viability for Study- Soli DG, Inc

Time and cost will be of varying importance based on the commodity that is being shipped. For high-margin commodities, lowering the transit time will be a high priority and driving down the cost will be a low priority. For low-margin commodities, the inverse will be true (cost will be primary, time will be secondary). To inform viability, each variable must be modified by its respective priority (Priority_C = cost priority, Priority_T = transit time priority)

Thus:

$$\text{Viability} = (\text{Cost x Priority}_C) + (\text{Time X Priority}_T)$$

Equation 4: Viability for Study Accounting for Priorities- Soli DG, Inc

As was indicated, the priorities are determined primarily by the commodity. Operating on the assumption that low cost is preferable to high cost, and low transit time is preferable to high transit time, viability can be expressed in very simple terms by plugging in rough sample values. In order to allow for intermodal comparison, cost per ton-mile will be used for Cost, as seen in Table 3. Transit time will be expressed as a relative measure of time. While it is acknowledged that there are several factors that come into play during a specific move, the ratios shown in Table 4 will be used.

In order to ensure that high viability goes to items with lower cost and lower transit time, it is easiest to express the Cost and Time values as the inverse of their ratio value, thus:

$Cost_{Maritime}$	1/1
$Cost_{Rail}$	1/1.167
$Cost_{Truck}$	1/2.17
$Time_{Martime}$	1/7
$Time_{Rail}$	1/2
$Time_{Truck}$	1/1

Table 5: Cost and Time values for each mode- Soli DG, Inc

This would yield Viability formulae as such:

$$Viability_{Truck} = ((1/2.17) \text{ X } Priority_C) + ((1 \text{ X } Priority_T)$$

Equation 5: Viability Truck- Soli DG, Inc

$$Viability_{Rail} = ((1/1.67) \text{ X } Priority_C) + ((1/2 \text{ X } Priority_T)$$

Equation 6: Viability Rail- Soli DG, Inc

$$Viability_{Maritime} = ((1/1) \text{ X } Priority_C) + ((1/7 \text{ X } Priority_T)$$

Equation 7: Viability Maritime- Soli DG, Inc

Viability could be determined by assigning values to each priority. For example, for shipping a container of pulp for paper, transit time would be low priority, and cost would be high priority. The table below demonstrates how the Viability of different modes changes as the priorities change.

$Priority_C$	$Priority_T$	$Viability_{Truck}$	$Viability_{Rail}$	$Viability_{Maritime}$
1	10	10.4608295	5.5988024	2.42857143
2	9	9.92165899	5.69760479	3.28571429
3	8	9.38248848	5.79640719	4.14285714
4	7	8.84331797	5.89520958	5
5	6	8.30414747	5.99401198	5.85714286
6	5	7.76497696	6.09281437	6.71428571
7	4	7.22580645	6.19161677	7.57142857
8	3	6.68663594	6.29041916	8.42857143
9	2	6.14746544	6.38922156	9.28571429
10	1	5.60829493	6.48802395	10.1428571

Table 6: Viability for Different Priorities - Soli DG, Inc

The Viability Formula can guide the manner in which transportation investments are made in an optimized system.

Essentially, a higher viability value indicates a better fit for a certain mode. As shown, as cost becomes a higher priority and transit time lower, maritime becomes more viable than trucking. At this point, the model is somewhat simple. It is based on a small body of data, and only accounts for cost and transit time as factors. As previously discussed, there are myriad additional factors that would play into a comprehensive model of viability.

The purpose of this illustration is to model the conceptual approach that should be used to make shipping decisions: finding the shipping option with the optimal capability to service the customer's priorities. The value of this model is to identify the optimal market for waterborne freight. The Viability Formula can also guide the targeted manner in which transportation investments are made in an optimized system.

Under real circumstances, there would be a number of additional factors affecting Viability: dimensions of the product, dimensions of the transport unit, volume of shipped units, distance between origin and destination, infrastructure, frequency of service, reliability. These factors could be incorporated into a more comprehensive model of Viability, creating an objective means of assessing freight logistics decisions.

Finding the Niche for Waterborne Freight - Cost

As previously discussed, allowable freight costs can be understood in relation to the available margin as it relates to value of the freight. Freight will not move if its transportation cost is in excess of its available margin. Based on this concept, there is a market of low-margin freight that could be moved by water that could not cost-effectively be moved by other modes (as waterborne freight movement is less expensive per ton-mile). Using freight margin in relation to cost to ship per ton-mile, the following graph illustrates roughly where this market exists:

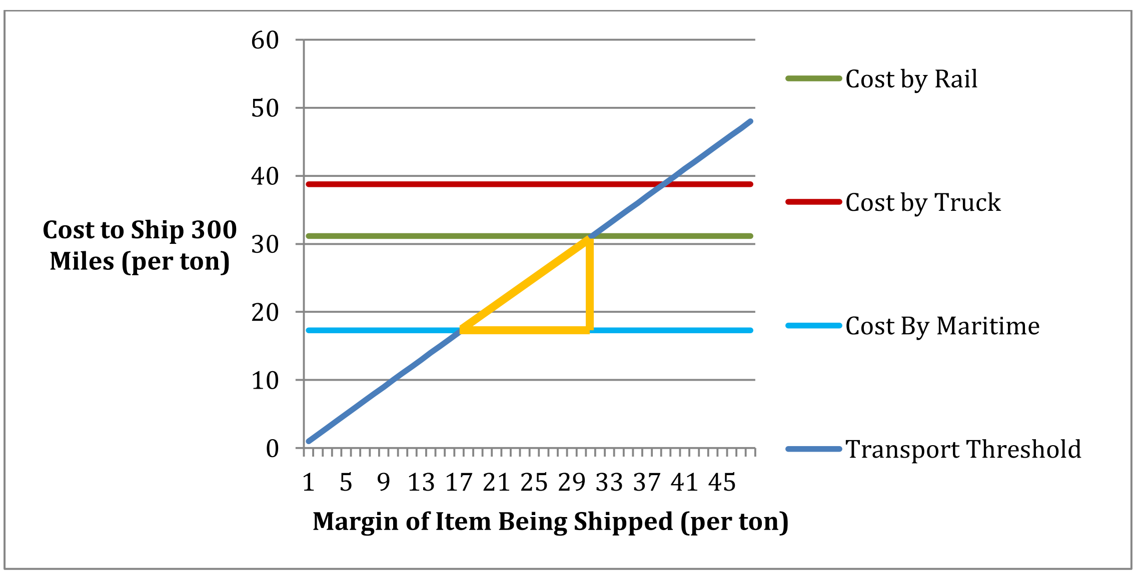

Figure 3: Cost Threshold - Soli DG, Inc

The Transport Threshold line shows where the cost of transportation is equal to the margin on the freight. The triangle shown in orange indicates the freight margins and acceptable rates of a market that is currently impractical for other modes of transportation to handle.

Accordingly, maritime freight transportation, and the NEMHP, should target low-margin commodities.

There is a market of low-margin freight that could be moved by water that could not cost-effectively be moved by other modes.

Finding the Niche for Waterborne Freight - Transport Unit

Each mode of transport utilizes a different transport unit, and each has certain weight and dimension characteristics it can offer to a shipper. These differences can be understood in terms of the dimensions and payload of the typical container unit for each of the modes.

Mode	Transport Unit	Payload (short tons)	Length	Width	Height	Cubic Footage
Truck	53' trailer	22.5	52'6"	8'5"	9'2"	4,050
Rail	50' railcar	67.5	50'6"	13'	9'6"	6,237
Maritime	40' container	30	39'5"	7'8"	7'10"	2,368

Table 7: Container Size for each Mode of Shipment- Soli DG, Inc

The following graph illustrates the above data in terms of ratios:

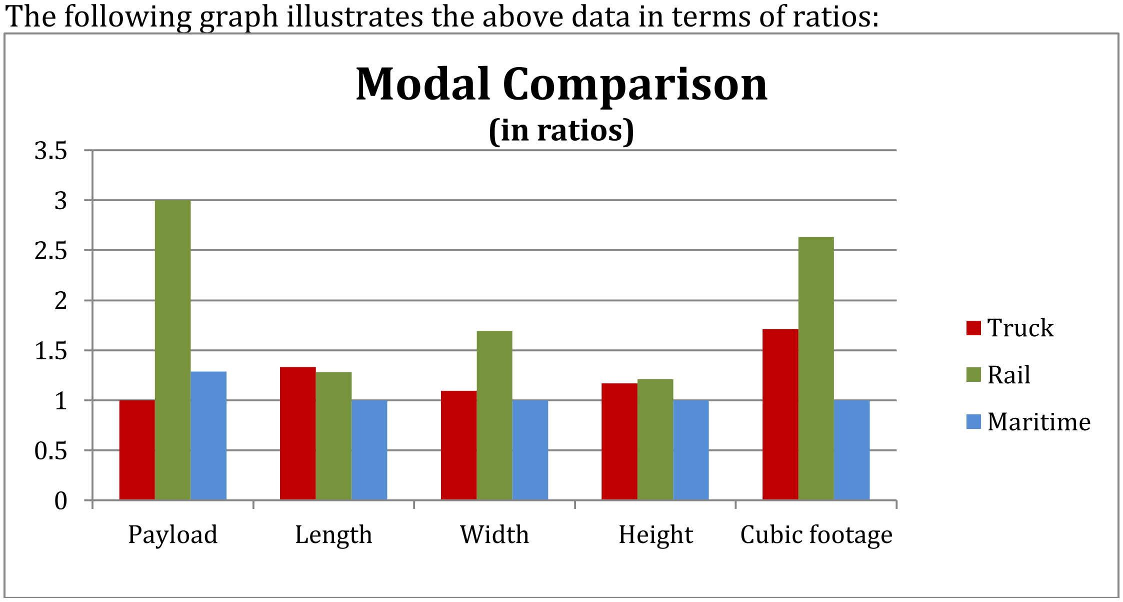

Figure 4: Modal Dimension Comparison- Soli DG, Inc

At first blush, rail appears to have a clear advantage in terms of its transport unit. This appears such as a result of the railcar being the largest transport unit. The graph is a better demonstration of the limits of each unit. For example, there are items that will be too large for 40' containers that will fit in railcars, and there are items that will be too heavy for trailers that would work in 40' containers.

Charges for containerized freight are assessed by unit: the customer pays for the use of a container, trailer, or railcar. In order to get the most out of a transport unit, customers seek to maximize as many of the aspects of the unit as possible: an ideal container is full, either by dimension ("cubed out") or payload ("weighed out"). To get the most for their money, the customer should strive to come as close to doing both as possible.

Selecting a sensible unit for transport is, thus, largely a function of commodity density. A customer with freight that takes up a large amount of space that does not weigh much (low density) will want to select the transport unit based on its dimensions more than its payload. Likewise, a customer with heavy freight that does not take up a large amount of space (high density) will (all other things being equal) select the option with the optimal payload.

Here is a comparison of the product density that a given transport unit (container, railcar, and trailer) can accommodate:

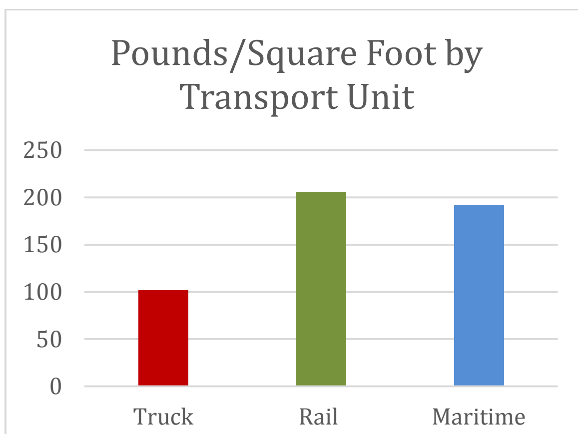

Figure 5: Pounds per Square Foot by Transport Unit- Soli DG, Inc

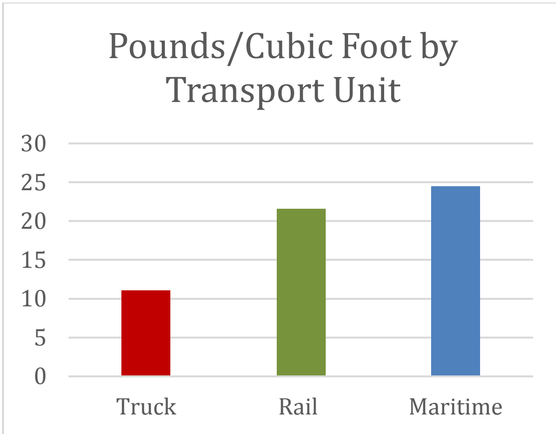

Figure 6: Pounds per Cubic Foot by Transport Unit- Soli DG, Inc

Density by volume and area are both shown here, as, depending on commodity dimensions, one or the other may be more relevant. If a customer has a product that weighs more than 100 lbs per sq foot, they will not be able to make the most out of shipping with a trailer, as they will have to leave some of it empty; in such an instance, a railcar or a container would be a better option. As is demonstrated with the above graphs, maritime and rail are the best options for high-density freight. Given their close tolerances, this graph below compares railcars and containers by their cost per square/cubic foot, expressed in terms of ratios:

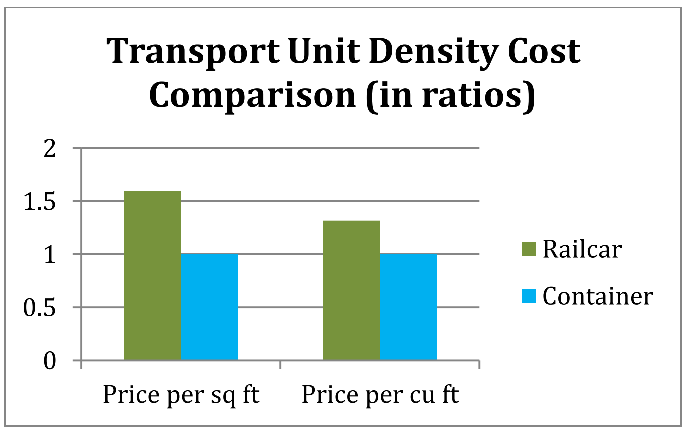

Figure 7: Transport Unit Density Cost Comparison - Soli DG, Inc

The container has a density cost advantage over the railcar. Examples of high-density freight are pulp, paper, and single-serving bottled beverages.

Accordingly, maritime freight transportation, and the NEMHP, should target heavy, high-density commodities.

Finding the Niche for Waterborne Freight - Freight Dimensions

The dimensions of the shipped commodity are also a crucial piece of selecting the most apt shipping option. This can be understood in terms of the price per shipped unit (e.g. pallet, paper roll, piece of machinery), which is calculated as follows:

Cost per shipped unit = (Number of transport units required X cost per transport unit) / number of shipped units

Equation 8: Cost per Shipped Unit- Soli DG, Inc

The cost to ship each unit of the given commodity is the product of the number of needed transport units and the cost per transport unit divided by the number of shipped units.

The number of transport units needed to ship the product volume is calculated based on the following considerations: the dimensions of the shipped unit, the dimensions of the transport unit, and the total quantity of shipped units. The interaction between the shipped unit dimensions and the transport unit dimensions is complex, due to the ability to rotate shipped units inside the transport unit in order to optimize the use of space.

The Maine Port Authority conducted a sample study on optimizing the shipping of single serving bottled beverages. To illustrate some of the aforementioned considerations, the study is excerpted below:

Optimization of a 40' Container for Shipping Bottled Water

22 pallets can fit into a 40' container as shown below. Pallets must not exceed 47 ¼" x 39 ¼" *(the standard size for an 1200mm x 1000mm ISO 6780 pallet)*:

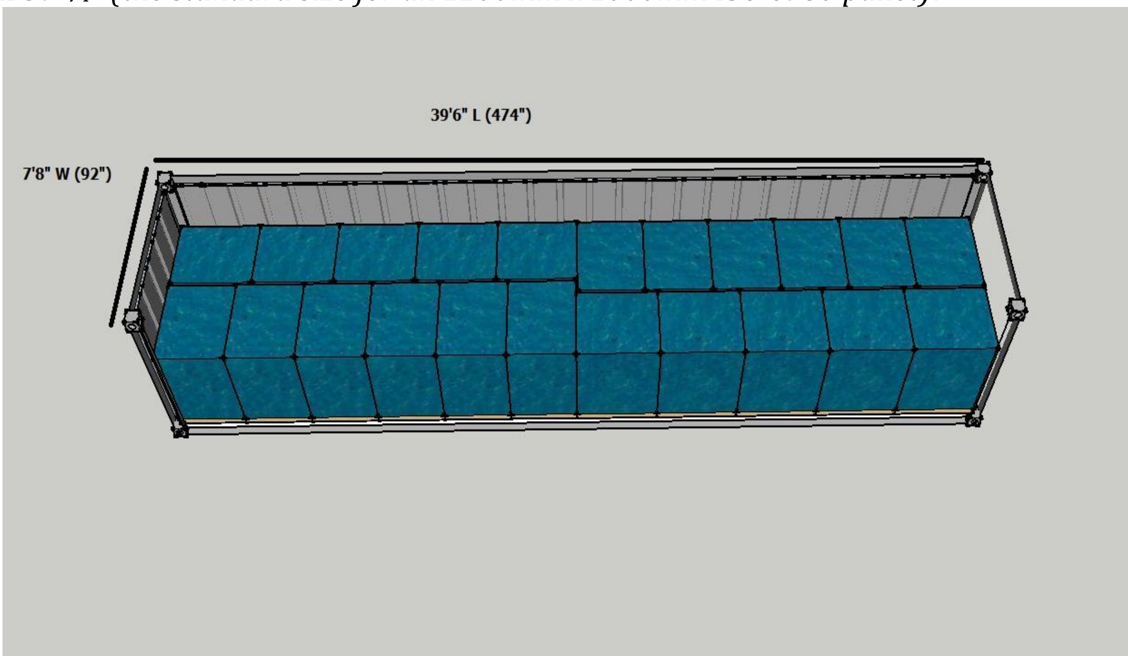

Figure 8 - Packing of Pallets in a 40' ISO Container, Courtesy of Sprague Operating Resources, LLC

40'containers have an edge due to their weight capacity when being transported by water: a 40' container can be loaded as heavy as 60,000 lbs. This can be capitalized on by increasing the weight of each pallet by stacking the freight higher. To test this hypothesis, we estimated what impact might be had by stacking 24 packs of 1/2 liter bottles of water slightly higher. Estimates are based on a case weight of 25.36 lbs, average height per layer of 8.25", and 12 cases per layer. The numbers are contrasted with a weight of 2250lbs/pallet.

Layers	Height (in inches)	Cases/ Pallet	Cases/ Container	Weight/ pallet (in pounds)	Weight/ container (in pounds)	Increase over estimate
8	66	96	2,112	2,435	53,561	8.2%
9	74.25	108	2,376	2,739	60,257	21.7%
10	82.5	120	2,640	3,043	66,952	35.3%

Table 8 - Pallet Layer Projections- Soli DG, Inc

To look at implications of stacking water higher, we surveyed the practices of three companies currently shipping water in 40' containers. Across their practices, it was found that pallet stability was greatly increased by the use of slip sheets, corner angles, and shrink wrapping all the way down over the pallet. The shipper employing these practices showed a considerably lower incidence of damage resulting from shifting of product in transit.

(End Excerpt)

As was shown in the excerpt, the positioning of the product within the transport unit, and the stacked height of the product had a profound impact on the amount of shipped units that could be loaded into a transport unit.

Accordingly, maritime freight transportation, and the NEMHP, should be cognizant of optimizing dimensional space inside transport units, and provide customers with innovate use of container space.

Finding the Niche for Waterborne Freight - Distribution

The excerpted study also demonstrated the value of stacking additional layers of product onto freight units (pallets, in that instance). In the examples given in the excerpt, a layer of product was added/taken off between modal shifts, in order to optimize transport unit usage for each mode. This is an example of adding value during transshipment - such practices are essential to integrating a multimodal freight network.

Freight moves falls loosely into two flow categories:

1. Direct to Customer (DTC) – freight that is going direct from the origin to the end user.
2. To Distribution Center (TDC) –freight that is going to a warehouse or intermediary step in the supply chain.

Requirements for the same freight can be different depending on if the freight is DTC or TDC. For example, Portland, ME handles a significant amount of newsprint for newspapers in New York, New Jersey, Pennsylvania, and Massachusetts. Newsprint represents an apt example for waterborne freight as it is a relative low-margin, high-density cargo. Once the newsprint is manufactured at a paper mill, it must be moved out of the facility as quickly as possible. Paper mills tend to be in rural areas where there is less access to low-cost trucking or ISO containers. For this reason, newsprint is often shipped utilizing rail or containerized/bulk maritime options. As the end destination does not (in all likelihood) have a dock or a rail siding, this freight is shipped TDC.

At the modal facility warehouse, value is added by storing the newsprint in a temperature- and humidity-controlled environment that ensures that the Newsprint is as dry as possible. Further, the logistics capabilities of the distribution center are greater than the origin (the mill). This means that the 3rd party logistics provider can add value by controlling the flow of shipments. Newsprint can be staged and safely stored at the warehouse until it is needed by the end user (the Newspaper): this allows the use of a "just-in-time" logistics model (which would be impossible without the warehouse).

These two legs of the supply chain for newsprint have distinctly different characteristics. The TDC move is focused on transporting the maximum amount of freight at the lowest cost. These large shipments can ship very slowly so long as the warehouse never runs out of supply for the customer, and represent the type of move that would be ideally handled by waterborne transportation (if the origin and warehouse were both abutting waterways). The DTC move is time-sensitive, focused on getting the freight to the customer as quickly as it is needed to satisfy the "just-in-time" requirements of the customer. Thus, a given freight move may contain some legs that are ideally suited for waterborne transportation, even if other legs are not. Re-evaluating supply chains leg-by-leg represents an opportunity for maximizing the utilization of the NEMHP and other maritime freight options.

Finding the Niche for Waterborne Freight - Regional Markets

Understanding regional markets is a critical aspect of identifying freight opportunities. At present, two regions[12] are relevant to the NEMHP:

1. Manhattan and Long Island;
2. Northern New England

The major relevant differences between the two regions are land mass, demographics, and resources.

In Manhattan & Long Island, the population exceeds 10,000,000 on less than 1500 sq miles of land, completely surrounded by water. The bridges to access this region have high tolls and congestion. This region has a large consumer market, which tends to possess a higher volume of door-to-door and "Direct-to-Customer" deliveries. There is also a larger volume of full, inbound truckload shipments.

On the other hand, Maine is a very large land mass (35,385 sq miles), with only 1,329,000 people. New Hampshire and Vermont have another 20,000 sq miles with approximately 2,000,000 people. Given the low population density, there is a much higher ratio of deliveries from and to distribution centers (TDC). Inbound cargo has a higher proportional volume of less-than-truckload shipments, or consolidated freight carriage (cargo in one transport unit that has multiple end users).

The Trade Imbalance and Equipment Sourcing

The differences between freight flows in the two regions create a trade imbalance that impacts the cargo flow. The NYC metro area has a glut of transport units that lie idle or are relocated empty after the cargo has been discharged. This is mainly

[12] Adding a southern New England port of call has been maintained as an option since the inception of the NEMHP. Such an addition is entirely dependent on demonstrable market demand.

due to such high volumes of inbound freight for local consumption. In Northern New England, the opposite is true.

There are large volumes of low-margin, high-density freight in Northern New England, including forest products, agricultural products, seafood, and water (to name a few). The large volumes of these outbound cargoes present a challenge to shippers due to the lack of transport units in the region. This imbalance makes it difficult for transportation providers to experience a balanced cargo flow (with freight going in both directions). Occasionally, the cost of relocating an empty will be passed on to the shipper, which can make accessing the desired market cost-prohibitive.

To mitigate the challenges raised by this imbalance, trucking companies have established warehousing operations between NYC metro and Northern New England. This allows the companies the highest utilization of their drivers and trucking assets. This allows trucking companies to offer "one way" rates in many instances, rather than pass the cost of repositioning an empty transport unit to the shipper.

Facilitating a balanced trade, and utilizing TDC freight flow structures represent an opportunity for increasing the cost savings and adding value for shippers.

Infrastructure Investment

Transit time and cost are not only a function of the operating speed of the vehicle, but also of the distance needed to travel between origin and destination. By way of example, from Portland, ME to NY, NY approximate distances are as follows:

- Truck: 300 miles
- Rail: 470 miles
- Maritime: 404 miles

For rail especially, this discrepancy is representative of the effect of the presence or absence of infrastructure. Roads are ubiquitous, and connect most points in the US; rail runs between a select number of sidings.

Accordingly, in addition to having the shortest distance to travel, trucking also can go directly from "door to door" (origin to end user), which maritime and rail can only accomplish in specific circumstances. Consequently, maritime and rail frequently require "double handling," typically using a truck at either/both end(s) of the supply chain.

Maritime transportation infrastructure investment is crucial to increasing its viability as a means of domestic freight transportation. Port facilities with appropriate infrastructure, depth of water and access to truck, rail, and/or distribution centers will facilitate faster transit times and lower costs. Such investment also permits the effective integration of intermodal transportation options.

Market Identification

Customer exploration began with the assumptions previously discussed: low-margin, high-density freight would be well-suited for the NEMHP. On this basis, customer meetings were arranged with Maine and New Hampshire shippers with qualifying freight. These meetings yielded freight movement data, which are proprietary (and otherwise unavailable). The data gathered are presented in aggregate, in order to protect the customers, and contain a combination of figures obtained from customers and through research. Customer meetings were valuable in promoting awareness of the service and establishing appropriateness of fit with each customer's supply chain.

Furthermore, customer meetings allowed an opportunity to address logistical inertia. Shippers have functional supply chains that are well-established, and the recent domestic waterborne freight options have been lackluster. These shippers need to be educated on the differences of the NEMHP service, and to know how they can benefit. Given enough such meetings, it is anticipated that the pendulum will swing, and transportation and logistics professionals will begin promoting the service on their own.

The table below presents the findings of the customer meetings. Values are listed by general freight type, weight in short tons[13], approximate total weight (as converted to 40'equivalent units, FEU's, which serve as an indicator of the number of truckloads the freight represents), and the target capture of freight by the NEMHP (in FEU's). A general description is also listed next to each line item to give an indication of what specific product types have been identified as potential freight for the NEMHP.

[13] Along with other data, the table draws on the following sources:
Maine Pulp and Paper Association "Economic Benefit of Maine's Paper Industry in 2011" (2011)
Hasbrouck, Sherman "The Forests of Maine" The University of Maine (May 1994)
Maine Forest Products Council "Maine Sawmill's Recommendations to Strengthen Maine's Competitive Position: A Report to Governor Paul LePage" (December 2011)
Maine Lobster Promotion Council "Annual Report 2012" (2012)
Maine Potato Board "A Review of the Industry" (2012)

Targeted Market Opportunity

Product	**Total Production by Weight** 2012 (short tons)	**Total market in 40' Equivalents** FEU's (20t; *25t)	**Target market for NEMHP** Target FEU	Details
Blueberries	45,550	2,278	800	NY Market (300), Int'l (500)
Potatoes	800,000	80,000	3,400	NY Tablestock (1400), Processed Frozen (2000)
Lobster	60,000	3,000	500	Frozen Processed (500)
Fish	95,400	4,770	1,000	Frozen Processed (1000)
Wood Pulp and Saw Logs	6,600,000	337,500	3,000	Unitized Wood Pulp, Dimensional Lumber
Paper	3,500,000	175,000	5,000	Newspaper, Paper Rolls
Bottled Non-Alcoholic Beverages	6,750,000	*270,000	35,000	Soda, Bottled Water, Single-Serve Beverages
Bottled Alcoholic Beverages	420,000	21,000	5,000	ME/NH Consumption (4000) Production (1000)
Dry Goods (grocery)	175,000	8,750	2,500	ME/NH Inbound (2000), NY Local (500)
Int'l Transhipment FCL	N/A	15,000	5,000	ME/NH Import/Export via Brooklyn, NY
TOTALS		**647,298**	**61,200**	

The totals above are approximates drawn from data sources, validated with customer meetings and research. The NEMHP target market commodities and volumes have been assessed using the criteria laid out herein, and have been found to be viable.

Market Opportunities

Maine's agricultural, seafood, and forest products industries produce a significant amount of resources and consumer products: Maine is the leading producer of wild blueberries in United States, 2nd to Wisconsin in Pulp and Paper production, 5th in the U.S. for the production of potatoes, and 8th in the United States for Seafood landings. Along with these resources, there are production facilities adding value to raw products, trucking out finished products.

Maine's products currently enjoy a wide base of national distribution. Instant quick frozen (IQF) wild blueberries are being used in a range of store-ready products already integrated into the national market and on grocery store shelves across the country. Potatoes grown in Maine are processed into French fries, hash browns, potato chips, and a vast array of frozen food products, and distributed nationally to major fast food chains and food vendors. Maine's paper products are being used for well-known newspapers, magazines, coated fabrics, laminates, packaging, and a vast array of products used and distributed throughout the globe.

These industries account for significant transportation volumes over the Interstate highway system, the shippers are some of the largest corporations in the US. Capitalizing on the opportunity to shift these corporations supply chains to integrate waterborne freight transportation (especially the NEMHP service) is a matter of making the shift appealing and viable.
The primary factors that will determine the successful attraction of freight to the NEMHP service are given below as an "if-then" statement:

- If the containerized ATB service between Portland, ME and NY can carry containers of freight 10-20% heavier than via interstate trucking;
- If the cost of the ATB service can be competitive with or less than trucking; and
- If the shippers and truckers are willing to work together with the NEMHP in order to improve supply chain efficiency, lower costs, and increase short-haul trucking opportunities;
- Then the New England Marine Highway Project will have sufficient freight to be sustainable – a benefit to shippers and the public.

Short sea shipping is a necessary addition to the surface transportation network of the United States. While the public benefits - reducing landside congestion, fewer emissions, and lessening degradation of America's road networks – are not inconsiderable, the commercial value of a fully-integrated intermodal surface transportation network is critical to the health and vitality of the American economy. Without maritime transportation integrated into our domestic surface transportation network, we are missing a crucial portion of our market capabilities and production capacity.

Design Parameters

As previous studies have pointed out, there are a large number of vessel types that could be used on the New England Marine Highway. The vessel types range from low capacity, high-speed vessels to large capacity vessels similar to oceangoing containerships. Other than size and speed, the primary difference between the vessels is the method by which the cargo is loaded and discharged. The two significant handling methods are lift-on/lift-off (LO/LO), and roll-on/roll-off (RO-RO). The former is characterized by more efficient use of space on the vessel and in the terminal (assuming stack operations), but far greater infrastructure (gantry or mobile harbor cranes) and greater labor cost (primarily due to gang size and composition). RO-RO, on the other hand, requires a far larger vessel for the same cargo capacity (and consequently far larger capital investment), greater acreage in the terminal (due to the fact that it is a wheeled operation), yet far less labor expense due to the composition of the gang (mostly drivers), and far less infrastructure (no cranes or stacking equipment required). After due consideration, the choice of a vessel for this project was narrowed down to a LO/LO vessel for its efficient use of space and lower capital costs, and designed to operate with the lowest manning and most efficient propulsion system possible. The vessel that met most or all of the desired features was an articulated tug/barge unit (ATB).

The ultimate object of this study, as previously indicated, is to design and operate a domestic, short sea, common carrier service. Accordingly, the initial focus of the operational portion of this study was the design of the ATB – how big the barge will be, how fast the unit will go, what and how much it will carry, what the power requirements and options will be, and so on. Experience has taught that it is usually far more prudent and efficient to have the contemplated trade or service determine what is needed in the way of a design, rather than attempt to impose preconceived notions of what the most suitable design should be. In this case, the market studies provided suggestions of the level of anticipated traffic, which could then be used to determine the foremost design constraint, which was vessel capacity. After that issue was brought into focus, it was then possible to examine other design criteria, such as operating speed, which, in turn, affected other features, such as LOA, breadth, depth, horsepower, hull shape, type of connection system, etc.

There are a number of potential domestic shippers in Maine with sufficient cargo volume to fill virtually any design of vessel. However, rather than attempting to swallow the entire volume of traffic, the intent of this study was to include the movement of only those parts of the potential annual shipments from Maine to New York that make sense. Thus, the base traffic pattern was limited to a few high volume shippers, whose transportation needs can be filled by a high capacity weekly service.

The port pair for this study was Portland and New York. Portland has one viable container terminal: the International Marine Terminal. However, there are a number of terminals in New York that could serve the proposed service. Brooklyn was posited as the preferred site in New York, because of (a) accessibility for an ATB (minimum maneuvering), and (b) the availability of covered shed space which does not exist at any other facilities in the port.[14]

In addition to the containers of domestic origin, there is expected to be a future demand to provide space for international containers in a limited feeder service in both directions. In this case, the Maine Port Authority has one international carrier, calling regularly at the port, and Brooklyn has several international carriers that call direct, or via intraport barge service, that can use the proposed service as a feeder.

Ultimately, the proposed service is intended to attract and develop northbound domestic freight, as well. However, since this is likely to be an unbalanced trade, with the largest flow of revenue-producing containers moving southbound, a large portion of the northbound capacity will need to be devoted to carrying empty containers.

Having made some assumptions about the ports, and the fact that a sufficient volume of cargo exists for the service (provided that schedules and rates are sufficient to attract the business), the next step was to examine the optimum capacity of the vessel, the optimum speed to maintain a regular service, as well as other critical operating parameters.

(a) **Capacity**: For the purposes of this exercise, the assumption is made that the existing volume of traffic that the service can attract consists of at least 50,000 truckloads of cargo to the New York metropolitan region each year. The cargo now generally ships in 53 ft. dry vans. However, because of OTR weight limitations, many of these dry vans tend not to utilize all their cubic capacity. The OTR weight limits do not apply to the water mode, and for this reason, ISO intermodal containers can be loaded with the same, or greater volumes of cargo. However, even when weight limits do not act as a constraint, intermodal containers still offer volumes of space that are competitive with typical dry vans. Since ISO intermodal containers are typically available only in lengths of 40 ft. and 45 ft., the traffic volumes are calculated as follows:

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[14] Shed space is considered critical to the concept of moving heavy containers southbound between the ports. If containers are loaded to their weight capacity as intended, then they will be too heavy for over the road (OTR) transport. That means that the loaded boxes from Portland will have to be moved to covered shed space in Brooklyn, where they can be stripped and the contents reloaded into trucks for distribution in the NY metropolitan area.

ONE WAY TRANSITS (Portland to Brooklyn)

THROUGHPUT IN 45 FT. BOXES								
Annual 45' Truckloads	Barge Share	Annual 45' Throughput	Weekly Throughput	TEUs	Weekly +5%	TEUs	Weekly +10%	TEUs
50,000	50%	25,000	481	1,082	505	1,136	529	1,190
50,000	45%	22,500	433	974	454	1,022	476	1,071
50,000	40%	20,000	385	865	404	909	423	952
50,000	35%	17,500	337	757	353	795	370	833
50,000	30%	15,000	288	649	303	681	317	714
50,000	25%	12,500	240	541	252	568	264	595
50,000	20%	10,000	192	433	202	454	212	476

THROUGHPUT IN 40 FT. BOXES								
Annual 45' Truckloads	Barge Share	Annual 40' Throughput	Weekly Throughput	TEUs	Weekly +5%	TEUs	Weekly +10%	TEUs
50,000	50%	28,125	541	1,082	568	1,136	595	1,190
50,000	45%	25,313	487	974	511	1,022	535	1,071
50,000	40%	22,500	433	865	454	909	476	952
50,000	35%	19,688	379	757	398	795	416	833
50,000	30%	16,875	325	649	341	681	357	714
50,000	25%	14,063	270	541	284	568	297	595
50,000	20%	11,250	216	433	227	454	238	476

Table 9: One-Way Transits - McAllister Transportation

For this aspect of the exercise, the assumption is that if the barge service can capture 35% of the available traffic, then the proposed service will meet its targets. Translating that volume into barge capacity, we see that the optimal size barge should be about 850 TEUs, or 425 standard 40 ft. marine containers.

(b) **Schedule/Speed**: One of the givens in this study is that the service must be operated on a fixed weekly schedule. The ability to meet that schedule will determine the speed which the ATB has to operate. The below tables show the approximate distances between Portland and Red Hook Terminal in Brooklyn, via three routes (via Nantucket Shoals, via the Cape Cod Canal and Long Island Sound/East River, and via the Cape Cod Canal, south of Long Island to Ambrose Light)

	Portland - NYC (outside)	Portland - NYC (CCC, LI Sound)	Portland - NYC (CCC, South Shore)
Miles	**415**	**315**	**300**
	HOURS		
Steaming Time - 5 kt	83	63	60
Steaming Time - 6 kt	69	53	50
Steaming Time - 7 kt	59	45	43
Steaming Time - 8 kt	52	39	38
Steaming Time - 9 kt	46	35	33
Steaming Time - 10 kt	42	32	30
Steaming Time - 11 kt	38	29	27
Steaming Time - 12 kt	35	26	25

	Portland - NYC (outside)	Portland - NYC (CCC, LI Sound)	Portland - NYC (CCC, LI South Shore)
Miles	**415**	**315**	**300**
	DAYS		
Steaming Time - 5 kt	3D 11H	2D 15H	2D 12H
Steaming Time - 6 kt	2D 20H	2D 5H	2D 2H
Steaming Time - 7 kt	2D 11H	1D 21H	1D 19H
Steaming Time - 8 kt	2D 4H	1D 15H	1D 14H
Steaming Time - 9 kt	1D 22H	1D 11H	1D 9H
Steaming Time - 10 kt	1D 18H	1D 8H	1D 6H
Steaming Time - 11 kt	1D 45H	1D 5H	1D 3H
Steaming Time - 12 kt	1D 11H	1D 2H	1D 1H

Table 10: Transit Times- McAllister Transportation

***Note**: As a technical aside, it is important to note that the operational speed of any vessel, an ATB included, will never be the maximum predicted still water speed. This particular trade route in particular, will be affected by wave heights and direction as well as wind, especially during the late fall to early spring time period. It is important then to consider these factors in predicting the actual speed to be expected for a given design. For ATB's, "traditional" speed reductions in waves do not apply. For this reason it is vital that the naval architect designing the unit have extensive experience in ATB design. A properly designed ATB will perform better than a ship - relatively speaking - in heavy seas*

> *because the propellers/rudders will not suffer from emersion.[15] All vessel types will slow in waves, but ATB's can be designed to suffer less. Also, ships are traditionally bound to an "85% of MCR" powering restriction, upon which fuel consumption is based. A properly designed ATB will always be capable of utilizing 100% of installed power if desired, 100% of the time if necessary. It can operate on less, and indeed may well in many cases. However, the philosophy of tug and barge operations does not traditionally employ unused powering capability by overpowering by 15%. The engines used in the proposed tug/barge unit are rated for 100% power output 24 hours a day. A secondary benefit is that ATB's can employ a wider range of powering/fuel options that can focus on not only fuel consumption, but reduced emissions.*

Given the length of the transit time over the various routes, it is then necessary to see how those speed/distance options fit into a workable operating schedule. The controlling factor at this stage of the analysis is the amount of time the two marine terminals will need to load and unload the barge. After visits with terminal operators in Brooklyn and Portland, it appears that Brooklyn is capable of working rates around 25 moves per hour per crane, and can work 2 cranes at a time on the barge. Portland, on the other hand, has only one crane and a realistic estimate of their productivity is 18 moves per hour. However, that productivity is increasing with experience and the facility is expected to have a second crane within two years. Accordingly, the assumption for this study is that Portland will also have 2 cranes, but each will work at 20 moves per hour. Given a theoretical loading of 400x40' boxes on and 400x40' boxes off (800 total moves), rough working times are calculated. The result is that the terminal working time required in Brooklyn for 800 moves will be approximately 16 hours, with 2 cranes, while the working time in Portland for the same loading will be 20 hours.

The information from the calculated terminal hours and the transit times from the above speed/distance tables, can be utilized to set up a variety of scenarios to evaluate what the optimum speed is required to maintain a regular schedule.
For example, based on an assumption of an operating speed of 9 knots, steaming times can be calculated as follows:

[15] The process or state of emerging from or being out of water after being submerged.

9 knots	Outside	Inside (via Sound)	CCC, Ambrose
Steaming - PTL to NYC	46	35	33
Steaming - NYC to PTL	46	35	33
Total	92	70	66

Table 11: 9-knot Transit Times - McAllister Transportation

The scenario that combines transit time and terminal working time requirements most efficiently yields a schedule that will permit a weekly, fixed day schedule. Using the times cited above, for example, we can estimate the following as a workable schedule

Hours: 9 kt Schedule					
Day	Port	Idle	Working	Steaming	Total
1	Portland	12	12	0	12
2	Portland	8	8	8	16
3	At Sea	0	0	24	24
4	Brooklyn	14	8	2	10
5	Brooklyn	8	8	8	16
6	At Sea	0	0	24	24
7	Portland	22	0	2	2
Total Hours		64	36	68	104

Table 12: Sample Service Schedule Hours - McAllister Transportation

Times: 9 kt Schedule						
Day	Port	Idle	Working	Steaming	Arrive	Depart
Mon.	Portland	0000 – 0800	0800 - 2000	N/A	N/A	N/A
	Portland	2000 – 2400	N/A	N/A	N/A	N/A
Tues.	Portland	0000 – 0800	0800 - 1600	1600 - 2400	N/A	1600
Wed.	At Sea	N/A	N/A	0000 - 2400	N/A	N/A
Thurs.	Brooklyn	0200 – 0800	0800 -1600	0000 - 0200	0200	N/A
	Brooklyn	1600 – 2400	N/A	N/A	N/A	N/A
Fri.	Brooklyn	0000 – 0800	0800 - 1600	1600 - 2400	1000 hr	N/A
Sat.	At Sea	N/A	N/A	0000 - 2400	N/A	N/A
Sun.	Portland	0200 – 2400	N/A	0000 - 0200	0200	N/A

Table 13: Sample Service Schedule Times- McAllister Transportation

Trial and error indicates that an operational speed of about 9 knots is optimum. Of course, the above are only rough estimates that do not account for delays in terminal operations, bad weather in transit, etc. However, the 9 knot speed scenario has enough slack in the schedule to permit delays of various types and still maintain a weekly, fixed day schedule.

In addition to the timing, the schedule exercise does yield some critical information on what speed the ATB needs to be capable of in order to maintain a schedule. While 9 knots does appear to be the minimum sustainable speed, in order to be able to meet deadlines, the ATB will need to be capable of higher speeds. This, in turn, suggests a design speed of around 12 knots, although actual working speed could be in the vicinity of 9 – 10 knots.

(c) Power Options: The terms of the grant require an examination of the issues of engine and fuel options for the ATB, especially with regard to the possibility of using LNG as a marine fuel.

1. Diesel-Electric Propulsion: After much internal discussion, it was agreed that the basic power plant for the tug will be diesel electric.[16] The technology is well-proven and these types of plants have been in use in

[16] A diesel-electric system consists of one or more diesel engines connected to an electrical generator, which produces electricity that powers electric propulsion motors.

one form or another for over 100 years.[17] Although the cost of installation is anticipated to be slightly higher than conventional diesel (due in part to the requirement for large electric motors as prime movers), this type of engine provides a number of distinct advantages over conventional marine power plants:

- Eliminates the need for gear boxes (for the reduction of engine shaft speed to propeller shaft speed) and clutches;

- Increased fuel efficiency and lower emissions by providing the option of running the main engines in optimum configurations for the load conditions (i.e., depending on the load condition, the diesel electric system can provide better fuel efficiency by running on fewer main engines);

- Increased efficiency in use of space due to the ability to locate main engines and generators in any part of the vessel independent of where the power will be used (the propulsive motors do not need to be mechanically linked or even adjacent to the diesel engines that drive the generators);

- The ability to replace large main engines with multiple smaller diesel engine/generator sets;

- Reduced noise and vibration;

- No need for long drive shafts;

- The capability of sharing electrical power with multiple devices (main propeller, bow thrusters, reefer load, pumps, etc);

- High reliability of propulsion due to multiple engine redundancy and reduced vulnerability to a single point of failure (i.e., even if one engine malfunctions, the vessel still has propulsive power from the other generator sets that supply power to the main bus);

- Reduction of main engine life cycle costs resulting from lower fuel consumption and reduced maintenance.

[17] The first diesel motorship was also the first diesel-electric ship, the Russian tanker *Vandal*, which was launched in 1903. Steam turbine-electric propulsion has been in use since the 1920s (e.g., the T-2 "Mission" tankers built during WWII). The diesel-electric technology now enjoys widespread use in the passenger ship trades, especially where those ships are equipped with azipods.

2. LNG Fuel: For the purposes of this study, dual fuel diesel engines have been specified in the design of the tug, although the final design may or may not include this type of main engines.

   A dual fuel engine is based on a traditional diesel engine, with the addition of additional hardware. When a dual fuel engine is operating in dual fuel mode, natural gas is introduced into the intake system. The air/natural gas mixture from the intake is drawn into the cylinder, but with a leaner air-to-fuel ratio. Near the end of the compression stroke, diesel fuel is injected, just as it would be in a traditional diesel engine. The diesel fuel ignites, and the diesel combustion causes the natural gas to burn. A dual fuel engine can operate either on 100 percent diesel fuel or a substitution mixture of diesel and natural gas, but it cannot operate on natural gas alone. Dual fuel engines deliver the same power density, torque curve and transient response as a conventional diesel engine of the same manufacture does.

   A critical parameter for dual fuel operation is the substitution rate, which is defined as the fraction of the total fuel energy that is provided by the natural gas. Substitution rates vary by load. A maximum substitution rate of around 70 percent can be achieved in some applications, but in marine operations of the type being studied, a realistic substitution rate of 50% is more likely. There is also flexibility with the quality of gas an operator uses. An operator can run on a lower-cost, lower-quality gas at a lower substitution rate, or use a higher-quality fuel at a higher cost with a higher substitution rate.

   Certain engine manufacturers can provide conversion kits for their engines to run on higher levels of LNG (as much as 80 – 85% LNG). These converted diesel engines are closer to pure LNG powered engines, and consequently are considered a step past "conventional" dual fuel engines. The possibility of installing one of these kits after the ATB is in service is a distinct possibility, but until the price and availability of LNG as a marine fuel become more certain, the cost-benefit analysis would be too speculative to include in this study.

   The barge design currently includes space for LNG tanks, although the full engineering for the installation has not been performed. An important part of this design parameter was that there is room on the barge for these tanks, and it would be far more efficient to store the fuel there, rather than utilize precious space aboard the tug. The biggest problem that was encountered was how big to make the tanks, since the volume of LNG to be stored was critical. In order to keep the barge size from expanding too much, the tanks were sized to provide about 5 days steaming. Thus, the design will result in the need to bunker LNG every trip, or possibly every other trip. Given the fact that there are no operational LNG bunkering facilities on the U.S. East Coast at the time of this writing, LNG storage on the ATB is highly problematic. Accordingly, the inclusion of a dual fuel engine and LNG tanks results in a more a conceptual design than a practical one.

One alternative to the demand for frequent LNG bunkering operations and the availability of LNG fueling facilities, is that a separate, small container bay can be designed into the barge to carry ISO tank containers designed and built to transport LNG. A manifold would be provided for hookup of the containers to deliver the fuel to the tug through an umbilical. While this approach would solve many problems, and permit the efficient bunkering of LNG to fuel the tug's main engines, there is considerable disagreement between regulatory authorities about how such a fuel system would work. In particular, the DOT and DHS seem to have difficulties in thinking this issue through. Therefore, while highly promising and easily implemented, this approach remains at the mercy of regulators, not engineers and naval architects.

NOTE: Although the design calls for the installation of a dual fuel engine, the economic analysis that follows uses the price of marine type diesel fuel, rather than some blend of diesel and LNG. The main reason for this is that even though diesel fuel prices have fluctuated tremendously in recent years, LNG is not a readily available marine fuel, and the costs of buying and transporting it shipside are undefined and unknown at this point. There is little doubt that as LNG becomes more readily available and more frequently used, its price will go up from current levels and marine diesel is likely to drop in price as LNG takes a larger share of the marine fuel market. However, those changes are virtually impossible to predict, and we choose to steer away from speculation.

(d) **<u>Other Considerations</u>**: Having determined that an ATB with a capacity of somewhere around 850 TEUs and a service speed in the range of 10 knots, with some speed to spare, the designer has looked at some other design particulars that affect performance, efficiency, and cost. The design takes the following into consideration:

- Barge dimensions have been carefully considered (LOA, breadth, depth, draft). This was necessary in order not to exceed crane outreach maximums, as well as available dock space at the terminals where the ATB is expected to work.

- Speed is a function of form, especially in regard to length and wetted surface. In other words, a longer, narrower barge should have a better hull speed than a shorter, beamier barge with the same capacity. Hull form or shape itself comes into play, as well, since a barge with a relatively fine entry, will be easier to push than a barge with a square, raked bow. All of these considerations went into the design.

- The designer also had to consider issues like minimizing the effect of water coming on board the barge – both as issues of stability and cargo safety. Water coming over the bow required a breakwater, and containers need protection in the form of coamings from water entering over the sides. Despite those protections, water will enter the cargo space, and space below the stacks was provided to collect the water and each hold is equipped with bilge pumps.

- Cargo stowage was considered, both as a function of loading and discharging efficiency, and as a matter of operational safety. With a low-slung deck barge in a pushing configuration, the height of the container stacks is necessarily limited due to the height of eye required for the tug. This suggested an open hatch hopper barge so that the stow can be accommodated in largely protected space, and a reasonable limit on the air draft to assure that the tug will have adequate visibility forward without an extreme height of eye.

- The stowage system itself was carefully considered. For the sake of simplicity and efficiency, the barge will be equipped with cell guides. That will not only speed up loading and discharging, it will also eliminate the need for lashing, a labor- and equipment-intensive process that is expensive. The design does permit the stowage of a tier of containers near the stern, above the coaming. These will not require lashing, and will be secured in place with twistlocks.

- The barge will have some ballasting capability. This will be necessary to reduce the height of eye restrictions and to provide an additional measure of intact stability on trips when the barge is in a light condition, such as when it is transporting mostly empty containers.

- Another design consideration is the ability of the barge to transport refrigerated cargo, a likely requirement since the service is to be operated as a common carrier. For the sake of simplicity, it was decided to outfit the aftermost bay with plugs for reefer containers. This has been determined to be the most efficient solution in terms of design and operating efficiency. In addition, the freight rate for reefer cargo will need to be higher, due to the additional cargo care needs and costs. However, for the sake of simplicity, the additional revenue generated by this cargo has not been factored into the economic analysis that follows.

The above analysis describes the primary considerations and methodology used to produce the input from which the naval architect developed the actual design which is attached. Although much of what transpired and discussed during the process is omitted here, the major points are covered with some degree of detail.

Financial Analysis

The discussion that follows will examine the various financial and economic aspects of the intended service. Unfortunately, since many of the financial parameters are uncertain, accurate and consistent estimates of what is most likely to actually occur can result in highly debatable conclusions. Therefore, the following discussion is primarily limited to the presentation of a framework for financial analysis, using some broad assumptions to illustrate the process. The intent, then, is to show *how* things will happen rather than precisely *what* will happen. This analysis is followed by some comments on what areas are most susceptible to change, and the possible effect of changes in those functional areas. What results is a pro-forma annual income statement, covering the first and second years of operation. The pro-forma posits that the first year of operation will be strongly affected by certain startup costs, lower volumes of cargo at the beginning of the service, and expected operational inefficiencies while experience is gained. The pro-forma then posits that the second year of operation will be the model for future years of operation, and is a better indication of expected financial results of the service.

As stated previously, the statement utilizes a number of assumptions which may or may not be valid two years from now when the ATB might be delivered. One major assumption is that while plans for the New England Marine Highway include linking a number of ports, it is not practical to expect more than two ports to fit into a weekly schedule with one ATB. Should the operation be successful and a second ATB be delivered, then calls at intermediate ports can be considered.

The basis for most of the major financial assumptions is explained in the material below.

- Revenue Considerations:

    - Year 1 is the Startup of the operation and during that period many of the startup costs will be incurred and absorbed. Year 2 is expected to reflect the future norm for the operation.

    - Revenue for various possible freight rates per box for loaded containers is shown in Table 1 ($600, $700, $800, $900, $1000).

    - Revenue for northbound empties is assumed to be $250 per box. This is well below handling costs, but it is presumed that customers will not pay for full handling costs just to reposition containers. In any event, it is assumed that the majority of northbound containers will be empties. This unbalanced flow of empties might be overcome if there is a demand for empties in New York and customer demand for empties in Portland can be satisfied through local pooling arrangements. However, that is not the current state of affairs, and that is not expected to change anytime soon. The northbound voyage might also develop greater proportions of loads, expected to be primarily international containers being feedered into New England. In that case, empties would need to be repositioned by other means.

  - Cargo flows in both directions were assumed to be at less than full capacity for at least 6 months. Southbound flow was predicted to start at 200 FEUs per trip, and building up to full capacity by the 7th month of operation. Similarly, northbound flows were predicted to begin slowly and build up over time.

  - The assumption for this exercise was made that capacity utilization would be 100% after the 6th month of operation. Although utilization rates less than 100% will certainly and adversely the revenue stream, it is too difficult to predict precisely what will happen in that event.

  - The statement assumes that a fuel surcharge (Bunker Adjustment Factor, or "BAF" in liner terminology) will be imposed at some point in the first year. This surcharge will fluctuate, from about 4% when first imposed, to about 8.3% in the second year, and approaching 12.5% in the last quarter of the second year. This may be a somewhat simplistic view of the trend in fuel prices, but it helps flesh out the exercise and lends some degree of credibility to the pro-forma.

- Charter Hire:

  - The term Charter Hire is used to describe the cost of ownership of the major assets – the tug and the barge. All operating costs (fuel, labor, stevedoring, etc.) of the service will be assumed by the "operator" and hire of the floating assets is assumed to be on a bareboat basis.

  - The tug is assumed for this exercise to be $25 million. The barge is assumed to cost $50 million. The actual cost of acquiring these assets will, of course, vary from these figures (see, e.g., the naval architect's cost estimates).

- It is assumed that the cost of acquisition will be partially offset by grants received from federal and state sources. The statement assumes that 50% of the costs will be covered by grants.

- Interest rates will vary with the market for loans, the rates that state transportation bonds must pay, the financial status of the partners in the venture, and myriad other factors. For the purposes of this exercise, a rate of 3.5% is assumed.

- The cost of ownership includes not only the amortization costs, but administration costs for the partners, and some reasonable profit. Accordingly, the amortization schedule was increased by 8% to arrive at the charter hire rate.

- Fuel and Lubes:

    - The tug will be powered by three 3,000 HP diesel engines. Although dual fuel engines are specified in the design, for the sake of simplicity, this analysis will assume that 100% of the fuel used will be marine diesel. In that configuration, full operating speed can be attained at about 5,000 HP in favorable conditions. Accordingly, the daily consumption at sea speed can be roughly calculated by multiplying the horsepower used by 1.1 gallons. Consumption during maneuvering is assumed at 75 gallons per hour, while consumption in port is assumed to be 240 gallons/day (largely because of the need to power reefer containers).

    - The price of marine diesel is assumed to be $3.00 per gallon. The delivered price in New York has varied in the last year from just under $3.00 per gallon to as high as $3.40 per gallon. Therefore, the assumed price is within the bounds of recent experience, but on the low side.

    - Consumption is calculated as follows:

FUEL CONSUMPTION PER TRIP			
	Idle	Maneuvering	Steaming
Day 1	24	0	0
Day 2	18	2	4
Day 3	0	0	24
Day 4	16	2	4
Day 5	24	0	0
Day 6	14	2	10
Day 7	0	0	24
Total	96	6	66
GPH	2.5	75	229
Burn	240	450	15,114

Total Burn/Trip	15,804
Adjusted Burn	17,384
Diesel @ $3.00	52,153
Annual Cost	2,711,966

Table 14: Fuel Consumption - McAllister Transportation

***Note**: The burn rate per trip is adjusted 10% upward to account for variations in speed/consumption due to bad weather, schedule changes, etc.*

- Port Charges:
    - Port charges are assumed to consist of linehandling expense and dockage (a charge from the terminal for the use of dock space, generally assessed according to length of the vessel).
    - Dockage rates in both ports are set forth in the respective terminal tariffs.
- Maintenance and Repair:
    - Maintenance costs are expected to be fairly low during the first year, due to the fact that the tug and barge will be new. However, costs will rise in the second year.

- The analysis assumes no drydocking costs in the first or second year.

- The analysis assumes that the partner owning the tug will supply labor and materials for maintenance, engineering supervision, etc. Those costs will be charged back to the operation.

- The analysis assumes that some repairs and/or maintenance will require outside technicians or labor.

- There will be some expenses related to class requirements, inspections, etc.

- Labor:

  - It is assumed that the ATB will be manned with a crew of 6.

  - The rates of pay for the various positions are comparable to existing pay for similarly situated seamen. If the current labor shortage for qualified personnel (especially licensed engineers) it can be assumed that the pay scales will increase in the future.

  - An annual pay increase of 3.5% is assumed.

  - Standard benefits at standard rates are assumed as per below.

  - The cost of labor is calculated as follows:

Position	**Daily Rate**	**Annualized**	**3.5% Increase**
Captain	600	219,000	226,665
Mate	500	182,500	188,888
Chief Engineer	550	200,750	207,776
Licensed Engineer	525	191,625	198,332
AB	250	91,250	94,444
AB	250	91,250	94,444
Total	**2,675**	**976,375**	**1,010,548**

Expense Item	Year 1	Year 2	% of Wages
Wages Crew	976,375	1,010,548	n/a
Grub	43,800	43,800	n/a
FICA	59,803	61,896	6.13%
Medicare	24,409	25,264	2.50%
Insurance Unemployment	4,882	5,053	0.50%
Jones Act /USLH / Workers Comp	97,638	101,055	10.00%
Major Medical	180,629	186,951	18.50%
Travel Expenses	14,646	15,158	1.50%
Crew Training & Licensing	50,000	5,000	n/a
Crew Testing, Evaluation	25,000	5,000	n/a
Other Labor	24,409	25,264	2.50%
Total Vessel Labor	**1,501,591**	**1,484,989**	

Table 15: Labor Expenses - McAllister Transportation

- Stevedoring:

  - Non-binding quotations for stevedoring were obtained in both Portland and Brooklyn and the rates shown are based upon those quotations. Actual stevedoring costs are expected to be the result of extensive negotiations with stevedores and shoreside labor. In particular, the operator will be seeking concessions on gang sizes, work rules, royalty payments, and wharfage..

  - Rates per box were quoted for the Brooklyn operation, while rates in Portland were quoted on a gang hour basis. Portland rates were converted to per box rates, using assumed productivity rates.

  - Crane production in Brooklyn was assumed to be 50 moves per hour (2 cranes, each at 25 moves per hour). Production in Portland was assumed to be 40 moves per hour (2 cranes, each at 20 moves per hour).

  - Differentials for overtime have been factored into the rate per box.

  - Empties in Brooklyn are charged at a slightly lower rate than loads. No distinction is made in Portland between loads or empties.

  - Both terminals are stack operations. There is a charge for unstacking and loading onto a chassis for movements out the gate.

However, that charge and the gate charge can be avoided if the boxes go directly to chassis.

- There is a gate charge for boxes moving out of the terminals. However, in Brooklyn, boxes moving to the shed for stripping will not incur that charge.

- Charges for maintaining reefers on the terminal (plug-in, electricity, etc.) are not included in the analysis.

- Stevedoring expenses per trip are calculated as follows:

PORTLAND STEVEDORING		
Per box rates (40 moves/hour, using 2 cranes)		
	SOUTHBOUND	**NORTHBOUND**
Stevedoring (load/discharge)	55.00	55.00
Overtime	9.00	9.00
Gate charges	45.00	45.00
Crane rental	22.50	22.50
Equipment rental	5.50	5.50
Wharfage	40.00	24.00
ILA Royalties/Charges	45.00	27.00
Total/Box – Portland	**222.00**	**188.00**

Per Trip Southbound	
Load 350 general boxes	77,700
Load 50 reefers	11,100
Load 45 feeder boxes	9,990
Sub Total	98,790
Per Trip Northbound	
Discharge 350 MT boxes	65,800
Discharge 95 feeder boxes	17,860
Sub Total	83,660
Stevedoring Cost per Trip	**182,450**
Average per box, all types	*203.85*

Table 16: Portland Stevedoring Costs - McAllister Transportation

BROOKLYN STEVEDORING				
Per box rates (50 moves/hour, using 2 cranes)				
	S/B General	S/B PIER	NORTHBOUND	MT
Stevedoring (loaded containers)	240.00	240.00	240.00	-
Stevedoring (empty containers)	-	-	-	235.00
Overtime	16.50	16.50	16.50	16.50
Gate charges	-		-	-
Wharfage	40.00	40.00	40.00	20.00
ILA Royalties/Charges	45.00	45.00	45.00	22.50
Total/Box Brooklyn	**341.50**	**341.50**	**341.50**	**294.00**

Per Trip Southbound	
Discharge 350 general boxes	119,525
Discharge 50 reefers	17,075
Discharge 45 feeder boxes	15,368
Sub Total	151,968
Per Trip Northbound	
Load 350 MT boxes	102,900
Load 95 feeder boxes	32,443
	135,343
Stevedoring Cost per Trip	**287,310**
Average per box, all types	*321.02*

Table 17: Brooklyn Stevedoring Costs - McAllister Transportation

- Insurance:
  - Insurance rates are based upon non-binding quotations received from underwriters through New York brokers. Terms and conditions of coverage were quoted on the basis of the assumptions contained in this study.
  - There will be some expense related to uninsured hull and machinery claims, due to retention of risk and deductible under the applicable insurance cover. A minimal dollar amount is assumed.
- Administration and Office Expense:
  - The assumption was made that shoreside staffing will consist of the following (all based in Maine):

General Manager
Port Captain
Stowage Coordinator
Technical Manager
Documentation clerk
Administrative Assistant

  - It was assumed that office space will be provided in Brooklyn at no cost.

  - Office space in Maine is assumed to be on the terminal grounds in the existing facility, or in space created in the terminal expansion slated for 2014. Rental and utility rates were assumed to be favorable.

- Data processing:

  - Some of the data processing expense is properly part of the balance sheet, but was included in this expense category to reflect the cost associated with the required hardware and software. The expense is expected to be greatest in the first year of operation.

  - Software will be required for administration (payroll, basic accounting, etc.), operations (stowage planning, logbooks, etc.), and especially for documentation (bills of lading, trick receipts/interchange reports, etc.). Cost of acquisition will be high in the first year and lower thereafter.
  - Much of the data processing functions will be provided by the partners and some outside vendors. The costs associated with this outsourcing is reflected in the analysis.

- Professional fees:

  - Although much of the legal work will be provided by the partners, fees for outside counsel, auditors, etc. will still accrue.

The pro-forma income statement follows this page and the following comments are in order with regard to that document:

- As a reminder, the spreadsheet uses the following major assumptions:

  - Cost of the tug will be $25,000,000, and the cost of the barge will be $50,000,000.
  - 50% of the cost of the assets will be subsidized (grants, etc.)
  - Capacity utilization by south bound loaded containers in Year 1 will be approximately 83%, and 100 % in the Year 2. Northbound

loads will use approximately 24% of available capacity in Year 1, and 33% in Year 2.

- The interest rate is 3.5% for both partners.
- Diesel fuel will cost $3.00 per gallon, delivery at New York.
- Stevedoring rates will be approximately $326 per box in Brooklyn and $202 in Portland.
- Empties will be charged a freight rate of $250.

The pro-forma income statement, based upon the above assumptions is shown on the following pages.

	$600/Box		$700/Box		$800/Box		$900/Box		$1,000/Box	
REVENUE	**YEAR 1**	**YEAR 2**	**YEAR 1**	**YEAR 2**	**YEAR 1**	**YEAR 2**	**YEAR 1**	**YEAR 2**	**YEAR 1**	**YEAR 2**
Southbound Revenue	$11,979	$13,884	$13,976	$16,198	$15,972	$18,512	$17,969	$20,826	$19,965	$23,140
Northbound Revenue	$6,925	$13,039	$7,478	$14,573	$8,030	$16,107	$8,583	$17,641	$19,175	$19,175
Fuel Surcharge	$741	$2,165	$741	$2,165	$741	$2,165	$741	$2,165	$741	$2,165
TOTAL REVENUE	**$19,645**	**$29,088**	**$22,194**	**$32,936**	**$24,743**	**$36,784**	**$27,292**	**$40,632**	**$39,881**	**$44,480**
VESSEL EXPENSE										
Hire - Tug	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557
Hire - Barge	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115
Total Charter Hire	**$4,672**	**$4,672**	**$4,672**	**$4,672**	**$4,672**	**$4,672**	**$4,672**	**$4,672**	**$4,672**	**$4,672**
Fuel	$2,712	$2,712	$2,712	$2,712	$2,712	$2,712	$2,712	$2,712	$2,712	$2,712
Lubes	$68	$68	$68	$68	$68	$68	$68	$68	$68	$68
Total Fuel & Lubes	**$2,780**	**$2,780**	**$2,780**	**$2,780**	**$2,780**	**$2,780**	**$2,780**	**$2,780**	**$2,780**	**$2,780**
Linehandling	$52	$52	$52	$52	$52	$52	$52	$52	$52	$52
Dockage	$190	$190	$190	$190	$190	$190	$190	$190	$190	$190
Total Port Charges	**$242**	**$242**	**$242**	**$242**	**$242**	**$242**	**$242**	**$242**	**$242**	**$242**
Maint. & Repair	$10	$50	$10	$50	$10	$50	$10	$50	$10	$50
Wages	$175	$175	$175	$175	$175	$175	$175	$175	$175	$175
Benefits	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35
Scheduled Maintenance	$50	$100	$50	$100	$50	$100	$50	$100	$50	$100
Outside Repair Labor	$25	$50	$25	$50	$25	$50	$25	$50	$25	$50
Supplies	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50
Unplanned Maintenance	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Failed in Service	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Dmg. Equip. Repl.	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Other M&R	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25

Total Maintenance & Repair	**$445**	**$560**	**$445**	**$560**	**$445**	**$560**	**$445**	**$560**	**$445**	**$560**
Wages Crew	$976	$1,011	$976	$1,011	$976	$1,011	$976	$1,011	$976	$1,011
Grub	$44	$44	$44	$44	$44	$44	$44	$44	$44	$44
FICA	$60	$62	$60	$62	$60	$62	$60	$62	$60	$62
Medicare	$24	$25	$24	$25	$24	$25	$24	$25	$24	$25
Unempl. Ins.	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Jones Act/USLH/WC	$98	$101	$98	$101	$98	$101	$98	$101	$98	$101
Major Medical	$181	$187	$181	$187	$181	$187	$181	$187	$181	$187
Travel Expenses	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
Crew Training & Licensing	$50	$5	$50	$5	$50	$5	$50	$5	$50	$5
Crew Testing, Evaluation	$25	$5	$25	$5	$25	$5	$25	$5	$25	$5
Other Labor	$24	$25	$24	$25	$24	$25	$24	$25	$24	$25
Total Vessel Labor	**$1,502**	**$1,485**	**$1,502**	**$1,485**	**$1,502**	**$1,485**	**$1,502**	**$1,485**	**$1,502**	**$1,485**
TOTAL VESSEL EXPENSE	**$9,641**	**$9,739**	**$9,641**	**$9,739**	**$9,641**	**$9,739**	**$9,641**	**$9,739**	**$9,641**	**$9,739**
TERMINAL EXPENSE										
Total Stevedoring - Portland	**$8,140**	**$9,487**	**$8,140**	**$9,487**	**$8,140**	**$9,487**	**$8,140**	**$9,487**	**$8,140**	**$9,487**
Total Stevedoring - Brooklyn	**$12,818**	**$14,940**	**$12,818**	**$14,940**	**$12,818**	**$14,940**	**$12,818**	**$14,940**	**$12,818**	**$14,940**
TOTAL STEVEDORING	**$20,958**	**$24,428**	**$20,958**	**$24,428**	**$20,958**	**$24,428**	**$20,958**	**$24,428**	**$20,958**	**$24,428**
SALARY, ADMINISTRATIVE, GENERAL EXPENSE										
Insurance										
P&I Insurance	$120	$125	$120	$125	$120	$125	$120	$125	$120	$125
Hull Insurance	$197	$203	$197	$203	$197	$203	$197	$203	$197	$203
Other Marine Insurance	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
CGL	$50	$53	$50	$53	$50	$53	$50	$53	$50	$53
Auto	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Property	$3	$3	$3	$3	$3	$3	$3	$3	$3	$3
Environmental	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
EPL & Other	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Uninsured Claims	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Total Insurance	**$440**	**$454**	**$440**	**$454**	**$440**	**$454**	**$440**	**$454**	**$440**	**$454**

Administration										
Wages Office	$500	$513	$500	$513	$500	$513	$500	$513	$500	$513
FICA	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33
Medicare	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13
Unempl. Ins.	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
Dis. Ins.	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4
WC/USLH	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18
Payroll Taxes	$3	$3	$3	$3	$3	$3	$3	$3	$3	$3
Life Insurance	$20	$21	$20	$21	$20	$21	$20	$21	$20	$21
Major Medical	$93	$95	$93	$95	$93	$95	$93	$95	$93	$95
Payroll services	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Crew Testing & Evaluation	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Other Sundry G&A	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Total Administration Wages	**$697**	**$714**	**$697**	**$714**	**$697**	**$714**	**$697**	**$714**	**$697**	**$714**
Rent	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12
Utilities	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Postage, courier, misc.	$5	$4	$5	$4	$5	$4	$5	$4	$5	$4
Telephone/fax	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8
Stationery/forms	$3	$1	$3	$1	$3	$1	$3	$1	$3	$1
Office supplies	$3	$2	$3	$2	$3	$2	$3	$2	$3	$2
Total Office Expense	**$35**	**$31**	**$35**	**$31**	**$35**	**$31**	**$35**	**$31**	**$35**	**$31**
Data processing fees	$15	$12	$15	$12	$15	$12	$15	$12	$15	$12
Hardware	$10	$2	$10	$2	$10	$2	$10	$2	$10	$2
Software	$75	$1	$75	$1	$75	$1	$75	$1	$75	$1
Systems support	$12	$13	$12	$13	$12	$13	$12	$13	$12	$13
Total Data Processing	**$112**	**$27**	**$112**	**$27**	**$112**	**$27**	**$112**	**$27**	**$112**	**$27**
Legal Fees	$25	$5	$25	$5	$25	$5	$25	$5	$25	$5
Other Prof. Fees	$15	$5	$15	$5	$15	$5	$15	$5	$15	$5
Total Professional Fees	**$40**	**$10**	**$40**	**$10**	**$40**	**$10**	**$40**	**$10**	**$40**	**$10**

Travel Expense	$24	$24	$24	$24	$24	$24	$24	$24	$24	$24
Entertainment Expense	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2
Registration & Licensing	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
Auto Expense	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
Bank charges	$3	$3	$3	$3	$3	$3	$3	$3	$3	$3
Sundry Office Expense	**$31**	**$30**	**$31**	**$30**	**$31**	**$30**	**$31**	**$30**	**$31**	**$30**
Depr. - Tug	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250
Depr. - Barge	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
Total Depreciation	**$3,750**	**$3,750**	**$3,750**	**$3,750**	**$3,750**	**$3,750**	**$3,750**	**$3,750**	**$3,750**	**$3,750**
TOTAL SAG EXPENSE	**$5,105**	**$5,016**	**$5,105**	**$5,016**	**$5,105**	**$5,016**	**$5,105**	**$5,016**	**$5,105**	**$5,016**
TOTAL EXPENSES	**$34,349**	**$37,917**	**$34,349**	**$37,917**	**$34,349**	**$37,917**	**$34,349**	**$37,917**	**$34,349**	**$37,917**
NET INCOME BEFORE TAXES	**-$14,704**	**-$8,829**	**-$12,155**	**-$4,981**	**-$9,606**	**-$1,133**	**-$7,057**	**$2,715**	**$5,532**	**$6,563**

Table 18: Pro Forma Income Statement - McAllister Transportation

While the bottom line results indicated by the first run through the income statement appear less than appealing, it is essential to remember that what is important is the methodology, not the results. There are several major expense categories that will have an inordinate effect on the profitability of the venture. These expenses can only be finalized in the real world, not the hypothetical world created here. Those major variables include the charter hire rate (dependent on the lending market), the price of steel (a major component of the cost of building), the cost of stevedoring (labor, royalty, and work rules like gang size remain to be actually negotiated), pricing for moving empties, the fluctuating price of fuel and what type of fuel will actually be used. All of these variables remain to be better quantified. Thus, what is presented here is really only a framework for analysis when more realistic figures can be supplied.

EFFECT OF INTEREST/CHARTER RATE CHANGES ON BASE ASSUMPTIONS

ANNUAL INCOME @ 3% Interest Rate (in thousands of dollars)

Amount Financed	$600/Box		$700/Box		$800/Box		$900/Box		$1,000/Box	
	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2
25%	(13,211)	(7,214)	(10,610)	(3,366)	(8,061)	482	(5,512)	4,330	7,077	8,178
50%	(15,427)	(9,430)	(12,826)	(5,582)	(10,277)	(1,734)	(7,728)	2,114	4,861	5,962
75%	(17,708)	(11,711)	(15,107)	(7,863)	(12,558)	(4,015)	(10,009)	(167)	2,580	3,681
100%	(19,989)	(13,992)	(17,388)	(10,144)	(14,839)	(6,296)	(12,290)	(2,448)	299	1,400

ANNUAL INCOME @ 4% Interest Rate (in thousands of dollars)

Amount Financed	$600/Box		$700/Box		$800/Box		$900/Box		$1,000/Box	
	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2
25%	(13,286)	(7,289)	(10,685)	(3,441)	(8,136)	407	(5,587)	4,255	7,002	8,103
50%	(15,648)	(9,651)	(13,047)	(5,803)	(10,498)	(1,955)	(7,949)	1,893	4,640	5,741
75%	(18,040)	(12,043)	(15,439)	(8,195)	(12,890)	(4,347)	(10,341)	(499)	2,248	3,349
100%	(20,432)	(14,435)	(17,831)	(10,587)	(15,282)	(6,739)	(12,733)	(2,891)	(144)	957

ANNUAL INCOME @ 5% Interest Rate (in thousands of dollars)

Amount Financed	$600/Box		$700/Box		$800/Box		$900/Box		$1,000/Box	
	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2
25%	(13,442)	(7,445)	(10,841)	(3,597)	(8,292)	251	(5,743)	4,099	6,846	7,947
50%	(15,876)	(9,879)	(13,275)	(6,031)	(10,726)	(2,183)	(8,177)	1,665	4,412	5,513
75%	(18,382)	(12,385)	(15,781)	(8,537)	(13,232)	(4,689)	(10,683)	(841)	1,906	3,007
100%	(20,888)	(14,890)	(18,287)	(11,042)	(15,738)	(7,194)	(13,189)	(3,346)	(600)	502

ANNUAL INCOME @ 6% Interest Rate (in thousands of dollars)

Amount Financed	$600/Box		$700/Box		$800/Box		$900/Box		$1,000/Box	
	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2
25%	(13,562)	(7,565)	(10,961)	(3,717)	(8,412)	131	(5,863)	3,979	6,726	7,827
50%	(16,110)	(10,113)	(13,509)	(6,265)	(10,960)	(2,417)	(8,411)	1,431	4,178	5,279
75%	(18,733)	(12,736)	(16,132)	(8,888)	(13,583)	(5,040)	(11,034)	(1,192)	1,555	2,656
100%	(21,356)	(15,359)	(18,755)	(11,511)	(16,206)	(7,663)	(13,657)	(3,815)	(1,068)	33

Table 19: Interest and Charter Rate Projections - McAllister Transportation

To illustrate the above, an analysis of the effect of interest rates on charter hire and the profitability of the service, all other variables remaining the same, the following table is presented. From this, it is also possible to infer the effect of the freight rate per box and the effect of capital costs (i.e., the construction subsidy).

It is obvious, therefore, that incremental reductions in certain key areas will result in incremental increases of the same size in the profitability of the venture. As already demonstrated above a reduction of ½% in the interest rate can significantly affect profitability.

Revenue and Expense Projections (in thousands of dollars)

	$600/Box		$700/Box		$800/Box		$900/Box		$1,000/Box	
	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2
TOTAL REVENUE	**19,645**	**29,088**	**22,194**	**32,936**	**24,743**	**36,784**	**27,292**	**40,632**	**39,881**	**44,480**
Charter Hire	4,672	4,672	4,672	4,672	4,672	4,672	4,672	4,672	4,672	4,672
Fuel & Lubes	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780
Port Charges	242	242	242	242	242	242	242	242	242	242
Maintenance & Repair	445	560	445	560	445	560	445	560	445	560
Vessel Labor	1,502	1,485	1,502	1,485	1,502	1,485	1,502	1,485	1,502	1,485
Stevedoring	20,958	24,428	20,958	24,428	20,958	24,428	20,958	24,428	20,958	24,428
Insurance	440	454	440	454	440	454	440	454	440	454
Administration Wages	697	714	697	714	697	714	697	714	697	714
Office Expense	35	31	35	31	35	31	35	31	35	31
Data Processing	112	27	112	27	112	27	112	27	112	27
Professional Fees	40	10	40	10	40	10	40	10	40	10
Office Expense	31	30	31	30	31	30	31	30	31	30
Depreciation	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750
TOTAL EXPENSES	**35,704**	**39,182**	**35,704**	**39,182**	**35,704**	**39,182**	**35,704**	**39,182**	**35,704**	**39,182**
NET INCOME BEFORE TAXES	(16,059)	(10,095)	(13,510)	(6,247)	(10,961)	(2,399)	(8,412)	1,449	4,177	5,297

Revenue and Expense Projections - 10% Reduction in Stevedoring Rates (in thousands of dollars)										
	$600/Box		$700/Box		$800/Box		$900/Box		$1,000/Box	
	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2
TOTAL REVENUE	**19,645**	**29,088**	**22,194**	**32,936**	**24,743**	**36,784**	**27,292**	**40,632**	**39,881**	**44,480**
Charter Hire	4,672	4,672	4,672	4,672	4,672	4,672	4,672	4,672	4,672	4,672
Fuel & Lubes	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780
Port Charges	242	242	242	242	242	242	242	242	242	242
Maintenance & Repair	445	560	445	560	445	560	445	560	445	560
Vessel Labor	1,502	1,485	1,502	1,485	1,502	1,485	1,502	1,485	1,502	1,485
Stevedoring	18,862	21,985	18,862	21,985	18,862	21,985	18,862	21,985	18,862	21,985
Insurance	440	454	440	454	440	454	440	454	440	454
Administration Wages	697	714	697	714	697	714	697	714	697	714
Office Expense	35	31	35	31	35	31	35	31	35	31
Data Processing	112	27	112	27	112	27	112	27	112	27
Professional Fees	40	10	40	10	40	10	40	10	40	10
Office Expense	31	30	31	30	31	30	31	30	31	30
Depreciation	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750
TOTAL EXPENSES	**33,608**	**36,740**	**33,608**	**36,740**	**33,608**	**36,740**	**33,608**	**36,740**	**33,608**	**36,740**
NET INCOME BEFORE TAXES	(13,963)	(7,652)	(11,414)	(3,804)	(8,865)	44	(6,316)	3,892	6,273	7,740

Revenue and Expense Projections - 10% Reduction in Stevedoring Rates, 25% of ATB Financed (in thousands of dollars)										
	$600/Box		$700/Box		$800/Box		$900/Box		$1,000/Box	
	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2
TOTAL REVENUE	19,645	29,088	22,194	32,936	24,743	36,784	27,292	40,632	39,881	44,480
Charter Hire	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643
Fuel & Lubes	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780
Port Charges	242	242	242	242	242	242	242	242	242	242
Maintenance & Repair	445	560	445	560	445	560	445	560	445	560
Vessel Labor	1,502	1,485	1,502	1,485	1,502	1,485	1,502	1,485	1,502	1,485
Stevedoring	18,862	21,985	18,862	21,985	18,862	21,985	18,862	21,985	18,862	21,985
Insurance	440	454	440	454	440	454	440	454	440	454
Administration Wages	697	714	697	714	697	714	697	714	697	714
Office Expense	35	31	35	31	35	31	35	31	35	31
Data Processing	112	27	112	27	112	27	112	27	112	27
Professional Fees	40	10	40	10	40	10	40	10	40	10
Office Expense	31	30	31	30	31	30	31	30	31	30
Depreciation	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875
TOTAL EXPENSES	29,704	32,835	29,704	32,835	29,704	32,835	29,704	32,835	29,704	32,835
NET INCOME BEFORE TAXES	(10,058)	(3,748)	(7,509)	100	(4,960)	3,948	(2,411)	7,796	10,178	11,644

Revenue and Expense Projections 10% Reduction in Stevedoring Rates, 25% of ATB Financed, Empties @ $300/box (in thousands of dollars)

	$600/Box		$700/Box		$800/Box		$900/Box		$1,000/Box	
	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2
TOTAL REVENUE	20,367	29,810	22,916	33,658	25,465	37,506	28,014	41,354	40,603	45,202
Charter Hire	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643
Fuel & Lubes	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780
Port Charges	242	242	242	242	242	242	242	242	242	242
Maintenance & Repair	445	560	445	560	445	560	445	560	445	560
Vessel Labor	1,502	1,485	1,502	1,485	1,502	1,485	1,502	1,485	1,502	1,485
Stevedoring	18,862	21,985	18,862	21,985	18,862	21,985	18,862	21,985	18,862	21,985
Insurance	440	454	440	454	440	454	440	454	440	454
Administration Wages	697	714	697	714	697	714	697	714	697	714
Office Expense	35	31	35	31	35	31	35	31	35	31
Data Processing	112	27	112	27	112	27	112	27	112	27
Professional Fees	40	10	40	10	40	10	40	10	40	10
Office Expense	31	30	31	30	31	30	31	30	31	30
Depreciation	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875
TOTAL EXPENSES	29,704	32,835	29,704	32,835	29,704	32,835	29,704	32,835	29,704	32,835
NET INCOME BEFORE TAXES	(9,336)	(3,026)	(6,787)	822	(4,238)	4,670	(1,689)	8,518	10,900	12,366

Table 20: Profit/Loss Projections by Rate - McAllister Transportation

Again, the intent of the above financial analysis is to provide a framework for further refinement and adjustment. Since the project is only in its conceptual stages, what is of primary concern at this time is that it can be demonstrated that the revenue stream from the coastal carriage of domestic cargo in containers can be sufficient to cover the costs of the operation. Given the nature of the variables, the above analysis shows that the operation can do more than break even, and can be profitable, provided time and effort are taken to keep the variables within reasonable limits.