A Logistics and Operational Analysis of the Use of Fast Container Vessels on Longer Distance (Transatlantic)

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DECLARATION

This is to certify that dissertation was submitted in order to obtain dual degrees of Master of Business Administration from the Department of Shipping Management at the Graduate School of Korea Maritime University

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Abstract

Worldwide containerized trade is growing continuously at 9.2% annual rate. The growth in containerized trade is anticipated to continue as more and more freight from general cargoes to containerized cargoes is transferred. The growth impacts on the size of container ship. These days, the world trend of container ships is divided two trends. They are the mega ships and fast ships. As the trend of ship designs moves to fast ships, several countries have already made a progress on the study of high speed vessel. The mega container ship is made by lower freight rates and the fast container ship is provided very fast integrated service to shippers. That is, the mega and fast container ships will form the most important direction of container transport. The paper concludes by a logistics and operational analysis of high speed ship that where the flexibility is the market winner high speed vessels are required whereas where cost is the market winner conventional ships will suffice.

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Introduction

High Speed Sealift(HSS) is defined as "oceangoing cargo vessels with speed capabilities of forty knots or greater" in the CCDoTT[1] High Speed Sealift/Agile Port Concept document, 1997(OCD 1997). The first generation of such craft expected to enter commercial service in the first decade of the twenty-first century is operated by FastShip Atlantic, Inc., where the vessel design is a semi-planning monohull of 863 LOA[2] powered by gas turbine engines with a range of 4,000 nautical miles carrying 1,440 TEU's at an average cruising speed of 37-40 knots maximum.

With high-speeded loading and discharging systems, the vessel is anticipated to be completely loaded or discharged in four to six hours at ports. If and when this vessel enters into the service on the North Atlantic trade route, it will represent the market maker for HSS referred to its commercial counterpart as a High Speed Sealift vessel in this paper

This paper aims to establish the logistics and operational analysis of High Speed Sealift ship services on Transatlantic route. For the purpose of this paper, technical and operating profiles were based on the widespread concept of FastShip Atlantic.

[1] CCDoTT is Center for the Commercial Deployment of Transportation Technologies
[2] LOA is Length Over All as designate the total length of ship.

Technical Background of High Speed Sealift

Various ships have been built in one design or another over the past decades that reduced hull displacement, coupled in some cases with new forms of motive force; these vessels have attained speeds in excess of sixty knots. A quick summary of several new and not so new technologies follows:

- **Hydrofoils.** This type of ship achieves greater speeds by riding on a pair of winglike extensions. New designs of this type employ from rear extensions to create greater lift. Speeds of seventy knots may be attained with current technology[3].

- **Surface Effect Ships(SES).** This type of vessels employ an air cushion beneath the craft to essentially float over the water. While this is not quite a flying boat, these craft do have shallow drafts and can attain a speed of fifty knots.

- **Wingships.** This type of watercraft takes the concept of SES to the next step, they are in effect small flying ships that fly just above the water surface. Tested by the Russians in the 1970's, these hybrid air/sea craft were capable of a speed of nearly three hundred knots[4].

- **Small Waterplane Area Twin Hull(SWATH).** This type of ships employ multiple hulls and with a series of connecting above the waterline interior spaces to significantly reduce drag while providing superior stability. Not as shallow drafted as

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[3] Robert Toguchi and Joseph Gerard, "Strategic Maneuver in 2020" paper resented at the Military Operations Research Society Symposium, Monterey, CA, 24 June 1998

[4] Bradley Olds, "The impact of Wingships on Strategic Lift" master's thesis, Naval Postgraduate School, September 1993

SES, SWATH hulls have attained speeds of over fifty knots[5].

- **Semi-Planning Monohulls.** This type of ships exploit their unique deep, V-shaped bow hull design to create lift at stern. Coupled with water jet propulsion, this ship can carry heavy loads with great stability at speeds up to 45 knots[6]. This design is offered by FastShip Atlantic due to its greater capacity, seakeeping ability and speed.

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5 Robert Toguchi and Joseph Gerard, "Strategic Maneuver in 2020" paper resented at the Military Operations Research Society Symposium, Monterey, CA, 24 June 1998

6 David Giles, "Faster Ships for the Future", Scientific American, October 1997, n. p.; online, Internet, 18 September 1998, available from http://www.sciam.com/1097issue/1097Giles.html.

Chapter 1. Logistics Analysis

1.1. The Size of Transatlantic Market

The Transatlantic route was inspiring in 2003. As the devaluation of the US dollar against Euro, the cargo flows from USA to Europe increased 5.3%. On the contrarily, the flows from Europe to USA fell down 1%. Demand was stronger during the first half of 2003 but not such as to cause carriers to add capacity, which had been reduced in the previous year(*UNCTAD/RMT 2004*).

	Transatlantic Route	
	USA→Europe	Europe→USA
2002	1.50	2.59
2003	1.58	2.56
Change(%)	5.3	-1.0

Table 1-1. Estimated cargo flows along Transatlantic route (millions of TEU)

Source: Complied by the UNCTAD secretariat from Containerisation International, several issues

The transatlantic market is expected to grow on an average of 4.2% per year between 2003 and 2008. This is assumed to an average of 3.7% for the Eastbound, and to remain constant for the forecast period. Containerized demand of TEU volume is illustrated in Figure 1-1. As shown, Eastbound TEU demand is growing continuously year after year.

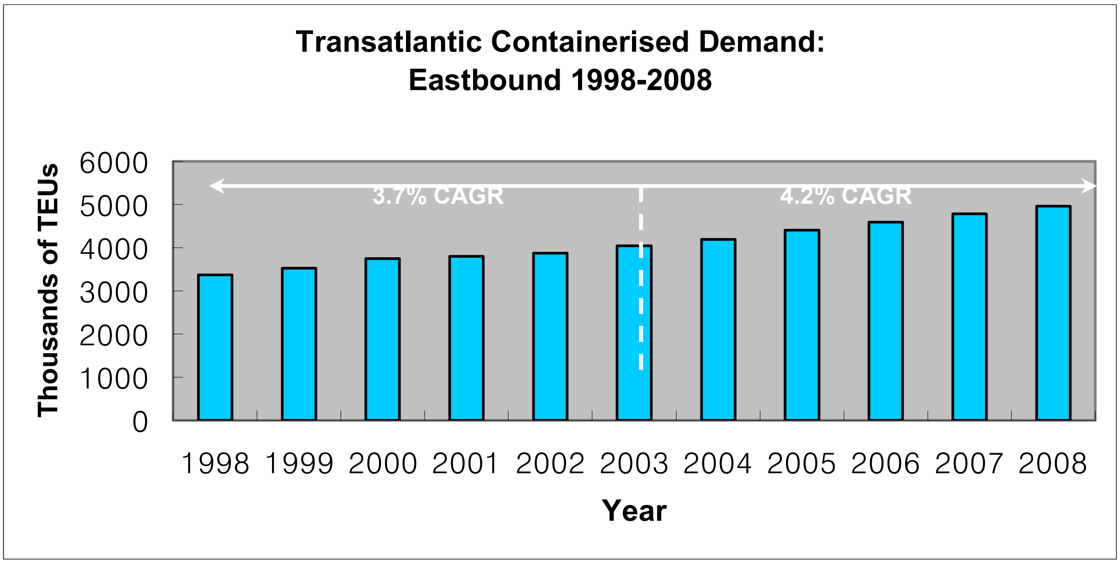

Figure 1-1. Transatlantic containerized Demand: 1998-2008

Source : Merge Global Inc. Global Container Demand Model, On-line available at:

http://www.mergeglobal.com/articles/Ocean_Freight/2004_Transatlantic_Ocean_Forecast.pdf

It should be provided high transatlantic cargo opportunities to HSS. Transatlantic cargo opportunities include imported and exported cargo moving to/from the ports on the HSS rotation plus cargo.

1.1.1. The Middle Market

Current market structure has a wide disproportion between ocean market and air market. There is the middle market which does exist for HSS ships between ocean market and air market. This market provides good opportunities for HSS ships for new technologies. The HSS ship is expected to provide higher speed than current ocean carriers but less than current air carriers, and freight rates greater than current ocean carriers but less than current air carriers. The HSS is necessary to focus on “middle market”.

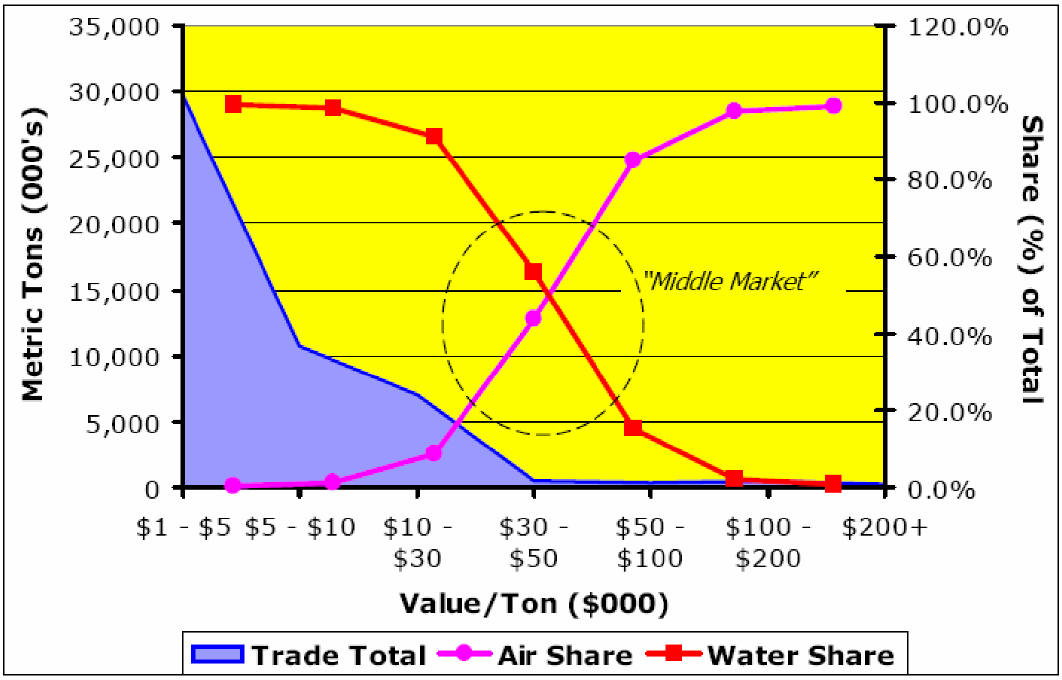

Figure 1-2. The "Middle Market"

Source: Manalytics International, On-line available at:

http://www.ccdott.org/Deliverables/1998/UofA2211/UofA%202211.pdf

Numbers of studies have been analyzed about "middle market". In case of FastShip Atlantic Inc., they had to analyse their middle market for making an opportunity to enter the market. FastShip Atlantic, Inc. employed a value-creating model which sought to determine the value of a high-speed sealift to shippers of high value, time sensitive commodities in June 1995. It was found that time sensitive products could realize a 44% savings in the total cost by reducing the inventory carrying charges (*Marketing analysis for FastShip Atlantic, June 1998*). It was further estimated that certain apparel, publications and packages, and seafood would experience an increase in demand overseas, from 20% to 100% (*Marketing analysis for FastShip Atlantic, June 1998*). The model was a total logistics cost model, which selected the most likely types of products to be shipped via the sealift, and compared the total cost of transport through a fast sealift with the total transportation costs associated with conventional shipping methods. This model was confirmed by the Massachusetts Institute of Technology (MIT), Center of Transportation Studies[7].

Merge Global also conducted an independent marketing analysis, and found that there is a market for the HSS transport of high value, time sensitive commodities. Likely shipping rates associated with FastShip Atlantic are shown in Figure 1-3.

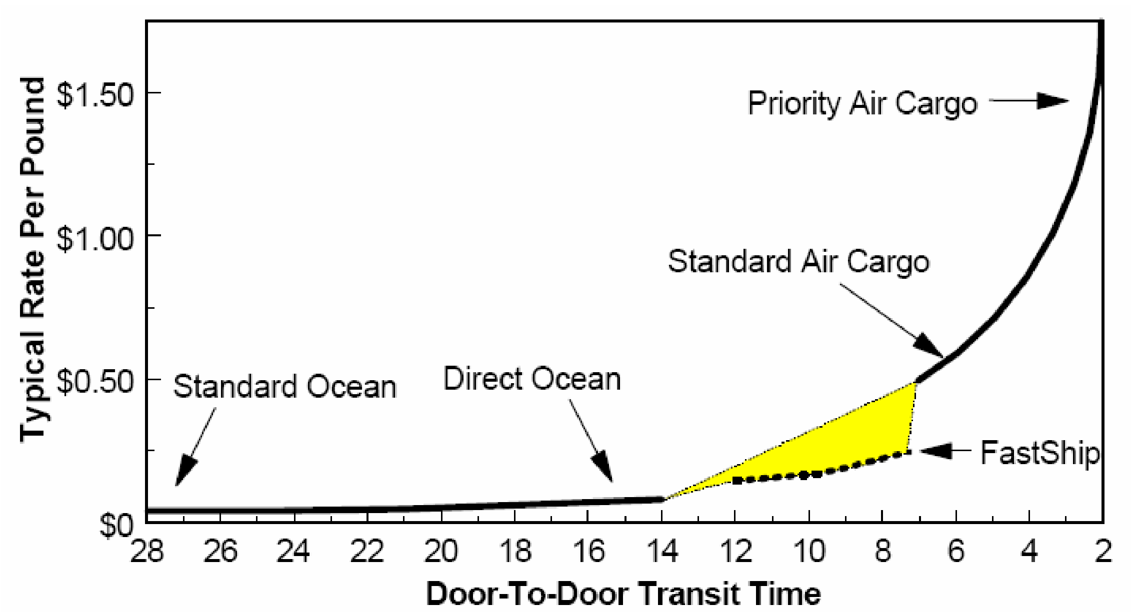

Figure 1-3. Delivery Time/Shipping Rates of Middle Market Commodities

Source: Merge Global primary research, On-line available at: http://www.mergeglobal.com/fastship.pdf

Research by Drewry Shipping Consultants in 1991 showed that, assuming high value, time-sensitive freight comprised about 25% of the total containerized cargo, the market for high value, time-sensitive containerized fright would be in the 35 million to range (*Advanced Technology for Transportation Applications Technical report, August 1997*).

[7] "Marketing Analysis for FastShip Atlantic", MIT Center for Transportation Studies, June 1995

1.2. Operating Characteristics of HSS

We can generalize the data acquired from marine engineers and other experts in maritime operations about characteristics of the HSS. Those data are based on the ones of Manalytics International. Vessel speed, price, vessel range and capacity are tested to determine the amount of cargo. As a result, vessel operating characteristics could be diverted to HSS vessel with the market assumptions. The specifications of HSS are shown in Table 1-2.

Vessel Maximum Service Speed	55 knots
Vessel Average Service Speed	50 knots
Capacity	1,700 TEU
Range(@ max capacity)	3,500 nmi
Fuel Burn/Hour @ 50 knots	58 knots
Capital Cost	US$ 105 – US$ 150 MM
Load/Discharge Speed	70 – 80 lifts per hour

Table 1-2: Utilized Vessel Specifications

Source: Kvaerner Masa, FastShip Atlantic, Band, Lavis & Associates, Manalytics estimates,

On-line available at:

ftp://www.foundation.csulb.edu/CCDoTT/Deliverables/2002/task%202.26/task%202.26_6%20%20FY%2002.pdf

Several variables, especially, speed, fuel consumption and capacity had major implications for the HSS ship service and vice-versa. However, in order for a HSS vessel to achieve distances between USA and Europe at speeds in the 40-60 knot range, most of the potential cargo capacity would have to be sacrificed for fuel-carrying capacity, that means too much fuel consumption for crossing transatlantic need more fuel-carrying capacity.

1.2.1. FastShip Atlantic, Inc.

FastShip Atlantic has designed a vessel that can travel at 37 to 42 knots, versus 25 knots for the fastest conventional ships. Their projected 3-times per week service between Cherbourg, France and Philadelphia, Pennsylvania requires to provide four-day transatlantic transit, including terminal transfers. Connecting to inland rail service providers, they require to be able to provide seven-days service between the U.S.A and Europe.

FastShip Atlantic transits are based on service speeds of 37 – 42 knots and a capacity of 1,400 TEU or approximately 8,000 long tons (*"Fast Ships", MGI Cargo Analyst, 1999*). They project that half of their market will come from current ocean cargo (approximately 2% - 3% of the surface market) and the other half from current air(*"Fast Ships", MGI Cargo Analyst, 1999*). Figure 1-4 and Table 1-3 illustrate about design and specification of FastShip Atlantic ship.

Figure 1-4. FastShip Atlantic(TG-770)

Source: FastShip Atlantic Inc., On-line available at: http://www.fastshipatlantic.com/innovativeshipdesign.html

Max Speed	42 knots (100% of rated power)
Capacity	115,840 sq.ft., 1,400 TEU(containerized)
Range	3,300nm (unrefueled)
Turnaround Time	8 – 10 hours
Draft(loaded)	33 ft. 4 in.
Length	770 ft
Beam	120 ft
Displacement	33,300 l.t.
Horsepower	300,000 hp(5 Rolls Royce "Trent" engines)

Table 1-3. Specifications of FastShip Atlantic TG-770

Source: FastShip Atlantic Inc., On-line available at: http://www.fastshipatlantic.com/innovativeshipdesign.html

1.3. Competitors Situation and Response to HSS

The HSS needs to examine current competitors situation and response for new market entry of new technology. It could give us some advantages such as strategic options and assessing staying power of current players. This is also adopted their interests to a new cooperative strategy with the new market entry. The new transportation technology is not easy to enter the market.

For assessing the competitive response to HSS, four factors will be examined:

- Ocean carriers
- Maritime ports
- Air carriers
- Integrated Express Carriers

1.3.1. Ocean Carriers

Current cargo market is divided into ocean and air market. The highest percentage of the cargo is controlled by current ocean carriers. The HSS service is same as existing ocean carriers' service in all respects except the price and the speed of the vessel. It means that higher price than ocean carriers is premium service and higher speed than ocean carriers saves the days in ocean transport time. Thus, the HSS service could offer the same type of port calls and service frequency like the current ocean service. In these circumstances, ocean carriers have several options for competitive response, and these are not mutually exclusive.

As mentioned above, the HSS targets on "middle market" related with high-value commodities, time-sensitive commodities. For these commodities, the days saved feature of HSS service have more value that more than offsets its price premium. On this, the ocean carriers could initiate price reductions. These days the conventional container ship's size is growing continuously. They provide higher speed, lower cost, larger vessels than before into the trade. In this case, the value proportion to shippers was the opposite of the HSS. The price reduction is compensation for lower speed. Current ocean carriers had strong enough finances. If they are price reduction, they can absorb the loss about the price reduction. The price will be a major competitive weapon between ocean carriers and the HSS.

Despite competitive relationship between ocean carriers and the HSS, current ocean carriers are able to consider joint venture or acquisition with the HSS for creating new service. That could be a good opportunity to expand services for both of them and offer various service options to their customers.

1.3.2. Maritime Ports

Maritime ports were also confronted with similar situation as ocean carriers. They are competing with the new dedicated terminal system of the HSS. The HSS needs new terminal system for itself. In addition, there is difference such as working hour according to ports call, capacity and intermodal transportation system between new terminal and maritime ports. On this, ports should provide more improved services. And also ports may compete among themselves to offer the best logistical and financial services. It is important not only to adapt the new technology, but also to keep existing ocean carriers clients.

1.3.3. Air Carriers

In spite of small amount of air cargo, the HSS targets on it. Air cargo has same characteristics such as high-value, time-sensitive commodities as HSS. The response by air carriers is price cut particularly in the lower-value segments of their market. However, they face the same problems as the ocean carriers; namely, uncertain ability to discriminate effectively price and sustainability of the price cuts. And air carriers must recover the entire cost of their flight from freight. If then, air carriers will be forced to reduce capacity and to exit in the market entirely. Nevertheless, air carriers need to consider to respond service against the HSS.

1.3.4. Integrated Express Carriers[8]

The integrated express carriers cater primarily to the high end of the transatlantic air cargo market: they offer the fastest, most reliable door-to-door service and receive handsome

[8] "Fast Ships" MGI Cargo Analyst, August 1999 p.14

yields in return. For this reason, we expect the integrators to face relatively little "downgrade" risk because the bulk of their traffic already resists much cheaper standard air cargo service. However, the integrators rely on standard air cargo traffic to "fill up" their freights, and therefore will suffer from the same declining yields and traffic base as the other airlines offering that product. On the positive side, the integrators might well utilize fast ocean services to develop new intermediate products, both for the small-package and heavyweight segments.

1.4. Terminal and Inland Operation

The HSS is the core component of a door-to-door supply chain that contains intermodal transportation system. This section outlines the principal terminal requirements for providing the expedited movement of cargo to/from the vessel, through the terminal, and to/from inland transportation with the underlying assumption that the various infrastructure, technologies and processes can be introduced and operated under a cooperative port labor environment. The terminal requirements are centered on two models:

- Use of existing terminal infrastructure and lift-on/lift-off gantry cranes
- Creation of new terminal infrastructure and cargo handling technology

The consideration on two models is driven by the early stage of vessel design, which has still to determine the cargo load/discharge characteristics of the HSS – either similar to today's lift-on/lift-off container ships or some types of ramp based load/discharge method.

1.4.1. Conventional terminal system[9]

The conventional terminal model assumes that the HSS vessel design incorporates the lift-on/lift-off container handling method of today's container ships and therefore HSS can be accommodated at today's container terminals. There would be some modification to terminal operations and processes to expedite the flow of containers through the terminal and thus maintain the high velocity of the HSS service throughout the door-to-door move.

Conventional terminal of container handling equipment has productivity of 70 containers per hour. Meeting these productivity levels would require at least two gantry cranes working the vessel to load and discharge containers.

The terminal would implement a process to expedite the flow of HSS containers through the terminal. The IT system of the terminal would flag each HSS container to distinguish it from any other container traffic handled by the terminal, assign the HSS container to a designated area of the terminal, and expedite of transfer of the HSS container to/from inland transportation. The terminal operating company would use its own terminal operating system to manage the HSS containers as they move through the terminal and the system would exchange data with the other IT systems adopted by HSS.

Under the conventional terminal model, HSS incorporates lift-on/lift-off design and would most likely utilize existing terminal infrastructure through contracts with third party terminal operating companies. HSS would pay a rate per container to the terminal operator

[9] CCDoTT, September 2003, "Operational, Economic and Financial Evaluation of a Logistics Solution based on the High Speed Ship/Agile Port Concept"

for terminal services and charges to the Port Authority to cover costs related to vessel use of the port.

1.4.2. New Dedicated Terminal System for HSS

The new dedicated terminal system assumes that the HSS vessel design incorporates a container cargo system by stern ramp that facilities load/discharge rates at least twice as fast as conventional lift-on/lift-off gantry cranes. The terminal system would be similar in concept to the container platform train system developed for the FastShip Atlantic project.

1.4.2.1. FastShip Atlantic Dedicated Terminal System

The terminal design is centered on the container platform train (CP train), which is a high capacity container handling system capable of turning FastShip around in six hours (including refueling). Figure 1-5 illustrates the FastShip terminal concept showing the dedicated berth and the storage yard for the CP trains. The terminal occupies up to 30 acres of land the expected throughput is 300,000 TEU per year (*CCDoTT Report, September 2003*).

Figure 1-5. FastShip Atlantic Dedicated Terminal System

Source: TTS technology , On-line available at: http://www.fastshipatlantic.com/enhancedcargohandling.html

Containers will arrive at the export terminal by truck or train and will immediately be positioned for transfer onto the ship using the innovative Container Train system. At the end of the voyage, when they are pulled off the ship into the terminal, they are transferred directly from the Container Train platforms onto trucks or trains for immediate transport to their destination. No dwell time; no piling up of containers in the terminal; no sorting through piles of containers when trucks come to pick them up. The FastShip terminals will be completely cleared of import and export cargo in 16 hours.

Philadelphia and Cherbourg have been selected as the locations of FastShip Atlantic terminals because they are uncongested greenfield sites with unimpeded access to the most dense time-definite freight markets in the U.S. and Europe.

Approximately 60 percent of the U.S. time-definite market lies within 12 hours trucking time of Philadelphia and over 80 percent lies within the 24-hour radius. Similar delivery times can be achieved at Cherbourg for 80 percent of the European time-definite business.[10]

In Philadelphia, the Delaware River Port Authority has agreed to underwrite $75 million to finance the terminal and is an investor in FastShip. Holt Oversight Logistics will be the Philadelphia terminal operator, Aegis Property Management will be the terminal project managers, Keating Building Corp. will be the general contractor, and Urban Engineers is responsible for design and engineering[11].

In Cherbourg, the French government, through the Direction du Transport Maritime, has committed $100 million to the project. GTM, the world's largest company in construction and associated services, will provide technical expertise in the engineering and construction of the terminal.[12]

1.4.3. Comparison of Terminal System

The principle benefits of the new dedicated terminal system over the conventional terminal are the gains in vessel turnaround time and terminal productivity, which would further support the time advantage of HSS and its attraction to shippers of high-value cargo. The preliminary comparison of productivity gains and terminal costs at Los Angeles are presented in Table 1-4.

[10] On-line available at: http://www.fastshipatlantic.com/dedicatedterminals.html
[11] On-line available at: http://www.fastshipatlantic.com/dedicatedterminals.html
[12] On-line available at: http://www.fastshipatlantic.com/dedicatedterminals.html

	New Dedicated Terminal System	Conventional Lift-on/ Lift-off terminal system
Productivity		
Lifts per Hour[1]	140	70
Vessel Turnaround Time[2]	12.9 hours	25.7 hours
Estimated Charges		
Capital Cost[3]	$210 million	none
Container Handling Charge[4]	$150 per container	$250 per container
Dockage[5]	$1,856	$1,856
Estimated Costs ($ million)		
Annual Lease Payment[6]	$27.81	0
Annual Container handling	$42.12	$70.20
Annual Dockage	$0.29	$0.58
Total Above	**$70.22**	**$70.78**
Estimated Cost per TEU($)	**$150**	**$151**

Table 1-4 Preliminary Cost Comparison of New Dedicated and Conventional Terminal Systems – Los Angeles Example

Note:

1. *Twice the lifts per hour under the cassette terminal system as presented in Manalytics International of the HSS deployment analysis.*
2. *Based on 1,800 containers per call*
3. *Assumes zero capital costs under the conventional terminal system because HSS uses existing container terminal infrastructure.*
4. *For the cassette terminal system, the rate shown is the one that results in total cost per TEU similar to the conventional terminal system*
5. *The rate per 24-hour period and part thereof. Other vessel port charges (pilotage, wharfage, etc.) are excluded from the cost comparison because they are charged by vessel size or per container and would most likely be the same under both terminal systems.*
6. *Assumes 30-year term and 15% cost of capital to recover $210 million terminal.*
7. *Based on annual throughput of 468,000 TEU.*

Source: Manalytics International, On-line available at:

ftp://www.foundation.csulb.edu/CCDoTT/Deliverables/2002/task%202.26/task%202.26_6%20%20FY%2002.pdf

1.5. Inland Interface and Transportation

The terminal must provide excellent interface with the various inland transportation modes in order to sustain the speed of the HSS door-to-door service. Access to warehousing in good proximity to the ports will also be required to support value-added services. Rapid exchange between terminal and inland transportation will contribute to the overall time advantage of HSS even though the inland move itself is expected to have similar transit times as today’s conventional shipping service. HSS could save around one day over today’s shipping services through efficient terminal operations – rapid transfer of containers to/from inland transportation combined with shorter vessel turnaround time.

As well as providing the basic ocean transportation, the shipping line logistics division will manage the contracting of intermodal rail, trucking services and airfreight, and coordinate the transfer between modes. This provides the shipper with a single source for the complete door-to-door moves. For example, Figure 1-6 illustrates the different transportation services that the logistics division would manage for import cargo once it has been discharged at the port.

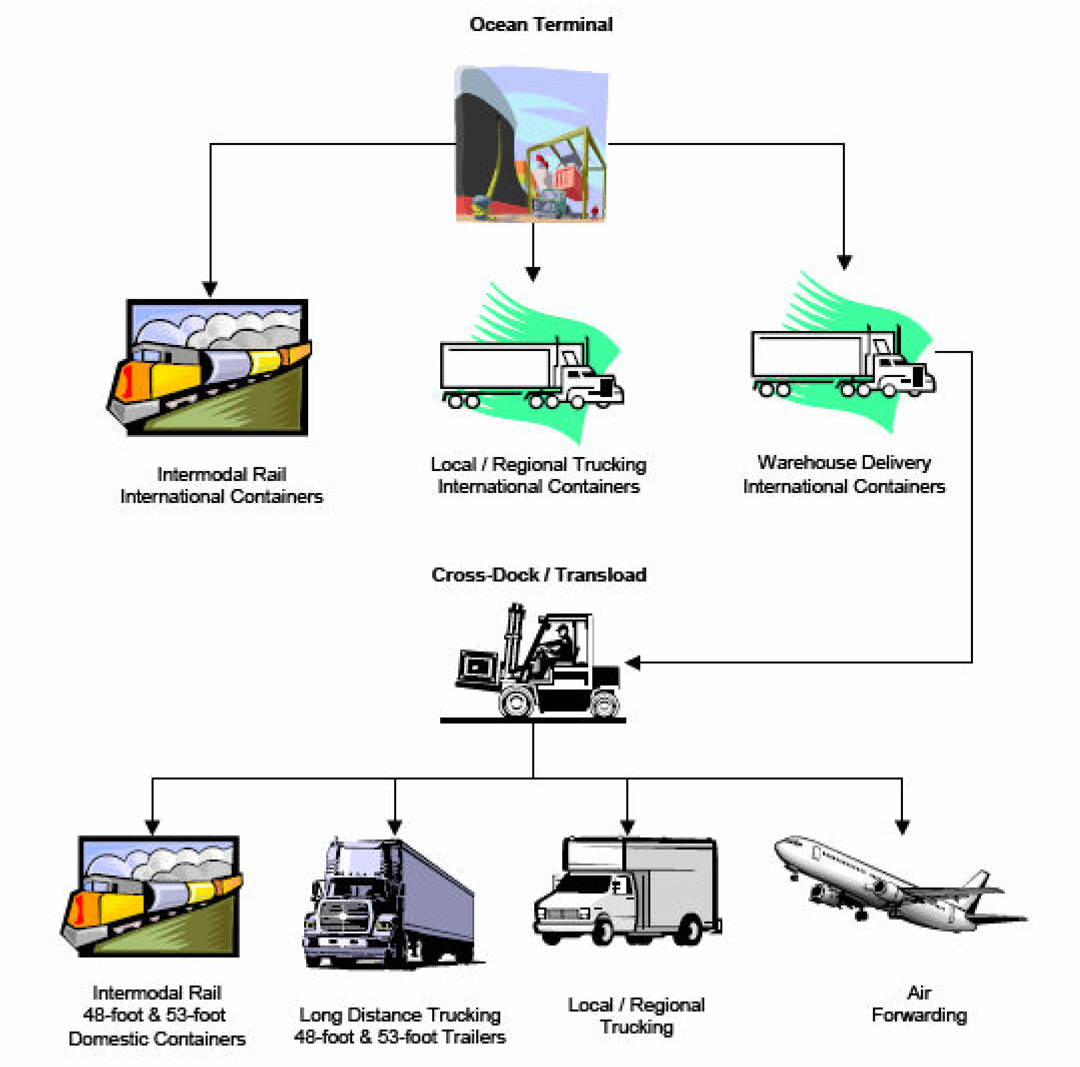

Figure 1-6. Inland Transport services from the Port

Source: Manalytics International

The logistics division normally provides the services through strategic partnerships with trucking companies and intermodal rail service providers. Inland transportation services are priced on per box or per mile basis.

In case of FastShip Atlantic, their logistics network includes flexible buffers to ensure reliability of the 7-day door-to-door service promise. And their inland transportation networks synchronized with ship schedules, operated by strategic partner Schneider Logistics in North America and Europe. Schneider Logistics will manage inland transportation in North America and Europe and act as leading logistics provider integrating product end to end. Figure 1-7 is shown as a whole about the logistics network of FastShip

	Ground transport in the US	Philadelphia Terminal	Shipping	Cherbourg Terminal	Ground transport in Europe	**Total**
Time (hours)	24	6	100	6	32	~168
Planned buffer (hours)	variable by location	←	10	→	variable by location	
Achievable Reliability Percent of time	~99	~99	98	~99	95-98	~90-95

Figure 1-7. The logistics Network of FastShip

Source: FastShip Inc., On-line available at:

http://hqinet001.hqmc.usmc.mil/pp&o/POE/POE-60/HIGH%20SPEED%20CONNECTOR/FastShip%20Brief.pptFastShip, INC. Brief (6 FEB 2002)

1.6. Value –Added Services

Provision of value-added services would make HSS additionally attractive for customers and would generate revenue streams above the basic ocean freight revenue. The various value-added services would be managed through a HSS logistics division, which either provides the services directly in-house or through strategic partnerships with specialist service providers. In the latter case, the services would be sold to the customer under the HSS brand and the individual companies making up the integrated service package would be invisible to the customer.

The expected service structure of a HSS logistics division is illustrated in Figure 1-8 based on the services offered by the logistics division of container shipping lines. The chart shows the major service groups within the division and the principal value-added services provided by the logistics division.

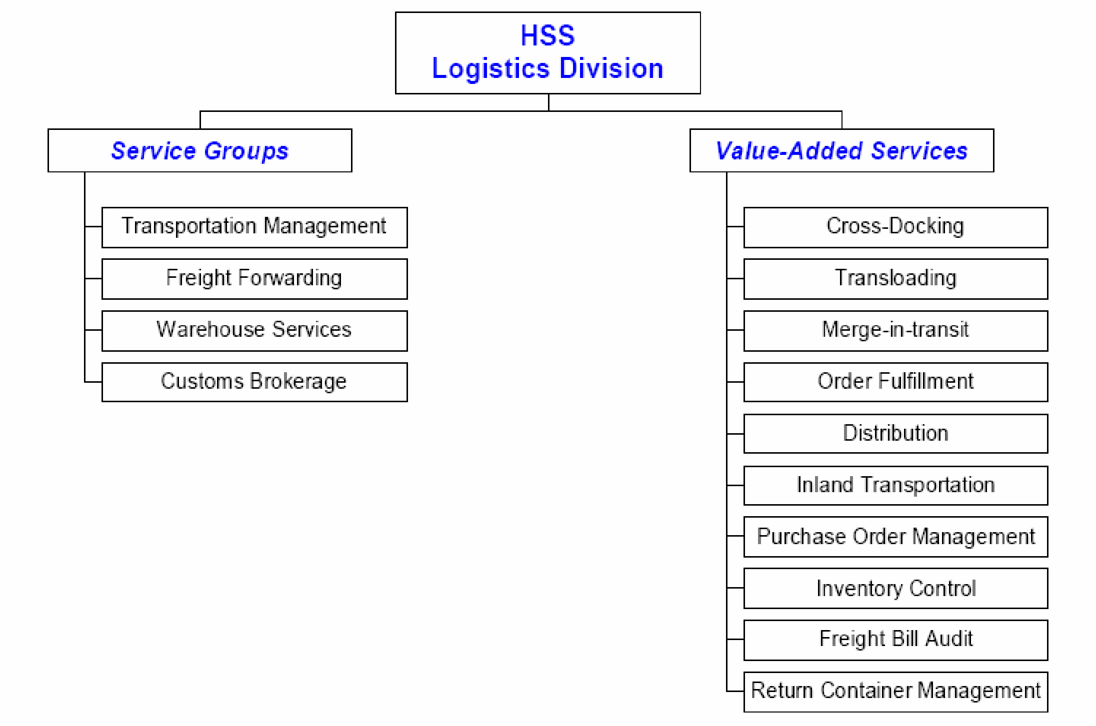

Figure 1-8. Service Structure of HSS Logistics Division

Source: Manalytics International

For instance, FastShip Atlantic has assembled a world-class group of strategic partners who are experts in areas of the business plan. The FastShip business approach is to outsource important technical and operational functions to partners who today perform these activities on a daily basis in their own businesses. Among these strategic partners are the following[13]:

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[13] FastShip Inc. "Transcom Briefing" 6 February 2002, n.p.; online, Internet, available from http://www.fastshipatlantic.com/strategicpartners.html

TECHNOLOGY	
Shipyard	**Kvaemer Philadelphia Shipyard Inc.** under MOU
Engines & Waterjets	**Rolls-Royce Plc.** under contract
Ship Construction Mgmt.	**John J. McMullen Associates, Inc.** – naval architect and marine engineer **Sea Technology(USA)** – owner's representatives
Gears	**Philadelphia Gear Corporation** under contract.
Loading System	***TTS Technology ASA*** under contract.
Terminal Philadelphia	• Aegis Property Management provides project management. • Urban Engineers Inc. is responsible for engineering and technical design of the terminal. • Keating Building Corp. is responsible for the General Construction of the terminal.
Terminal - Cherbourg	Vinci is responsible for terminal construction

OPERATIONS	
Fuel	***BP*** will supply fuel in Cherbourg and Philadelphia
Vessel Operation	**Interocean Ugland Management (IUM)** under MOU to operate the ships.
Information Technology	***Schneider Logistics and CP Ships*** to execute IT development and integration.
Inland Transportation USA & Europe	**Schneider Logistics** will manage inland transportation in North America and Europe and act as lead logistics provider integrating product end to end.
Container and Chassis Management	**CP Ships** will manage the container and chassis fleets.
Terminal Operations	**Holt Cargo Systems** will be the Philadelphia terminal operator.
Program Management	**Lockheed Martin** will manage systems and project integration.

FINANCE	
Port of Cherbourg	• **Chambre de Commerce et d'Industrie de Cherbourg-Cotentin** provides terminal site and infrastructure, and seed financing • **SNCF** is an investor in the terminal; providing dedicated rail performance assurances
Port of Philadelphia	**Delaware River Port Authority** agreed to underwrite $75 million to finance the Philadelphia terminal and is an equity investor in FastShip. Agreement of Sale signed for terminal site in Port Richmond.
U.S. Government	Application well advanced with **MARAD** for $1.6 billion loan guarantee.
French Government	**Direction du Transport Maritime** responsible for coordination of public investments in port and regional infrastructure; $100 million committed.
Investment Bankers	***J.P. Morgan*** is the lead bank for financing process and will be equity investor.

MARKETING	
Commercial Management	**CP Ships** will manage sales and marketing, backoffice functions, and customer service.
Freight Forwarders	**AEI, Barthco, BAX Global, Circle, Direct Container Lines, Emery, Geologistics, MSAS, and Panalpina** have all committed to Preliminary "Take or Pay" Agreements

Chapter 2. Operational Analysis

2.1. The HSS operating environment

After nearly two decades without commercial high speed sealift development, various shipping concerns have begun to revisit the potential of lift platforms which can deliver cargo faster than conventional container ships at lower cost than that required for air shipment. To succeed, the HSS must not only create a sufficiently large market segment, but must concentrate enough traffic at a single port on each side of the Atlantic to fill its ships.

FastShip would launch transatlantic service with three roundtrips per week, providing roughly 420,000 TEUs of capacity per year (*"Fast Ships", MGI Cargo Analyst, 1999*). It is clear that FastShip must convert a port of the much larger transatlantic ocean market. Increasing the air cargo flows and it's tempting to conclude that FastShip could fill its ships with less than a 2% share of a 186.8 million ton market (*"Fast Ships", MGI Cargo Analyst, 1999*)..

Existing transatlantic cargo services range from second-day priority air at $1.50/pound to 35-day deferred ocean service for as little as $0.04/pound (*"Fast Ships", MGI Cargo Analyst, 1999*). In general, transit time and cost per pound are inversely related. Naturally, the rate per pound paid by a particular shipper depends on both the size of the shipment and the annual volume of the shipper (larger shippers typically get better rates). Traffic density also plays a big role – obviously, the more pounds of freight per container, the lower the per-pound rate.

Product	Door-To-Door Time	Transit time Variability	Typical Rate/Lb.
Priority Air	2-3 days	Virtually None	$1.50
Standard Air	4-7 days	Moderate(1-3 days)	$0.45 - $0.85
FastShip	7-12 days	Low (1 day)	$0.12 - $0.20
Direct Ocean	14-28 days	High (up to 5 days)	$0.06 - $0.12
Standard Ocean	21-35 days	Very high(up to 7 days)	$0.04 - $0.08

Table 2-1 The North Atlantic Cargo Market

Source: Merge Global Inc. primary research, On-line available at: http://www.mergeglobal.com/fastship.pdf

Air trade typically averages about 9.5 pound per cubic foot, while ocean shipments average between 15 to 20 pound per cubic foot (*"Fast Ships", MGI Cargo Analyst, 1999*). In case of FastShip Atlantic, their average density probably will fall somewhere between air and ocean – we assume 12.5 pounds per cubic foot.

There is a current clear market gap with the slowest and least expensive air service providing a 7-day door-to-door transit time, and the fastest "direct" ocean service providing a 14-day transit time. Since the fastest reliable ocean service is around 21 days the true market gap is even larger (*"Fast Ships", MGI Cargo Analyst, 1999*).. Figure 2-1 shows FastShip Atlantic is positioned the only modes available to international freight shippers between air and ocean

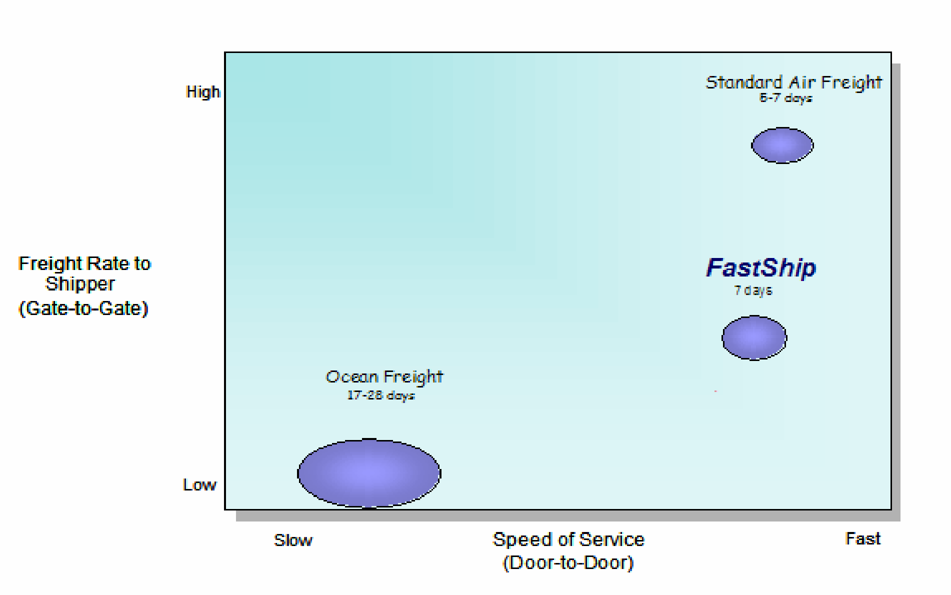

Figure 2-1. Transatlantic Freight Transportation Options Service VS. Rates

Source: FastShip Atlantic, Inc. Transcom Briefing 6 February 2002

At the high end of the market, rapid and dependable transit times are available with premium air freight (such as FedEx's International Priority product), but at a very high rate per pound. Standard air cargo is substantially cheaper, but still multiples of the ocean rates, which range from $0.12/pound for "direct" service (no inter-porting), moderate density traffic, all the way down to $0.04/pound for dense freight moving on slow, and highly unreliable, standard ocean services(*"Fast Ships", MGI Cargo Analyst, 1999*). Shipper generally has no speed options between 7 and 14 days, and no rate options between $0.12/pound and $0.45/pound(*"Fast Ships", MGI Cargo Analyst, 1999*).

2.2. Operating Costs Analysis

In order to assess the commercial potential of the emerging HSS designs under consideration, a preliminary life cycle cost analysis was performed for each design. Also, the same analysis was performed for a conventional container ship for comparison. The purpose of the analysis is to obtain approximate costs of owning and operating this selected set of vessels. The principle assumptions for this analysis are as follows. These characteristics are for comparison only and were specifically chosen because they present cross-cut of capabilities applicable to the ship designs considered in this study.

- Voyage distance, one way : 3,300 nautical miles
- Total annual volume : 150,000 containers
- Shipping cost, one way, via conventional container ship : $2,400
- Shipping cost, one way, via HSS : $3,600/container

It should be noted that costs were summarized into two major categories: ownership costs (capital recovery), and annual operating costs. The latter category consists of costs of fuel, crew, and insurance. Additional model outputs are depicted in Appendix A.

The lower part of Table 2-2 includes calculation of the ship cost for each of 2 types of vessels under consideration. The costs are divided into fixed and variable. Fixed costs include construction(capital), crewing, maintenance and repair and insurance costs; Variable costs include fuel.

Table 2-2. Service Capacity and Ship Cost

	Relationship	Conventional Container Ship C-11	FastShip TG-770
1. Distance per voyage(miles, one way)	*Given*	3,300	3,300
2. Speed(knots)	*Given*	22	42
3. Time per crossing (hours)	(1)/(2)	150	79
4. Turnaround line per departure(hours)	*Given*	32	8
5. Total transp. time per departure(hours)	(3) + (4)	182	86
6. Total transp. time (days)	(5)/24	7.58	3.58
7. Avail optg hours per year	358.24*24	8,600	8,600
8. Departures per year per ship	(7)/(5)	47	100
9. Container capacity per vessel (40-ft containers)	*Given*	2,400	755
10. Average capacity per container(tons)	*Given*	7.5	7.5
11. Cargo capacity per vessel(tons)	(9)*(10)	18,750	5,663
12. Annual capacity required (40-ft containers)	Given	150,000	150,000
13. Voyage required to handle demand	(12)/(9)	63	199
14. Vessels required to handle annual demand	(13)/(8)	1	2
15. Initial cost per vessel	*Given*	$90,000,000	$160,000,000
16. Operating life of vessel (years)	*Given*	25	25
17. Estimated residual(salvage) value of vessel (40%)	*Given*	$36,000,000	$64,000,000
18. Cost of capital (before income taxes)	*Given*	0.20	0.20
19. Capital recovery cost per vessel (before tax)	Computed	$18,114,411	$32,203,398
20. Capital recovery cost of fleet(before tax)	(14)*(19)	$18,114,411	$64,406,800
21. Engine requirements(HP)	*Given*	87,500	300,000
22. Fuel consumption rate(KG/HP/HR)	*Given*	0.145	0.16
23. Fuel consumption per hour(short tons)	Computed	8.33	42.7
24. Fuel consumption per crossing(short tons)	(3)*(23)	1,249.50	3,355.00
25. Cost of fuel per ton	Given	$95	$160
26. Cost of fuel per voyage	(24)*(25)	$118,703	$536,800
27. Cost of fuel per year	(26)*(13)	$7,418,906	$106,649,007
28. Crew per vessel	*Given*	25	25
29. Annual cost per crewmember	*Given*	$50,000	$50,000
30. Annual crew cost per vessel	(28)*(29)	$1,250,000	$1,250,000
31. Annual crew cost per fleet	(14)*(30)	$1,500,000	$2,500,000

32. Annual cost of insurance(3%)	0.03*(15)*(14)	$9,000,000	$9,600,000
33. Total capital & optg cost per fleet per year	(20)+(27)+(31)+(32)	$36,033,317	$183,155,807
34. Total capital & optg cost per container used	(33)/(12)	$240	$1,221
35. Est. revenue per container each time used	*Given*	$2,400	$3,600
36. Net revenue per container per usage (gross margin)	(35)-(34)	$2,160	$2,379
37. Percent pf capacity required to break even	(34)/(35)	0.10	0.34

** Note: Conventional Container Ship: C-11 class of APL (shipping company)*

** Assumptions:*

3: This is the equivalent container capacity, at 4 cars per forty-foot container

5: The normalized fuel consumption rate(not given) was assumed to be same as the FastShip.

Source: Center for Advanced Transportation Technologies, University of Southern California

Table 2-2 is presented in a format that allows the reader to reconstruct all calculations. In the column labeled “relationship”, the procedures for all calculations are explained. In those instances when the cell values are treated as exogenous variables, “given” is shown for the associated row.

The total capital and operating costs per fleet per year are summarized in row 33 of the table. These values are roughly comparable , as they have normalized assuming a fixed annual capacity, namely 150,000 forty-foot containers(ISO). Given the assumptions adopted in this analysis, it would be appear that, at approximately $40 million annually, the conventional (C-11) container ships are significantly less costly than any of the alternative HSS vessel. The costs are normalized on the basis of common annual level of service. In each case, we have assumed 150,000 forty-foot containers transported annually. However, what is not reflected in these figures is the speed with which an individual container is transported between origin and destination. For example, the FastShip Atlantic system(Sea+land transport) would move cargo at roughly 1/2 to 1/3 the time required to move cargo via a conventional container ship(C-11). Surely, the shipper would be willing to pay a premium for this additional service advantage. This is to say that, although the costs of owning and operating HSS vessels are higher that conventional container ships, the revenue would be higher. Adjustments for revenue differences are reflected in lines 35-37 in the table. Therefore, allowing for differences in revenue due to (to the carrier) improved levels of service, the additional costs would appear to be more than offset. For example, look at the comparison between FastShip and the conventional container ship: the total capital and operating costs per container transported for FastShip is $1,218-$270=$948 more than the cost for the conventional container ship(C-11), yet the anticipated premium is $3,600-$2,400=$1,200. Moreover, it could be argued that the assumption of a full ship (100% capacity) is obviously unrealistic for the conventional container ship(C-11), while for the HSS, this could be more likely to be true. This would further support the argument for the HSS vessels.

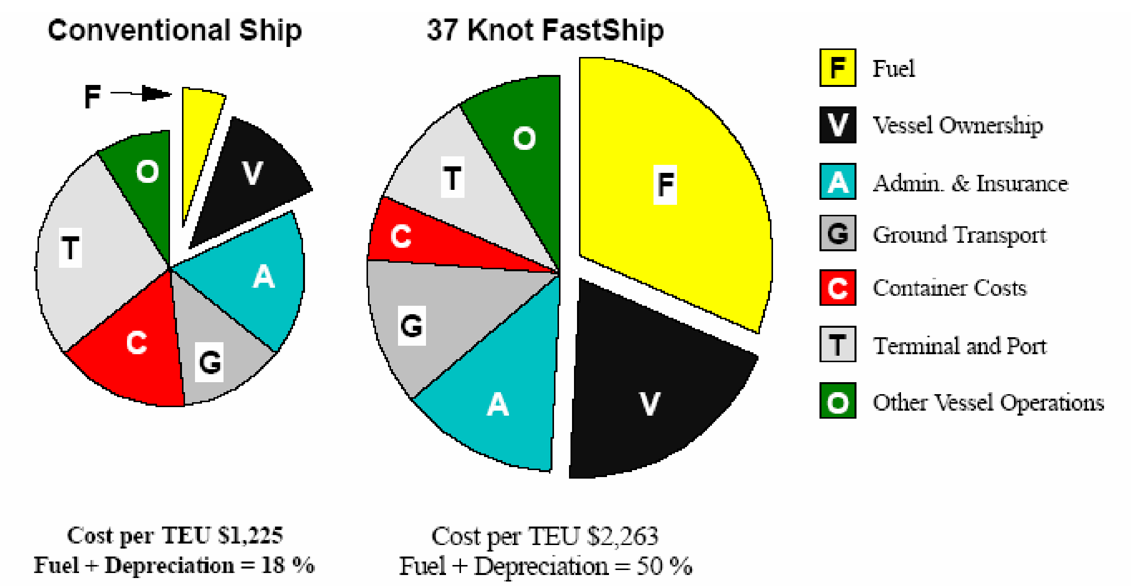

Figure 2-2. The Cost of Speed: Estimated Cost per Revenue TEU*

** - Assumes a conventional container ship operating standard, inter-ported ocean service with a 62% load factor, compared to a FastShip TG-770 operating at 37.5 knots with a 70% load factor of 12.5 lb./cubic foot freight.*

Source: Merge Global primary research, On-line available at: http://www.mergeglobal.com/fastship.pdf

In commercial service, FastShip plans to enhance on-time performance by operating 37.5 knots, rather than its maximum cruise speed of 42 knots, so that the speed reserve can be used to outrun bad weather and to make up for delays. To use some illustrative numbers, a conventional container ship with a capacity of 2,500TEUs burns about 1,000 tons of bunker fuel on a transatlantic crossing – about one-third of a ton of fuel per TEU, for a 7- to 8-day transatlantic crossing time (*"Fast Ships", MGI Cargo Analyst, 1999*). In contrast, the proposed 37 knots FastShip would carry 1,360 TEUs and would burn 4,600 tons of fuel on the same trip – about 3.4 tons of fuel per TEU for a 3.9-day crossing time (*"Fast Ships", MGI Cargo Analyst, 1999*). Moreover, FastShip uses a significantly more expensive type of fuel. In terms of cost per revenue TEU, we estimate that a doubling in diesel prices would drive up FastShip's costs 37%, whereas a doubling in bunker oil prices would increase a conventional vessel's costs by only 6% (*"Fast Ships", MGI Cargo Analyst, 1999*).

2.3. Risks of The FastShip Atlantic, Inc.

The FastShip Atlantic concept is attempting to capture the middle market on the transatlantic. But there is still lots of remained uncertainty and unanswered questions about the price, value tradeoff between current service provider and the FastShp Atlantic.

The FastShip has several risks and has taken a comprehensive approach to mitigating risk, building on a $32 million investment to date on technical and business development.

The first risk is market risk. For reducing market risks, their conservative business plan based on diversion of existing cargo flows in the market. And wholesale approach to market development based on alliances with leading international freight forwarders. Protected market position through patents combined with the first mover advantage.

The second risk is about technical risk. Although the ships were tested, still remain several uncertain problems, they are going on exhaustive program of design, testing and classification society scrutiny. And also they lead world-class suppliers are providing expertise, performance warranties and investment in FastShip. If they are necessary to meet to rework performance, that will be covered by insurance.

The third risk is construction cost overrun and delay. For preventing this risk, they could make a contract by fixed price with supplier and use MARAD funding which includes two layers of cost overrun protection amounting to over $200 million. Supply contracts have firm delivery dates with penalties for late delivery, and suppliers have demonstrated track record of on-time delivery.

The forth risk is operating risk. They could be working together with world class partners who will operate the ships, terminals and inland networks for reducing this risk. They have to consider about whole operating system, and a nine month period between delivery of the first and second ships permits extensive shakedown of ships, terminals, inland networks and IT. Also, they have to check operating buffers which ensure on-time performance

The fifth risk is fuel. The HSS ship is a fuel guzzler. For this characteristic, the HSS ship is impacted by fuel consumption. The FastShip has less fuel exposure than competing aircraft. However, FastShip consumes lots of fuel. High fuel prices have been assumed throughout business projections. Risk management will be done by BP(strategic partner of operation). These strategic partnering approaches bring existing world-class capabilities to bear in the key areas of technology, operations, sales and marketing and finance.

However, the FastShip project has been delayed several times and little progress had been made on signing contracts for the building of the ships. Hence, the launch of commercial service, which had been planned for 2000, is unlikely to start in 2008.

2.4. Profitability

The largest expense associated with the enterprise is fuel, which is consumed at an estimated rate of 43 tons per hour at a vessel service speed of 42 knots. Fuel costs account for approximately 52%-53% of total annual expenses of the enterprise. Typically, large unexpected increases in fuel prices are passed on to the shipper/consignee in the from of bunker surcharges, in an effort to recover the incremental fuel expenses that were not already built into the contracted rate. Secondary to fuel costs are the terminal charges associated with the load and discharge of cargo.

In this analysis, several items are added or subtracted from EBIT to derive a simple total cash flow. Added back to EBIT is depreciation and subtracted are interest, taxes, principal payments and capital investments. The total cash flow is then discounted to generate a net present value over the 25-year life of the operation or investment. A strong factor in determining the overall financial success of the operation is the price of vessel. The base case results were generated assuming a new build price of $180million, an estimate based on US construction. The final cost of this vessel will have a major impact on profitability, and therefore, some additional scenarios were run addressing the potential range of this cost assuming in that case that construction takes place in the US and that financing terms are equal to those in the base case.[14] In order to be eligible for MARAD loan guarantees, the vessel must be US built and US-flagged, and therefore, employ US officers and crews.

For the container ship operator there are several options related to vessel finance and ownership. Assumptions regarding those various options have been applied to gauge the impact on profitability. The base case assumes the vessels are US-built and underwritten by a MARAD loan guarantee allowing the investor to finance 87.5% of total construction costs at an interest rate of 5.5% over a 25-year term. If the vessels are to be built by an overseas shipyard, there are potential capital cost savings in the range of 40-50% although loan terms would not be as favorable. Alternative scenario one assumes that the vessels are built oversea, therefore, there is no MARAD loan guarantee and commercial rates are applied, 80% of costs are financed at 8% interest over a 12-year term. Alternative scenario two and three assume that the enterprise charters the vessel from a third party. The charter rates are term(annual charter rates equal $15.5 million and $18.3 million per vessel, respectively), assuming the vessels can be purchased at $100 million each from a shipyard overseas. The profitability results of these alternative scenarios are presented in Table 2-3. It is important to note that if the vessels are built overseas they could be manned by foreign officers and crew, at a substantial cost saving over the use of US officers and crew.

[14] MARAD loan guarantee allowing the financing of 87.5% of construction costs at 5.5% interest over a term 25 years

Case	Purchase Options	Vessel cost (US$ MM)	Net Present Value @10%(in millions)
Base	US built/flagged-MARAD Loan guarantee	$180	($57.3)
Alt 1	Foreign built, 80% financed @ 8% over 12 yrs	$100	$143.6
Alt 2	Foreign built, lease/chartered @ 15.5MM/yr	$100	($28.6)
Alt 3	Foreign built, lease/chartered @ 18.3MM/yr	$100	($162.5)

Table 2-3. Alternative Purchase Options

Note: Alternative cases 1,2 and 3 assume that the vessels are manned by foreign officers and crew

Source: Manalytics International

The results displayed in the table above and accompanying figures reflecting the current conventional containership load and discharge technology, crane usage. Another option, depending on the vessel final design is a cassette-type system as explained in the logistics analysis. This option would allow the vessel to save time in port during the load/discharge process. In fact, if this system is twice as fast as the conventional system in all ports of call, it will generate time savings of such a degree that HSS service could save one vessel and still maintain three times-weekly service. In additional to the capital investment saving s by having one less vessel, there would be port cost as days saved in door-to-door transit would increase.

Conclusions

HSS vessels represent an alternative line of development of advanced technology for vessels. Those vessels offer higher speeds than current vessels in exchange for higher construction and operating costs per TEU. This means that the longer the distance to be traversed, the more profitable and valuable the service is, especially for high-value and time sensitive cargoes.

However, high speed ocean transportation is a multi-faced challenge involving interactions between technology, economics and market requirements. A significant advance in ship and port design and construction is desirable. An intermodal approach to the port design is required.

The present study was limited to port-to-port transportation, and did not address the full logistical procedures. To determine the proper role of high speed shipping a study of the entire door-to-door market over specific routes should be made including the factors as below

- total shipping costs
- integration of high speed ocean shipping with land and air shipping facilities
- intermodal implications of high speed shipping
- comparison with alternate shipping methods
- price elasticity of the proposed market.

The most important factor is harmonization of whole logistics system. The HSS system regards time as an importance. If one par of a total logistics system is not operated as it should, they will lose their own merit.

High speed ocean freight rates are projected to be higher than current shipping rates, perhaps twice as high. The ships are expensive to operate because of the high cost of fuel required to move them crossing the sea at high speed. Define one of them increases their sensitivity to fuel prices. The high speed ship operating costs for current high speed cargo are directly associated with the cost of fuel they burn. In other word, fuel consumption is by far the most important cost of providing the HSS service. The current design for "FastShip", a semi-planning monohull proposed for operation between Cherbourg and Philadelphia, reportedly requires that it carries 3,000,000 gallons of fuel on a single voyage. There is a need for reducing the fuel required for high speed ship operation.

Based on the analysis finding merits of the HSS. Speed is doubled the current container ship speed. And service will improve logistics performance and potentially open new markets for transatlantic shippers. Port-to-port service will be moving to door-to-door service by the HSS. Also, terminal will be impacted by this service.

But we cannot help considering about uncertainties of the HSS. The HSS service do not exist now. Therefore, terminal concept has not also been fully tested yet. Cost of the HSS service is not decided yet, and we are not able to expect to relate with shipper response, particularly on the current ocean side with regards to price.

In these circumstances, we have to take a good look at all elements such as market size, competitors, operating characteristics of the HSS, operating cost, infrastructure and inland networks and IT.

There is no high speed ocean freight operation in the world today. Thus there is no experience base for projection of technology needs or the market conditions. The high-speed ship service creates a significant opportunity for shipbuilders and shippers to develop the technology and markets and take the lead in international high speed shipping.

APPENDIX A: Capital Recovery: an important factor in HSS Economic Analysis[15]

A term widely accepted in engineering economy, describes the uniform series of cash flows equivalent to cash flows associated with the initial cost and salvage value of the investment. It should be emphasized that, as a cash flow equivalence, capital recovery is not the same as straight line depreciation. The latter is an accounting concept capital recovery(CR) is defined as follows:

$$CR = (P - S)\left[\frac{i(1+i)^{n}}{(1+i)^{n-1}}\right] + iS$$

where P = initial cost

S = estimated salvage(residual) value at the end of N interest periods

N = number of interest periods

i = interest rate per interest period

Some caveats concerning the use of this formulation are in order here. First, it is assumed that the initial cash flow, P, is an expenditure at the start of the first period and the terminal cash flow, S, is received at the end of the Nth period. It is unlikely, of course, that actual receipts and expenditures will occur quite so conveniently in practice. Nevertheless, in the absence of information allowing for greater precision, we believe that this approximation is not unreasonable. Second, the interest rate, I, represents the investor's opportunity cost expressed as a percentage, that is, a rate per interest period.

The interest rate used in the formula is the "cost" to of employing the capital, P, in this

[15] *City of Long Beach's report*, August 1997, "Advanced Technologies for Transportation Applications Technical Report", United States Transportation Command Strategy & Policy Division. p.c-1 ~ c-3 (Appendix C)

investment rather that employing the same funds elsewhere where the rate of return, I, would be expected. These are very crude estimates, of course, and thus the resulting calculations should be viewed with considerable caution.

The interest rate, I, used in calculating capital recovery, is assumed to be 20% per annum, a figure which we believe represents a reasonable approximation of the pre-tax cost of capital for investors in this industry.

One other caveat: the economic analyses summarized in Table 1-5 are conducted on a pre-tax basis. The effect on equivalent annual costs of cash flows due to local, state, federal and foreign income taxes have not been considered. Nevertheless, the current research effort has been necessarily constrained in time and personnel resources, and a more detailed study has not been possible under the circumstances.

Abbreviations and Acronyms

Acronym	Definition
#	Number
%	Percent
@	At
AP	Agile Port
CAGR	Compound annual growth rate
CP Train	Container Platform Train
EBIT	Earnings before interest and taxes
Hrs	Hours
HSS	High Speed Sealift
IT	Information Technology
Knot	Nautical Mile
MARAD	U.S. Department of Transportation’s Maritime Administration
M & R	Maintenance and Repair
MM	Million
MT	Metric Tons
nmi	Nautical miles
RTG	Rubber Tired Gantry Crane
SES	Surface effect ships
SWATH	Small waterplane Area Twin Hull
TEU	Twenty-foot Equivalent Unit
US	United States

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